# Hazardous Chemicals Database

**Printed Version**

It seems that there are a few people out there who feel the need for a paper version of our hazardous chemicals advice.

The tabbed layout of the new pages makes for a better user experience but makes it much more difficult to print as just pressing print only gives you one of the tabs.

We have therefore put together this version.

It only contains the main Health and Safety information: given the size, including the data pages and the uses and control measures was simply impractical.

Do be aware that while this will be updated from time to time, It is a static document and we cannot guarantee that the copy you are consulting contains up to date information.

January 2019

# Hazardous Chemicals Index

| | Name | Listed as | Location |
|---|---|---|---|
| | 2,4-D | 2,4-dichlorophenoxy-ethanoic acid | Biochemicals (Plant & Animal hormones) |
| | 2,4-D | | Biochemicals (plant and animal hormones) |
| | 2,4-dichlorophenoxy-ethanoic acid | | Biochemicals (Plant & Animal hormones) |
| | acetaldehyde | ethanal | ethanal and its oligomers |
| | acetamide | ethanamide | ethanamide |
| | acetic acid | ethanoic acid | ethanoic acid |
| | acetic acmoid | | Dyes and Stains |
| | acetic alcohol | ethanol | Biochemicals – Microscopy Chemicals (Fixatives) |
| | acetic anhydride | ethanoic anhydride | ethanoic anhydride |
| | acetic carmine | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | acetic carmine | | Dyes and Stains |
| | acetic orcein | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | acetic orcein | | Dyes and Stains |
| | acetone | propanone | propanone |
| | acetone-xylene | | Biochemicals – Microscopy Chemicals (Clearing Agents) |
| | acetyl chloride | ethanoyl chloride | ethanoyl chloride |
| | acetylcholine | | Biochemicals (Plant & Animal hormones) |
| | acetylcholine | | Biochemicals (plant and animal hormones) |
| | acetylene | ethyne | calcium carbide and ethyne |
| | acetylsalicylic acid | aspirin | Hydroxybenzoic acid and derivatives |
| | acid alcohol | | Dyes and Stains |
| | acid fuschin (Mallory) | | Dyes and Stains |
| | adenine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | adeniosine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | adenosine triphosphate | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | adrenalin | | Biochemicals (plant and animal hormones) |
| | adrenaline | | Biochemicals (Plant & Animal hormones) |
| | alanine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | albumen | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | albumin | | Biochemicals (Nucleic acids, Amino acids & other proteins) |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | Albustix test strips |  | Biochemical Tests (Proteins) |
|  | alcohol /1,2-dimethylbenzene |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | algal mountant |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | algal preservative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | alizarin red S |  | Dyes and Stains |
|  | allyl bromide | 3-bromopropene | halogenopropenes, 3- |
|  | allyl chloride | 3-chloropropene | halogenopropenes, 3- |
|  | allyl iodide | 3-iodopropene | halogenopropenes, 3- |
|  | alum | aluminium potassium sulphate | aluminium compounds |
|  | aluminium |  | aluminium |
|  | aluminium ammonium sulphate |  | aluminium compounds |
|  | aluminium bromide |  | aluminium halides |
|  | aluminium chloride |  | aluminium halides |
|  | aluminium ethanoate |  | aluminium compounds |
|  | aluminium iodide |  | aluminium halides |
|  | aluminium nitrate-9-water |  | aluminium compounds |
|  | aluminium oxide |  | aluminium compounds |
|  | aluminium potassium sulphate |  | aluminium compounds |
|  | aluminium silicate |  | aluminium compounds |
|  | aluminium sulphate |  | aaluminium compounds |
|  | amalgam | sodium mercury amalgam | sodium metal |
|  | Amann’s medium |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | AMG |  | Biochemicals (Enzymes) |
|  | amidosulphonic acid | sulphamic acid | sulphamic acid |
| 4- | amino-1-hydroxybenzene | 4-aminophenol | 4-aminophenol |
| 4- | aminobenzenesulphonic acid | sulphanilic acid | sulphanilic acid |
|  | aminoethane | ethylamine | ethylamine |
|  | aminomethane | methylamine | methylamine |
| 4- | aminophenol | 4-aminophenol | 4-aminophenol |
|  | ammonia |  | ammonia (gas and solution) |
|  | ammonium bromide |  | ammonium compounds |
|  | ammonium carbonate |  | ammonium compounds |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | ammonium chloride |  | ammonium compounds |
|  | ammonium dichromate |  | ammonium dichromate |
|  | ammonium dichromate |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | ammonium duhydrogen phosphate |  | phosphates |
|  | ammonium ethanedioate |  | ammonium compounds |
|  | ammonium ethanedioate |  | ethanedioic acid and ethanedioates |
|  | ammonium ethanoate |  | ammonium compounds |
|  | ammonium fluoride |  | fluorides |
|  | ammonium hexachloroplatinate |  | hexachloroplatinic acid and hexachloroplatinates |
|  | ammonium hydrogen phosphate |  | phosphates |
|  | ammonium hydroxide |  | ammonia (gas and solution) |
|  | ammonium iodide |  | ammonium compounds |
|  | ammonium iron II sulphate |  | ammonium compounds |
|  | ammonium iron III citrate |  | ammonium compounds |
|  | ammonium metavanatate V |  | vanadium and compounds |
|  | ammonium nitrate |  | ammonium nitrate |
|  | ammonium oxalate |  | ammonium compounds |
|  | ammonium oxalate |  | ethanedioic acid and ethanedioates |
|  | ammonium peroxodisulphate VI |  | peroxodisulphates VI |
|  | ammonium persulphate |  | peroxodisulphates VI |
|  | ammonium phosphate |  | ammonium compounds |
|  | ammonium phosphate |  | phosphates |
|  | ammonium sulphate |  | ammonium compounds |
|  | ammonium sulphide |  | ammonium sulphide |
|  | ammonium tartrate |  | ammonium compounds |
|  | ammonium thiocyanate |  | thiocyanates |
|  | ammonium trioxovanadate |  | vanadium and compounds |
|  | ammonium vanadate V |  | vanadium and compounds |

| | Name | Listed as | Location |
|---|---|---|---|
| n- | amyl acetate | pentyl ethanoate | pentyl ethanoate |
| | amyl alcohol | pentanol | pentanols |
| n- | amyl alcohol | pentan-1-ol | pentanols |
| sec- | amyl alcohol | pentan-2-ol | pentanols |
| | amylase | | Biochemicals (Enzymes) |
| | amyloglucosidase | amyloglucosidase | Biochemicals (Enzymes) |
| | aniline | phenylamine | phenylamine |
| | aniline blue | | Dyes and Stains |
| | aniline blue-lactophenol | | Dyes and Stains |
| | aniline hydrochloride | | Biochemical tests (Carbohydrates) |
| | aniline hydrochloride | phenylammonium chloride | phenylammonium chloride |
| | aniline sulphate | | Biochemical tests (Carbohydrates) |
| | aniline sulphate | | Dyes and Stains |
| | antimony | | antimony metal and compounds |
| | antimony III chloride | | antimony metal and compounds |
| | antimony III fluoride | | antimony metal and compounds |
| | antimony III oxide | | antimony metal and compounds |
| | antimony potassium tartrate | | antimony metal and compounds |
| | antimony V chloride | | antimony metal and compounds |
| | antimony V fluoride | | antimony metal and compounds |
| | arginine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | arsenic | | arsenic metal and compounds |
| | arsenic pentoxide | | arsenic metal and compounds |
| | arsenic trioxide | | arsenic metal and compounds |
| | asbestos | | asbestos |
| | asparagine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | asparagine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | Aspirin | acetylsalicylic acid | Hydroxybenzoic acid and derivatives |
| | ATP | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | azole | pyrrole | pyrrole |
| | azure A | | Dyes and Stains |
| | Baker‘s fixative | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | Barfoed’s reagent | | Biochemical tests (Carbohydrates) |
| | barium | | barium metal and compounds |
| | barium carbonate | | barium metal and compounds |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | barium chloride |  | barium metal and compounds |
|  | barium hydroxide-8-water |  | barium metal and compounds |
|  | barium nitrate V |  | nitrates V |
|  | barium peroxide |  | peroxides |
|  | barium sulphide |  | barium metal and compounds |
|  | basic fuschin |  | Dyes and Stains |
|  | Benedict’s solution |  | Benedict’s solution |
|  | Benedict’s solution |  | Biochemical tests (Carbohydrates) |
|  | Bensley’s fixative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | benzaldehyde | benzenecarbaldehyde | benzenecarbaldehyde |
|  | benzene |  | benzene |
|  | benzene 1,2 diamine |  | benzene-(1,4),(1,3) & (1,2)-diamine |
|  | benzene 1,2 diol |  | Benzene diols |
|  | benzene 1,2,3, triol |  | benzene triols |
|  | benzene 1,3 diol |  | Benzene diols |
|  | benzene 1,4 diamine |  | benzene-(1,4),(1,3) & (1,2)-diamine |
|  | benzene 1,4 diol |  | Benzene diols |
|  | benzene-1,2-dicarboxylic anhydride |  | benzene-1,2-dicarboxylic anhydride |
|  | benzene-1,3,5-triol |  | Biochemical tests (Carbohydrates) |
|  | benzenecarbaldehyde |  | benzenecarbaldehyde |
|  | benzenecarbonyl chloride |  | benzenecarbonyl chloride |
| 1,3- | benzenediol |  | Benzene diols |
| 1,3,5- | benzenetriol |  | benzene triols |
|  | benzidine |  | Biochemical tests (Carbohydrates) |
|  | benzocaine |  | Biochemicals – Microscopy chemicals |
|  | benzol | benzene | benzene |
|  | benzoyl chloride | benzenecarbonyl chloride | benzenecarbonyl chloride |
|  | benzoyl peroxide | di(benzenecarbonyl) peroxide | di(benzenecarbonyl) peroxide |
|  | benzyl alcohol | phenylmethanol | phenylmethanol |
|  | benzyl chloride | chloromethylbenzene | chloromethylbenzene |
|  | Berlese‘s fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | Berlese’s fluid |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | beryllium |  | beryllium metal and compounds |
|  | beryllium compounds |  | beryllium metal and compounds |
|  | beta-galactosidase | Lactase | Biochemicals (Enzymes) |

| | Name | Listed as | Location |
|---|---|---|---|
| | bial’s reagent | | Biochemical tests (Carbohydrates) |
| | bile salts | sodium tauroglycholate | sodium compounds |
| | biphenyl-4,4′-diamine | | Biochemical tests (Carbohydrates) |
| | bis(4-isocyanatophenyl)methane | | bis(4-isocyanatophenyl)methane |
| | bismuth | | bismuth metal and compounds |
| | bismuth III chloride | | bismuth metal and compounds |
| | bismuth III nitrate-5-water | | bismuth metal and compounds |
| | biuret test | | Biochemical Tests (Proteins) |
| | bleach solution | | chlorates I |
| | borax | sodium tetraborate | boron compounds |
| | boric acid | | boron compounds |
| | boron tribromide | | boron compounds |
| | boron trichloride | | boron compounds |
| | boron triiodide | | boron compounds |
| | Bouin‘s solution | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | brilliant orange | | indicators |
| | Bromelain | | Biochemicals (Enzymes) |
| | bromine | | bromine |
| 2- | bromo-2-methylpropane | | methylpropanes 2- 2-bromo- & 2-chloro- |
| | bromobenzene | | bromobenzene |
| 1- | bromobutane | | bromobutanes |
| 2- | bromobutane | | bromobutanes |
| | bromocresol green | | indicators |
| | bromocresol purple | | indicators |
| | bromoethane | | bromoethane |
| | bromophenol blue | | indicators |
| 3- | bromopropene | | halogenopropenes, 3- |
| | bromothymol blue | | indicators |
| | buckminsterfullerene | | carbon |
| | Buffer Solutions | | Buffer Solutions |
| | butan-1-ol | | butanols |
| | butan-2-ol | | butanols |
| | butan-2-one | | butan-2-one |
| | butanal | | butanal |
| | butane | | butane |
| | butyl acetate | butyl ethanoate | butyl ethanoate |
| n- | butyl acetate | butyl ethanoate | butyl ethanoate |

|  | Name | Listed as | Location |
|---|---|---|---|
| n- | butyl alcohol | butan-1-ol | butanols |
| sec- | butyl alcohol | butan-2-ol | butanols |
| tert- | butyl alcohol | 3-methylpropan-2-ol | methylpropanols |
| n- | butyl bromide | 1-bromobutane | bromobutanes |
| s- | butyl bromide | 2-bromobutane | bromobutanes |
| n- | butyl bromide | 1-bromobutane | chlorobutanes |
| sec- | butyl bromide | 2-bromobutane | chlorobutanes |
| t- | butyl bromide | 2-bromo-2-methylpropane | methylpropanes 2- 2-bromo- & 2-chloro- |
| n- | butyl chloride | 1-chlorobutane | chlorobutanes |
| sec- | butyl chloride | 2-chlorobutane | chlorobutanes |
| t- | butyl chloride | 2-chloro-2-methylpropane | methylpropanes 2- 2-bromo- & 2-chloro- |
| n- | butyl ethanoate |  | butyl ethanoate |
|  | butyl iodide | iodobutane, 1- | iodobutane, 1- |
|  | butyraldehyde | butanal | butanal |
|  | C-60 Fullerene | carbon | carbon |
|  | cadmium |  | cadmium metal and compounds |
|  | cadmium chloride |  | cadmium metal and compounds |
|  | cadmium oxide |  | cadmium metal and compounds |
|  | cadmium sulphate |  | cadmium metal and compounds |
|  | cadmium sulphide |  | cadmium metal and compounds |
|  | caffeine |  | Biochemicals (Plant & Animal hormones) |
|  | Cajal's fixative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | calcium |  | calcium metal |
|  | calcium bromide |  | calcium compounds |
|  | calcium carbide |  | calcium carbide and ethyne |
|  | calcium carbonate |  | calcium compounds |
|  | calcium chlorate I |  | chlorates I |
|  | calcium chloride |  | calcium compounds |
|  | calcium dicarbide |  | calcium carbide and ethyne |
|  | calcium dihydride |  | calcium hydride |
|  | calcium dihydrogen phosphate |  | phosphates |
|  | calcium fluoride |  | calcium compounds |
|  | calcium formate | calcium methanoate | calcium compounds |
|  | calcium hydride |  | calcium hydride |
|  | calcium hydrogen phosphate |  | phosphates |
|  | calcium hydroxide |  | calcium oxide and hydroxide |
|  | calcium hypochlorite | calcium chlorate I | chlorates I |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | calcium iodide |  | calcium compounds |
|  | calcium methanoate |  | calcium compounds |
|  | calcium nitrate V |  | nitrates V |
|  | calcium oxide |  | calcium oxide and hydroxide |
|  | calcium phosphate |  | calcium compounds |
|  | calcium phosphate |  | phosphates |
|  | calcium phosphide |  | calcium compounds |
|  | calcium sulphate |  | calcium compounds |
|  | calcium sulphide |  | calcium compounds |
|  | calcium sulphite |  | calcium compounds |
|  | camping gas fuel |  | butane |
|  | Canada balsam |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | Caradate 30 |  | bis(4-isocyanatophenyl)methane |
|  | Carbohydrase |  | Biochemicals (Enzymes) |
|  | carbol fuschin |  | Dyes and Stains |
|  | carbol gentian violet |  | Dyes and Stains |
|  | carbol thionin |  | Dyes and Stains |
|  | carbolic acid | phenol | phenol |
|  | carbon |  | carbon |
|  | carbon dioxide |  | Biochemicals – Microscopy chemicals |
|  | carbon dioxide |  | carbon dioxide |
|  | carbon disulphide |  | carbon disulphide |
|  | carbon monoxide |  | carbon monoxide |
|  | carbon sulphide |  | carbon disulphide |
|  | carbon tetrachloride |  | Biochemicals – Microscopy chemicals |
|  | carbon tetrachloride | tetrachloromethane | tetrachloromethane |
|  | carmine acetic |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | carmine acetic |  | Dyes and Stains |
|  | Carnoy‘s fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | Carnoy’s fluid |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | casein |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | catalase |  | Biochemicals (Enzymes) |
|  | caustic potash | potassium hydroxide | potassium hydroxide |
|  | caustic soda | sodium hydroxide | sodium hydroxide |
|  | cedarwood oil |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | celloidin |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | cellosolve |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | cellulose acetate |  | Biochemicals – Microscopy Chemicals (Macerating & Narcotising Agents) |
|  | cellulose ethanoate |  | Biochemicals – Microscopy Chemicals (Macerating & Narcotising Agents) |
|  | cetyl alcohol | Hexadecan-1-ol | Alcohols (monohydric) |
|  | Champy‘s fixative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | charcoal | carbon | carbon |
|  | chloral hydrate |  | Biochemicals – Microscopy chemicals |
|  | chlorbutol |  | Biochemicals – Microscopy chemicals |
|  | chloretone |  | Biochemicals – Microscopy chemicals |
|  | chloric acid |  | chloric acid |
|  | chlorine |  | chlorine |
| 2- | chloro-2-methylpropane |  | methylpropanes 2- 2-bromo- & 2-chloro- |
|  | chloroacetic acid | chloroethanoic acid | chloroethanoic acids |
|  | chlorobenzene |  | chlorobenzene |
| 1- | chlorobutane |  | chlorobutanes |
| 2- | chlorobutane |  | chlorobutanes |
|  | chloroethane |  | chloroethane |
|  | chloroethanoic acid |  | chloroethanoic acids |
|  | chloroform |  | Biochemicals – Microscopy chemicals |
|  | chloroform | trichloromethane | trihalogenomethanes |
|  | chloromethylbenzene |  | chloromethylbenzene |
| 1- | chloroprapane |  | chloropropanes |
| 2- | chloropropane |  | chloropropanes |
| 3- | chloropropene |  | halogenopropenes, 3- |
|  | chlorosulphonic acid |  | chlorosulphonic acid |
|  | chlorosulphuric acid | chlorosulphonic acid | chlorosulphonic acid |
| α- | chlorotoluene | chloromethylbenzene | chloromethylbenzene |
|  | Chlor-zinc-iodine |  | Biochemical tests (Carbohydrates) |
|  | Chlor-zinc-iodine |  | Biochemical Tests (Lipids) |
|  | Chorionic gonadotrophin |  | Biochemicals (Plant & Animal hormones) |
|  | chrom-acetic fixative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | Chromates |  | chromates VI |
|  | chromic acid (chromium (VI) oxide) |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | chromic acid (Priestley) |  | Biochemicals – Microscopy Chemicals (Macerating & Narcotising Agents) |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | chromic acid (Ranvier) |  | Biochemicals – Microscopy Chemicals (Macerating & Narcotising Agents) |
|  | chromium |  | chromium metal and compounds |
|  | chromium II chloride |  | chromium metal and compounds |
|  | chromium III chloride |  | chromium metal and compounds |
|  | chromium III nitrate |  | chromium metal and compounds |
|  | chromium III oxide |  | chromium metal and compounds |
|  | chromium III potassium sulphate |  | chromium metal and compounds |
|  | chromium III sulphate |  | chromium metal and compounds |
|  | chromium III sulphate (basic) |  | chromium metal and compounds |
|  | chromium trioxide | chromium VI oxide | chromium VI oxide |
|  | chromium VI oxide |  | Biochemical Tests (Lipids) |
|  | chromium VI oxide |  | chromium VI oxide |
|  | chromo – ethanoic fixative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | chymosin |  | Biochemicals (Enzymes) |
|  | Clarke's fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | clinistix strips |  | Biochemical tests (Carbohydrates) |
|  | clinitest tablets |  | Biochemical tests (Carbohydrates) |
|  | clove oil |  | Biochemicals – Microscopy chemicals |
|  | clove oil / glacial ethanoic acid |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | CMS wool |  | Machine-made mineral fibres |
|  | cobalt |  | cobalt metal and compounds |
|  | cobalt acetate | cobalt ethanoate | cobalt metal and compounds |
|  | cobalt carbonate |  | cobalt metal and compounds |
|  | cobalt chloride |  | cobalt metal and compounds |
|  | cobalt ethanoate |  | cobalt metal and compounds |
|  | cobalt nitrate |  | cobalt metal and compounds |
|  | cobalt oxide |  | cobalt metal and compounds |
|  | cobalt sulphate |  | cobalt metal and compounds |
|  | cobalt sulphide |  | cobalt metal and compounds |
|  | colchicine |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | colchicine |  | Biochemicals (Plant & Animal hormones) |
|  | collodion |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | congo red |  | Dyes and Stains |
|  | copper I chloride |  | copper compounds |
|  | copper I oxide |  | copper compounds |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | copper II acetate | copper II ethanoate | copper compounds |
|  | copper II bromide |  | copper compounds |
|  | copper II carbonate |  | copper compounds |
|  | copper II chloride |  | copper compounds |
|  | copper II chromate |  | copper compounds |
|  | copper II ethanoate |  | copper compounds |
|  | copper II nitrate |  | copper compounds |
|  | copper II oxide |  | copper compounds |
|  | copper II sulphate |  | copper compounds |
|  | cotton blue lactophenol |  | Dyes and Stains |
|  | cresol | methylphenol | methylphenols |
|  | cresol red |  | indicators |
|  | crystal violet |  | Dyes and Stains |
|  | cyclohexane |  | cyclohexane |
|  | cyclohexanol |  | cyclohexanol |
|  | cyclohexanone |  | cyclohexanone |
|  | cyclohexene |  | cyclohexene |
|  | cysteine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | cytidine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | cytosine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | Dammar |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | DCPIP |  | Biochemical Tests (Miscellaneous) |
|  | De Faure's mountant/fixative |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | decane |  | decane |
|  | decanedioyl dichloride |  | decanedioyl dichloride |
|  | deoxyribose nucleic acid |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | di(benzenecarbonyl) peroxide |  | di(benzenecarbonyl) peroxide |
|  | di(dodecanoyl) peroxide |  | di(dodecanoyl) peroxide |
|  | Diabur-Test 5000 strips |  | Biochemical tests (Carbohydrates) |
|  | diammonium phosphate |  | ammonium compounds |
|  | diastase | Amylase | Biochemicals (Enzymes) |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | diazonium salts |  | diazonium salts |
|  | dichloroacetic acid | dichloroethanoic acid | chloroethanoic acids |
|  | dichlorodimethylsilane | dimethyldichlorosilane | dimethyldichlorosilane |
|  | dichloroethanoic acid |  | chloroethanoic acids |
|  | dichloromethane |  | dichloromethane |
|  | dichlorophenol indophenol, sodium salt |  | Biochemical Tests (Miscellaneous) |
| 2,4- | dichlorophenoxy-ethanoic acid |  | Biochemicals (plant and animal hormones) |
|  | dichromates |  | Dichromates |
|  | diethyl ether |  | Biochemicals – Microscopy chemicals |
|  | diethyl ether | ethoxyethane | ethoxyethane |
|  | diethyl ketone | pentan-3-one | pentanones |
|  | diethylamine | diethylamine | diethylamine |
|  | diethyldithiocarbamate |  | lead metal & compounds |
|  | diethylene dioxide |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | diethylene oxide | dioxane, 1,4- | dioxane, 1,4- |
| 2,2- | dihydroxy-1,3-indandione | ninhydrin | ninhydrin |
| 1,3- | dihydroxybenzene |  | Benzene diols |
| 1,4- | dihydroxybenzene |  | Benzene diols |
| 1,2 | dihydroxybenzene |  | Benzene diols |
| p- | dihydroxybenzene | benzene-1,4-diol | Benzene diols |
| m- | dihydroxybenzene | benzene-1,3-diol | Benzene diols |
| p- | dihydroxybenzene | benzene-1,4-diol | Benzene diols |
|  | diiodine hexachloride |  | diiodine hexachloride |
|  | dilauroyl peroxide | di(dodecanoyl) peroxide | di(dodecanoyl) peroxide |
| 2,9- | dimethyl-1,10-phenanthroline |  | Colorimetric Reagents |
|  | dimethylamine |  | dimethylamine |
|  | dimethylbenzene |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | dimethylbenzene |  | dimethylbenzenes |
|  | dimethyldichlorosilane |  | dimethyldichlorosilane |
|  | dimethylglyoxime |  | Colorimetric Reagents |
|  | dinitrogen tetroxide |  | nitrogen oxides |
| 2,4- | dinitrophenol |  | 2,4-dinitrophenol |

|  | Name | Listed as | Location |
|---|---|---|---|
| 2,4- | dinitrophenol |  | indicators |
| 2,6- | dinitrophenol |  | indicators |
| 2,4- | dinitrophenylhydrazine |  | 2,4-dinitrophenylhydrazine |
|  | dioxane |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
| 1,4- | dioxane |  | dioxane, 1,4- |
|  | diphenylcarbazide |  | Colorimetric Reagents |
|  | diphosphorus pentoxide | phosphorus V oxide | phosphorus compounds |
|  | dipotassium disulphate |  | sulphates & sulphites |
|  | disodium disulphate |  | sulphates & sulphites |
|  | disodium tetraborate | sodium tetraborate | boron compounds |
|  | disulphur dichloride |  | disulphur dichloride |
|  | dithizone |  | Colorimetric Reagents |
|  | DNA |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | DPX mountant |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | Dubosq-brasil (alcoholic Bouin) |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | dyestuffs |  | Dyes and Stains |
|  | Eau de Javelle |  | Biochemicals – Microscopy Chemicals (Macerating & Narcotising Agents) |
|  | EDTA |  | EDTA |
|  | eosin |  | Dyes and Stains |
|  | epinephrine | adrenalin | Biochemicals (plant and animal hormones) |
|  | eriochrome Black T |  | Colorimetric Reagents |
|  | eriochrome cyanine R |  | Colorimetric Reagents |
|  | erythrosin |  | Dyes and Stains |
|  | ethanal |  | ethanal and its oligomers |
|  | ethanal tetramer |  | ethanal and its oligomers |
|  | ethanal trimer |  | ethanal and its oligomers |
|  | ethanamine |  | ethylamine |
|  | ethane-1,2-diol |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | ethanedioic acid |  | ethanedioic acid and ethanedioates |
|  | ethanoic acid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | ethanoic acid |  | ethanoic acid |
|  | ethanoic anhydride |  | ethanoic anhydride |
|  | ethanol |  | Biochemicals – Microscopy chemicals |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | ethanol |  | ethanol (and methylated spirits) |
|  | ethanoyl chloride |  | ethanoyl chloride |
|  | ethenyl ethanoate |  | ethenyl ethanoate |
|  | ethex |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | ethidium bromide |  | Biochemicals (Plant & Animal hormones) |
|  | ethoxyethane |  | Biochemicals – Microscopy chemicals |
|  | ethoxyethane |  | ethoxyethane |
| 2- | ethoxyethanol |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | ethyl 3-aminobenzoate |  | Biochemicals – Microscopy chemicals |
|  | ethyl 4-aminobenzoate |  | Biochemicals – Microscopy chemicals |
|  | ethyl acetate | ethyl ethanoate | ethyl ethanoate |
|  | ethyl alcohol | ethanol | ethanol (and methylated spirits) |
|  | ethyl bromide | bromoethane | bromoethane |
|  | ethyl carbamate |  | Biochemicals – Microscopy chemicals |
|  | ethyl chloride | chloroethane | chloroethane |
|  | ethyl ethanoate |  | ethyl ethanoate |
|  | ethyl ethanoateethyl acetate |  | Biochemicals – Microscopy chemicals |
|  | ethyl iodide |  | iodoethane |
|  | ethyl urethane |  | Biochemicals – Microscopy chemicals |
|  | ethylamine | iodoethane | ethylamine |
|  | Ethylenediaminetetraacetic acid |  | EDTA |
|  | ethylene glycol |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | ethyne |  | calcium carbide and ethyne |
|  | euparal |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | Farmer‘s fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | fast green F.C.F |  | Dyes and Stains |
|  | fast red 7B |  | Dyes and Stains |
|  | Fehling’s reagent |  | Biochemical tests (Carbohydrates) |
|  | Fehling’s solution |  | Fehling’s Solution No.1 & No.2 (solutions A & B) |
|  | Feulgen stain |  | Dyes and Stains |
|  | fir oil | turpentine | turpentine |
|  | firedamp | methane | methane |
|  | Flemming‘s fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | formaldehyde | methanal | methanal |
|  | formalin | methanal | Biochemicals – Microscopy Chemicals (Fixatives) |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | formalin | methanal | methanal |
|  | formic acid | methanoic acid | methanoic acid |
|  | fromase |  | Biochemicals (Enzymes) |
|  | fullerene | carbon | carbon |
|  | furfuryl aminopurine | Kinetin | Biochemicals (Plant & Animal hormones) |
|  | Gatenby‘s fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | gelatin |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | gibson’s fixative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | glucose isomerase |  | Biochemicals (Enzymes) |
|  | glucose oxidase |  | Biochemicals (Enzymes) |
|  | glutamic acid |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | glutamine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | glycerine |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | glycerol |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | glycine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | gold III chloride |  | silver & other precious metals |
|  | gold metal |  | silver & other precious metals |
|  | Gram stain |  | Dyes and Stains |
|  | Gram‘s iodine |  | Dyes and Stains |
|  | graphite | carbon | carbon |
|  | green algae preservative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | guanidine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | gum chloral |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | gum chloral |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | haematoxylin (Delafield‘s) |  | Dyes and Stains |
|  | haematoxylin (Ehrlich‘s) |  | Dyes and Stains |
|  | haematoxylin (Harris‘s) |  | Dyes and Stains |
|  | haemoglobin |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | Harlow’s solutions |  | Biochemicals – Microscopy Chemicals (Macerating & Narcotising Agents) |

| | Name | Listed as | Location |
|---|---|---|---|
| | Heidenhain‘s Susa | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | hemoglobin | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | hex-1-ene | | hex-1-ene |
| | hexachloroplatinic acid | | hexachloroplatinic acid and hexachloroplatinates |
| | hexahydrobenzene | cyclohexane | cyclohexane |
| | hexahydrophenol | cyclohexanol | cyclohexanol |
| | hexamethylene diamine | hexane 1,6 diamine | hexane 1,6 diamine |
| n- | hexane | | hexane |
| | hexane 1,6 diamine | | hexane 1,6 diamine |
| | histidine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | Histological & biological solutions | | Histological & Biological Solutions – Introduction |
| | hydriodic acid | | hydrogen iodide & hydriodic acid |
| | hydrobromic acid | | hydrobromic acid & hydrogen bromide |
| | hydrochloric acid | | hydrochloric acid & hydrogen chloride |
| | hydrofluoric acid | | hydrofluoric acid & hydrogen fluoride |
| | hydrogen | | hydrogen gas |
| | hydrogen bromide | | hydrobromic acid & hydrogen bromide |
| | hydrogen chloride | | hydrochloric acid & hydrogen chloride |
| | hydrogen fluoride | | hydrofluoric acid & hydrogen fluoride |
| | hydrogen iodide | | hydrogen iodide & hydriodic acid |
| | hydrogen peroxide | | hydrogen peroxide |
| | hydrogen sulphide | | hydrogen sulphide |
| | hydroquinone | benzene-1,4-diol | Benzene diols |
| 3- | hydroxy-4-nitroso-naphthalene-disulphonic acid, Na salt | | Colorimetric Reagents |
| 4- | hydroxyaniline | 4-aminophenol | 4-aminophenol |
| 2- | hydroxybenzoic acid | | hydroxybenzoic acid, 2- |
| | hydroxylamine hydrochloride | | hydroxylamine |
| | hydroxylamine sulphate | | hydroxylamine |
| | Hypo | sodium thiosulphate | sulphates & sulphites |
| | IAA | indole-3- acetic acid | Biochemicals (Plant & Animal hormones) |
| | IBA | | Biochemicals (plant and animal hormones) |
| | IDA | methylated spirits | ethanol (and methylated spirits) |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | IDS | methylated spirits | ethanol (and methylated spirits) |
|  | IMA | methylated spirits | ethanol (and methylated spirits) |
|  | immersion oil |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | imodole | pyrrole | pyrrole |
| 2,2-dihydroxy-1,3- | indandione | ninhydrin | ninhydrin |
|  | indole acetic acid |  | Biochemicals (Plant & Animal hormones) |
|  | Indole Acetic Acid | indole-3- acetic acid | Biochemicals (Plant & Animal hormones) |
|  | indole butyric acid |  | Biochemicals (Plant & Animal hormones) |
|  | indole-3- acetic acid |  | Biochemicals (Plant & Animal hormones) |
|  | Indole-3-ethanoic acid | indole-3- acetic acid | Biochemicals (Plant & Animal hormones) |
| 3- | indolylethanoic acid | indole-3- acetic acid | Biochemicals (Plant & Animal hormones) |
|  | industrial spirits |  | ethanol (and methylated spirits) |
|  | Invertase |  | Biochemicals (Enzymes) |
|  | iodine |  | iodine |
|  | iodine in potassium iodide |  | Dyes and Stains |
|  | iodine solution (aq. in KI) |  | Biochemical tests (Carbohydrates) |
|  | iodine trichloride | diiodine hexachloride | diiodine hexachloride |
| 1- | iodobutane |  | iodobutane, 1- |
|  | iodoethane |  | iodoethane |
|  | iodoform | triiodomethane | trihalogenomethanes |
| 1- | iodopropane |  | iodopropanes |
| 2- | iodopropane |  | iodopropanes |
| 3- | iodopropene |  | halogenopropenes, 3- |
| 3- | iodopropene |  | halogenopropenes, 3- |
|  | iron II ammonium sulphate | ammonium iron II sulphate | ammonium compounds |
|  | iron II chloride |  | iron metal and compounds |
|  | iron II sulphate |  | iron metal and compounds |
|  | iron II sulphide |  | iron metal and compounds |
|  | iron II/III oxide |  | iron metal and compounds |
|  | iron III ammonium citrate | ammonium iron III citrate | ammonium compounds |
|  | iron III chloride |  | iron metal and compounds |
|  | iron III nitrate |  | iron metal and compounds |
|  | iron III oxide |  | iron metal and compounds |
|  | iron III sulphate |  | iron metal and compounds |

| | Name | Listed as | Location |
|---|---|---|---|
| | iron metal | | iron metal and compounds |
| | iron metal | | iron metal and compounds |
| | isoamyl alcohol | 3-methyl butan-1-ol | Alcohols, monohydric |
| | iso-butyl alcohol | | methylpropanols |
| | isoleucine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | isopropyl aalcohol | | Biochemical Tests (Lipids) |
| | iso-propyl alcohol | | propanols |
| | janus green B | | Dyes and Stains |
| | Jeffery's macerating fluid | | Biochemicals – Microscopy Chemicals (Macerating & Narcotising Agents) |
| | Jensen's red | | Dyes and Stains |
| | Kaiserling's fixative | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | kinetin | | Biochemicals (Plant & Animal hormones) |
| | La Cour's fixatives (2BX, 2BE & 2BD) | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | lactase | | Biochemicals (Enzymes) |
| | lacto – fuschin | | Dyes and Stains |
| | lactophenol | | Biochemicals – Microscopy Chemicals (Clearing Agents) |
| | lactopropionic orcein | | Dyes and Stains |
| | lactozym | lactase | Biochemicals (Enzymes) |
| | lamp black | carbon | carbon |
| | laughing gas | nitrous oxide | nitrogen oxides |
| | lead | | lead metal and compounds |
| | lead acetate | | lead metal and compounds |
| | lead bromide | | lead metal and compounds |
| | lead carbonate | | lead metal and compounds |
| | lead chloride | | lead metal and compounds |
| | lead citrate | | lead metal and compounds |
| | lead ethanoate | | lead metal and compounds |
| | lead fluoride | | lead metal and compounds |
| | lead II nitrate | | lead metal and compounds |
| | lead II oxide | | lead metal and compounds |
| | lead II/IV oxide | | lead metal and compounds |
| | lead iodide | | lead metal and compounds |
| | lead IV oxide | | lead metal and compounds |
| | lead perchlorate | | lead metal and compounds |
| | lead sulphate | | lead metal and compounds |
| | lead sulphide | | lead metal and compounds |
| | lead tartrate | | lead metal and compounds |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | Leibermann Burchard Reagent |  | Biochemical Tests (Lipids) |
|  | Leishman's stain |  | Dyes and Stains |
|  | lime (garden) |  | calcium oxide and hydroxide |
|  | lipase |  | Biochemicals (Enzymes) |
|  | litharge |  | lead metal and compounds |
|  | lithium aluminium hydride |  | lithium hydride & lithium aluminium hydride |
|  | lithium bromide |  | lithium compounds |
|  | lithium carbonate |  | lithium compounds |
|  | lithium chloride |  | lithium compounds |
|  | lithium fluoride |  | lithium compounds |
|  | lithium hydride |  | lithium hydride & lithium aluminium hydride |
|  | lithium hydroxide |  | lithium compounds |
|  | lithium metal |  | lithium metal |
|  | lithium nitrate |  | lithium compounds |
|  | Lugol's iodine |  | Dyes and Stains |
|  | lysine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | machine made mineral fibres |  | Machine-made mineral fibres |
|  | magnesium (powder, turnings or ribbon) |  | magnesium metal |
|  | magnesium bromide |  | magnesium compounds |
|  | magnesium carbonate |  | magnesium compounds |
|  | magnesium chloride |  | magnesium compounds |
|  | magnesium chloride / magnesium sulphate |  | Biochemicals – Microscopy chemicals |
|  | magnesium dihydrogen phosphate |  | phosphates |
|  | magnesium hydrogen phosphate |  | phosphates |
|  | magnesium iodide |  | magnesium compounds |
|  | magnesium nitrate V |  | nitrates V |
|  | magnesium phosphate |  | phosphates |
|  | magnesium sulphate |  | magnesium compounds |
|  | malachite green |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | Mallory's triple stain |  | Dyes and Stains |
|  | manganese dioxide | manganese(IV) oxide | manganese(IV) oxide |
|  | manganese II bromide |  | manganese II compounds |
|  | manganese II carbonate |  | manganese II compounds |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | manganese II chloride |  | manganese II compounds |
|  | manganese II ethanoate |  | manganese II compounds |
|  | manganese II nitrate |  | manganese II compounds |
|  | manganese II sulphate |  | manganese II compounds |
|  | manganese IV oxide |  | manganese(IV) oxide |
|  | Man-made mineral fibres |  | Machine-made mineral fibres |
|  | marsh gas | methane | methane |
|  | Maxiren | Chymosin | Biochemicals (Enzymes) |
|  | MDI |  | bis(4-isocyanatophenyl)methane |
|  | MEK | butan-2-one | butan-2-one |
|  | menthol |  | Biochemicals – Microscopy chemicals |
|  | mercaptoethanoic acid |  | Colorimetric Reagents |
|  | mercuric potassium iodide | Nessler’s reagent | Nessler’s reagent |
|  | mercury |  | mercury metal |
|  | mercury compounds |  | mercury compounds |
|  | mercury II chloride |  | mercury compounds |
|  | mercury II oxide |  | mercury compounds |
|  | mercury II potassium iodide | Nessler’s reagent | Nessler’s reagent |
|  | Merkel‘s fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | metaldehyde |  | ethanal and its oligomers |
|  | methanal |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | methanal |  | methanal |
|  | methanal – Hg(II) sublimate |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | methanal / alcohol |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | methanal / dichromate |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | methanal / saline |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | methane |  | methane |
|  | methanoic acid |  | methanoic acid |
|  | methanol |  | methanol |
|  | methionine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| 3- | methybutan-1-ol |  | methybutan-1-ol, 3- |
|  | methyl acetate | methyl ethanoate | methyl ethanoate |
|  | methyl alcohol | methanol | methanol |
|  | methyl chloroform |  | trichloroethane, 1,1,1- |
|  | methyl ethanoate |  | methyl ethanoate |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | methyl ethyl ketone | butan-2-one | butan-2-one |
|  | methyl methacrylate | methyl-2-methylpropenoate | methyl-2-methylpropenoate |
|  | methyl orange |  | indicators |
| 2- | methyl propan-1-ol |  | methylpropanols |
| 2- | methyl propan-2-ol |  | methylpropanols |
|  | methyl propyl ketone | pentan-2-one | pentanones |
|  | methyl red litmus |  | indicators |
|  | methyl violet 6B |  | Dyes and Stains |
|  | methyl-2-methylpropenoate |  | methyl-2-methylpropenoate |
|  | methylamine |  | methylamine |
|  | methylated spirits |  | ethanol (and methylated spirits) |
|  | methylbenzene |  | methylbenzene |
|  | methylene blue |  | Dyes and Stains |
|  | methylene dichloride |  | dichloromethane |
| 4,4′- | methylenediphenyl diisocyanate | bis(4-isocyanatophenyl)methane | bis(4-isocyanatophenyl)methane |
|  | methylphenol |  | methylphenols |
|  | Millon’s reagent |  | Biochemical Tests (Proteins) |
|  | Millon’s reagent |  | Millon’s reagent |
|  | Millon’s Reagent – Cole’s modification |  | Biochemical Tests (Proteins) |
|  | mineral wool |  | Machine-made mineral fibres |
|  | Molisch’s reagent |  | Biochemical tests (Carbohydrates) |
|  | MS-222 |  | Biochemicals – Microscopy chemicals |
|  | naphthalene |  | naphthalene |
|  | naphthalene-1-ol |  | naphthalen-1&2-ols |
|  | naphthalene-2-ol |  | naphthalen-1&2-ols |
|  | naphthas |  | petroleum spirit fractions including naphthas |
| 1- | naphthol | naphthalene-1-ol | naphthalen-1&2-ols |
| 2- | naphthol | naphthalene-2-ol | naphthalen-1&2-ols |
| 1- | naphtholphthalein |  | indicators |
|  | naphthylethylene-diamine hydrochloride |  | Colorimetric Reagents |
|  | natural gas | methane | methane |
|  | Navashin‘s fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | NED hydrochloride |  | Colorimetric Reagents |
|  | neo-cuproin |  | Colorimetric Reagents |
|  | Nessler’s reagent |  | Colorimetric Reagents |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | Nessler's reagent |  | Nessler's reagent |
|  | neutral red |  | Dyes and Stains |
|  | neutral red |  | indicators |
|  | Neutrase |  | Biochemicals (Enzymes) |
|  | nickel |  | nickel metal and compounds |
|  | nickel bromide |  | nickel metal and compounds |
|  | nickel carbonate |  | nickel metal and compounds |
|  | nickel chloride |  | nickel metal and compounds |
|  | nickel nitrate |  | nickel metal and compounds |
|  | nickel sulphate |  | nickel metal and compounds |
|  | nickel tetracarbonyl |  | nickel metal and compounds |
|  | nicotine |  | Biochemicals (Plant & Animal hormones) |
|  | nigrosine |  | Dyes and Stains |
|  | ninhydrin |  | ninhydrin |
|  | nitric acid |  | nitric acid |
|  | nitrobenzene |  | nitrobenzene |
|  | nitrogen monoxide |  | nitrogen oxides |
| 3- | nitrophenol |  | indicators |
| 4- | nitrophenol |  | indicators |
| 2- | nitrophenol |  | nitrophenols |
| 3- | nitrophenol |  | nitrophenols |
| 4- | nitrophenol |  | nitrophenols |
|  | nitrophenol |  | nitrophenols |
|  | nitroso-R-salt |  | Colorimetric Reagents |
|  | nitrous oxide |  | nitrogen oxides |
|  | nuloidin |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | oct-1-ene |  | oct-1-ene |
|  | octane |  | octane |
|  | oil of vitriol | sulphuric acid | sulphuric acid |
|  | oleum |  | sulphuric acid |
|  | orcein acetic |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | orceine acetic |  | Dyes and Stains |
|  | ornithine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | osmic acid |  | Biochemical Tests (Lipids) |
|  | osmic acid | osmium VIII oxide | osmium(VIII) oxide |
|  | osmium tetroxide |  | Biochemical Tests (Lipids) |
|  | osmium tetroxide | osmium VIII oxide | osmium(VIII) oxide |
|  | osmium VIII oxide |  | osmium(VIII) oxide |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | osmium(VII) oxide |  | Biochemical Tests (Lipids) |
|  | osmium(VIII) oxide (osmium tetroxide) |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | oxalic acid |  | ethanedioic acid and ethanedioates |
|  | oxidation by hydrogen peroxide |  | Colorimetric Reagents |
|  | oxidation by iodate(VII) (periodate) |  | Colorimetric Reagents |
|  | ozone | trioxygen | trioxygen |
|  | Pampel's fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | pancreatin |  | Biochemicals (Enzymes) |
|  | pancrelipase | Lipase | Biochemicals (Enzymes) |
|  | papain |  | Biochemicals (Enzymes) |
|  | paradichlorbenzene |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | paraformaldehyde | poly(methanal) | poly(methanal) |
|  | paraldehyde |  | ethanal and its oligomers |
|  | pectic enzyme | Pectinase | Biochemicals (Enzymes) |
|  | pectinase |  | Biochemicals (Enzymes) |
|  | pectinesterase |  | Biochemicals (Enzymes) |
|  | pectolase | pectinase | Biochemicals (Enzymes) |
|  | pentan-1-ol |  | pentanols |
|  | pentan-2-ol |  | pentanols |
|  | pentan-2-one |  | pentanones |
|  | pentan-3-one |  | pentanones |
| n- | pentane |  | pentane |
| n- | pentane |  | pentane |
|  | pentyl ethanoate |  | pentyl ethanoate |
|  | pepsin |  | Biochemicals (Enzymes) |
|  | pepsin |  | Biochemicals (Enzymes) |
|  | peptone |  | Biochemicals (Enzymes) |
|  | perchloric acid |  | chloric acid |
|  | periodic acid Schiff – (PAS) reaction |  | Biochemical tests (Carbohydrates) |
|  | PET ethers |  | petroleum spirit fractions including naphthas |
|  | petroleum ethers |  | petroleum spirit fractions including naphthas |
|  | petroleum spirit |  | petroleum spirit fractions including naphthas |
| 1,10- | phenanthroline |  | Colorimetric Reagents |
|  | phenol |  | phenol |
|  | phenol / 1,2-dimethylbenzene |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | phenol red |  | indicators |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | phenolphthalein |  | indicators |
|  | phenolphthalein |  | phenolphthalein |
|  | phenyl bromide |  | bromobenzene |
|  | phenyl chloride |  | chlorobenzene |
|  | phenylalanine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | phenylamine |  | phenylamine |
|  | phenylamine blue |  | Dyes and Stains |
|  | phenylammonium chloride |  | Biochemical tests (Carbohydrates) |
|  | phenylammonium chloride |  | phenylammonium chloride |
|  | phenylammonium sulphate |  | Biochemical tests (Carbohydrates) |
| m- | phenylenediamine | benzene1,3-diamine | benzene-(1,4),(1,3) & (1,2)-diamine |
| o- | phenylenediamine | benzene1,2-diamine | benzene-(1,4),(1,3) & (1,2)-diamine |
| p- | phenylenediamine | benzene1,4-diamine | benzene-(1,4),(1,3) & (1,2)-diamine |
|  | phenylethene |  | phenylethene |
|  | phenylhydrazine |  | Biochemical tests (Carbohydrates) |
|  | phenylhydrazine |  | phenylhydrazine |
|  | phenylhydrazine hydrochloride |  | phenylhydrazine |
|  | phenylmethanol |  | phenylmethanol |
| 1,3,5- | phloroglucinol | Benzene-1,3,5-triol | benzene triols |
|  | phloroglucinol |  | Biochemical tests (Carbohydrates) |
|  | phloroglucinol |  | Dyes and Stains |
|  | Phosphatase |  | Biochemicals (Enzymes) |
|  | phosphoric acid & sodium tungstate |  | Colorimetric Reagents |
|  | phosphoric V acid |  | phosphoric acid |
|  | phosphorus III chloride |  | phosphorus compounds |
|  | phosphorus pentachloride | phosphorus V chloride | phosphorus compounds |
|  | phosphorus trichloride | phosphorus III chloride | phosphorus compounds |
|  | phosphorus V chloride |  | phosphorus compounds |
|  | phosphorus V oxide |  | phosphorus compounds |
|  | phosphoruus pentoxide | phosphorus V oxide | phosphorus compounds |
|  | Phosphovanado-molybdate method |  | Colorimetric Reagents |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | phthalic anhydride | benzene-1,2-dicarboxylic anhydride | benzene-1,2-dicarboxylic anhydride |
|  | picric acid |  | Dyes and Stains |
|  | picric acid |  | trinitrophenol, 2,4,6- |
|  | platinum metal |  | silver & other precious metals |
|  | poly(methanal) |  | poly(methanal) |
|  | polyvinyl lactophenol |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | potassium |  | potassium metal |
|  | potassium antimony III tartrate |  | antimony metal and compounds |
|  | potassium bisulphate |  | sulphates & sulphites |
|  | potassium bromate V |  | bromates V |
|  | potassium bromide |  | potassium compounds |
|  | potassium carbonate |  | potassium compounds |
|  | potassium chlorate V |  | chlorates V |
|  | potassium chlorate VII |  | chlorates VII |
|  | potassium chloride |  | potassium compounds |
|  | potassium chromate VI |  | chromates VI |
|  | potassium chromium III sulphate |  | chromium metal and compounds |
|  | potassium cyanide |  | Biochemicals – Microscopy chemicals |
|  | potassium cyanide |  | cyanides |
|  | potassium dichromate |  | dichromates VI |
|  | potassium dihydrogen phosphate |  | phosphates |
|  | potassium ethanedioate |  | ethanedioic acid and ethanedioates |
|  | potassium ethanoate |  | potassium compounds |
|  | potassium ethanolate | potassium ethoxide | methoxides and ethoxides |
|  | potassium ethoxide |  | methoxides and ethoxides |
|  | potassium ferricyanide | potassium hexacyanoferrate III | potassium hexacyanoferrates |
|  | potassium ferrocyanide | potassium hexacyanoferrate II | potassium hexacyanoferrates |
|  | potassium fluoride |  | fluorides |
|  | potassium hexachloroplatinate |  | hexachloroplatinic acid and hexachloroplatinates |
|  | potassium hexacyanoferrate II |  | potassium hexacyanoferrates |
|  | potassium hexacyanoferrate III |  | potassium hexacyanoferrates |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | potassium hydrogen carbonate |  | potassium compounds |
|  | potassium hydrogen ethanoate-1-ethanedioic acid |  | potassium compounds |
|  | potassium hydrogen phosphate |  | phosphates |
|  | potassium hydrogen sulphate |  | sulphates & sulphites |
|  | potassium hydroxide |  | potassium hydroxide |
|  | potassium iodate V |  | iodates |
|  | potassium iodate VII |  | iodates |
|  | potassium iodide |  | potassium compounds |
|  | potassium manganate VII |  | potassium manganate VII |
|  | potassium metabisulphite |  | sulphates & sulphites |
|  | potassium methanolate | potassium methoxide | methoxides and ethoxides |
|  | potassium methoxide |  | methoxides and ethoxides |
|  | potassium molybdate |  | potassium compounds |
|  | potassium nitrate III |  | nitrates III |
|  | potassium nitrate V |  | nitrates V |
|  | potassium nitrite | potassium nitrate III | nitrates III |
|  | potassium oxalate |  | ethanedioic acid and ethanedioates |
|  | potassium perchlorate | potassium chlorate VII | chlorates VII |
|  | potassium periodate | potassium iodate VII | iodates |
|  | potassium permanganate | potassium manganate VII | potassium manganate VII |
|  | potassium peroxodisulphate VI |  | peroxodisulphates VI |
|  | potassium persulphate |  | peroxodisulphates VI |
|  | potassium phosphate |  | phosphates |
|  | potassium sodium tartrate |  | potassium compounds |
|  | potassium sulphate |  | sulphates & sulphites |
|  | potassium sulphate IV |  | sulphates & sulphites |
|  | potassium sulphate VI |  | sulphates & sulphites |
|  | potassium sulphite |  | sulphates & sulphites |
|  | potassium tetroxalate |  | potassium compounds |
|  | potassium thiocyanate |  | Colorimetric Reagents |
|  | potassium thiocyanate |  | thiocyanates |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | proline |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | propan-1-ol |  | propanols |
|  | propan-2-ol |  | Biochemical Tests (Lipids) |
|  | propan-2-ol |  | propanols |
|  | propanal |  | propanal |
|  | propane-1,2,3-triol |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | propanoic acid |  | propanoic acid |
|  | propanoic orcein |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | propanone |  | propanone |
|  | propanone – 1,2-dimethylbenzene |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | propioaldehyde | propanal | propanal |
|  | propionic acid | propanoic acid | propanoic acid |
| n- | propyl acetate | propyl ethanoate | propyl ethanoate |
| n- | propyl alcohol |  | propanols |
| iso- | propyl alcohol |  | propanols |
| n- | propyl chloride |  | chloropropanes |
| sec- | propyl chloride |  | chloropropanes |
|  | propyl ethanoate |  | propyl ethanoate |
| n- | propyl iodide |  | iodopropanes |
| sec- | propyl iodide |  | iodopropanes |
|  | Protease |  | Biochemicals (Enzymes) |
|  | pyridine |  | pyridine |
|  | pyrocatechol |  | Benzene diols |
|  | pyrogallol |  | benzene triols |
|  | pyrolusite | manganese(IV) oxide | manganese(IV) oxide |
|  | pyrrole |  | pyrrole |
|  | quicklime |  | calcium oxide and hydroxide |
|  | quicksilver |  | mercury metal |
|  | quinol |  | Benzene diols |
|  | quinoline |  | quinoline |
|  | RCF |  | Machine-made mineral fibres |
|  | red lead oxide |  | lead metal and compounds |
|  | refractory ceramic fibres |  | Machine-made mineral fibres |
|  | Rennet | Chymosin | Biochemicals (Enzymes) |
|  | Rennilase | Chymosin | Biochemicals (Enzymes) |
|  | Rennin | Chymosin | Biochemicals (Enzymes) |
|  | resorcinol |  | Benzene diols |

| | Name | Listed as | Location |
|---|---|---|---|
| | Ribose Nucleic Acid | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | RNA | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | Rochelle salt | potassium sodium tartrate | potassium compounds |
| | Rossman‘s fluid | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | Rust | iron III oxide | iron metal and compounds |
| | Sacchs solutions | | Biochemicals (Plant & Animal hormones) |
| | Sacchs solutions | | Biochemicals (plant and animal hormones) |
| | safranine | | Dyes and Stains |
| | Sakaguchi test | | Biochemical Tests (Proteins) |
| | salicylic acid | | hydroxybenzoic acid, 2- |
| | Sandell’s reagent | | Biochemical tests (Carbohydrates) |
| | Schaudinn‘s fixative | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | Schiff‘s reagent | | Dyes and Stains |
| | Schultze’s solution | | Biochemical tests (Carbohydrates) |
| | Schultze’s solution | | Biochemical Tests (Lipids) |
| | Schultze’s solution | | Dyes and Stains |
| | Schulze’s macerating fluid | | Biochemicals – Microscopy Chemicals (Macerating & Narcotising Agents) |
| | sebacoyl chloride | | decanedioyl dichloride |
| | Serine | | Biochemicals (Nucleic acids, Amino acids & other proteins) |
| | silicon tetrachloride | | silicon tetrachloride |
| | silver bromide | | silver & other precious metals |
| | silver chloride | | silver & other precious metals |
| | silver iodide | | silver & other precious metals |
| | silver metal | | silver & other precious metals |
| | silver nitrate | | silver & other precious metals |
| | silver oxide | | silver & other precious metals |
| | slaked lime | | calcium oxide and hydroxide |
| | Smith‘s fixative | | Biochemicals – Microscopy Chemicals (Fixatives) |
| | sociun acetate | | sodium compounds |
| | soda lime | | soda lime |
| | sodium | | sodium metal |
| | sodium azide | | sodium compounds |
| | sodium bismuthate | | bismuth metal and compounds |
| | sodium bisulphate | | sulphates & sulphites |
| | sodium borohydride | | boron compounds |
| | sodium bromate V | | bromates V |
| | sodium bromide | | sodium compounds |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | sodium carbonate |  | sodium compounds |
|  | sodium carbonate/hydrogen carbonate |  | sodium compounds |
|  | sodium chlorate I |  | chlorates I |
|  | sodium chlorate V |  | chlorates V |
|  | sodium chlorate VII |  | chlorates VII |
|  | sodium chloride |  | sodium compounds |
|  | sodium chromate VI |  | chromates VI |
|  | sodium citrate |  | sodium compounds |
|  | sodium cyanides |  | cyanides |
|  | sodium dichromate |  | dichromates VI |
|  | sodium dihydrogen phosphate |  | phosphates |
|  | sodium disulphate |  | sulphates & sulphites |
|  | sodium dithionite |  | sulphates & sulphites |
|  | sodium dodecyl sulphate |  | sodium compounds |
|  | sodium ethanedioate |  | ethanedioic acid and ethanedioates |
|  | sodium ethanoate |  | sodium compounds |
|  | sodium ethanolate | sodium ethoxide | methoxides and ethoxides |
|  | sodium ethoxide |  | methoxides and ethoxides |
|  | sodium fluoride |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | sodium fluoride |  | fluorides |
|  | sodium formate |  | sodium compounds |
|  | sodium hexacobaltinitrate |  | sodium compounds |
|  | sodium hydrogen carbonate |  | sodium compounds |
|  | sodium hydrogen phosphate |  | phosphates |
|  | sodium hydrogen sulphate |  | sulphates & sulphites |
|  | sodium hydroide |  | sodium hydride |
|  | sodium hydrosulphite |  | sulphates & sulphites |
|  | sodium hydroxide |  | sodium hydroxide |
|  | sodium hypochlorite |  | chlorates I |
|  | sodium iodate V |  | iodates |
|  | sodium iodate VII |  | iodates |
|  | sodium iodide |  | sodium compounds |
|  | sodium mercury amalgam |  | sodium metal |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | sodium metabisulphite |  | sulphates & sulphites |
|  | sodium metavanadate V |  | vanadium and compounds |
|  | sodium methanoate |  | sodium compounds |
|  | sodium methanolate | sodium methoxide | methoxides and ethoxides |
|  | sodium methoxide |  | methoxides and ethoxides |
|  | Sodium molybdate reagent with ascorbic added. |  | Colorimetric Reagents |
|  | sodium nitrate III |  | nitrates III |
|  | sodium nitrate V |  | nitrates V |
|  | sodium nitrite | sodium nitrate III | nitrates III |
|  | sodium nitroprusside |  | sodium compounds |
|  | sodium octadec-9-enoate |  | sodium compounds |
|  | sodium octadecanoate |  | sodium compounds |
|  | sodium oleate | sodium octadec-9-enoate | sodium compounds |
|  | sodium oxalate |  | ethanedioic acid and ethanedioates |
|  | sodium perchlorate | sodium chlorate VII | chlorates VII |
|  | sodium periodate | sodium iodate VII | iodates |
|  | sodium peroxide |  | peroxides |
|  | sodium peroxodisulphate VI |  | peroxodisulphates VI |
|  | sodium persulphate |  | peroxodisulphates VI |
|  | sodium phosphate |  | phosphates |
|  | sodium sesquicarbonate |  | sodium compounds |
|  | sodium silicate |  | sodium compounds |
|  | sodium stearate | sodium octadecanoate | sodium compounds |
|  | sodium sulphate |  | sulphates & sulphites |
|  | sodium sulphate IV |  | sulphates & sulphites |
|  | sodium sulphate VI |  | sulphates & sulphites |
|  | sodium sulphide |  | sodium compounds |
|  | sodium sulphite |  | sulphates & sulphites |
|  | sodium tauroglycholate |  | sodium compounds |
|  | sodium thiocyanate |  | thiocyanates |
|  | sodium thiosulphate |  | sulphates & sulphites |
|  | sodium thiosulphate (hypo) |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | sodium trioxovanadate |  | vanadium and compounds |
|  | sodium vanadate V |  | vanadium and compounds |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | sodium-mercury amalgam |  | sodium-mercury amalgam |
|  | Solochrome Black |  | Colorimetric Reagents |
|  | Stearic alcohol | Octadecan-1-ol | Alcohols, monohydric |
|  | styrene | phenylethene | phenylethene |
|  | Subtilisin |  | Biochemicals (Enzymes) |
|  | Sudan black |  | Biochemical Tests (Lipids) |
|  | Sudan black |  | Dyes and Stains |
|  | Sudan III |  | Biochemical Tests (Lipids) |
|  | Sudan III |  | Dyes and Stains |
|  | Sudan IV |  | Biochemical Tests (Lipids) |
|  | Sudan IV |  | Dyes and Stains |
|  | Sudan red |  | Dyes and Stains |
|  | sulphamic acid |  | sulphamic acid |
|  | sulphanilamide & NED hydrochloride (naphthylethylene-diamine hydrochloride |  | Colorimetric Reagents |
| p- | sulphanilic acid |  | sulphanilic acid |
|  | sulphur |  | sulphur |
|  | sulphur dichloride dioxide |  | sulphur dichloride dioxide |
|  | sulphur dichloride oxide |  | sulphur dichloride oxide |
|  | sulphur dioxide |  | sulphur dioxide |
|  | sulphur monochloride | disulphur dichloride | disulphur dichloride |
|  | sulphuric acid |  | sulphuric acid |
|  | sulphuryl chloride | sulphur dichloride dioxide | sulphur dichloride dioxide |
|  | Susa fixative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | Termamyl | Amylase | Biochemicals (Enzymes) |
|  | tetrachloroethene |  | trichloroethene & tetrachloroethene |
|  | tetrachloromethane |  | Biochemicals – Microscopy chemicals |
|  | tetrachloromethane |  | tetrachloromethane |
|  | tetrachlorosilane |  | silicon tetrachloride |
| 1,2,3,4- | tetrahydrobenzene | cyclohexene | cyclohexene |
|  | tetrahydrofuran |  | tetrahydrofuran |
|  | thermit mixture |  | thermit mixture |
|  | THF | tetrahydrofuran | tetrahydrofuran |
|  | Thiazole Yellow G |  | Colorimetric Reagents |
|  | Thiocarbamide |  | Biochemicals (Plant & Animal hormones) |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | Thiocarbamide |  | Biochemicals (plant and animal hormones) |
|  | thiocarbamide | thiourea | thiourea |
|  | thioglycollic acid |  | Colorimetric Reagents |
|  | thionyl chloride | sulphur dichloride oxide | sulphur dichloride oxide |
|  | thiourea | Thiocarbamide | Biochemicals (Plant & Animal hormones) |
|  | thiourea |  | thiourea |
|  | Threonine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | Thymine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | thymol blue |  | indicators |
|  | thymolphthalein |  | indicators |
|  | thyroxine |  | Biochemicals (Plant & Animal hormones) |
|  | tin II chloride |  | tin(II) compounds |
|  | tin II sulphate |  | tin(II) compounds |
|  | tin IV chloride |  | tin IV compounds |
|  | tin IV iodide |  | tin IV compounds |
|  | titan yellow |  | Colorimetric Reagents |
|  | titan yellow |  | indicators |
|  | toluene | methylbenzene | methylbenzene |
|  | trichloriacetic acid | trichloroethanoic acid | chloroethanoic acids |
| 1,1,1- | trichloro-2-methyl-propan-2-ol |  | Biochemicals – Microscopy chemicals |
| 1,1,1- | trichloroethane |  | trichloroethane, 1,1,1- |
| 2,2,2- | trichloroethanediol |  | Biochemicals – Microscopy chemicals |
|  | trichloroethanoic acid |  | chloroethanoic acids |
|  | trichloroethene |  | trichloroethene & tetrachloroethene |
|  | trichloromethane |  | Biochemicals – Microscopy chemicals |
|  | trichloromethane |  | trihalogenomethanes |
| 1,2,3- | trihydroxybenzene |  | benzene triols |
|  | triiodomethane |  | trihalogenomethanes |
|  | trinitrophenol |  | Dyes and Stains |
| 2,4,6- | trinitrophenol |  | trinitrophenol, 2,4,6- |
|  | trioxygen |  | trioxygen |
|  | trypsin |  | Biochemicals (Enzymes) |
|  | tryptophan |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | turpentine |  | turpentine |
|  | tyrosine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |

|  | Name | Listed as | Location |
|---|---|---|---|
|  | uracil |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | urease |  | Biochemicals (Enzymes) |
|  | uridine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | valine |  | Biochemicals (Nucleic acids, Amino acids & other proteins) |
|  | Van Gieson‘s stain |  | Dyes and Stains |
|  | vanadium V oxide |  | vanadium and compounds |
|  | vinyl acetate |  | ethenyl ethanoate |
|  | vitriol | sulphuric acid | sulphuric acid |
|  | Xanthoproteic test |  | Biochemical Tests (Proteins) |
|  | xylene |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | xylene | dimethylbenzene | dimethylbenzenes |
|  | xylol |  | Biochemicals – Microscopy Chemicals (Clearing Agents) |
|  | xylol | dimethylbenzene | dimethylbenzenes |
|  | Yttrium oxide |  | silver & other precious metals |
|  | Zenker‘s fixative |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | Zenker‘s methanal |  | Biochemicals – Microscopy Chemicals (Fixatives) |
|  | zinc (powder, granules, foil) |  | zinc metal |
|  | zinc chloride |  | zinc compounds |
|  | zinc chromate |  | zinc compounds |
|  | zinc iodide |  | zinc compounds |
|  | zinc nitrate |  | zinc compounds |
|  | zinc oxide |  | zinc compounds |
|  | zinc sulphate |  | zinc compounds |
|  | Zirkle’s fluid |  | Biochemicals – Microscopy Chemicals (Fixatives) |

# Alcohols, monohydric

This page covers various monohydric alcohols that do not have their own pages. The most common ones such as ethanol and propanol can be found in their own entries.
These alcohols are colourless liquids that are slightly soluble or insoluble in water, but miscible with other alcohols or ethers, except cetyl and steryl alcohols that are waxy white solids.
Other names: Hexadecan-1-ol = Cetyl alcohol, octadecan-1-ol (stearyl alcohol), 3-methyl butan-1-ol (isoamyl alcohol)

## Hazards

These alcohol are of fairly low hazard. They may cause slight irritation to eyes and skin, even if not classified as such, and in large concentrations can cause nausea, dizziness, headache and narcosis. Prolonged or repeated exposure can sometimes cause dermatitis.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hexan-1-ol, heptan-1-ol | Warning | Acute toxin (oral) Cat 4 | H302: Harmful if swallowed |  |
| octan-1-ol, octan-2-ol | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2 | H315: Causes skin irritation<br>H319: Causes severe eye irritation |  |
| hexadecan-1-ol, octadecan-1-ol | Warning | No significant hazard | | |

## Incompatibility

Strong oxidising agents, strong acids, acid chlorides and acid anhydrides.

## Handling

Wear nitrile or pvc gloves and eye protection. While not extremely flammable, avoid heat, flames and sparks.
FF – WS, DP & VL.

## Storage

With organics in general store.

## Disposal

Due to the insolubility of these compounds, and the inability to easily convert them to compounds that can be simply disposed of, the only real option is to store for collection by a specialist contractors.

## Spillage

The hexadecan-1-ol and octadecan-1-ol, as solids, can just be swept up. The others should be absorbed onto mineral absorbent and then they in turn can be swept up. The solid can be placed in the domestic waste bin.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth with water. Don't induce vomiting. Seek medical attention.

**Lungs**
Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.
**Skin**
Wash well with soap and water. Obtain medical attention if irritation persists or area affected is large.

## Alcohols, other

Description: The ‘oxy’ alcohols belong to a class of compound called ‘glycol ethers’. They are colourless liquids, miscible with water and a range of other liquids and they are widely used in industry as solvents. Cholesterol and menthol are waxy solids sparingly soluble in water but soluble in many other solvents.
Opresol is a 1% (v/v) solution of 2-phenoxyethanol dissolved in diethylene glycol. Its hazards are the same as diethylene glycol.

### Hazards

Glycol ethers, particularly the lower MW ones, are flammable and are likely to be harmful if ingested or if the vapour is inhaled Ethoxyethanol is TOXIC by inhalation). Ethoxy and methoxyethanols are also REPRODUCTIVE TOXINS. Methoxy and ethoxy ethanols can be readily absorbed through the skin leading to systemic toxicity. Mentol, cholesterol and similar compounds are either harmless or slight irritants.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 2-methoxyethanol | Danger | Flammable liquid Cat 3<br>Acute Toxin Cat 4 (oral, dermal inhalation)<br>Reproductive toxin Cat 1B | H226: flammable liquid and vapour<br>H302: Harmful if swallowed<br>H312: Harmful in contact with skin<br>H332: Harmful if inhaled<br>H360FD: May damage fertility or the unborn child |  |
| 2-ethoxyethanol | Danger | Flammable liquid Cat 3<br>Acute Toxin Cat 4 (oral)<br>Acute Toxin Cat 3 (inhalation)<br>Reproductive toxin Cat 1B | H226: flammable liquid and vapour<br>H302: Harmful if swallowed<br>H331: Toxic if inhaled<br>H360FD: May damage fertility or the unborn child |  |
| 2-phenoxyethanol | Warning | Acute Toxin Cat 4 (oral)<br>Eye irritant Cat 2 | H302: Harmful if swallowed.<br>H319: Causes serious eye irritation |  |
| 1-phenoxypropan-2-ol | Warning | Eye irritant Cat 2 | H319: Causes serious eye irritation |  |
| menthol | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2 | H315: Causes skin irritation<br>H319: Causes serious eye irritation |  |
| diethylene glycol | Warning | Acute Toxin Cat 4 (oral) | H302: Harmful if swallowed. |  |
| cholesterol | | No significant hazard | | |

## Incompatibility

Keep all away from strong oxidising agents. Methoxy and ethoxy ethanol should also be kept away from strong bases and aluminium and magnesium (methoxyethanol) or copper (ethoxyethanol)

## Handling

Wear nitrile or pvc gloves and eye protection. Avoid inhalation of vapour of ethoxyethanol in particular. Avoid heat, flames and sparks when handling flammable substances.
FF – WS, DP & VL.

## Storage

With organics in general store.

## Disposal

Due to the insolubility of these compounds, and the inability to easily convert them to compounds that can be simply disposed of, the only real option is to store for collection by a specialist contractors.

## Spillage

The cholesterol and menthol can just be swept up. The others should be absorbed onto mineral absorbent and then they in turn can be swept up. The solid can be placed in the domestic waste bin.

## Remedial Measures

**Eyes**
Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

**Mouth**
Wash out mouth with water. Don’t induce vomiting. Seek medical attention.

**Lungs**
Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

**Skin**
Wash well with soap and water. Obtain medical attention if irritation persists. For ethoxy and methoxy ethanols, obtain medical attention immediately.

# Alcohols, polyhydric

Description: The diols and triols are colourless liquids that are miscible with water. Sorbitol, mannitol and xylitol are described as ‘sugar alcohols’ and are white crystalline solids that are soluble in water, as is 2,2,2-trichloro 1,1-diol

## Hazards

These alcohol are of fairly low hazard. They may cause slight irritation to eyes and skin, even if not classified as such, and in large concentrations can cause nausea, dizziness, headache and narcosis. Prolonged or repeated exposure can sometimes cause dermatitis. 2,2,2-trichloro 1,1-diol (chloral hydrate) was used as a sleeping remedy in the past (‘knockout drops’) and can have narcotic or toxic effects if ingested.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethane-1,2-diol | Warning | Acute toxin (oral) Cat 4 | H302: Harmful if swallowed. |  |
| propane-1,2-diol,<br>propane-1,2,3-triol | | | No significant hazard | |
| sorbitol, mannitol,<br>Xylitol | | | No significant hazard | |
| 2,2,2-trichloroethane-1,1-diol | Danger | Acute toxin (oral) Cat 3<br>Skin irritant Cat 2<br>Eye irritant cat 2 | H301: Toxic if swallowed<br>H315: Causes skin irritation<br>H319: May cause serious eye irritation |   |

## Incompatibility

Ethane and propane diols should be kept away from strong oxidising or reducing agents agents, strong acids and bases, acid chlorides and acid anhydrides. propane-1,2,3-triol should be kept away from strong oxidising agents and bases and the sugar alcohols should be kept away from strong oxidising agents. 2,2,2-trichloro 1,1-diol is incompatible with alkalis, group 2 metals, oxidising agents, iodides, tetraborates and ethanol.id chlorides, Acid anhydrides

## Handling

Low hazard. Wear gloves or eye protection if you are prone to irritation. While not very flammable, avoid heat, flames and sparks with the diols. 2,2,2-trichloro 1,1-diol, wear gloves and eye protection.

**FF** – WS, DP & VL.

## Storage

With organics in general store.

## Disposal

Wash to waste with copious quantities of cold running water. Alternatively store for collection by a specialist contractors.

## Spillage

The sugar alcohols can just be swept up. The others should be absorbed onto mineral absorbent and then they in turn can be swept up. The solid can be placed in the domestic waste bin. 2,2,2-trichloro 1,1-diol should be swept up and treated as for disposal

## Remedial Measures

**Eyes**

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

**Mouth**

Wash out mouth with water. Don’t induce vomiting. Seek medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

**Skin**

Wash well with soap and water.  Obtain medical attention if irritation persists.

## Aluminium metal

Description: Grey metallic powder or grey, sometimes shiny metal sheet or foil.

### Hazards

Though inert the dust is harmful if inhaled in quantity. Possibility of dust explosion when exposed to flame. Hydrogen is evolved with acids, alkalis and even from water. Damp powder will self-heat and may ignite

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| aluminium powder (pyrophoric) | Danger | Flammable solid Category 1<br>Water reactive Category 2 | H250: Catches fire spontaneously if exposed to air<br>H261: In contact with water releases flammable gases |  |
| aluminium powder (stabilised) | Danger | Flammable solid Category 2<br>Water reactive Category 2 | H228: Flammable solid.<br>H261: In contact with water releases flammable gases |  |

### Incompatibility

With strong oxidising agents there is a possibility of explosions e.g. a mixture with oxidising agents including chlorates(V), metal oxides, sulphur, halogens, ammonium nitrate, silver nitrate. It can react violently with halogenated hydrocarbons with formation of carbonyl chloride, carbon dioxide, alcohols (often after a long induction period). With mercury and mercury salts the oxide layer will be removed, the metal then rapidly oxidises and may undergo self-ignition.

### Handling

Wear eye protection and pvc gloves. Powder must be handled carefully to avoid dust rising. Remove samples out of bottle at a distance away from Bunsen and replace lid after removing what is required. For many reactions use coarse powder, granules or foil. **FF** – DP, S. NOT halon or $CO_2$.

### Storage

In general store with reducing agents. Keep dry and away from mercury and mercury salts. Containers may develop pressure.

SSL – 3 years max for fine powder, which can react exothermically with moisture in the air to produce hydrogen gas. Container can explode from the increase in pressure.

### Disposal

Wear eye protection and pvc gloves. Extinguish sources of ignition. Very small amounts can be dissolved in dil hydrochloric acid and run to waste. Mix larger amounts with 10-20 volumes of dry sand, seal in plastic bag and store for disposal by waste contractor.

### Spillage

Wear eye protection and pvc gloves. Remove all sources of ignition. Carefully sweep up to avoid raising dust and treat as in **Disposal**.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Treat as for non-toxic foreign body in the eye. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Seek medical attention.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

## Aluminium halides

Description: Solids, very hygroscopic. Used in organic syntheses.

### Hazards

Corrosive causing painful skin and eye burns. Inhalation of the dust produces irritation or burns of the mucous membranes. If ingested causes severe internal burns. Containers may develop pressure due to reaction with atmospheric moisture. The hydrate is much less corrosive.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| aluminium chloride | Danger | Skin Corrosive Cat 1B | H314: Causes severe skin burns and eye damage. |  |
| aluminium bromide | Danger | Acute toxin (oral) Cat 4<br>Skin Corrosive Cat 1B | H302 Harmful if swallowed.<br>H314 Causes severe skin burns and eye damage.<br>EUH014 Reacts violently with water |   |
| aluminium iodide | Danger | Skin Corrosive Cat 1B<br>Skin sensitiser Cat 1 | H314 Causes severe skin burns and eye damage.<br>H317 May cause an allergic skin reaction.<br>EUH014 Reacts violently with water. |   |

### Incompatibility

With water they react violently, get hot and form hydrogen halides (chloride, bromide and iodide). Old samples become coated with a yellow layer and often have an initial induction period.

### Handling

Wear goggles (BS EN 166 3) and rubber gloves. Powders must be handled carefully to avoid raising dust. Because of a slow reaction with water vapour taken in when the lid was previously removed, pressure may have built up inside closed containers – open with caution. Keep lid off for shortest practicable time so as to admit the minimum of damp air.

### Storage

In general store with acids. Keep in small quantities and store as a corrosive volatile in larger container with desiccant.

**SSL –** 3 years max. Water reactive and over time reacts with moisture from the air. If the lid becomes cemented, the container can explode from the increase in pressure.

### Disposal

For small quantities such as washings from glassware – In fume cupboard, add a little at a time to a large quantity of water, allowing time for reaction before adding the next portion. Wash to waste with running water. If quantity is large neutralise the acid produced before running to waste.

## Spillage

Wear rubber gloves and a face shield. Shovel into dry bucket, transport to safe open site and cautiously add, in small portions, to a large volume of water. After the reaction is completed run to waste with a large volume of water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Aluminium compounds

## Hazards

Aluminium compounds are generally of low hazard though many of them are moderate to severe eye and skin **irritants**.  The nitrate is an oxidising agent as well and contact with combustible material may cause fire. Dust particles, especially of the oxide and the silicates can be hazardous and should not be inhaled.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| aluminium ethanoate,<br>aluminium oxide,<br>aluminium potassium sulphate,<br>aluminium silicate | | No significant hazards | | |
| aluminium nitrate | Warning | Oxidising solid Cat 3<br>Skin irritant Cat 2<br>Eye irritant Cat 2B | H272: May intensify fire; oxidiser.<br>H315: Causes skin irritation.<br>H319: Causes severe eye irritation. |  |
| aluminium ammonium sulphate-12-water | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H315: Causes skin irritation.<br>H319: Causes severe eye irritation.<br>H335: May cause respiratory irritation |  |
| aluminium sulphate | Danger | Serious eye damage Cat 1 | H318: causes serious eye damage |  |

## Incompatibility

Most of these will react to some degree with strong bases (Aluminium ammonium sulphate can release toxic fumes of ammonia).

## Handling

Wear goggles (BS EN 166 3). Avoid raising dust from compounds in the solid state. Intense/prolonged heating of aluminium ammonium sulphate can produce toxic fumes. Wash hands after use.

## Storage

Securely in store. Keep nitrate with oxidising agents.

## Disposal

Reasonably small amounts can be bagged and put in with household waste or washed to waste with copious quantities of water. Nitrate should not be placed in dry waste.

## Spillage

Wear plastic gloves and eye protection. Sweep up with a dustpan and brush and treat as for **Disposal**.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

## Amides

Description: white powders or crystals.

### Hazards

Most of these are of relatively low hazard but prop-2-enamide is toxic (cat 3) and carcinogenic(Cat 1B) while phenylthiocarbamide is extremely toxic (Cat 1). The others no more than are harmful or irritant. Prop-2-enamide and PTC are Not Recommended as they are significantly hazardous and there is generally no need for their use in the chemistry classroom. The inorganic amides of potassium and (more commonly used) sodium are violently water reactive and should be used with caution.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| prop-2-enamide | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Skin Irritant Cat 2<br>Eye Irritant Cat 2<br>Skin sensitiser Cat 1<br>Mutagen Cat 1B<br>Carcinogen Cat 1B<br>Reproductive Toxin Cat 2<br>Specific Target Organ Toxin on Repeated Exposure Cat 1 | H301: toxic if swallowed<br>H312: harmful in contact with skin<br>H332: harmful if inhaled<br>H315: causes skin irritation<br>H317 may cause an allergic skin reaction<br>H319: causes serious eye irritation<br>H340: may cause genetic defects<br>H350: may cause cancer<br>H361f: may damage fertility<br>H372 causes damage to organs |  |
| phenylthiourea (PTC) | Danger | Acute toxin Cat 1 (oral)<br>Skin sensitiser Cat 1 | H300: Fatal if swallowed<br>H317 may cause an allergic skin reaction |  |
| paracetomol, N-phenylethanamidel, thiooxamide | Warning | Acute toxin Cat 4 (oral)<br>Skin Irritant Cat 2<br>Eye Irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H302: harmful if swallowed<br>H315: causes skin irritation<br>H319: causes serious eye irritation<br>H335: may cause respiratory irritation |  |
| urea | | No significant hazard | | |

### Incompatibility

Strong oxidising and bases. (prop-2-enamide is also incompatible with acids, iron and its salts, copper brass and free radical initiators)

Sodium and potassium amide should be kept away from water as well as oxidising agents.

### Handling

For prop-2-enamide contact SSERC. For PTC, avoid raising dust and wear gloves. For the others, wear eye protection and gloves if needed. Potassium and sodium amide are corrosive to skin and eyes as well as water reactive. Wear goggles (EN 166 3) and gloves.

**FF** – WS, DP & VL.

### Storage

With organics in general store.

SSL – Potassium and sodium amide react with water vapour from the atmosphere to produce toxic and corrosive products. Where water vapour is limited, shock-sensitive explosives can be produced. Pressure can also build up in containers leading to explosion. The hazardous decomposition can be recognised by the appearence of a yellow/brown colour.

## Disposal

Sodium and potassium amides, prop-2-enamide and PTC should be kept for disposal by a licensed contractor. The others can be washed to waste with large quantities of cold water..

## Spillage

For Prop-2-enamide and especially PTC, great care should be taken to avoid raising any dust Carefully sweep up solids absorb solutions on paper towels or mineral absorbent, then treat as for disposal above. For the others, carefully sweep up solids absorb solutions on paper towels or mineral absorbent, then treat as for disposal.

## Remedial Measures

### Eyes

Remove contact lenses, if present and easy to do. Irrigate with water for at least 15 minutes. Obtain medical advice.

### Mouth

Wash out mouth with water. Don’t induce vomiting. Seek medical attention for sodium and potassium amides and prop-2-enamide and **immediately** in the case of PTC. If the others are swallowed, seek medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention in the case of sodium and potassium amide, prop-2-enamide or PTC or for the others if feeling unwell.

### Skin

For sodium and potassium amides, prop-2-enamide and PTC, remove contaminated clothing. Wash well with soap and water. Obtain medical attention if area affected is large or irritation persists.

## Amines, aliphatic

Description: Generally volatile liquids with a strong ammoniacal or fishy smell. solids, such as hexamine, also smell.

### Hazards

The volatile amines are extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Other symptoms include cough, shortness of breath, headache and nausea.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| butan-1-amine | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Corrosive Cat 1A | H225 highly flammable liquid and vapour<br>H302 Harmful if swallowed<br>H312 harmful in contact with skin<br>H332 harmful if inhaled |  |
| butan-2-amine | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Corrosive Cat 1A<br>Hazardous to the aquatic environment Cat 1 | H225 highly flammable liquid and vapour<br>H302 Harmful if swallowed<br>H332 harmful if inhaled<br>H314 causes severe skin burns and eye damage<br>H400 very toxic to aquatic life |  |
| 2-methylpropan-1-amine | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Corrosive Cat 1A<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H225 highly flammable liquid and vapour<br>H301 toxic if swallowed<br>H311 toxic in contact with skin<br>H331 toxic if inhaled<br>H314 causes severe skin burns and eye damage<br>H335 may cause respiratory irritation |  |
| 2-methylpropan-2-amine | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 3 (inhalation)<br>Corrosive Cat 1A<br>Hazardous to the aquatic environment with long lasting effects Cat 3 | H225 highly flammable liquid and vapour<br>H302 harmful if swallowed<br>H332 toxic if inhaled<br>H314 causes severe skin burns and eye damage<br>H412 harmful to aquatic life with long lasting effects |  |

| | | | | |
|---|---|---|---|---|
| 1,2-diaminoethane | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Corrosive Cat 1A<br>Skin sensitiser Cat 1 | H226 flammable liquid and vapour<br>H302 harmful if swallowed<br>H312 harmful in contact with skin<br>H314 causes severe skin burns and eye damage<br>H317 may cause an allergic skin reaction<br>H334 may cause allergy, asthma symptoms or breathing difficulties if inhaled |  |
| hexamine | Danger | Flammable solid Cat 2<br>Skin sensitiser Cat 1 | H228 flammable solid<br>H317 may cause an allergic skin reaction |  |

## Incompatibility

Strong oxidising agents. 1,2-diaminoethane is also incompatible with aldehydes organic halides and phosphorus halides.

## Handling

Wear nitrile gloves and goggles (BS EN 166 3). Handle ina fume cupboard. (Hexamine can be handled in the open lab using eye protection and gloves if needed).

**FF** – WS, DP & VL.

## Storage

The liquid amines should be stored in the flammable cabinet. Hexamine can be stored with organics in the general store. (Hexamine absorbs water from the air so keep dry). Butylamine isomers and 1,2-diaminoethane should be checked regularly for signs of leakage or deterioration of bottle caps. A white solid may accumulate on the outside of the bottles (the chloride) which can be wiped off,

## Disposal

Wear goggles (BS EN 166 3) and rubber gloves. Dilute up to 50 cm3 with 50 volumes of water, neutralise with 2M hydrochloric acid (IRRITANT) and wash to waste with running water.

## Spillage

Ventilate room. Wear goggles (BS EN 166 3) and rubber gloves. Mop up into bucket or soak up on adsorbent. Add water to dissolve, neutralise carefully with dilute hydrochloric acid (IRRITANT) and wash solution to waste with running water

## Remedial Measures

### Eyes

Remove contact lenses, if present and easy to do. Irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible, continuing irrigation on the journey.

### Mouth

Wash out mouth with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large or if irritation persists.

# Amines, aromatic

Description: White powders or crystals. monomers and dimers are generally soluble in water. Polymers tend not to be

## Hazards

There are no specific hazards associated with many of these compounds. Care should still be taken, however, to avoid the inhalation of powders.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzocaine | Warning | Skin sensitiser Cat 1 | H317 may cause an allergic skin reaction |  |
| luminol | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H315 causes skin irritation<br>H302 causes severe eye irritation<br>H335 may cause respiratory irritation |  |
| n,n-dimethylphenylamine | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Carcinogen Cat 2<br>Hazardous to the aquatic environment with long lasting effects Cat 2 | H301 toxic if swallowed<br>H311 toxic in contact with skin<br>H331 toxic if inhaled<br>H351 suspected of causing cancer<br>H412 harmful to aquatic life with long lasting effects |    |
| diphenylamine | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Specific Target Organ Toxin on Repeated Exposure Cat 2<br>Hazardous to the aquatic environment with long lasting effects Cat 1 | H301 toxic if swallowed<br>H311 toxic in contact with skin<br>H331 toxic if inhaled<br>H373 may cause damage to organs<br>H410 very toxic to aquatic life with long lasting effects |    |

## Incompatibility

Strong oxidising and reducing agents. Strong acids and bases. n,n-dimethylphenylamine is also incompatible with acid chlorides & anhydrides and with halogens.

## Handling

Wear gloves and eye protection. Diphenylamine and n,n-dimethylphenylamine should be handled in a fume cupboard and goggles (BS En166 3) should be worn.

FF – WS, DP & VL.

## Storage

With organics in general store.

## Disposal

n,n-dimethylphenylamine should be kept for disposal by a licensed contractor though small amounts such as washings from glassware can be washed to waste with large amounts of water. Phenylamine and benzocaine should be neutralised, 1g or 1cm per 100cm$^3$ of 1M ethanoic acid, and washed to waste. Luminol Insoluble carbohydrates can be bagged and put in the domestic waste. Up to 10g of luminol can be dissolved in 100cm$^3$ of water and washed to waste.

## Spillage

Sweep up solids absorb liquids on paper towels or mineral absorbent, then treat as for disposal above.

## Remedial Measures

### Eyes

Remove contact lenses, if present and easy to do. Irrigate with water for at least 15 minutes. Obtain medical attention (if irritation persists in the case of luminol or benzocaine).

### Mouth

Wash out mouth with water. Don’t induce vomiting. Seek medical attention (if feeling unwell in the case of luminol or benzocaine).

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention in the case of phenylamine or n,n-dimethylphenylamine or if breathing is affected.

### Skin

Wash well with soap and water. Obtain medical attention if area affected is large or irritation persists.

# Aminophenol, 4

Alternative names: (4-amino-1-hydroxybenzene, 4-hydroxyaniline)

Description: Off-white crystals, slightly soluble in water. Still used occasionally as a photographic developer.

## Hazards

**Harmful** by inhalation and if swallowed. Can cause irritation on skin, eyes and upper respiratory tract. Like phenols and amines can be rapidly absorbed via the skin and cause systemic effects, including cyanosis, with the onset possibly being delayed by several hours May cause allergic reactions in sensitive individuals. Very toxic to aquatic organisms. **May cause long term adverse effects in the aquatic environment**. **Mutagen/Teratogen** – may cause adverse mutagenic or teratogenic effects. Possible carcinogen. Possible risk of irreversible effects. Light sensitive. Air sensitive. Classification does not include dermal toxicity but many other sources suggest it can be absorbed through the skin so it would be prudent to take precautions to avoid skin contact.

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 4-aminophenol | Warning | Acute Toxin cat 4 (oral)<br>Acute Toxin cat 4 (inhalation)<br>Mutagen category 2<br>Hazardous to the aquatic environment (with long lasting effects) cat 1 | H302: Harmful if swallowed<br>H332: Harmful if inhaled<br>H341: Suspected of causing genetic defects<br>H:410 Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Strong oxidising agents, acids, strong bases, acid chlorides, acid anhydrides, alkalis, chloroformates. Combustible at high temperature.

## Handling

Wear safety goggles and rubber or plastic gloves. Avoid raising dust or contact with skin or eyes.

## Storage

Store in a cool dry place. Store in a tightly closed container. Store protected from light and air.

## Disposal

Wear goggles and rubber or plastic gloves. Transfer to a container to await uplift by a licensed disposal contractor.

## Spillage

Use PPE as in Disposal. Soak up on sand or mineral absorbent. Retain large amounts for disposal by licensed waste disposal contractor. Wash spillage site thoroughly with water and detergent.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Exposure via this route is unlikely. Obtain medical attention if feeling unwell or seek medical advice if concerned.

### Skin

Wash well with water for 10 minutes. Remove and wash contaminated clothing. Seek medical attention as soon as possible.

# Ammonia gas and solution

Alternative name: anhydrous ammonia, ammonium hydroxide

Description: Gas – pungent smell, lachrymatory.  Commercially available as 0.88 specific gravity (880 or 35% w/v) solution and dilutions.

## Hazards

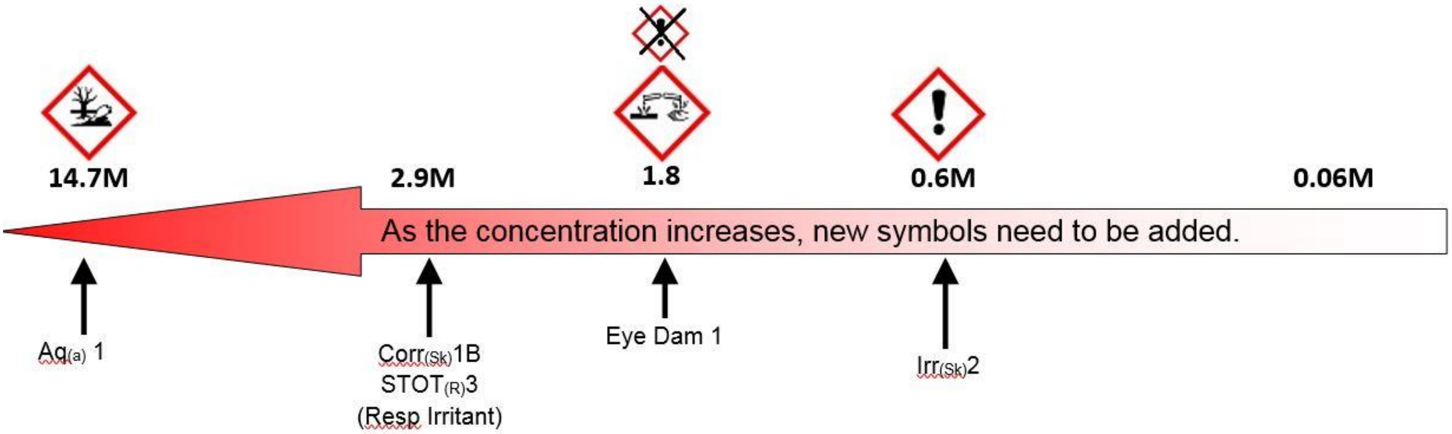
**Toxic** if the gas is inhaled in high concentrations or if swallowed. Forms explosive mixtures in air (16-25%). Gas and solutions corrosive or very irritant particularly to the eyes. Solution burns skin and swallowing causes internal damage.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Ammonia gas (anhydrous) | Danger | Flammable gas Cat 2<br>Acute toxin Cat 3 (inhalation)<br>Skin corrosive Cat 1B<br>Harmful to the aquatic environment Cat 1 | H221: Flammable gas<br>H331: Toxic if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life.<br>EUH071 Corrosive to the respiratory tract |  |
| Ammonia solution | Danger | (not technically Toxic by inhalation but releases ammonia gas – see Left)<br>Skin corrosive Cat 1B<br>Harmful to the aquatic environment Cat 1 | H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life. |  |

## Concentration Effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Reacts violently with halogens, bleaching powder. Forms explosive compounds with silver salts and with mercury.

## Handling

Many recirculatory fume cupboards cannot handle 880 ammonia. Wear rubber gloves and goggles (BS EN 166 3) and handle in fume cupboard. Remove stopper carefully (pointed away from body) from stored containers (especially in warm conditions) of the concentrated solution as pressure can build up.

## Storage

As corrosive liquid on drip tray in cool cupboard at low level in general store. Effective concentration will reduce once bottles have been opened. SL – 4 years. Deteriorates and becomes less effective once bottle is opened.

## Disposal

Dilute 10 fold, neutralise with 1M hydrochloric acid (IRRITANT) and wash to waste with running water.

## Spillage

Ventilate and evacuate the room even when spillage is quite small. Wear rubber gloves, goggles (BS EN 166 3) and rubber boots for medium spillage. Absorb, lift into bucket and neutralise. Wash to waste with running water.

## Remedial Measures

### Eyes

If liquid is splashed in the eye irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. If swallowed, don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Ammonia gas and solution

## Hazards

Most ammonium compounds, other than those listed on their own pages, are of low or no hazard.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium ethanoate,<br>ammonium sulphate | | No Hazard | | |
| ammonium bromide | Warning | Eye irritant Cat 2 | H319 Causes serious eye irritation. |  |
| ammonium chloride | Warning | Acute toxin Cat 4 (oral)<br>Eye irritant Cat 2 | H302 Harmful if swallowed.<br>H319 Causes serious eye irritation |  |
| ammonium carbonate | Warning | Acute toxin Cat 4 (oral) | H302 Harmful if swallowed. |  |
| ammonium iron II sulphate,<br>ammonium iron III citrate,<br>ammonium iodide,<br>diammonium phosphate,<br>ammonium tartrate | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin Cat 3 | H315 Causes serious skin irritation.<br>H319 Causes serious eye irritation.<br>H335 Causes respiratory irritation. |  |

## Incompatibility

Strong oxidising agents such as chlorates or manganates can form explosive mixtures) Strong acids and alkalis (can release toxic fumes). (See separate entries for dichromate, fluorides, nitrate, sulphide, thiocyanate and vanadateV ).

## Handling

Wear goggles (BS EN 166 3). Avoid raising dust from compounds in the solid state. Intense/prolonged heating can produce toxic fumes. Wash hands after use. (See separate entries for dichromate, fluorides, nitrate, sulphide, thiocyanate and vanadate V).

## Storage

Securely in store. Keep nitrate and dichromate(VI) with oxidising agents.

## Disposal

Wear goggles (BS EN 166 3). Dissolve up to 20 g in bucket of water and wash to waste with a large quantity of running water. (See separate entries for dichromate, fluorides, nitrate, sulphide, thiocyanate and vanadate V ).

## Spillage

Wear plastic gloves and eye protection. Moisten with water, shovel into bucket and treat as for Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

# Ammonium compounds

## Hazards

Most ammonium compounds, other than those listed on their own pages, are of low or no hazard.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium ethanoate,<br>ammonium sulphate | | No significant hazard | | |
| ammonium bromide | Warning | Eye irritant Cat 2 | H319 Causes serious eye irritation. | ⚠ |
| ammonium chloride | | Acute toxin Cat 4 (oral)<br>Eye irritant Cat 2 | H302 Harmful if swallowed.<br>H319 Causes serious eye irritation. | ⚠ |
| ammonium carbonate | | Acute toxin Cat 4 (oral) | H302 Harmful if swallowed. | ⚠ |
| ammonium iron II sulphate,<br>ammonium iron III citrate, ammonium iodide, diammonium phosphate,<br>ammonium tartrate | | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin Cat 3 | H315 Causes serious skin irritation.<br>H319 Causes serious eye irritation.<br>H335 Causes respiratory irritation. | ⚠ |

## Incompatibility

Strong oxidising agents such as chlorates or manganates can form explosive mixtures) Strong acids and alkalis (can release toxic fumes). (See separate entries for dichromate, fluorides, nitrate, sulphide, thiocyanate and vanadate V ).

## Handling

Wear goggles (BS EN 166 3). Avoid raising dust from compounds in the solid state. Intense/prolonged heating can produce toxic fumes. Wash hands after use. (See separate entries for dichromate, fluorides, nitrate, sulphide, thiocyanate and vanadate V).

## Storage

Securely in store. Keep nitrate and dichromate(VI) with oxidising agents.

## Disposal

Wear goggles (BS EN 166 3). Dissolve up to 20 g in bucket of water and wash to waste with a large quantity of running water. (See separate entries for dichromate, fluorides, nitrate, sulphide, thiocyanate and vanadate V ).

## Spillage

Wear plastic gloves and eye protection. Moisten with water, shovel into bucket and treat as for Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

## Ammonium dichromate

Description: Orange/red crystalline solid or powder. Soluble in water.

### Hazards

Oxidiser – will intensify fire. Toxic in contact with skin and very toxic if inhaled. The dust is corrosive to the eyes, skin and respiratory tract and may produce asthmatic symptoms. Skin contact may lead to sensitisation and frequent exposure to skin ulcers. Category 1B carcinogen, mutagen and respiratory toxin by inhalation of the dust.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Ammonium dichromate | Danger | Oxidising solid Cat 2<br>Acute toxin Cat 3 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin cat 2 (inhalation)<br>Skin corrosive Cat 1B<br>Respiratory sensitiser Cat 1<br>Carcinogen Cat 1B<br>Mutagen Cat 1B<br>Reproductive toxin Cat 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Harmful to the aquatic environment with long lasting effects Cat 1 | H272: May intensify fire; oxidiser<br>H301: Toxic if swallowed<br>H312: Harmful in contact with skin.<br>H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction.<br>H340: May cause genetic defects<br>H350: May cause cancer<br>H360: May damage fertility or the unborn child<br>H372: Causes damage to organs<br>H410: Very toxic to aquatic life with long lasting effects. |  |

### Incompatibility

If heated, will decompose violently and, if confined, will explode. It is an oxidising agent which will assist fire and form explosive mixtures with reducing agents, including metals, especially if powdered e.g. aluminium, and magnesium. Also incompatible with carbon, sulphur, phosphorus and combustible material including organic substances. DO NOT MIX with any of these classes of compounds.

### Handling

Use rubber gloves and eye protection. Usually crystalline but powder must be handled carefully to avoid dust rising. Never heat when confined in any way, even in a test tube. Take care to avoid contamination by organic materials or dust.

### Storage

Store in small quantities with oxidising agents and away from flammables.

SSL – 2 years max. if frequently opened. Is sensitive to the presence of dust or contaminants. Such mixtures can ignite or detonate if exposed to friction.

## Disposal

Wear eye protection and rubber gloves. Minute amounts only of washings from glassware may be to waste. Mix larger amounts with damp sand and store for collection by waste disposal contractor. If in solution, acidify to approximately pH2 and add sodium hydrogensulphite to reduce to Cr(III). Precipitate the Cr3+ as hydroxide, filter and keep for disposal by a contractor.

## Spillage

Wear eye protection and rubber gloves. Moisten with water, sweep into bucket and if amounts are small wash to waste with a large volume of water. Otherwise treat as for Disposal. Could be dangerous if traces of carbonaceous dust had become mixed with it; in this event wet immediately, dissolve, reduce to Cr3+and proceed as above. Wash the area well and mop with a little hydrogensulphite solution.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. If dust inhaled obtain medical advice.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Wash skin with water until washings are colourless.

# Ammonium nitrate

Solid, white, crystalline. anhydrous salt used in organic syntheses. Soluble in water. See also: nitrates(V)

## Hazards

A powerful oxidising agent. Dust is irritant to eyes, skin and respiratory system. Prolonged exposure leads to disorders in the digestive and blood systems. Decomposes readily at 169°C explodes when heated above 250°C and more readily when contaminated by organic matter. Small quantities only should be heated. Do not grind it or heat solutions to dryness.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium nitrate | Warning | Oxidising solid cat 3<br>Eye irritant Cat 2 | H272: May intensify fire; oxidiser<br>H319: Causes serious eye irritation. |  |

## Incompatibility

Forms dangerous mixtures with acids, chlorates( I, III and V), combustible materials, flammable liquids, ammonium dichromate or potassium dichromate, sodium chloride, potassium nitrate, nitrates(III) (nitrites), sulphur, carbon, potassium manganate(VII), ethanoic acid, organic compounds and metals (especially if finely divided).

## Handling

Use plastic gloves and eye protection. Powder must be handled carefully to avoid dust rising. Never heat when confined in any way, even in a test tube. Never mix with powdered aluminium or magnesium. Never grind.

## Storage

Store with oxidising agents, away from flammables. Keep in small quantities. Keep containers well closed. Take care to avoid contamination of bottle by dust or organic materials.

SSL – 2 years max. if frequently opened. Is sensitive to the presence of dust or contaminants. Such mixtures can ignite or detonate if exposed to friction.

## Disposal

Wear plastic gloves and eye protection. Dissolve up to 20 g in bucket of water and wash to waste with a large quantity of running water.

## Spillage

Wear plastic gloves and eye protection. Moisten with water, shovel into bucket and treat as for Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If large amount swallowed obtain medical attention.

### Lungs

In the unlikely event of such exposure Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

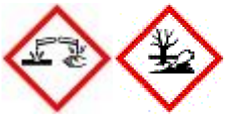
## Ammonium sulphide

Description: Yellow liquid with bad smell. Soluble in water. Purchase as 20% w/w in water. (40 – 48%) is also available but not needed)

### Hazards

Corrosive and toxic liquid and vapour – if high concentration are inhaled it may cause unconsciousness – low concentrations cause headache, giddiness and loss of energy some time after exposure. Hazardous to the aquatic environment.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium sulphide | Danger | Skin Corrosive 1B<br>Harmful to the aquatic environment Cat 1 | H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life.<br>EUH031: Contact with acids liberates toxic gas |  |

### Incompatibility

Acids and acid fumes – very toxic gas hydrogen sulphide given off.

### Handling

Wear rubber gloves and goggles (BS EN 166 3) and handle commercial (6M) solution only in fume cupboard. For most applications use 0.2-0.3M solutions.

### Storage

General store as a toxic chemical. Useful concentration will deteriorate. Replace when it begins to fail in sulphide precipitations.

### Disposal

Wear rubber gloves and goggles (BS EN 166 3); very small amounts such as washings from glassware can be run to waste. Otherwise store for disposal by waste contractor.

### Spillage

Wear rubber gloves and goggles (BS EN 166 3) and open windows and doors. Soak onto absorbent and if amounts are small, rinse the absorbent well; seal in plastic bag and place with ordinary waste. Otherwise store for disposal by waste contractor.

### Remedial Measures

#### Eyes

Irrigate with water for at least 10 minutes. Then obtain medical attention immediately.

#### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

#### Lungs

Remove patient from exposure to fresh air. Obtain medical attention as soon as possible.

#### Skin

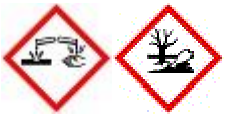
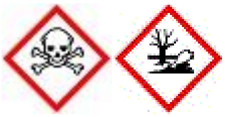
Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Antimony metal and compounds

## Hazards

The metal and most of its compounds are harmful and irritating if swallowed or inhaled though the fluoride is toxic by all routes. The pentafluoride is also toxic by skin absorption. Most of the other compounds are irritating to skin, eyes and respiratory system and can cause burns. Chronic exposure can result in weight loss and anaemia. The trioxide is a Category 2 carcinogen.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| antimony metal & compounds – except tetroxide, pentoxide, trisulphide & pentasulphide | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Harmful to the aquatic environment with long lasting effects Cat 2 | H302 Harmful if swallowed.<br>H332 Harmful if inhaled<br>H411: Toxic to aquatic life with long lasting effects. |  |
| antimony(III) chloride, antimony(V) chloride | Danger | Skin corrosive Cat 1B<br>Harmful to the aquatic environment with long lasting effects Cat 2 | H314: Causes severe skin burns and eye damage.<br>H411: Toxic to aquatic life with long lasting effects. |  |
| potassium antimony III tartrate | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Harmful to the aquatic environment with long lasting effects Cat 2 | H302 Harmful if swallowed.<br>H332 Harmful if inhaled<br>H411: Toxic to aquatic life with long lasting effects. |  |
| antimony(III) fluoride | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Harmful to the aquatic environment with long lasting effects Cat 2 | H301 Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331 Toxic if inhaled.<br>H411: Toxic to aquatic life with long lasting effects. |  |
| antimony(V) fluoride | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Harmful to the aquatic environment with long lasting effects Cat 2 | H302 Harmful if swallowed.<br>H332 Harmful if inhaled<br>H411: Toxic to aquatic life with long lasting effects. |  |
| antimony(III) oxide | Danger | Carcinogen Cat 2 | H351: Suspected of causing cancer by inhalation. |  |

## Incompatibility

Very poisonous gas antimony hydride (stibine) is formed by the action of acidic reducing agents on antimony & compounds. Metal ignites in halogens and reacts violently when heated with aluminium powder, alkali nitrates, sodium nitrite, nitric acid and fused ammonium nitrate. The sulphide forms a dangerous mixture with oxidising agents – chlorates(V) and chlorates(VII) (perchlorates). The tri- and pentahalides fume in moist air or react violently with water (hydrolysis) to the antimony oxyhalide – therefore do not use water fire extinguishers on fires involving antimony or its compounds.

## Handling

Wear nitrile gloves and goggles (BS EN 166 3) and handle in a fume cupboard.

## Storage

Keep containers tightly closed in a dry place and locked up. The trichloride can crystallise in cold weather – keep if possible at room temp. (20 °C).

## Disposal & Spillage

**Metal** – Wear protective clothing, respirator, nitrile rubber gloves and eye protection. Sweep carefully into a bag and hold for recycling by licensed contractor.

**Trioxide or trisulphide** – Wear protective clothing, nitrile rubber gloves and goggles (BS EN 166 3). Mix with sand and transfer to container for removal by disposal contractor.

**Trifluoride** – Wear nitrile gloves and eye protection. Add calcium carbonate or calcium hydroxide, mix well then transfer to container for removal by disposal contractor.

**Pentachloride or pentafluoride** – Ventilate the area and wear protective clothing, respirator, nitrile rubber gloves and goggles (BS EN 166 3). Pour on the minimum of concentrated hydrochloric acid until a white precipitate forms. Filter off the precipitate and transfer to container for removal by disposal contractor. For larger amounts mix with sand or mineral absorbent, transfer to bucket, add water, stir well and decant the liquid and wash to waste with lots of water. Transfer the sand mixture to a container for removal by disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed, seek medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. In the case of metal, metal hydride and fluoride obtain medical attention as soon as possible. For the chloride obtain medical attention if irritation is produced.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. For fluoride obtain medical attention as soon as possible and for others obtain medical attention if irritation persists.

# Arsenic metal and compounds

The use of arsenic or its compounds is not recommended in schools but may nevertheless be encountered in a variety of areas.

## Hazards

Extremely poisonous (toxic) if inhaled, swallowed or absorbed by the skin. Chronic effects by inhalation, by ingestion of dust and by skin contact. A recognised Category 1 carcinogen.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| arsenic metal | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (inhalation)<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed<br>H331: Toxic if inhaled.<br>H410: Very toxic to aquatic life with long lasting effects |  |
| arsenic compounds excepting trioxide & pentoxide | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (inhalation)<br>Carcinogen Cat 1A<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed<br>H331: Toxic if inhaled.<br>H350: May cause cancer<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| arsenic pentoxide | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (inhalation)<br>Carcinogen Cat 1A<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed<br>H331: Toxic if inhaled.<br>H350: May cause cancer<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| arsenic trioxide | Danger | Acute toxin Cat 2 (oral)<br>Skin corrosive Cat 1B<br>Carcinogen Cat 1A<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H300: Fatal if swallowed.<br>H314: Causes severe skin burns and eye damage<br>H350: May cause cancer<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Arsenic when heated or on contact with acid produces very toxic fumes. Arsenic compounds can react with reducing agents, especially with ‘nascent hydrogen’ to form the toxic gas arsine.

## Handling

If vapour is likely to be given off, substances must be handled in a fume cupboard using rubber gloves and eye protection. Avoid acidic reducing media which will reduce Arsenic compounds to the highly toxic amine gas.

## Storage

Keep securely in store

**The use of arsenic or its compounds is not recommended in schools**

## Disposal

Wear rubber gloves and eye protection. Very small quantities such as washings of glassware can be run to waste. Otherwise store and await uplift by disposal contractor.

## Spillage

Wear rubber gloves and eye protection and carefully shovel into a bucket. Store to await uplift by disposal contractor. Mop up area of spillage thoroughly with water.

## Remedial Measures

In all cases of exposure take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention as soon as possible.

# Asbestos

**Asbestos, or items containing asbestos, should not be in schools**

Description: Although it will not be in use in school laboratories, it might very occasionally be encountered on oven door seals and parts of older apparatus which required heat-resistant material. All such soft forms or the apparatus containing them should be replaced. Some hard forms such as asbestos cement working surfaces or sides in fume cupboards must be assessed by the employer. In many cases it is much safer to leave these intact or seal them in than to have them removed.

## Hazards

Dust is irritant to eyes, lungs and skin. Blue asbestos (crocidolite) and other forms; actinolite, amosite, anthophyllite, chrysotile (white asbestos) and tremolite are all toxic and carcinogenic and should be avoided. Inhalation, even of a very small amount, can cause asbestosis, tuberculosis and cancer of the lung. Effect is often only detected years after exposure. Soft forms including paper tape, rope and asbestos wool should not be available in school laboratories. Hard cement form may be still be present in some old schools or equipment as a heat resistant insulator, hot pipe covering, brake linings, fireproof gloves and clothing etc – though it has not been used in this way since the mid 1970s. If any is found it should be disposed of and should be replaced by alternatives. Bench mats have been asbestos-free for decades now (calcium silicate matrix reinforced with cellulose fibre). Heat resistant ceramic paper such as Superwool is also available from suppliers.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| asbestos | Danger | Carcinogen 1A<br>Specific target organ toxin on repeated exposure Cat 1 | H350 May cause cancer<br>H372: Causes damage to organs |  |

## Handling

Not handled in laboratories but may conceivably be encountered in car maintenance workshops. Handle carefully to avoid dust formation e.g. spray with water when changing brake shoes/pads on cars. Less danger with asbestos/cement board. Soft asbestos or wool most dangerous since dust easily formed. The use of asbestos in the UK is controlled in the first instance by the Control of Asbestos at Work Regulations

## Storage

If asbestos geological samples are kept for exhibition purposes they should be securely stored in sealed jars or sealed display cases.

## Stock

**Asbestos should not be used in school laboratories and, with the exception of geological samples, should not be kept.**

## Disposal

Any items found which are suspected of containing asbestos should be treated as if they do contain it. They should be double-bagged and taped securely and then stored in a safe place to await collection by a licensed specialist asbestos disposal contractor.

## Spillage

If dust is created or if type of asbestos unknown, the room should be evacuated and specialist asbestos disposal contractors contacted.

## Remedial Measures

In the event of contamination clothing should be removed, placed in labelled polythene bags and sealed. Persons contaminated by dust should immediately take a shower or bath. Eyes and mouth should be well irrigated.

# Barium metal and compounds

Description: Barium is a silvery-white metal stored under liquid paraffin.

## Hazards

Barium is very harmful if swallowed or in contact with the skin. If finely divided presents an explosion/fire risk and is harmful if inhaled. Reacts with water, (slightly less vigorously than sodium) to produce extremely flammable hydrogen and a corrosive toxic solution of barium hydroxide.

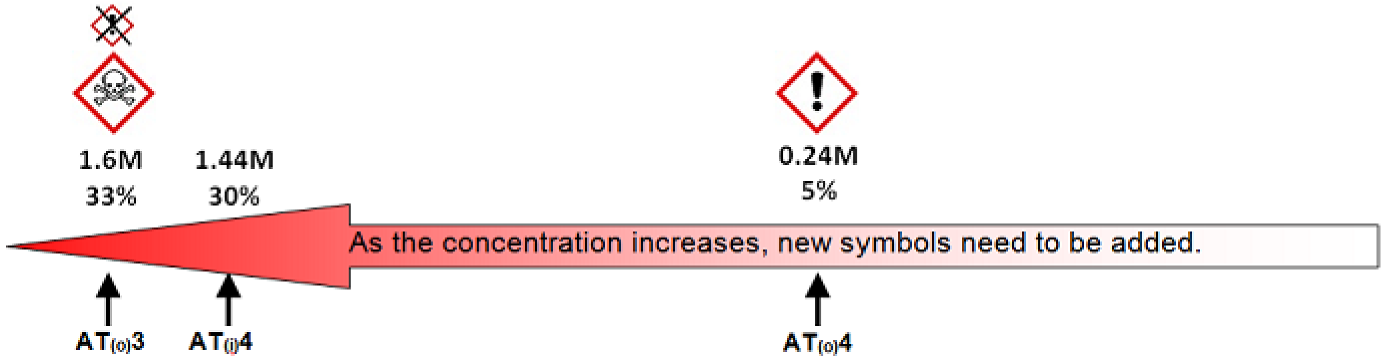
Most compounds are harmful if swallowed, by skin contact or if dust inhaled. However, the chloride is toxic. May be mutagenic or teratogenic. Hydroxide also corrosive to skin, eyes and mucous membranes. Barium oxide is, strictly speaking, not corrosive but it is hygroscopic and thus readily forms corrosive barium hydroxide. Barium sulphate is only slightly water soluble and virtually non-toxic. See also barium nitrate(V).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| barium metal | Danger | Water reactive solid Cat 2<br>Skin /eye irritant Cat 2<br>Respiratory irritant cat 3 | H261: In contact with water releases flammable gases.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |
| barium carbonate | Warning | Acute toxin Cat 4 (oral) | H302: Harmful if swallowed |  |
| barium chloride | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 4 (inhalation) | H301: Toxic if swallowed.<br>H332: Harmful if inhaled. |  |
| barium hydroxide,<br>barium oxide | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin corrosive 1B<br>Eye damage Cat 1 | H302: Harmful if swallowed.<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage<br>H318: Causes serious eye damage |  |
| barium peroxide | | Oxidising solid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation) | H272 May intensify fire; oxidiser.<br>H302: Harmful if swallowed.<br>H332: Harmful if inhaled. |  |
| barium sulphate | | No significant hazard | | |
| barium sulphide | | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Harmful to the aquatic environment Cat 1 | H302: Harmful if swallowed.<br>H332: Harmful if inhaled.<br>H400: Very toxic to aquatic life |  |

## Concentration effects

Barium chloride only



## Incompatibility

Metal has a violent reaction with oxidising agents, water, sulphur, phosphorus and with chlorinated hydrocarbons, especially if polyhalogenated.

Hydroxide reacts vigorously with acids. Nitrate forms explosive mixtures with reducing agents and particularly with finely divided metals.

## Handling

Wear goggles (BS EN 166 3) and rubber gloves. Use tongs or forceps, do not use hands when lifting the metal. It is very hard and care is needed in cutting. Place in a dry mortar for cutting. Handle on dry filter paper and away from water. Expose to air for minimum time.

FF – Extinguish small fires with soda ash, graphite or sodium chloride.

## Storage

Securely in store. Metal with other water reactive metals. Store in air-tight bottle. Barium metal should be kept covered with liquid paraffin or other liquid in which it has been supplied. Great care required that proper liquid is used for topping up.

## Disposal

For the metal, wear rubber gloves and faceshield. Small amounts up to pea size can be added to propan-2-ol one at a time in a bucket. When reaction is complete, dilute with water, neutralise with dilute sulphuric acid and run supernatant to waste with more water. Place residue with ordinary refuse.

For compounds, Barium sulphate is of low toxicity and can be placed in a sealed bag and put in the normal waste. Otherwise, wear goggles (BS EN 166 3) and rubber gloves. Washings from glassware can be run to waste with lots of water.

Soluble salts such as the chloride can be dissolved in water (if not already in solution) and mixed with sodium sulphate solution. This produces a precipitate of barium sulphate that can be filtered out and disposed of above. The filtrate can be washed to waste. The carbonate is insoluble in water but can be dissolved in dilute hydrochloric acid and similarly treated with sodium sulphate.

## Spillage

For metal, wear face shield and rubber gloves. Cover with dry anhydrous sodium carbonate, shovel into a dry bucket and treat as for **Disposal**.

For compounds, wear rubber gloves and goggles (BS EN 166 3). Carefully sweep up the solid and treat as above. In the case of solutions mix in sufficient mineral absorbent and carefully lift with the aid of a dustpan or small shovel. Seal into a bag, label and store for disposal by contractor. Wash the affected area, all the equipment and utensils well.

## Remedial Measures

If the eyes are exposed to the metal or the hydroxide they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached & thereafter for possibly HOURS to leach out any hydroxide ions which may have been absorbed into the eye. It is important to flush under eyelids also. The irrigation in transit may be difficult in a vehicle other than an ambulance.

### Eyes

See above. For other compounds irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water (for an extended for metal and hydroxide) time as damage can continue after irritation has eased. Remove and wash contaminated clothing.

# Benedict’s solution

Contains sodium carbonate, sodium 2-hydroxypropane-1,2,3-tricarboxylate (sodium citrate) & copper(II) sulphate. Solutions used for quantitative work also contain potassium thiocyanate and a trace of potassium hexacyanoferrate(II)

## Hazards

Less corrosive than Fehling’s Solution. Slightly harmful if swallowed owing to presence of copper salts, approximately molar sodium carbonate and the thiocyanate.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Benedict’s solution | Warning | Eye irritant Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H319: Causes serious eye irritation.<br>H411: Toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Zinc, aluminium.

## Handling

Wear eye protection.

## Storage

General store as alkalis.

## Disposal

Wear gloves and eye protection. Run very small quantities such as washings from test tubes to waste. Larger amounts: store to await uplift by disposal contractor or displace the copper from solution with excess iron and recycle.

## Spillage

Wear gloves and eye protection. Soak up on absorbent, wash the absorbent well and place the washed absorbent with ordinary refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice.

### Lungs

Most unlikely to happen but if it does, move patient from area of exposure. Obtain medical advice.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Benzene

**The use of benzene is no longer legally banned forbidden in educational establishments such as schools – as a result of a revision to COSHH in 2013. That said, there is no reason for its use and so schools should consider it to be still banned.**

It may be found in other formulations such as crude oil (has >0.1% benzene), certain adhesives or unleaded petrol. Care should be taken to avoid the use of any such materials in school science courses. Take care not to accidentally make it e.g. by heating phenol with zinc dust or the decarboxylation of benzoic acid etc. Suitable alternatives would be 2- or 4-methylphenol and methyl benzoic acid respectively. Use isomers such as methyl benzene as a solvent or to demonstrate substitution reactions of an aromatic nucleus.

## Hazards

Highly flammable. The liquid and vapour are toxic if swallowed, by inhalation and if absorbed through the skin. Category 1A Carcinogen. Exposure to low concentrations over prolonged period can cause aplastic leukaemia. Tolerance of individuals cannot be assessed.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzene | Danger | Flammable liquid Cat 2<br>Skin / Eye irritant Cat 2<br>Aspiration toxin Cat 1<br>Mutagen Cat 1B<br>Carcinogen Cat 1A<br>Specific target organ toxin on repeated exposure Cat 1 | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation<br>H319: Causes serious eye irritation.<br>H304: May be fatal if swallowed and enters airways<br>H340: May cause genetic defects<br>H350: May cause cancer<br>H372: Causes damage to haemopolitic system through prolonged or repeated exposure via oral, inhalation and dermal routes |  |

As it is **not to be used in schools**, there is no need for information on its uses.

# Benzene triols

Description: Benzene-1,2,3-triol is a white crystalline powder or lustrous crystals. Darkens on exposure to the air. The 1,3,5-triol is a colourless to beige powder. Both are slightly soluble in water.

## Hazards

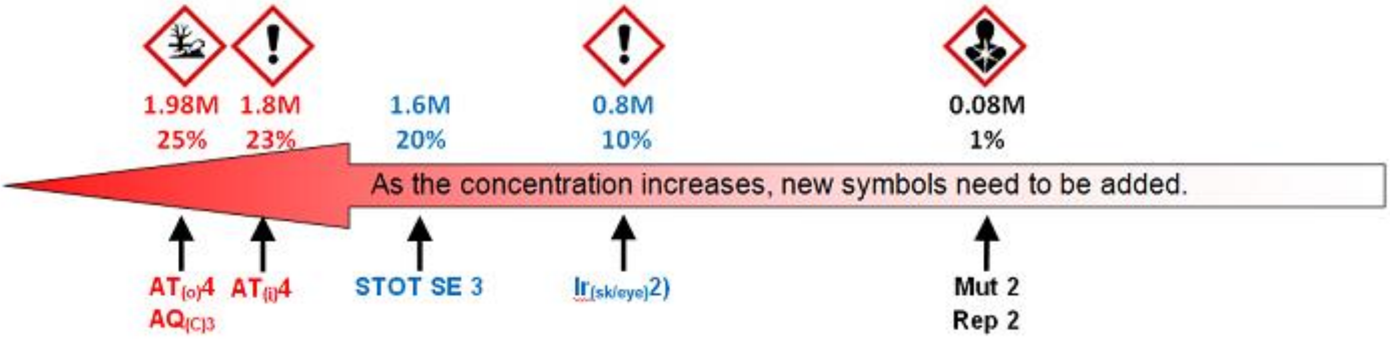
Both are harmful and severely irritant to the eyes and lungs. Prolonged contact can cause burns. They are Category 2 Mutagens and there is some evidence, though not conclusive, of carcinogenic, and teratogenic and reproductive effects. Benzene 1,2,3-triol is readily absorbed through the skin, by inhalation if in dusty form as well as by ingestion. It is also harmful to aquatic organisms. When heated to decomposition gives off acrid smoke and irritating fumes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzene-1,2,3-triol | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Mutagen Cat 2<br>Harmful to the aquatic environment with long-lasting effects Cat 3 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin<br>H332: Harmful if inhaled.<br>H341: Suspected of causing genetic defects.<br>H412: Harmful to aquatic life with long lasting effects |  |
| benzene-1,3,5-triol | Danger | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ toxin Cat 3<br>Mutagen Cat 2<br>Reproductive toxin Cat 2 | H315: Causes skin irritation<br>H319: Causes serious eye irritation<br>H335: May cause respiratory irritation<br>H341: Suspected of causing genetic defects<br>H361: Suspected of damaging fertility or the unborn child |  |

## Concentration Effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.* ***Red*** *= benzene-1,2,3-triol,* ***blue*** *= benzene-1,3,5-triol,* ***black*** *= both*



## Incompatibility

The reagent for removal of oxygen is highly alkaline or is made so just before use and therefore is highly corrosive.

Both compounds are incompatible with oxidising agents, nitric acid, ammonia, alkalis, phenol, iron & lead salts and potassium manganate(VII).

## Handling

Wear rubber or pvc gloves and eye protection. Do not breathe dust, vapour or mist.

## Storage

General store. Keep away from oxidising agents.

## Disposal

Wear eye protection and rubber or pvc gloves. Washings of glassware may be washed to waste. Otherwise store to await uplift by disposal contractor.

## Spillage

Wearing rubber or pvc gloves and face shield carefully brush spilled powder into dust pan and treat as in Disposal. Soak up solution on absorbent and dispose as above. For small quantities mop up with plenty of water and wash to waste.

## Remedial Measures

Keep polyethylene glycol (PEG) or propane-1,2,3-triol (glycerol) handy for treating spills on the skin.

If swallowed, a large area of skin is involved, breathing is affected or if eyes are irritated take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical advice.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Give pint of water to drink. If unconscious do not give anything to drink. Seem medical advice if feeling unwell.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

## Benzene diols

Benzene-1,2-diol (catechol, pyrocatechol, 1,2-dihydroxybenzene) – colourless, monoclinic crystals. Used in photography as a developing agent and in dyeing.

Benzene-1,3-diol (resorcinol, 1,3-benzenediol, m-dihydroxybenzene) – White, needle-like crystals with slight smell. Become pink when exposed to light. Used in tanning, resins, cosmetics, explosives and dyeing. Very slightly soluble in water.

Benzene-1,4-diol (1,4-dihydroxybenzene, quinol, p-dihydroxybenzene, hydroquinone) – White to Light-tan or light-gray, or colorless crystals. Used in photographic developers and skin whitening products.

### Hazards

Benzene-1,2-diol: Harmful if swallowed or in contact with the skin. Burns and is severely irritating to the skin and eyes. Systemic effects are similar to those caused by phenol. Very harmful by prolonged exposure to low concentrations. Questionable evidence of carcinogenicity and of human reproductive effects but not enough for classification.

Benzene-1,3-diol: Harmful if swallowed or via skin absorption if dissolved in suitable organic solvent, leading to hyperaemia, oedema, itching, dermatitis and more serious systemic disorders and possibly death. Irritates the skin and is severely irritating to the eyes. May cause sensitisation by skin contact or exposure to low concentrations over a long period. Questionable evidence of carcinogenicity but not enough to be classified as such.. Very toxic to aquatic organisms.

Benzene-1,4-diol: Harmful by inhalation and in contact with the skin (also allergenic skin sensitiser and severe irritant causing dermatitis). In normal use it is dissolved in water (1 part to 18 parts water) and should therefore be relatively safe in such low concentrations. It is however a Category 2 carcinogen, Category 2 mutagen and likely teratogen Swallowing of small amounts i.e. up to 1 g can produce nausea, tinnitus, vomiting, cyanosis and lead to collapse. Irritates the eyes and can cause inflammation and discoloration of the cornea. The vapour is to be avoided and is generally regarded as being more toxic than phenol by inhalation. Combustible when exposed to heat or flame.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzene-1,2-diol | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Skin / Eye irritant cat 2 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation. |  |
| benzene-1,3-diol | Warning | Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2<br>Hazardous to the aquatic environment Cat 1 | H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H400: Very toxic to aquatic life. |  |
| benzene-1,4-diol | Danger | Acute toxin Cat 4 (oral)<br>Eye damage Cat 1<br>Skin sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 2<br>Hazardous to the aquatic environment Cat 1 | H302: Harmful if swallowed<br>H318: Causes serious eye damage.<br>H317: May cause an allergic skin reaction<br>H341: Suspected of causing genetic defects<br>H351: Suspected of causing cancer<br>H400: Very toxic to aquatic life. |  |

## Incompatibility

Oxidising agents 1,2-diol can have explosive reaction with concentrated nitric acid and emits highly toxic fumes when heated. The 1,4-diol is incompatible with sodium hydroxide.

## Handling

Wear pvc gloves and eye protection. Handle in fume cupboard.

FF – F, DP, CO2 or WS

## Storage

Securely in general store. Keep away from light.

## Disposal

Wear pvc gloves and eye protection. Washings of glassware may be washed to waste. Otherwise store to await uplift by disposal contractor.

## Spillage

Wear pvc gloves and face shield. Carefully brush spilled powder into dust pan and treat as in Disposal. Soak up solution on absorbent and dispose as above. For small quantities mop up with plenty of water and wash to waste.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if affected area is large or if feeling unwell and/or or if irritation persists.

# Benzene diamines

Alternative names: p, m & o-phenylenediamine

## Hazards

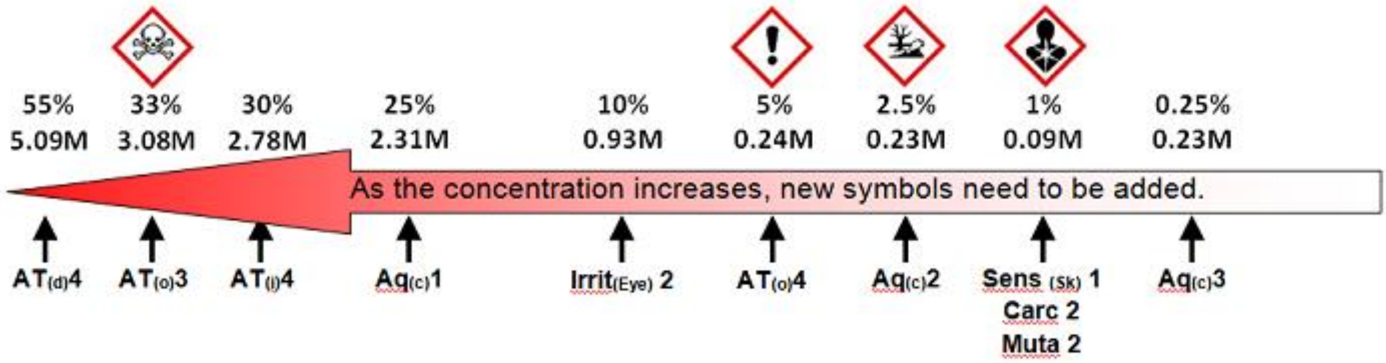
All isomers are toxic by inhalation of vapour or dust, in contact with the skin and if swallowed. Contact with skin causes allergic contact dermatitis (blackening occurs) and it can be readily absorbed. Very irritant to eyes (conjunctivitis can occur). The 1,4 and 1,3(p- & m-) are more toxic (Cat 3) (by skin/inhalation)than the 1,2-(o-) isomer. Experimental carcinogen (1,2 isomer) and mutagens (1,2 &1,3 isomers). Emit toxic fumes when heated to decomposition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzene-1,2-diamine | Warning | Acute toxin cat 3 (oral)<br>Acute toxin cat 3 (dermal)<br>Acute toxin cat 3 (inhalation)<br>Eye irritant cat 2<br>Skin Sensitiser Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H319: Causes serious eye irritation.<br>H317: May cause an allergic skin reaction.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| benzene-1,3-diamine | Warning | Acute toxin cat 3 (oral)<br>Acute toxin cat 3 (dermal)<br>Acute toxin cat 3 (inhalation)<br>Eye irritant cat 2<br>Skin Sensitiser Cat 1<br>Mutagen Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H319: Causes serious eye irritation.<br>H317: May cause an allergic skin reaction<br>H341: Suspected of causing genetic defects<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| benzene-1,4-diamine | Danger | Acute toxin cat 3 (oral)<br>Acute toxin cat 4 (dermal)<br>Acute toxin cat 4 (inhalation)<br>Eye irritant cat 2<br>Skin Sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H319: Causes serious eye irritation.<br>H317: May cause an allergic skin reaction<br>H341: Suspected of causing genetic defects<br>H351: Suspected of causing cancer<br>H410: Very toxic to aquatic life with long lasting effects. |  |

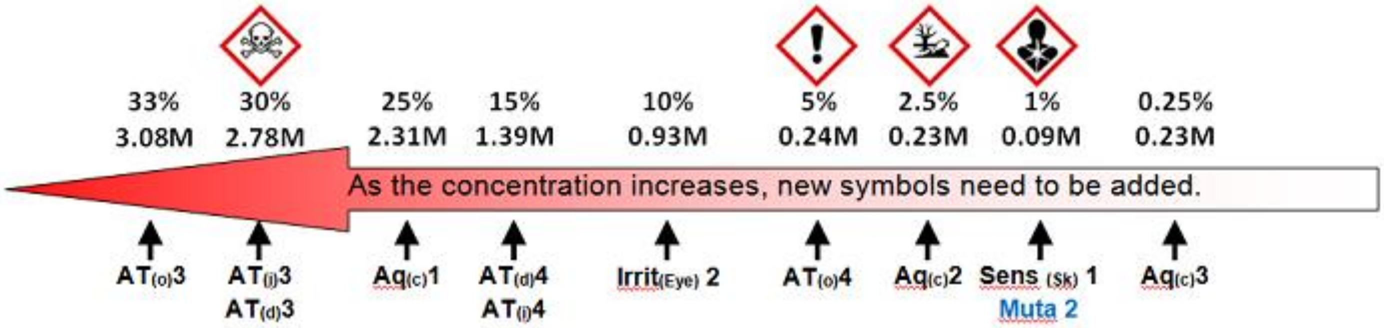
## Concentration effects

Benzene 1,2 diamine only



Benzene 1,3 and 1,4 diamines

Note the **blue** (Mutagen) classification applies to the 1,3 isomer only)



## Incompatibility

Acid anhydrides and acid chlorides. It reacts vigorously with oxidising agents. Can be ignited by flame played on it.

## Handling

Wear high grade pvc gloves and eye protection. Avoid raising dust. Use only in a fume cupboard. Flammable when exposed to heat or flame.

FF – DP, VL, WS or CO2.

## Storage

Securely in store. Keep container tightly closed and away from light.

## Disposal

Washings from glassware can be acidified with dilute hydrochloric acid and run to waste with large amounts of water. Otherwise store to await uplift by disposal contractor.

## Spillage

Wear pvc gloves and face shield, shovel into plastic bucket. Very small amounts can be treated as for disposal. Otherwise store to await uplift by waste disposal contractor.

## Remedial Measures

If swallowed or a large area of skin is involved or breathing is affected or if eyes are irritated then seek medical attention.

**Eyes**

Irrigate with water for at least 10 minutes.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed seek medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

# Benzene-1,2-dicarboxylic anhydride

Alternative name: phthalic anhydride.  Description: White crystalline needles. Dissolves in hot water to form phthalic acid.

## Hazards

The dust, fumes or vapours are corrosive irritants to skin, eyes, mucous membranes and if swallowed. A pulmonary sensitiser. Repeated exposure can cause dermatitis, erythema, eczema – also asthma and other diseases of the respiratory and digestive systems. An experimental teratogen. Will burn if exposed to heat or flame. Dust can form explosive mixtures with air.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzene-1,2-dicarboxylic anhydride | Danger | Eye Damage Cat 1<br>Skin irritant Cat 2<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H302: Harmful if swallowed<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction.<br>H317: May cause an allergic skin reaction.<br>H335: May cause respiratory irritation |  |

## Incompatibility

Forms explosive mixtures with oxidising agents including copper(II) oxide, sulphuric acid, fuming nitric acid or sodium nitrite.

## Handling

Wear pvc or nitrile gloves and (BS EN 166 3). Avoid raising dust – if this is a risk then wear a dust mask. FF – DP, VL & WS.

## Storage

General store, away from oxidising agents.

## Disposal

Wear pvc or nitrile gloves and goggles (BS EN 166 3). Place up to 10 g at a time in a bucket or large beaker, add three parts hydrated sodium carbonate or 2 parts sodium hydrogencarbonate, a little water and stir into a slurry. Alternatively use 2M sodium hydroxide at the rate of 100 cm3 per 10 g of anhydride. Allow time for the hydrolysis to be completed. Neutralise if necessary, greatly dilute and run to waste.

## Spillage

Wear pvc or nitrile gloves and goggles (BS EN 166 3). Slightly dampen then add sodium carbonate and carefully brush up treating as in Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Remove and wash any contaminated clothing. Wash area with running water for several minutes. Obtain medical attention.

# Benzenecarbaldehyde

Alternative name: benzaldehyde.  Description: Colourless to yellow refractive liquid with almond smell. Slowly oxidises in the air to benzoic acid. Insoluble in water.

## Hazards

Harmful and irritant to eyes, lungs and skin. Vapour is narcotic in high concentrations and may cause convulsions. Poisonous by swallowing and by skin absorption and can act as an allergen with dermatitis. Lower doses may cause nervous system depression. Flammable – keep away from sources of ignition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzenecarbaldehyde | Warning | Acute toxin Cat 4 (oral) | H302: Harmful if swallowed |  |

## Incompatibility

It is a strong reducing agent. Keep away from oxidising agents e.g. potassium manganate(VII), sodium peroxide and peroxyformic acid.

## Handling

Wear nitrile gloves and eye protection. Handle in well ventilated lab or fume cupboard away from any flames or sources of ignition.

## Storage

Flammables store. It slowly oxidises to benzoic acid. Whilst not a danger this can give rise to some confusion. SL – 3 years if opened frequently. Deteriorates by oxidation to benzoic acid and becomes less effective, thus giving confusing results. Can give confusing results. No increased hazard.

FF – F, DP, CO2 or VL.

## Disposal

Wear nitrile gloves and eye protection. Washings of glassware can be emulsified and run to waste. Larger amounts: store for uplift by waste disposal contractor.

## Spillage

Evacuate and ventilate the room. Turn off all sources of ignition. If spillage is in the fume cupboard then allow to evaporate if the amount is small. Wear face shield and nitrile gloves, cover larger volumes (>10 cm3) with mineral absorbent, package and store to await uplift by waste disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical advice/attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice/attention as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical advice/attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. If a large area is involved or if irritation persists obtain medical attention.

# Benzenecarbonyl chloride

Alternative name: benzoyl chloride.  Description: Description: Colourless, fuming liquid with pungent smell. Used for acylation in organic syntheses (Schotten-Baumann reaction) – adding benzoyl group to alcohols, amines and phenols.

## Hazards

Vapour and liquid are very corrosive to the eyes, skin and respiratory system, causing burns. Lachrymatory. Possible carcinogen by skin contact. Poisonous if swallowed causing immediate irritation and damage.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzenecarbonyl chloride | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Skin corrosive Cat 1B<br>Skin sensitiser Cat 1 | H302: Harmful if swallowed<br>H312: Harmful in contact with skin<br>H332: Harmful if inhaled<br>H314: Causes severe skin burns and eye damage.<br>H317: May cause an allergic skin reaction. |  |

## Incompatibility

Oxidising agents. Hydrolysed by water, alkanols or steam (reacts to give benzoic acid, hydrochloric acid and heat), alkalis. Explosive reaction with dimethyl sulphoxide, aluminium chloride + naphthalene and sodium azide + potassium hydroxide.

## Handling

Wear pvc gloves and goggles (BS EN 166 3). Use fume cupboard.

FF – DP, VL or WS.

## Storage

Keep locked up in ventilated area of main store. Alternatively with other fuming corrosives in special container with desiccant. Check any metal shelving nearby.

SSL – 3 years max.if frequently opened. Water reactive and over time reacts with moisture from the air. Decomposition products include Hydrogen chloride, phosgene, and carbon monoxide.

## Disposal

Wear pvc gloves, goggles (BS EN 166 3) and use a fume cupboard. Add small portions – up to 20 cm3 to a large volume of water in a bucket, leave over-night, neutralise with alkali solution and run to waste with lots of water.

## Spillage

Open windows and doors; wear pvc gloves and goggles (BS EN 166 3). For small spillages apply detergent and work to an emulsion with brush and water then run this to waste diluting greatly. For larger spillages cover with anhydrous sodium carbonate, carefully transfer to a bucket of water and treat as above. Area of spillage should be washed thoroughly with water and detergent.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical attention if feeling unwell.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if feeling unwell.

# Benzonitrile

Alternative name: cyanobenzene, phenyl cyanide.  Description: Description:  colourless oiily liquid, smelling of sweet almonds.

## Hazards

The fumes or vapours are irritating to skin, eyes, mucous membranes and it is harmful if swallowed or in contact with the skin. Symptoms of severe exposure include: fatigue, excessive sweating, thirst, pyrexia, anxiety, tachycardia, & hyperventilation. Symptoms may resolve on cessation of exposure. Will burn if exposed to heat or flame and can produce toxic cyanides.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzonitrile | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal) | H302: Harmful if swallowed<br>H312: Harmful in contact with skin. |  |

## Incompatibility

Incompatible with strong oxidizers such as acids, acid salts, chlorates and nitrates. Strong alkalis can produce ammonia.

## Handling

Wear pvc or nitrile gloves and eye protection. FF – DP, CO2 & WS.

## Storage

General store, away from oxidising agents. Benzonitrile is hygroscopic so the container should be kept tightly stoppered.

## Disposal

Small amounts such as washings from glassware can be run to waste with copious quantities of cold water. Larger amounts should be kept for disposal by a registered contractor.

## Spillage

Wear pvc or nitrile gloves and eye protection. mop up with mineral absorbent or paper towels and place in a fume cupboard to evaporate.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if unconscious or if feeling unwell

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Remove and wash any contaminated clothing. Wash area with soap and water for several. Obtain medical attention if area affected is large or if irritation persists.

# Beryllium metal and compounds

**Should not be available in school labs. Not recommended.**

## Hazards

Very toxic and can cause cancer. Category 2 carcinogen by inhalation. Toxic if swallowed. Irritates the skin, eyes and respiratory system. Harmful by skin absorption and may cause sensitisation by skin contact or inhalation. Cuts and scratches containing particles of beryllium may be slow to heal. Chronic effects by inhalation of dust. Beryllium metal dust or powder will burn if exposed to flame and may present an explosion risk dependent upon the fineness of the particles.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| beryllium metal | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 2 (inhalation)<br>Skin / Eye irritant Cat 2<br>Skin sensitiser Cat 1<br>Carcinogen cat 1B<br>Specific target organ toxin on repeated exposure cat 1<br>Specific target organ toxin on single exposure cat 3 | H311: Toxic by ingestion<br>H330: Fatal if inhaled.<br>H315: Causes skin irritation<br>H319: Causes serious eye irritation<br>H317: May cause an allergic skin reaction.<br>H335: May cause respiratory irritation.<br>H350i: May cause cancer by inhalation<br>H372: Causes damage to lungs via inhalation |  |
| Beryllium compounds excepting aluminium beryllium silicates | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 2 (inhalation)<br>Skin / Eye irritant Cat 2<br>Skin sensitiser Cat 1<br>Carcinogen cat 1B<br>Specific target organ toxin on repeated exposure cat 1<br>Specific target organ toxin on single exposure cat 3<br>Harmful to the aquatic environment cat 2 | H311: Toxic by ingestion<br>H330: Fatal if inhaled.<br>H315: Causes skin irritation<br>H319: Causes serious eye irritation<br>H317: May cause an allergic skin reaction.<br>H335: May cause respiratory irritation.<br>H350i: May cause cancer by inhalation<br>H372: Causes damage to lungs via inhalation |  |

## Incompatibility

With halocarbons or halogens. Mixtures of the metal powder with tetrachloromethane will flash or spark on impact. Very toxic fumes of beryllium oxide are emitted when beryllium or its sulphate are heated to decomposition.

## Handling

Avoid exposure – special instruction to be obtained before use – appropriate respirator, eye protection and heavy rubber gloves and apron; avoid raising dust of metals and compounds. For any machining or drilling of alloys wear eye protection and gloves and use local exhaust ventilation or a fume cupboard.

## Storage

Securely in store away from oxidising agents, acids, caustics and chlorinated hydrocarbons.

## Stock

Should not be available in school labs

## Disposal

These require specialist treatment from a licensed contractor.

## Spillage

These require specialist treatment from a licensed contractor.

## Remedial Measures

In all cases of exposure take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed, seek medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

# bis(4-isocyanatophenyl)methane

4,4′-methylenediphenyl diisocyanate, Caradate 30, MDI.  Description: Yellow crystals or viscous liquid with irritating smell. Used in preparation of polyurethane foam polymer.

## Hazards

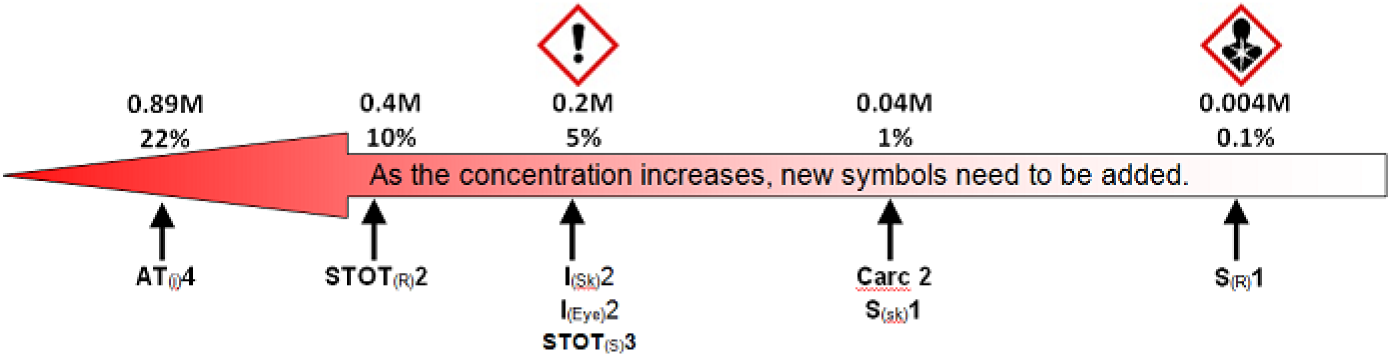
Harmful by inhalation, swallowing or absorption through the skin. A suspect carcinogen. An allergic sensitiser. Dangerous solid like cyanides.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| bis(4-isocyanatophenyl)methane | Danger | Acute toxin Cat 4 (inhalation)<br>Skin / Eye irritant cat 2<br>Skin Sensitiser Cat 1<br>Respiratory Sensitiser Cat 1<br>Carcinogen cat 2<br>Specific target organ toxin on repeated exposure cat 2<br>Specific target organ toxin on single exposure cat 3 | H332: Harmful if inhaled<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction.<br>H351: Suspected of causing cancer<br>H335: May cause respiratory irritation.<br>H373: May cause damage to Respiratory System by inhalation |  |

## Concentration Effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Reacts with water (hydrolysis).

## Handling

Wear pvc gloves and eye protection. Use in a fume cupboard. Should not be heated above 40°C. Any spillage on skin should be washed off immediately.

## Storage

In airtight container at temperature below 20°C in outside store if possible or securely in cool part of store. Storage at 5°C limits the formation of polymeric solids.

SL – Do not store beyond manufacturer’s recommended shelf life, typically 1 year. Water reactive and over time reacts with moisture from the air to form insoluble polyureas.

## Disposal

Wear pvc gloves and eye protection. Polymerise it in small batches using catalyst supplied with it. Once completely cured the polymerised product can be disposed of with ordinary refuse. Otherwise use specialist waste contractor.

## Spillage

Open windows and doors. Wear pvc gloves, face shield and dust mask. Shovel carefully into dry bucket and treat as in Disposal. Mop area of spillage with water and detergent. Wash to waste with running water.

## Remedial Measures

If swallowed, a large area of skin is involved, breathing is affected or if eyes are irritated take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

# Bismuth metal and compounds

Description: Bismuth is used in fusible alloys, silvering mirrors, electric fuses, pharmaceuticals and as neutron-transparent windows in medical irradiation devices. The telluride is used in electronics as a semiconductor. The nitrate is used in luminous paints and in the precipitation of alkanoids.

## Hazards

Bismuth and its salts can cause kidney damage if ingested in relatively large quantities. Its pharmacological effects are similar to that of lead although in industry it is regarded as one of the less toxic heavy metals. The metal is of low oral toxicity but prolonged exposure by ingestion to lower amounts can lead to mental & nervous disorders. The metal and compounds, more so in powder form, are irritants to the eyes, skin and mucous membranes. The nitrate is a strong oxidising agent and contact with combustible material may cause fire. The pentafluoride is corrosive.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Bismuth | Warning | Flammable solid Cat 2 | H228 Flammable solid. |  |
| Bismuth (III) chloride | Warning | Skin/Eye irritant Cat 2 | H315 Causes skin irritation.<br>H319 Causes serious eye irritation. |  |
| Bismuth (III) nitrate | Warning | Oxidising solid Cat 2<br>Eye irritant Cat 2 | H272: May intensify fire; oxidiser<br>H319: Causes serious eye irritation. |   |
| sodium bismuthate | Warning | Acute toxin Cat 4 (oral) | H302: Harmful if swallowed |  |

## Incompatibility

Powdered bismuth reacts explosively with fused ammonium nitrate, chloric(VII) or chloric(V) acid and when molten explodes on contact with concentrated nitric acid. The metal is also incompatible with chlorine with which it reacts to produce the chloride. The telluride is incompatible with water or oxidising agents and decomposes on contact with nitric acid. The trioxide reacts explosively with aluminium powder, violently with chlorine trifluoride and incandescently with potassium or sodium when heated. The oxychloride is incompatible with strong oxidising agents and gives off toxic fumes when heated to decomposition. The pentafluoride decomposes violently with water, Vaseline (petroleum jelly) and acids. The nitrate emits toxic fumes when heated to decomposition.

## Handling

Wear pvc gloves and eye protection. Powders should be handled carefully to avoid dust rising. Keep the nitrate away from combustible material.

## Storage

Keep bismuth and its compounds (excepting the nitrate) in a cool, dry place away from acids and oxidising agents. The nitrate may be stored as above but with the oxidising agents.

## Disposal

Wear pvc gloves and eye protection. For small amounts of bismuth (up to 10 g) sweep up and keep for re-use or recycling. Mix small amounts of the trioxide thoroughly within a bucket of sand and keep for disposal by contractor. Very small amounts such as washings from glassware may be washed to waste with copious quantities of water.

## Spillage

Wear pvc gloves and eye protection. Small spillages can be oxidised to a water soluble state by adding to the minimum of conc. hydrochloric acid (CORROSIVE) then diluting to form the oxychloride precipitate. This is filtered and collected for disposal by a contractor. Wash the soluble part to waste with plenty of water. For larger spillages contact disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if eye irritation occurs

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Boron compounds

## Hazards

Tribromide, trichloride and trifluoride (halogen compounds) are very toxic, volatile liquids by inhalation, swallowing or absorption through skin, especially if skin is broken. Sodium tetrahydridoborate(III) (borohydride) is toxic if swallowed in large quantities and the powder can be irritating to the skin, eyes and respiratory system. It is also a reproductive toxin. Boric acid and disodium heptaoxotetraborate(III) (borax) are harmful if swallowed in large amounts. Dust irritates the eyes and respiratory system.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium borohydride | Danger | Water reactive solid Cat 1<br>Acute toxin Cat 3 (oral)<br>Skin corrosive Cat 1B<br>Eye damage Cat 1 | H260: In contact with water releases flammable gases which may ignite spontaneously.<br>H301: Toxic if swallowed.<br>H314: Causes severe skin burns and eye damage.<br>H318: Causes serious eye damage. |  <br> |
| borax (sodium tetraborate) | Danger | Reproductive toxin Cat 1B (above 8.5%) | H360: May damage fertility or the unborn child |  |
| boric acid | Danger | Reproductive toxin Cat 1B (above 5.5%) | H360: May damage fertility or the unborn child |  |
| boron tribromide & trichloride | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 2 (inhalation)<br>Skin corrosive Cat 1B | H300 Fatal if swallowed.<br>H330 Fatal if inhaled.<br>H314 Causes severe skin burns and eye damage. |   |
| boron trifluoride | Danger | Acute toxin Cat 2 (inhalation)<br>Skin corrosive Cat 1B | H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage. |   |

## Incompatibility

General store. Keep sodium tetrahydridoborate with chemicals which are reactive to water e.g. sodium and potassium metal.

## Handling

Powders should be handled carefully to avoid dust rising. The halogen compounds should be handled in a fume cupboard using pvc gloves and goggles (BS EN 166 3). Wear goggles (BS EN 166 3) and remove any sources of ignition when handling sodium tetrahydridoborate.

## Storage

General store. Keep sodium tetrahydridoborate with chemicals which are reactive to water e.g. sodium and potassium metal.

## Disposal

Wear pvc gloves and goggles (BS EN 166 3). Up to a few cm3 of halogen compounds should be added slowly to a large quantity of water in a fume cupboard. The resulting solution can be neutralised with alkali and washed to waste with water. Up to 100 g of boric acid and its salts in concentrations not exceeding 10% can be dissolved in water and washed to waste with water.

## Spillage

Sodium tetrahydridoborate – Wear pvc gloves and goggles (BS EN 166 3). Add slowly small portions (< 1 g) to a large volume of water and allow time to react before adding more. Neutralise and wash to waste with lots of water.

Halogen compounds – Wear pvc gloves, goggles (BS EN 166 3) and respirator. Absorb in dry sand and shovel into a bucket. Add soda ash and carefully run to waste with water in small portions at a time.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes and longer for the tetrahydridoborate. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention and in the case of the tetrahydridoborate as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## Bromates(V)

Potassium or sodium bromates are the only ones likely to be encountered. Description: White crystals or powder.

### Hazards

Potassium bromate is toxic by ingestion and both salts irritate the eyes, skin and respiratory system. More toxic than chlorates(V). Potassium salt and possibly the sodium salt as well are Category 2 carcinogens but sodium salt is not yet so harmonised. Both are powerful oxidising agents and may cause fire or explosion with organic compounds or reducing agents. Dangerous when heated to decomposition, giving very toxic and corrosive fumes of bromine.

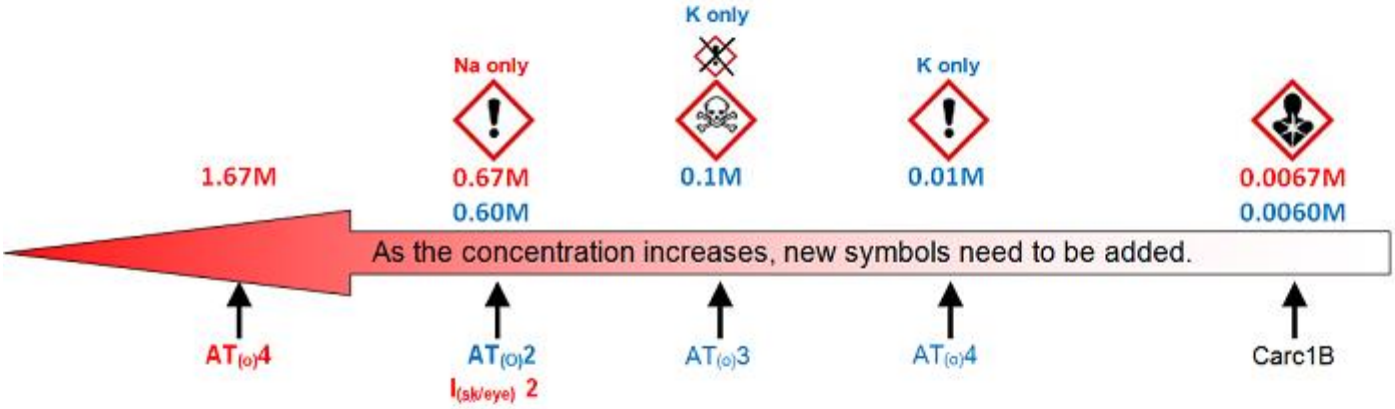
### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium bromate(V) | Danger | Oxidising solid Cat 1<br>Acute toxin Cat 2 (oral)<br>Carcinogen Cat 1B | H271 May cause fire or explosion; strong oxidiser.<br>H301 Toxic if swallowed.<br>H350 May cause cancer. |  |
| sodium bromate(V) | Danger | Oxidising solid Cat 1<br>Acute toxin Cat 4 (oral)<br>Skin / Eye irritant cat 2<br>Carcinogen Cat 1B | H271 May cause fire or explosion; strong oxidiser<br>H302 Harmful if swallowed.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H350 May cause cancer. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

Sodium dichromate in red, potassium dichromate in blue.



### Incompatibility

Reducing agents. Reacts violently with oxidisable material, the potassium salt explosively, with e.g. metals if finely divided, non-metals, organic compounds and substances, often causing vigorous combustion.

### Handling

Wear eye protection and rubber or plastic gloves. Keep away from combustible materials.

## Storage

General store with oxidising agents and out of sunlight.

## Disposal

Dissolve up to 50 g at a time in 2 litres of water, acidify with 1 litre of 1M sulphuric acid (IRRITANT). Then add sufficient iron(II) salt (up to 100 g) to reduce the bromate – using starch/iodide as an indicator. Then run to waste with copious amounts of water. Alternatively reduce with sodium sulphite or metabisulphite (up to 60 g) in a fume cupboard. Test with starch/iodide to check completion of reduction and run to waste. Sulphur dioxide (TOXIC) may be evolved.

## Spillage

Sweep up and wash to waste with water. Wash area well to remove bromate which makes organic material (wooden floor, bench, etc.) more combustible.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. If breathing is affected or if feeling unwell, see a doctor.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Bromine

Description: Very dense dark red liquid with irritating smell. Saturated solution in water is 3.6%

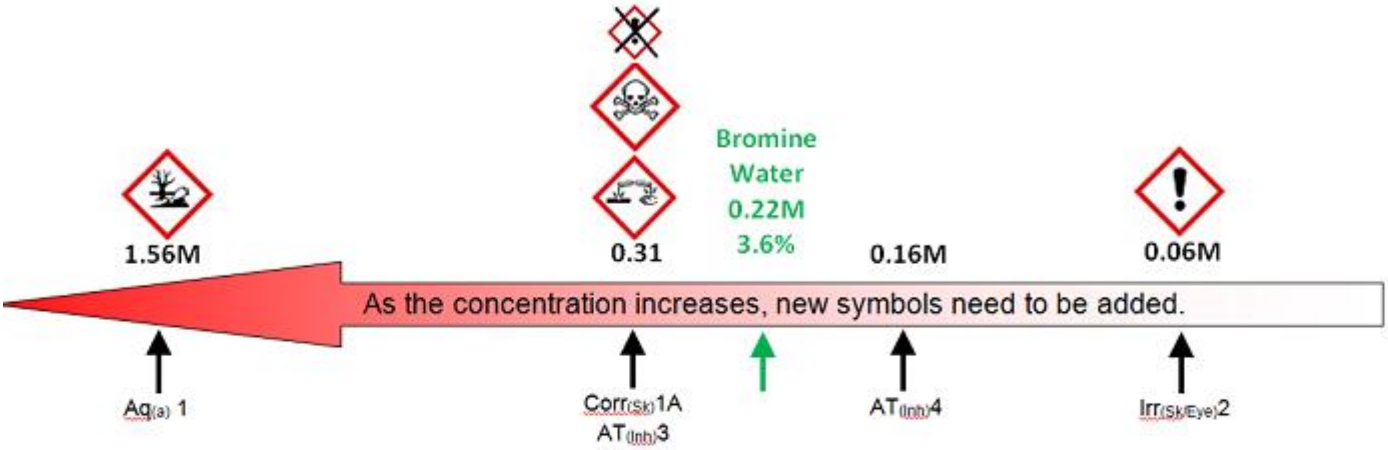
## Hazards

Vapour is very toxic by inhalation and the liquid causes severe burns to skin and eyes. Bromine water is much less corrosive and less hazardous. It is still classed as harmful and irritant but soon loses bromine and reduces in concentration. This safer solution diluted 10 fold shows the decolourisation of bromine by unsaturated compounds. Label this diluted bromine water ‘Harmful’.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| bromine | Danger | Acute toxin cat 2 (inhalation)<br>Skin corrosive Cat 1A<br>Harmful to the aquatic environment Cat 1 | H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life. |  |

## Concentration Effects



## Incompatibility

Dangerous if mixed with ammonia, hydrocarbons, hydrogen, sodium, potassium, aluminium, mercury, magnesium, powdered metals, turps, ethoxyethane (diethyl ether), methanol and propanone (acetone).

## Handling

Keep at least 0.5 litre of approx. 1M sodium thiosulphate to hand for treating any small spills (a few drops) on the skin or on the bench. Wear goggles (BS EN 166 3) and nitrile gloves for bromine liquid and non-aqueous solutions and handle in a fume cupboard. The outside of the bottle should be washed with water after use, to remove any bromine that may have run down the side during pouring. A teat pipette can be used for transferring small quantities. This is much safer than pouring from the bottle, but because of its high density, bromine will fall out of a teat pipette if it is overloaded or moved jerkily.

## Storage

Bottles and ampoules with acids in general store. If ampoules are used, which is preferable, pay strict attention to instructions for opening.

## Disposal

Wear goggles (BS EN 166 3) and nitrile gloves. Carry out in a fume cupboard. To a bucket or beaker (of at least 1 litre capacity) add up to 20 cm3 of bromine. Cover with about 100 cm3 of water and stir in 2M sodium carbonate solution (IRRITANT) until the colour of the bromine has been discharged. Wash to waste with plenty of water.

## Spillage

Wear goggles (BS EN 166 3) and nitrile gloves. Evacuate room and open windows. For small spills up to 1 cm3 close door and after 3 hours cover spill with anhydrous sodium carbonate. Mop up with lots of water and wash to waste. For larger spills evacuate room and call emergency services.

## Remedial Measures

If swallowed, a large area of skin is involved, breathing is affected or if eyes are irritated take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Immediately wash well with 1M sodium thiosulphate solution and water. Remove and wash contaminated clothing.

# Bromobenzene

Alternative names: phenyl bromide.  Description: Colourless liquid with aromatic smell. Insoluble in water.

## Hazards

Moderately toxic if swallowed. It is harmful by skin absorption. The vapour is mildly toxic by inhalation and narcotic in high concentrations. Irritates the eyes. Flammable. (explosive levels 0.5 – 3.0%) Toxic fumes of hydrogen bromide, carbon monoxide and carbon dioxide are given off when heated to decomposition. Avoid release to the environment.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| bromobenzene | Warning | Flammable liquid Cat 3<br>Skin irritant cat 2<br>Harmful to the aquatic environment with long-lasting effects Cat 2 | H226 Flammable liquid and vapour.<br>H315 Causes skin irritation.<br>H411 Toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Oxidising agents. May be unstable in light. Violent reaction above 30 °C with 1-bromobutane and sodium in ether.

## Handling

Wear nitrile gloves and eye protection and use fume cupboard if chemical to be exposed for more than a minute or so.

FF – DP, CO2 or VL.

## Storage

Flammables store. Keep in a tightly closed container away from heat or any sources of ignition.

## Disposal

Wear nitrile gloves and eye protection. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Larger quantities should be stored in a bottle for waste halogenated hydrocarbons to await disposal by licensed contractor.

## Spillage

Turn off all sources of ignition and evacuate room. Wearing lab coat, eye protection, rubber boots and nitrile gloves, brush to an emulsion with water and detergent. Alternatively, for larger spills, soak up on sand-soda ash (90:10) or vermiculite-sodium carbonate mixture, collect into a bucket and carry to a safe open space for evaporation or store to await collection by waste disposal contractor. The site of the spillage should be washed well with water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Bromobutanes

Alternative names: n-butyl bromide and sec-butyl bromide.  Description:

1-bromobutane irritates the eyes and skin – avoid breathing the fumes. It may be harmful by inhalation, skin contact and by ingestion. It can be narcotic in high concentrations. Flammable (1-isomer), highly flammable (2-isomer) – avoid any sources of ignition Explosion limits 2.6 – 6.6%).

2-bromobutane is highly flammable and can form explosive mixtures with the air. May irritate and be harmful to eyes, lungs, and if swallowed. When either isomer is heated to decomposition toxic fumes are emitted.

## Hazards

1-bromobutane irritates the eyes and skin – avoid breathing the fumes. It may be harmful by inhalation, skin contact and by ingestion. It can be narcotic in high concentrations. Flammable (1-isomer), highly flammable (2-isomer) – avoid any sources of ignition Explosion limits 2.6 – 6.6%).

2-bromobutane is highly flammable and can form explosive mixtures with the air. May irritate and be harmful to eyes, lungs, and if swallowed. When either isomer is heated to decomposition toxic fumes are emitted.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 1-bromobutane | Danger | Flammable liquid Cat 3<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H226 Flammable liquid and vapour.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation<br>H335 May cause respiratory irritation. |  |
| 2-bromobutane | Danger | Flammable liquid Cat 2 | H225 Highly flammable liquid and vapour. |  |

## Incompatibility

Oxidising agents. 1-bromobutane reacts violently with bromobenzene + sodium above 30 °C.

## Handling

In well-ventilated area. Wear eye protection and nitrile gloves. Do not distil to dryness.

FF – F, DP, CO2 or VL.

## Storage

Flammables store. Keep away from sources of ignition.

## Disposal

Wear eye protection and nitrile gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware etc. should be emulsified with detergent and water and washed to waste. It can be hydrolysed to the relatively harmless butanols by refluxing with 2M sodium hydroxide (CORROSIVE). For larger amounts store in waste bottle for halogenated hydrocarbons for disposal by waste disposal contractor.

## Spillage

Wear eye protection and nitrile gloves. Turn off sources of ignition, open windows to thoroughly ventilate the room and absorb in sand or inert absorbent. If amounts are small evaporate in open air. For larger spillages package absorbent in labelled bags for removal by an approved contractor. Wash spillage area thoroughly with detergent and water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Obtain medical attention if feeling unwell.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if large area of skin is affected or if irritation persists.

# Bromoethane

Alternative names: ethyl bromide.  Description: Very volatile, highly flammable, colourless liquid with ether-like smell. Slightly soluble in water.

## Hazards

A **Category 2 carcinogen. Very volatile. Harmful** by inhalation, swallowing or skin contact. Irritates the eyes and respiratory system and has narcotic and anaesthetic effects if breathed in high concentrations – oedema, lung congestion and liver/kidney damage can occur. When heated to decomposition emits toxic fumes. Less toxic than bromomethane but more toxic than chloroethane. Chronic effects from exposure to low concentrations. **Highly flammable** – moderate explosion risk when exposed to heat, sparks or flame (Explosion Limits 6.7 – 11.3%).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| bromoethane | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Carcinogen Cat 2 | H225 Highly flammable liquid and vapour.<br>H302 Harmful if swallowed.<br>H332 Harmful if inhaled.<br>H351 Suspected of causing cancer. |  |

## Incompatibility

Oxidising agents including hydrogen peroxide, ammonium nitrate, chromic(VI) acid, nitric acid, oxygen, chloric(VII) acid (perchloric acid) and chlorates(VII) (perchlorates). Risk of explosion when being prepared from ethanol and bromine.

## Handling

In fume cupboard away from sources of ignition. Wear nitrile gloves and eye protection. Do not distil to dryness.

FF – WS, DP or VL.

## Storage

Flammables store.  Keep away from sources of ignition.

## Disposal

Wear eye protection and nitrile gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware etc. should be emulsified with detergent and water and washed to waste. It can be hydrolysed to the relatively harmless ethanol by refluxing with 2M sodium hydroxide (CORROSIVE). For larger amounts store in waste bottle for halogenated hydrocarbons for disposal by waste disposal contractor.

Spillage

Wear eye protection and nitrile gloves. Turn off sources of ignition, open windows to thoroughly ventilate the room and absorb in sand or inert absorbent. If amounts are small evaporate in open air or from paper towels in a fume cupboard. For larger spillages package absorbent in labelled bags for removal by waste disposal contractor. Wash spillage area thoroughly with detergent and water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area of skin involved is large.

# Buffer Solutions

Buffer solutions are solutions that resist change of pH to a certain degree and thus are useful for processes, especially biochemical reactions, where pH control is important

## Hazards

At the concentrations required for preparation of the buffer solutions mentioned on these pages, all of the substances used are classified as being of no significant hazard. However, preparation of these solutions will involve working with more concentrated, and hence more hazardous substances. This is particularly the case for sodium hydroxide, hydrochloric acid and ethanoic acid.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium hydrogen phthalate | | No significant hazard | | None |
| 2-hydroxypropane-1,2,3-tricarboxylic acid (citric acid) | Warning | Eye irritant Cat 2 | H319: Causes severe eye irritation |  |
| potassium hydrogen ethanoate-1-ethanedioic acid-2-water (potassium tetroxalate) | Warning | Acute toxin cat 4 (oral)<br>Acute toxin cat 4 (dermal) | H302: Harmful if swallowed<br>H312: Harmful in contact with skin |  |

## Incompatibility

Most phosphates are of low reactivity and will not react in any hazardous manner. Ammonium compounds will react with strong acid or alkali to release toxic fumes. Citric acid should be kept away from strong oxidising agents

## Handling

Avoid raising dust from compounds in the solid state. Wear eye protection to handle any of those classed as irritant.

FF – no special requirements

## Storage

Securely in store. Unless stated otherwise, low hazard compounds can be placed with domestic waste or, if in solution, run to waste with copious quantities of water.

## Disposal

Wear eye protection.  Small to moderate amounts can be washed to waste with copious quantities of water. Larger amounts should be kept for disposal by licensed contractor.

## Spillage

Wear plastic gloves and eye protection as appropriate. Moisten with water, shovel into bucket and treat as for Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Give pint of water to drink. If unconscious do not give anything to drink. Obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

## Butanols

Butan-1-ol and Butan-2-ol.  Alternative names: n-butyl alcohol & sec-butyl alcohol

### Hazards

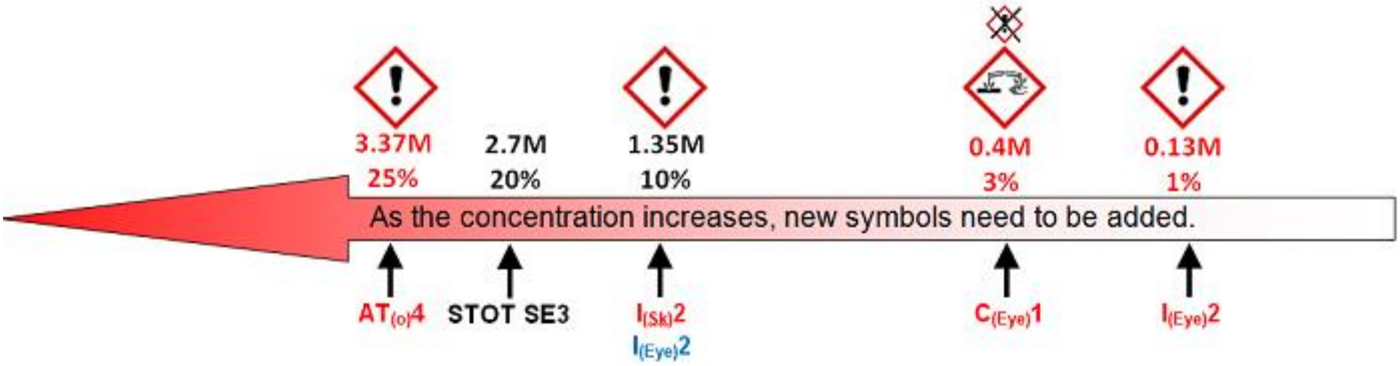
**Harmful vapour** which irritates the respiratory tract and depresses the central nervous system, causing drowsiness. Liquid is **irritating** to skin and can be readily absorbed causing internal injury. Dangerous to eyes. **Flammable** – form explosive mixture with air (explosive range 1.4 – 11.2%). Keep away from all sources of ignition.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| butan-1-ol | Danger | Flammable liquid Cat 3<br>Acute toxin cat 4 (oral)<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Single target organ toxin on single exposure cat 3 | H226: Flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H335: May cause respiratory irritation<br>H336: May cause drowsiness or dizziness. |  |
| butan-2-ol | Danger | Flammable liquid Cat 3<br>Eye irritant 2<br>Single target organ toxin on single exposure cat 3 | H226: Flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation<br>H336: May cause drowsiness or dizziness. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. Butan-1-ol in red, butan-2-ol in blue.



### Incompatibility

Flammables store. Up to 250 cm3 in laboratory. Store away from all sources of ignition, heat and direct sunlight.

### Handling

Wear nitrile gloves and eye protection. In a fume cupboard preferably; if not available in well-ventilated room away from all sources of ignition.

FF – F, DP, CO2 or VL.

## Storage

Flammables store. Store away from all sources of ignition, heat and direct sunlight.

## Disposal

Wear nitrile gloves and eye protection. Turn off all sources of ignition. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Up to 50 cm3can be greatly diluted (x100) and washed to waste.

## Spillage

Turn off all sources of ignition. Wear face shield and nitrile gloves. Emulsify and run to waste. For larger spills ventilate the room and absorb with sand or vermiculite, shovel into a bucket and then wash the absorbent free of the alkanol. Thoroughly wash and ventilate spillage area.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected or if feeling unwell.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area of skin affected is large.

## Butan-2-one

Alternative names: methyl ethyl ketone, MEK

### Hazards

**Highly flammable** – there is a high explosion and fire risk when exposed to heat and sources of ignition (explosive range 1.9 – 11%). Vapour harmful to eyes and causes drowsiness. Liquid can cause corneal damage. If swallowed can cause gastric irritation. Suspect mutagen and teratogen. Mildly irritant to skin. Regarded as a relatively 'safe' solvent of mild toxicity.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| butan-2-one | Danger | Flammable liquid Cat 2<br>Eye irritant cat 2<br>Single target organ toxin on single exposure cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H336: May cause drowsiness or dizziness |  |

### Incompatibility

In flammables store away from sources of heat, ignition and direct sunlight.

### Handling

In well-ventilated area, well away from flames, etc. Wear eye protection and gloves (natural rubber or neoprene – not pvc). Fumes are more dense than air – therefore beware accumulations and flash back to sources of ignition. FF – WS, DP or VL.

### Storage

In flammables store away from sources of heat, ignition and direct sunlight.

### Disposal

Wear eye protection and rubber gloves and remove sources of ignition. Absorb small quantities on to paper and place in a fume cupboard for evaporation. Alternatively, thoroughly emulsify washings of flasks by mixing with water and detergent and wash to waste – beware any explosive solvent vapour accumulations in the drains.

### Spillage

Wear eye protection and rubber gloves and remove sources of ignition. For small spillages, absorb on paper towel and place in a fume cupboard to allow evaporation. For larger spills. absorb on sand and take to the open air for evaporation. Wash area of spillage well with water and detergent, mopping up and washing to waste with large quantity of water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice/attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

### Skin

Turn off sources of ignition. Soak contaminated clothing with water and remove. Wash well with soap and water.

# Butanal

Alternative names: butyraldehydr. Description: Colourless liquid with pungent smell. Slightly soluble in water. Butanal is less flammable and less hazardous than ethanal.

## Hazards

**Highly flammable**, forming explosive mixture with air (l.e.l. 2.5%). Liquid should be used away from sources of heat and ignition. It is moderately harmful if inhaled and irritates skin and eyes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| butanal | Danger | Flammable liquid Cat 2 | H225: Highly flammable liquid and vapour. |  |

## Incompatibility

Incompatible with oxidising agents and may react dangerously with chlorosulphonic acid, nitric acid, oleum or sulphuric acid.

## Handling

Wear nitrile gloves and eye protection. Use only in a fume cupboard or on a small scale in a well ventilated laboratory.

FF – F, DP, CO2 or WS.

## Storage

Store in a cool, dry place away from heat, light and any sources of ignition.

SSL – 3 years maximum. Can form explosive peroxides in storage.

## Disposal

Wear eye protection and nitrile gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware etc. should be emulsified with detergent and water and washed to waste. Remove all sources of ignition and allow small volumes to evaporate in a safe place.

## Spillage

Turn off all sources of ignition and ventilate the room. Wear eye protection and nitrile gloves. Soak up small spillages on mineral absorbent. Carry outside and allow to evaporate in a safe place.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area of skin affected is large or if irritation persists.

# Butane

Alternative names: camping gas (LPG is a mixture of propane and butane). Description: Used commercially for domestic/industrial use in compressed form in steel cylinders.

## Hazards

**Extremely flammable.** There is a serious risk of explosion and fire if butane is exposed to heat or sources of ignition (explosive range 1.9 – 8.5%). It is more dense than air and so can collect in pockets (drawer bottoms and cupboards). It causes asphyxia by excluding air and is mildly anaesthetic in high concentrations. The pure gas has no smell but an odour is added to cylinders of the gas.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| butane | Danger | Pressurised gas<br>Flammable gas Cat 1 | H220: Extremely flammable gas.<br>H280: Contains gas under pressure; may explode if heated. (for cylinders only) |  |

## Incompatibility

It forms a highly explosive mixture with nickel tetracarbonyl and oxygen. It is incompatible with strong bases. There is a dangerous fire hazard with oxidising agents.

## Handling

In school, teachers or pupils will not handle the liquefied gas directly unless inadvertently when a cylinder/burner with the valve open is knocked over. Use stabilising bases where available. Extra care should be taken with Bluet-type Camping Gaz disposable cylinders which cannot be resealed once punctured. Self-sealable e.g. EPIgas types are preferred but take care that the seal is intact (check with soapy water and rinse afterwards). You may have problems using these with standard tripods as the cylinder plus burner is much taller than the usual bunsen. The bigger resealable cylinders Calor, J & Macgas types with pressure reduction valves are unsuitable for use in school laboratories.

## Storage

Store cylinders/small cartridges outside in a locked, cool, well ventilated, fire-resist store away from oxidising agents, flames and other sources of ignition. Some schools in remote areas may have piped-in supplies from large permanent tanks located outside. Observe supplier’s instructions in the use of this gas.

## Disposal

Never burn ’empty’ disposable cartridges as traces of gas can explode. Leave in secure place outside for any residual liquid to evaporate and place spent cartridge in domestic refuse.

## Spillage

A spillage of the liquefied burning gas should not be extinguished, unless the gas flow can be safely stopped. Cool the cylinders with a water spray, and if safely possible, move them away from the fire.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. If liquid butane splashed in eyes obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. If swallowed, don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Remove contaminated clothing and air away from sources of ignition.

# Butyl ethanoate

n-butyl ethanoate and iso-butyl ethanoate.  Alternative name: n-butyl acetate, isobutyl acetate. Description: Colourless/yellowish liquids with fruity smell. Insoluble in water.

## Hazards

**Flammable** – form an explosive mixture in air, especially if warmed (explosive range 1.4 – 7.5%). Keep away from sources of ignition. Harmful vapour which irritates the eyes, nose and throat and may cause drowsiness. Low toxicity (high $LD_{50}$) but acts as a depressant on the central nervous system. Liquid defats and cracks skin.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| n-butyl ethanoate | Warning | Flammable liquid Cat 3<br>Specific target organ toxin on single exposure Cat 3 | H226: Flammable liquid and vapour.<br>H336: May cause drowsiness or dizziness. |  |
| iso-butyl ethanoate | Warning | Flammable liquid Cat 2 | H225: Highly flammable liquid and vapour |  |

## Incompatibility

Oxidising agents. Reacts violently with potassium tert-butoxide causing ignition.

## Handling

In a fume cupboard or in well-ventilated area away from source of ignition. Wear eye protection and nitrile gloves. Vapours are more dense than air and can collect in low areas and travel back to sources of ignition causing flashbacks. FF – F, DP, CO2 or VL.

## Storage

Flammable store away from heat, light and sources of ignition. Keep well ventilated.

## Disposal

Turn off all sources of ignition. Wear eye protection and nitrile gloves. Small quantities such as washings from flasks should be emulsified with detergent and water and washed to waste. Larger quantities may be hydrolysed to the water soluble alcohol by refluxing with 2M sodium hydroxide (CORROSIVE) and sodium salt which can be washed away.

## Spillage

Turn off all sources of ignition. Wear eye protection and nitrile gloves. Small spillages may be absorbed on to paper towels and evaporated in a fume cupboard. Larger spillages may be absorbed on to sand and taken to an open area for evaporation. Spillage area should be thoroughly ventilated.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical advice if feeling unwell.

### Skin

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing.

# Cadmium compounds

**AVOID USE UNLESS REALLY NECESSARY**

Metal – silvery white sticks or granules. Used to make alloys, in electroplating, photo cells, NiCad batteries etc. Compounds are often brightly coloured and might be encountered in artists pigments etc.

## Hazards

The metal and most compounds are very toxic by inhalation, in contact with skin or eyes and if swallowed and may cause cancer. Most of the compounds are Category 1B or Category 2 carcinogens. If the metal is finely divided it is flammable and forms explosive mixtures with air, oxidising agents and other materials. When heated strongly it produces toxic fumes of cadmium and cadmium oxide which can cause metal fume fever. Brief exposure to high concentrations of dust or fumes may be fatal. Exposure to low concentrations over a long period results in severe damage to lungs, liver and kidneys.

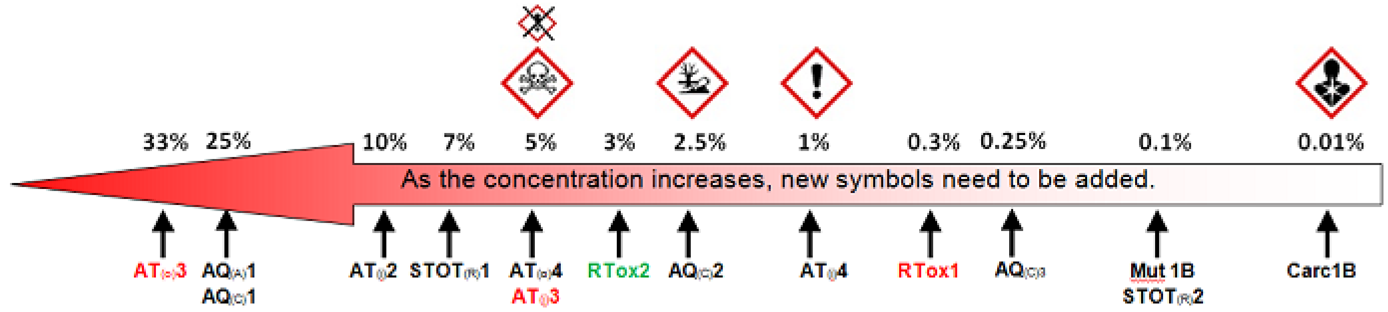
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| cadmium, cadmium oxide | Danger | Acute toxin Cat 2 (inhalation)<br>Reproductive toxin Cat 2<br>Mutagen Cat 2<br>Carcinogen Cat 1B<br>Specific target organ toxin on repeated exposure cat 1<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H330: Fatal if inhaled.<br>H361: Suspected of damaging fertility or the unborn child<br>H341: Suspected of causing genetic defects<br>H350: May cause cancer<br>H372: Causes damage to organs<br>H413: May cause long lasting harmful effects to aquatic life. |  |
| cadmium chloride, sulphate, sulphide | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 2 (inhalation)<br>Reproductive toxin Cat 2<br>Mutagen Cat 1B<br>Carcinogen Cat 1B<br>Specific target organ toxin on repeated exposure cat 1<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed.<br>H330: Fatal if inhaled.<br>H360: May damage fertility or the unborn child<br>H340: May cause genetic defects<br>H350: May cause cancer<br>H372: Causes damage to organs<br>H410: Very toxic to aquatic life with long lasting effects |  |
| other cadmium compounds | Danger | Acute toxin Cat 4 (oral, dermal, inhalation)<br>Harmful to the aquatic environment with long-lasting effects Cat 1<br>Mutagen Cat 1B<br>Carcinogen Cat 1B<br>Specific target organ toxin on repeated exposure cat 1<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H340: May cause genetic defects<br>H350: May cause cancer<br>H372: Causes damage to organs<br>H410: Very toxic to aquatic life with long lasting effects |  |

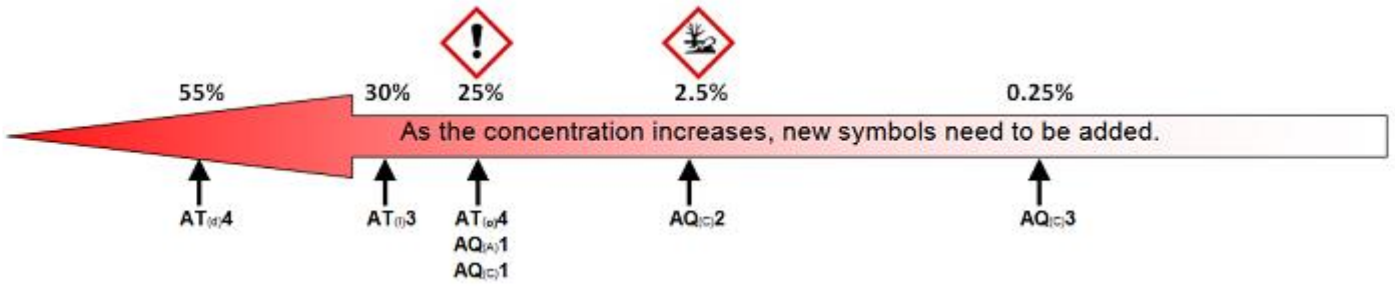
## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

Cadmium chloride, oxide, sulphate and sulphide GREEN = Oxide only, RED = Except oxide



Other Cadmium compounds



## Incompatibility

Oxidising agents e.g. explosive reaction with ammonium nitrate. Incompatible also with some acids, ammonia, zinc and other metals.

## Handling

Handle solids carefully, with eye protection and pvc gloves. If process used creates vapour or dust, handle in fume cupboard.

## Storage

Securely in store – away from oxidising agents.

## Disposal

Extremely small quantities such as washings of glassware can be run to waste. Otherwise store to await disposal by a licensed contractor.

## Spillage

Wear eye protection and pvc gloves.

Solids – carefully sweep up.

Solutions – soak up on absorbent and treat as in Disposal. Wash the contaminated area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention.

# Calcium compounds

## Hazards

In general these calcium compounds are of low hazard. Many of them are moderate to severe eye and skin irritants.  The nitrate and chromate are oxidising agents and contact with combustible material may cause fire. Phosphide releases flammable and toxic gases in contact with water and, with the fluoride releases toxic gases in contact with acids) Under GHS, most calcium compounds are not classified as Harmful to the Aquatic Environment

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| calcium bromide,<br>calcium carbonate,<br>calcium iodide,<br>calcium phosphate,<br>calcium sulphate,<br>calcium sulphite | | No significant hazard | | |
| calcium chloride,<br>calcium chloride – 6-water | Warning | Eye irritant Cat 2 | H319 Causes serious eye irritation. |  |
| calcium methanoate | Danger | Eye Damage Cat 1 | H318: Causes serious eye damage |  |
| calcium phosphide | Danger | Substances, which in contact with water, emit flammable gases Cat 1<br>Acute toxin (oral) Cat 2<br>Harmful to the aquatic environment Cat 1 | H260: In contact with water releases flammable gases which may ignite spontaneously.<br>H300: Fatal if swallowed.<br>H400: Very toxic to aquatic life. |  <br> |
| calcium fluoride,<br>calcium sulphide | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin Cat 3<br>(Harmful to the aquatic environment Cat. 1 S only) | H315 Causes serious skin irritation.<br>H319 Causes serious eye irritation.<br>H335 Causes respiratory irritation.<br>(H400: Very toxic to aquatic life. S only) |   |
| calcium chromate | Danger | Acute toxin (oral) Cat 4.<br>Carcinogen Cat 1B.<br>Harmful to the aquatic environment with long lasting effects Cat. 1 | H302: Harmful if swallowed.<br>H350: May cause cancer<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long-lasting effects |  <br> |

### Incompatibility

Nitrate and chromate should be kept away from combustible materials. Phosphide reacts with water to release flammable and toxic gases. Phosphide and fluoride react with acids to release toxic and flammable and toxic gases respectively.

### Handling

Avoid raising dust from compounds in the solid state. Wear eye protection to handle chloride, fluoride and sulphide and goggles (BS EN166 3) when handling methanoate and phosphide.

FF – For phosphide, do not use water. Dry sand or dry powder.

### Storage

Securely in store. Keep nitrate and chromate (VI) with oxidising agents. Unless stated otherwise, low hazard compounds can be placed with domestic waste or, if in solution, run to waste with copious quantities of water.

### Disposal

Wear goggles (BS EN 166 3) where appropriate.  For small amounts of phosphide: add the solid to water in small amounts in a fume cupboard. Wait until the reaction is finished before more is added. Wash to waste. Larger amounts should be kept for disposal by licensed contractor, as should the fluoride and the chromate.

### Spillage

Form most, wear plastic gloves and eye protection as appropriate. Moisten with water, shovel into bucket and treat as for Disposal. Do NOT add water to the phosphide.

### Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

# Calcium dicarbide & ethyne

Alternative names: calcium carbide (calcium dicarbide), acetylene (ethyne).

## Hazards

Contact with water evolves ethyne, an extremely flammable gas and leaves a suspension of calcium hydroxide (IRRITATING). Calcium dicarbide is extremely damaging to the skin and eyes. Do not inhale dust. Explosive mixtures (explosive range 2.5 to 82%) of ethyne with air can be initiated by sparks – beware opening steel container with e.g. metal spatula. Take precautionary measures against static discharges. Ethyne explosions may also be caused by heat with or without contact with air (explosive range 2.5 to 82%). Ethyne is only mildly toxic by inhalation but acts as a simple asphyxiant.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| calcium dicarbide | Danger | Water reactive solid Cat 1 | H260: In contact with water releases flammable gases which may ignite spontaneously. |  |
| c ethyne | Danger | Flammable gas Cat 1 | H220: Extremely flammable gas. |  |

## Incompatibility

Water, dilute acids, chlorine, bromine, iodine, halogen oxoanions, silver nitrate solutions, tin, hydrogen chloride, magnesium, methanol, sodium peroxide, sulphur, copper compounds and other heavy metals.

## Handling

Wear pvc gloves and eye protection. Handle only on dry bench away from water. Remove lid with care as pressure may have built up in container.

FF – DP or S.

## Storage

Keep the dicarbide securely in store – not in laboratory, preferably in an airtight can and not a bottle. Keep well ventilated. Store away from flammable chemicals and oxidising agents.

SSL – 3 years maximum if stored under good conditions. Water reactive and over time reacts with moisture from the air to form highly flammable acetylene gas, which may ignite spontaneously.

## Disposal

Wear pvc gloves and eye protection and ensure ignition sources are absent. Small quantities: in a fume cupboard or outside (ethyne evolved), add up to 2 g at a time to water in a bucket. When reaction is complete, neutralise with 2M hydrochloric acid (IRRITANT) and wash the calcium salt to waste with plenty of water.

## Spillage

Wear pvc gloves and eye protection. Carefully sweep up avoiding raising dust. Treat as in Disposal. Wash spillage area well with a very wet cloth. Wash the cloth afterwards.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical advice/attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Calcium hydride

Alternative names: calcium dihydride.  Description: Greyish crystalline powder reacts with water to produce hydrogen and calcium hydroxide

## Hazards

Reacts with water and dilute acids to form hydrogen gas (EXTREMELY FLAMMABLE – explosive range 4 – 74%) and calcium hydroxide (IRRITANT and can cause serious damage to eyes and serious irritation to skin and respiratory tract). Keep away from sources of ignition. Harmful to eyes, lungs, mouth and skin. Avoid inhaling dust.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| calcium hydride | Danger | Water reactive solid Cat 1 | H260 In contact with water releases flammable gases which may ignite spontaneously |  |

## Incompatibility

Powder can form dust cloud which is explosive if in contact with flame, spark, heat or oxidising agents. Reacts with water to form hydrogen gas (EXTREMELY FLAMMABLE) and calcium hydroxide (IRRITANT). Heated with water or acids, an exothermic reaction evolving hydrogen occurs and temperature may be high enough to cause ignition. Mixtures with various bromates, chlorates, perchlorates explode on grinding. Dangerous with halogens on heating, manganese(IV) oxide, silver halides and tetrahydrofuran. FF – DP or S.

## Handling

Wear rubber gloves and goggles (BS EN 166 3). Keep away from water. Open containers carefully as pressure may have built up inside due to reaction with atmospheric moisture.

## Storage

Well-stoppered bottle in a dry place. General store with reducing agents.

SSL – 2 years maximum. Water reactive and over time reacts with moisture from the air, to form highly flammable hydrogen. If the lid becomes cemented, the container can explode from the increase in pressure.

## Disposal

Extinguish all sources of ignition. Wear face shield in a well-ventilated area (hydrogen evolved) and add a little at a time to large volume of water using spatula in hand held well away from body. Stir and leave for one hour or so for reaction to be complete and wash to waste with water.

## Spillage

Wear rubber gloves and face shield. Cover with dry anhydrous sodium carbonate and carefully shovel into dry bucket. In an open area add the mixture a little at a time to a large volume of water and stand back after each addition. Allow to stand 24 hours and wash down the drain with running water.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached & thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water continuously (see note above) to leach out any hydroxide ions which may have been absorbed into the eye. It is important to flush under eyelids also. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Turn off sources of ignition. Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing.

## Calcium metal

Description: Silver grey metallic granules.

### Hazards

Flammable. Contact with water liberates extremely flammable hydrogen gas which presents an explosion hazard when mixed with the air. The solid metal is destructive to eyes, lungs and skin as moisture forms the corrosive calcium oxide and hydroxide. Fumes from burning calcium are composed of calcium oxide (quicklime). Reacts explosively with alkalis, lead chloride and, if ignited, sulphur.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| calcium | Danger | Water reactive solid Cat 2 | H261: In contact with water releases flammable gases. |  |

### Incompatibility

Finely divided calcium reacts violently with water or dilute acids. The hydrogen formed may ignite, due to the heat of reaction. A dangerous mixture with oxidising agents. Explosions have occurred with alkali metals and their hydrides, hydroxides & carbonates, lead chloride, dinitrogen tetroxide, phosphorus(V) oxide and sulphur (when ignited).

### Handling

Use forceps or spatula, and make sure bench and heat resistant mats are dry. Explosions have occurred when molten metal dropped on to a moisture laden asbestos mat. Wear eye protection and rubber gloves. Extinguish small fires with sand or allow to burn out if it is a very small amount.

FF – DP or S.

### Storage

General store in airtight bottle, with reducing agents. Keep well away from any water, oxidising agents or where water may be used for fire-fighting measures.

SSL – 3 years maximum. Water reactive and over time reacts with moisture from the air to form highly flammable hydrogen. If the lid becomes cemented, the container can explode from the increase in pressure.

### Disposal

Wear eye protection and rubber gloves. Ventilate the area and extinguish all sources of ignition. As only small quantities will be involved in schools, add to water in a trough, bucket or basin and leave until reaction is complete (say 1 hour). Neutralise with 2M nitric (CORROSIVE) or hydrochloric acid (IRRITANT) and wash to waste.

### Spillage

Wear eye protection and rubber gloves. Collect carefully as much calcium as possible and place in a dry container. Treat as in Disposal. Wash the spillage area well with a very wet cloth and place cloth in sink under running water for 10 minutes.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached & thereafter for possibly HOURS. Irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water for continuously (see note above) to leach out any hydroxide ions which may have been absorbed into the eye. It is important to flush under eyelids also. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route unlikely. If affected by calcium oxide fumes obtain medical advice.

### Skin

Brush off any loose particles and wash well with soap and water. Remove and wash contaminated clothing. If a large area of skin is affected or if blistered then obtain medical attention.

# Calcium oxide & hydroxide

Alternative names: quicklime and slaked lime. Description: white lumps or powder & white powder or granules

## Hazards

Calcium oxide and calcium hydroxide are very irritating to eyes, skin, and lungs. The oxide reacts with any moisture to produce the alkaline hydroxide along with considerable heat. The result is that tissue may be burned chemically and thermally.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Calcium oxide | Danger | Skin irritant cat 2<br>Eye damage Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H335: May cause respiratory irritation. |  |
| calcium hydroxide | Danger | Skin irritant cat 2<br>Eye damage Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H335: May cause respiratory irritation. |  |

## Incompatibility

Lumps of oxide freshly made from roasting marble chips may disintegrate violently when water is added, again with a large evolution of heat. The reaction with old stock of the oxide will be generally of a milder nature although the resultant alkali is still an irritant to all tissue. Calcium oxide is also dangerous on contact with steam, acids or acid fumes since it reacts to produce heat. Some mixtures with water develop enough heat to ignite combustible materials. Glass bottles of calcium oxide may burst due to expansion as the oxide is hydrated to become the hydroxide.

## Handling

Wear goggles (BS EN 166 3) and rubber gloves when adding water to calcium oxide. Prepare lime water with calcium hydroxide.

## Storage

General store with alkalis away from risk of physical damage or contamination by moisture or water. Will become less effective over time as it absorbs water vapour. Dispose when it is no longer effective.

## Disposal

Wear goggles (BS EN 166 3) and rubber gloves. small quantities: Calcium oxide – by adding it in small portions to a large volume of water, stirring and washing to waste. Calcium hydroxide – by washing to waste with water. larger quantities: as above, but neutralise the thin slurry of hydroxide with 2M hydrochloric acid.

## Spillage

Wear face shield and rubber gloves. Brush up carefully and collect in dry plastic bucket. Carry to open area and treat as in Disposal.

## Remedial Measures

If the eyes are exposed to a large amount of powdered CaO (quicklime) they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached.

**Eyes**

Irrigate with water continuously (see note above). If powdered freshly-made CaO has entered the eye wash under the eyelids to ensure hydroxide ions are leached out (see note above). Obtain medical attention as soon as possible.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if large area is affected or if irritation persists.

# Carbon

Alternative names: charcoal, powdered graphite, lampblack, buckminsterfullerene.

Description: Black solid or powder. buckminsterfullerene – supplied also as solution (lilac) in methylbenzene

## Hazards

Charcoal, graphite and buckminsterfullerene dust are irritants if inhaled or if they go into eyes. Activated charcoal presents a fire hazard and an explosion risk in the form of dust when exposed to heat or flame. Charcoal blocks used for oxide reduction can cause fires if stored away after use without ensuring that area of the block used in reduction is properly cooled and extinguished.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| carbon (activated charcoal) | Warning | Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H318: Causes serious eye damage.<br>H335: May cause respiratory irritation. |  |
| fullerene | Warning | Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H318: Causes serious eye damage.<br>H335: May cause respiratory irritation. |  |

## Incompatibility

Contamination with drying oils or oxidising agents can lead to spontaneous ignition.

## Handling

Normal chemical laboratory care to prevent accidental spillage and scattering of dust. Keep lids on jars when not in use to prevent stray sparks igniting the carbon.

FF – W

## Storage

General store with reducing agents.

## Disposal

Wear eye protection. Moisten and put in sealed bags in normal waste bin.

## Spillage

Wear eye protection. Moisten, sweep up carefully into shovel and put in waste bin.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical advice.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

## Carbon dioxide

Description: Colourless and odourless denser than air gas. White snow-like solid.

### Hazards

Gas is simple asphyxiant. Supplied in cylinders as a liquid. To produce solid carbon dioxide (snow, dry ice) a syphon type cylinder must be used (identified by a white stripe down the side). Solid carbon dioxide is very cold and in contact with skin may cause frostbite burns. Experimental teratogen with reproductive effects. Carbon dioxide and carbon monoxide levels can build up in a closed laboratory with several Bunsen burners lit.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 33-50% – Rapid respiration with diminished mental ability and muscle coordination.<br>50-75% – Depressed sensations, emotional instability and fatigue leading to unconsciousness, convulsions, coma and death. | | | |  |
| Carbon dioxide (gas and solid) | | | | |

### Incompatibility

Potassium, lithium, sodium, metal hydrides, metal oxides, finely divided aluminium, calcium, magnesium and tin.

### Handling

Leather gloves (not rubber) and eye protection should be worn when handling the solid. The “Jetfreezer” attachment for cylinders allows carbon dioxide to form pellets under pressure as the gas expands through a small hole into a cylindrical chamber. The cylinder must be kept upright. The solid must not be placed in a closed container since there is a danger of explosion due to gas formed from the solid. Do not wear watches or metal jewellery when handling dry ice.

### Storage

General store. The solid can only be stored for a short time by wrapping in paper or other insulating material, care being taken that any gas formed can escape. Store single gas cylinder in an upright position on a trolley or bench clamped in a convenient lab away from sources of heat and direct sunlight. If establishment has more than one cylinder put others in outside store. See also Gas cylinders.

### Disposal

Leave the solid in a well ventilated space.

### Spillage

Wear eye protection and leather gloves. Shovel solid into bucket and leave in an open area to sublime.

### Remedial Measures

**Eyes**

For solid in the eyes irrigate with water for at least 10 minutes and obtain medical attention.

**Mouth**

Exposure by this route unlikely unless dry ice is being used in place of ice cubes in drinks for theatrical effects. Wash out mouth thoroughly with water.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Do not remove contaminated clothing until area is thawed. Immediately flood skin with cold water. If skin is burnt place affected area in a water bath at 42-45°C. Never use dry heat or hot water to treat burn areas.

# Carbon disulphide

Alternative names: carbon sulphide

Description: Clear, colourless, mobile liquid with an unpleasant smell. Odourless if pure.

## Hazards

Should not normally be available in educational labs. The vapour is very toxic by inhalation and is readily absorbed through the skin leading to effects akin to vapour inhalation. Chronic exposure affects the central nervous system, memory and personality. Liquid is poisonous if swallowed. Vapour is extremely irritant to the eyes and lungs. Extremely flammable vapour – forms explosive mixtures with air (1 – 44%) at room temperature. Very easily ignited by comparatively low temperature sources.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| carbon disulphide | Danger | Flammable liquid Cat 2<br>Skin / Eye irritant Cat 2<br>Reproductive toxin Cat 2<br>Specific target organ toxin on repeated exposure Cat 1 | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation.<br>H320: Causes eye irritation.<br>H360: May damage fertility or the unborn child<br>H372: Causes damage to cardiovascular system, central and peripheral nervous system |  |

## Incompatibility

Explosive reactions with aluminium, potassium, sodium, zinc dust, halogens, 1,2-diaminoethene, aziridine, azides, sodium peroxide and oxidising agents such as permanganic acid, nitric oxide, dinitrogen tetroxide and nitrogen dioxide.

## Handling

Wear nitrile gloves and eye protection. Turn off all sources of ignition. Small amounts could be used in a fume cupboard for teacher demonstrations. Notice the low autoignition temperature and hence the need to make sure that the vapour does not come in contact with hot surfaces, e.g. electric storage heater, radiators, hotplate, hot tripod, gauze, light bulb, even steam pipes etc. It ignites at much lower temperatures on rusty surfaces.

FF – F, DP, CO2 or VL.

## Storage

Flammables store at low level and well away from any ignition sources (see above).

## Disposal

Wear eye protection and nitrile gloves. Ensure no sources of ignition are present. Allow small quantities to evaporate in fume cupboard. Emulsify washings from glassware and wash to waste with plenty of water. Beware accumulations of non-dispersed disulphide in drains because of explosion risk.

## Spillage

Open windows and close doors. Remove sources of ignition and allow to evaporate. For larger spillages evacuate the area, soak up on absorbent and transfer to fume cupboard or outside for evaporation.

## Remedial Measures

In all cases of exposure take the casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing.

# Carbon monoxide

Description: colourless, highly toxic and odourless gas, very slightly soluble in water.

## Hazards

Toxic by inhalation. Combines with haemoglobin in the blood to produce carboxyhaemoglobin thus limiting its oxygen-carrying ability 0.02% in air results in 30% of the haemoglobin being bonded with carbon monoxide resulting in headaches, easy fatigue, vomiting, impaired vision and judgement and dizziness. 0.08% in air leads to coma, convulsions and death. Danger of severe damage to health by prolonged exposure even to lower concentrations. The biggest cause of injury from this gas comes not from its preparation or use in the lab, but from fumes from malfunctioning heating boilers drifting in the rooms, often along service ducts. May harm the unborn child. It is extremely flammable and presents a dangerous explosion hazard with air (12.5-74.2%) when exposed to heat or other sources of ignition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| carbon monoxide | Danger | Flammable gas Cat 1<br>Acute toxin Cat 3 (inhalation)<br>Reproductive toxin Cat 1A<br>Specific target organ toxin on repeated exposure Cat 1 | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation.<br>H320: Causes eye irritation.<br>H360: May damage fertility or the unborn child<br>H372: Causes damage to cardiovascular system, central and peripheral nervous system |  |

## Incompatibility

Reacts explosively with bromine trifluoride, chlorine dioxide, peroxodisulphuryl difluoride, iron oxide and liquid oxygen. Also explosive reactions with sodium, potassium, silver(I) oxide, caesium(I) oxide, iron(III) oxide, liquid dinitrogen oxide, bisfluoroformyl peroxide, bromine trifluoride, bromine pentafluoride and aluminium powder.

## Handling

Generate and use only in a ducted fume cupboard. (Filters in recirculatory fume cupboards do not adsorb this gas)

## Storage

Do not use or keep carbon monoxide cylinders in schools. In other establishments keep in an outside store below 52°C, away from all sources of ignition and with adequate ventilation. Warning stickers for the escape of carbon monoxide can be purchased in most DIY stores nowadays.

## Gas escape

Eliminate all sources of ignition and ventilate the area.

## Remedial Measures

Take casualty to hospital immediately by ambulance.

### Lungs

Move patient from area of exposure. If unconscious do not give anything to drink. Convulsions may cause the patient to lapse into unconsciousness. Loosen clothing and clear the area so that the patient is in no danger of injuring themselves whilst they are convulsing. If in shock, lie the casualty down flat and keep warm, raising their legs slightly above their head level.

# Chlorates(I)

The only ones likely to be encountered are the sodium and calcium compounds.

Alternative names:  calcium hypochlorite / bleaching powder sodium hypochlorite / household bleach solution

Description:  Calcium chlorate (I) – White powder with a smell of chlorine. Slowly decomposes in water releasing chlorine gas. Sodium chlorate (I) – Colourless to pale yellow liquid with chlorine smell.  Usually supplied as solution with 10 – 14% w/v available chlorine, (1.5M), 100,000 ppm.  Note that some domestic bleaches are based on peroxides, not hypochlorite.

## Hazards

Corrosive, very harmful to skin and especially dangerous to eyes as it causes burns. Inhalation of dust or swallowing is extremely destructive to all respiratory tissue. In contact with acids, or on heating, and even with carbon dioxide in the air, the toxic gas chlorine is evolved. Inhalation of chlorine is destructive to all mucous tissue.

Calcium chlorate (I) is a powerful oxidising agent, particularly at high temperatures. Hence fire hazard if in contact with combustible materials.

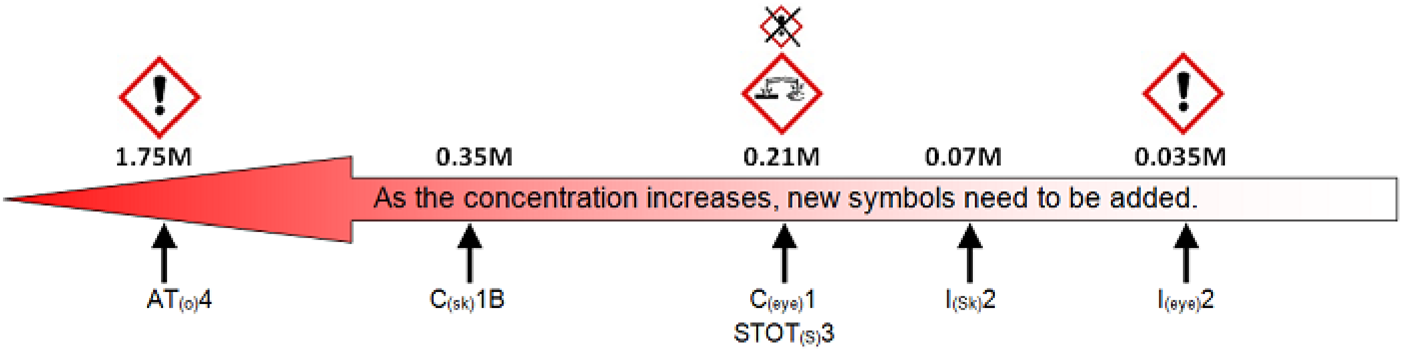
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| calcium chlorate(I) | Danger | Oxidising solid Cat 2<br>Acute toxin cat 4 (oral)<br>Skin corrosive Cat 1B<br>harmful to the aquatic environment Cat 1 | H272: May intensify fire; oxidiser.<br>H302: Harmful if swallowed.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life. |  |
| sodium chlorate(I) | Danger | Skin corrosive 1B<br>Hazardous to the aquatic environment Cat 1<br>Contact with acid liberates toxic gas | H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life.<br>EUH031: Contact with acid liberates toxic gas |  |

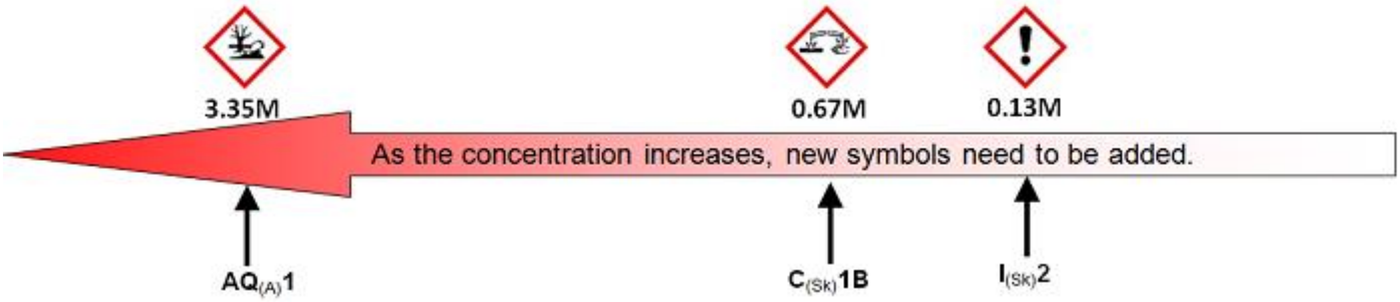
## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

### Calcium chlorate (I)



**Sodium chlorate (I)** Normal household bleach is commonly 5.25%, which is 0.71M. (Different formulations will vary so check the label.)



## Incompatibility

Pure calcium chlorate compound is a powerful oxidising agent. The anhydrous solid of sodium chlorate (obtained by dessication of the pentahydrate) will decompose violently or explode on heating or with friction.

With dilute acids and even water/air, TOXIC chlorine gas is evolved. Decomposition can be catalysed by rust (calcium salt) or cobalt and other transition metal compounds (sodium salt). With concentrated acids the reaction may be explosive. Amines, ammonium salts or EDTA react to form unstable or explosive N-chloro compounds; explosions also reported with methanol and benzyl cyanide. Violent reactions have also been reported with also with sulphur, ethyne and calcium dicarbide, finely divided charcoal, hydroxy compounds (e.g. alkanols and propane-1,2,3-triol and diols), nitromethane, starch, benzonitrile and other reducing agents/combustible materials.

## Handling

Wear gloves and goggles (BS EN 166 3). Avoid raising dust with calcium chlorate. Open sodium chlorate (I) solutions carefully as pressure may have built up. Do not warm.

## Storage

Calcium chlorate (I) – in dry airtight bottle. Substance is sensitive to the presence of dust. Clean the outside of containers carefully. Store with oxidising agents.

Sodium chlorate (I) – store in cool dry place. Up to 0.5 litres in lab. Older stock may have less available chlorine than stated. During hot spells bottles may burst due to pressure build-up if venting cap is ineffective.

**SSL** – two years maximum for calcium and 5 years for sodium compounds. calcium chlorate (I) is water reactive and over time reacts with moisture from the air. In the presence of small amounts of water it can decompose to form dangerously unstable dichlorine monoxide, which is sensitive to friction, shock or static spark. Sodium chlorate (I) simply loses effectiveness over time as slowly decomposes on contact with air. Exposure to sunlight accelerates decomposition.

## Disposal

Wear gloves and goggles (BS EN 166 3) or face shield. Small amounts such as washings of glassware can be washed to waste. For larger amounts, before running to waste, reduce the resulting solution with sodium metabisulphite (TOXIC sulphur dioxide may be evolved), iron(II) salt or sodium thiosulphate, mix and spray with water. Add 1M sulphuric acid (IRRITANT) for rapid reduction.

## Spillage

Wear gloves and goggles (BS EN 166 3). Shovel and solid carefully into plastic bucket and add in small portions to a large volume of water and treat as in Disposal. Wash spillage area well, especially clothes and wooden floors. For sodium chlorate (I) or solutions, soak up as much as possible and wash to waste. Cover residue with a reducing agent e.g. sodium metabisulphite, (TOXIC sulphur dioxide may be evolved), iron(II) salt or sodium thiosulphate, mix and spray with water. Add 1M sulphuric acid (IRRITANT) for rapid reduction. Transfer slurry to a large container of water, neutralise with soda ash and wash to waste with lots of running water.

## Remedial Measures

If the eyes are exposed obtain medical attention as soon as possible.

### Eyes

Irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

If chlorine inhaled remove patient from exposure to fresh air and obtain medical attention. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.  Brush off solid and wash with plenty of running water

# Chlorates(V)

Description: Crystalline, deliquescent compounds of sodium or potassium and the chlorate(V) ion. Sodium chlorate(V) is used as a weedkiller.

## Hazards

Corrosive, very harmful to skin and especially dangerous to eyes as it causes burns. Inhalation of dust or swallowing is extremely destructive to all respiratory tissue. In contact with acids, or on heating, and even with carbon dioxide in the air, the toxic gas chlorine is evolved. Inhalation of chlorine is destructive to all mucous tissue.

Calcium chlorate (I) is a powerful oxidising agent, particularly at high temperatures. Hence fire hazard if in contact with combustible materials.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium chlorate(V) | Danger | Oxidising solid Cat 1<br>Acute toxin Cat 4 (oral)<br>Harmful to the aquatic environment with long-lasting effects Cat 2 | H271: May cause fire or explosion; strong oxidiser.<br>H302: Harmful if swallowed.<br>H411: Toxic to aquatic life with long lasting effects. |  |
| potassium chlorate(V) | Danger | Oxidising solid Cat 1<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Harmful to the aquatic environment with long-lasting effects Cat 2 | H271: May cause fire or explosion; strong oxidiser.<br>H302: Harmful if swallowed.<br>H332: Harmful if inhaled.<br>H411: Toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Reducing agents including ammonium salts, antimony sulphide, carbon, combustible materials, most organic compounds, finely divided materials, metal powders, sawdust, sugar, sulphur, phosphorus; and with concentrated sulphuric acid.

## Handling

For oxygen preparation wear eye protection and nitrile gloves. Only pure manganese(IV) oxide should be used with potassium chlorate(V) but the method is not recommended. A safer way of preparing oxygen is by catalytic decomposition of 20 or 10 volume hydrogen peroxide solution.

FF – flood with water.

## Storage

With oxidising agents. Only store small quantities. Dispense carefully to avoid contamination with dust etc.

SSL – 4 years maximum. Is sensitive to the presence of dust or organic contaminants. Such mixtures can ignite or detonate.

## Disposal

Wear face shield and nitrile gloves. Washings from glassware can be washed to waste with a large excess of running water.

For larger amounts, remove any sources of ignition or combustible materials. In a fume cupboard dissolve up to 20 g of sodium chlorate(V) or potassium chlorate(V) in water and acidify with 2M sulphuric acid (CORROSIVE). Add for each 1 g of chlorate 20 g of iron(II) sulphate or 2 g of iron filings and stir. Leave until reaction goes to completion and run to waste with large amounts of water.

## Spillage

Cover with one of the following – sodium metabisulphite, an iron(II) salt (e.g. the sulphate) or sodium thiosulphate. Mix, then spray with water. Use of the first two above require the mixture to be acidified with 2M sulphuric acid (CORROSIVE)to speed up the reduction (some Sulphur dioxide (TOXIC) evolved form metabisulphite or thiosulphate – dangerous for asthmatics). Scoop into bucket of water and use soda ash to neutralise. Wash to waste with lots of running water. Wash spillage site well especially if it is an absorbent surface such as wood or has splashed on to clothes.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Chlorates(VII)

Alternative names: sodium & potassium perchlorate

Description: Crystalline, deliquescent compounds of sodium or potassium and the chlorate(VII) ion. Chlorate VII (perchlorate) compounds should only be used if absolutely necessary and, if used, great care should be taken.

## Hazards

Powerful oxidising agents. Unstable compounds which can explode if heated above 400ºC, if shocked or if mixed with combustible material or finely divided metals. Toxic fumes are given off if heated to decomposition. Irritant to the eyes and harmful by inhalation and if swallowed. There is some, inconclusive, evidence of destruction of red blood cells and possible damage to the kidneys and the heart. Some studies show potassium chlorate(VII) to be an experimental teratogen.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium chlorate(VII) | Danger | Oxidising solid Cat 1<br>Acute toxin Cat 4 (oral) | H271: May cause fire or explosion; strong oxidiser.<br>H302: Harmful if swallowed. |  |
| potassium chlorate(VII) | Danger | Oxidising solid Cat 1<br>Acute toxin Cat 4 (oral) | H271: May cause fire or explosion; strong oxidiser.<br>H302: Harmful if swallowed. |  |

## Incompatibility

Reducing agents including ammonia and ammonium salts (mixtures can explode), antimony sulphide, ethanol, carbon, combustible materials, finely divided materials, metal powders, sawdust, sugar, sulphur, phosphorus; and with concentrated sulphuric acid. Diazonium perchlorates are very dangerous.

## Handling

In the open laboratory away from combustible materials and reducing agents. Wear nitrile gloves and goggles (BS EN 166 3).

FF – Flood with water.

## Storage

With oxidising agents.

## Disposal

Wear face shield and nitrile gloves. Small quantities of washings from glassware can be washed to waste with a large excess of running water.

For larger amounts remove any sources of ignition or combustible materials. In a fume cupboard dissolve up to 20 g of sodium chlorate(VII) or potassium chlorate(VII) in water and acidify with 2M sulphuric acid (CORROSIVE). Add for each 1 g of chlorate 20 g of iron(II) sulphate or 2 g of iron filings and stir. Leave until reaction goes to completion and run to waste with large amounts of water.

## Spillage

Cover with one of the following – sodium metabisulphite, an iron(II) salt (e.g. the sulphate) or sodium thiosulphate. Mix then spray with water. The first two above require the mixture to be acidified with 2M sulphuric acid (CORROSIVE)to speed up the reduction (sulphur dioxide (TOXIC) evolved – dangerous for asthmatics – ventilate the area well). Scoop into bucket of water and use soda ash to neutralise. Wash to waste with lots of running water. Wash spillage site well especially if it is an absorbent surface such as wood or has splashed on to clothes.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing very well. Obtain medical attention if irritation persists.

# Chloric(VII) acid

**Should not be used in establishments without a specially designed fume cupboard with wash down facilities.**

Colourless, volatile, hygroscopic liquid. Used as reagent for the decomposition of metals and organic material. Sold in concentrations of 20-70%.

## Hazards

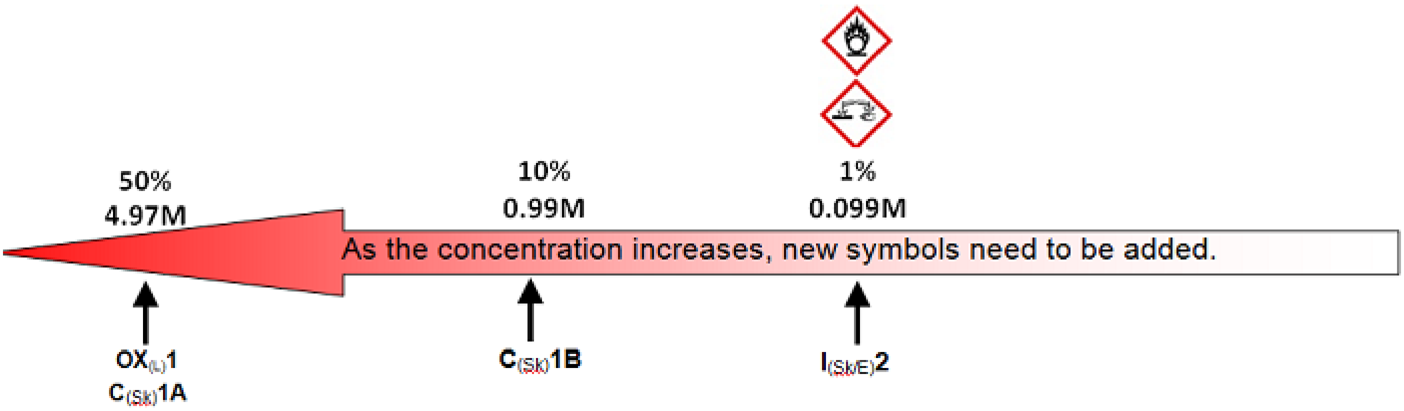
A powerful oxidising agent which has a high risk of explosive reactions, especially in anhydrous form if it is in contact with combustible material or is subjected to heat, fire or other source of ignition. The fumes and liquid are corrosive and cause severe burns to the eyes, skin, mouth and respiratory system. Prolonged or repeated exposure can lead to damage to the pancreas.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chloric(VII) acid | Danger | Oxidising liquid Cat 1<br>Skin corrosive 1A | H271: May cause fire or explosion; strong oxidiser<br>H314: Causes severe skin burns and eye damage. |  |

## Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.*



## Incompatibility

Can cause fire or explosion when in contact with reducing agents, a wide range of organic and inorganic substances and finely divided metals. Heavy metal chlorates(VII) are explosive. When heated to decomposition toxic fumes are given off.

## Handling

Greatest care required. Do not breathe the fumes or vapour. Handle only in fume cupboard especially designed for chloric(VII) acid. (The fumes can react dangerously with the materials in a normal fume cupboard, especially a recirculatory one). Wear nitrile gloves, goggles (BS EN 166 3) and suitable protective clothing (rubber apron etc.) Keep away from incompatible materials, including paper tissues, cloth dusters and wood.

## Storage

Keep locked up in a specially designed fume cupboard fitted with wash down facilities and out of reach of children.

Stock – Should not be used in establishments without a specially designed fume cupboard with wash down facilities.

## Disposal

Wear nitrile gloves and goggles (BS EN 166 3). Small quantities can be added to a large volume of water, neutralised with sodium carbonate and washed to waste with running water. Larger amounts should be packaged and labelled and disposed of by a licensed contractor.

## Spillage

Wear nitrile gloves and face shield. Open windows and doors. Spread a reducing agent over the spill e.g. sodium thiosulphate, sodium metabisulphite or an iron(II) salt (the latter two require the addition of a little 2M sulphuric acid (CORROSIVE) to help reduction – sulphur dioxide (TOXIC) evolved, dangerous for asthmatics – ensure good ventilation). Mix thoroughly, spray with water and transfer to a plastic bucket. Neutralise with soda ash and wash to waste with large quantity of running water. The spillage area should be repeatedly washed with water, since contaminated wood, paper and cloth are easily ignited at a later time or may explode on percussion. If spillage is large absorb on to sand and dispose of via a licensed contractor.

## Remedial Measures

If swallowed or the skin is burned, if breathing is affected or if eyes are irritated take the casualty to hospital immediately.

### Eyes

Irrigate with water for at least 15 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Seek medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

## Chlorine

Description: Greenish/yellow gas or liquid. Choking smell.

### Hazards

Toxic – very poisonous. Concentrated chlorine water emits chlorine gas. Extremely harmful/irritant to the eyes, skin, respiratory tract and lungs. High concentrations cause asphyxia and burn tissue. The threshold of odour detection is 0.2-0.4 ppm. resulting in itching nose after 4-20 mins. Asthmatics and those with breathing problems are particularly susceptible to attacks – they must not be allowed to inhale chlorine.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chlorine | Danger | Oxidising gas Cat 1<br>Acute toxin Cat 3 (inhalation)<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Harmful to the aquatic environment Cat 1 | H270: May cause or intensify fire; oxidiser<br>H331: Toxic if inhaled<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation.<br>H400: Very toxic to aquatic life. |  |

### Concentration Effects

| | |
|---|---|
| 0.2-0.4 ppm | threshold of odour detection |
| 1 ppm | sore eyes, dry throat, coughing |
| 1.3 ppm | Severe headache, breath short |
| 15 ppm | immediate throat irritation |
| 50 ppm | short exposure dangerous |
| 1000 ppm | fatal |

### Incompatibility

Can react and cause fire or explosion with an extremely large range of elements and compounds – turpentine, ethoxyethane (diethyl ether) and other organic liquids, ethyne (acetylene), ammonia gas and ammonium compounds, coal gas, natural gas, hydrogen gas & hydrides, phosphorus (yellow explosively) and powdered metals. Mixing gases with chlorine before initiation by flash photolysis is particularly hazardous – the reaction can be accidentally set off by sunlight or artificial light.

### Handling

Wear safety goggles and chemical resistant gloves. Always handle in a fume cupboard. Use dilute chlorine water/bleach only in an open area.

## Storage

Not applicable. Cylinders are not recommended for use in schools.

## Disposal

Wear eye protection. In fume cupboard use anti-suck back device to absorb chlorine gas in water or preferably in a strong solution of sodium metabisulphite or thiosulphate. Chemicals from which chlorine has been prepared should be left there until reaction is complete or until all chlorine has gone. Wash to waste with cold water.

## Spillage

This mainly applies to spillage of chemicals which react to form chlorine. Open windows. Evacuate the laboratory and wait for fumes to disperse. Wear eye protection and gloves and add water to dilute and stop reaction. Mop up and wash to waste with water. In the event of a large escape of chlorine into the laboratory (500 cm3 or more) evacuate the laboratory. Outside windows should be opened and internal windows and doors closed.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. If more than just a whiff obtain medical attention as soon as possible.

# Chloroethanoic acids

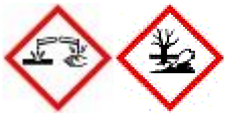
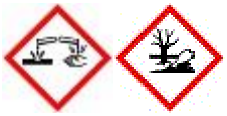
Alternative names: chloro, dichloro & trichloroacetic acids

Description: Colourless, deliquescent liquids or crystals with faint acidic smell. Soluble in water.

## Hazards

Chloroethanoic acids are toxic if swallowed, corrosive causing burns and are very toxic to aquatic organisms. The vapour and liquid of all three are are extremely corrosive to the eyes, skin and respiratory system. Emit fumes of carbonyl chloride (phosgene) when heated to decomposition. All are hazardous to the aquatic environment, the trichloro form has long-lasting effects.

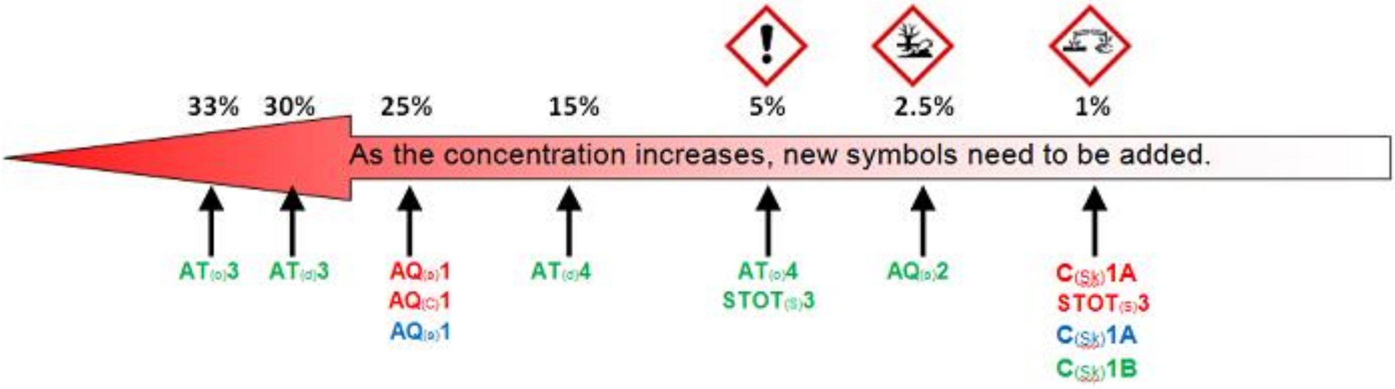
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chloroethanoic acid | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Skin corrosive cat 1B<br>Harmful to the aquatic environment Cat 1 | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H330: Toxic if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life. |  |
| dichloroethanoic acid | Danger | Skin corrosive Cat 1A<br>Harmful to the aquatic environment Cat 1 | H314 Causes severe skin burns and eye damage.<br>H400 Very toxic to aquatic life. |  |
| trichloroethanoic acid | Danger | Skin corrosive Cat 1A<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H314: Causes severe skin burns and eye damage.<br>H410: Very toxic to aquatic life with long lasting effects |  |

## Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.*

*(**Green** = chloroethanoic acid, **Blue** = dichloroethanoic acid and **Red** = trichloroethanoic acid)*



## Incompatibility

Dangerous reactions with oxidising agents and reactive metals. Combustible when exposed to heat and flame.

## Handling

Wear pvc gloves and goggles (BS EN 166 3) and use in a well-ventilated laboratory or a fume cupboard. Do not distil to dryness.

FF– WS, DP, CO2 for mono-.

## Storage

Store with acids in general store. Do not store aqueous solutions of trichloroethanoic acid at concentrations of less than 30% for longer than is necessary. Such solutions are hydrolysed to give trichloromethane, hydrochloric acid, carbon dioxide and carbon monoxide. This can build up a high pressure in a stoppered bottle.

## Disposal

Wear goggles (BS EN 166 3) and pvc gloves. Very small, unavoidable discharges such as washings from glassware may be run to waste diluting greatly with running water. Larger amounts should be stored for disposal by a licensed contractor or converted to the relatively harmless hydroxy acid by refluxing with excess 2M sodium carbonate.

## Spillage

Wear pvc gloves and goggles (BS EN 166 3) – also rubber boots if spillage is large. Spread soda ash over spillage to neutralise. This should be carefully lifted and stored to await disposal by a licensed contractor.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water continuously. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if any significant amount has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if blistering occurs or if irritation persists.

# Chlorobenzene

Alternative name: phenyl chloride

## Hazards

Vapour is harmful to eyes, skin and respiratory & digestive system and may cause damage to the lungs, liver and central nervous system. Toxic effects include headaches, dizziness, drowsiness, stomach irritation and numbness and pain in muscles, especially in the hands. Flammable (Cat 3) liquid which presents a fire risk, especially when heated (explosion limits 1.3-7%). Keep away from sources of ignition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chlorobenzene | Danger | Flammable liquid Cat 3<br>Acute toxin Cat 4 (inhalation)<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H226: Flammable liquid and vapour.<br>H332: Harmful if inhaled.<br>H411: Toxic to aquatic life with long lasting effect |  |

## Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.*

## Incompatibility

Oxidising agents and reactive metals e.g. sodium. Reacts violently with dimethyl sulphoxide. In the preparation of triphenyl phosphine from chlorobenzene, phosphorus trichloride and sodium in toluene, explosions are avoided by the addition of lower alcohols.

## Handling

In a well-ventilated lab for small amounts; otherwise in a fume cupboard. Ensure absence of any source of ignition. Wear nitrile gloves and eye protection.

FF – F, DP, CO2 or VL.

## Storage

Flammables store in well ventilated place away from sources of ignition and direct sunlight.

## Disposal

Wear nitrile gloves and eye protection. Turn off all sources of ignition. Unavoidable discharges, e.g. very small amounts such as washings from glassware etc. should be emulsified with detergent and washed to waste. Small quantities can be absorbed on to paper towels and evaporated in the fume cupboard. Collect in chlorinated hydrocarbon residues bottle for disposal by a licensed waste disposal contractor.

## Spillage

Turn off all sources of ignition. Wearing nitrile gloves and face shield, evacuate the room and treat as for disposal or absorb spillage on dry sand, shovel into bucket. Small amounts can be taken to an open area for evaporation; larger quantities should be stored for disposal by contractor. Wash site of spillage well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical advice/attention.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Chlorobutanes

Alternative name: n-butyl chloride & sec-butyl chloride

Description: Colourless liquids, ethereal odour

## Hazards

Both isomers are highly flammable. Air/vapour mixtures are explosive (1.9 – 10.1%); keep away from heat or sources of ignition. Dangerous when heated to decomposition emitting carbonyl chloride (phosgene). 2-chlorobutane is an experimental carcinogen and is slightly harmful by ingestion, inhalation and skin contact.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 1-chlorobutane | Danger | Flammable liquid Cat 2 | H225: Highly flammable liquid and vapour. |  |
| 2-chlorobutane | Danger | Flammable liquid Cat 2 | H225: Highly flammable liquid and vapour. |  |

## Incompatibility

Oxidising agents and reactive metals.

## Handling

In fume cupboard. Wear nitrile gloves and eye protection. Do not distil to dryness.

FF – F, DP, CO2 or VL.

## Storage

Keep in a well ventilated position in the flammables store well away from any possible sources of ignition.

## Disposal

Wear nitrile gloves and eye protection. Very small, unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified with detergent before washing to waste. Do not pour directly down drains. It can be hydrolysed to relatively harmless butanols by refluxing with 2M sodium hydroxide (CORROSIVE). Larger quantities should be collected in halogenated hydrocarbon residues bottle to await disposal by contractor.

## Spillage

Wear eye protection and nitrile gloves. Turn off all possible sources of ignition and open windows to thoroughly ventilate the room. Instruct others to keep at a safe distance. Brush to an emulsion with water and detergent. Alternatively absorb on sand, and take to open area for evaporation. For larger spillages package absorbent in labelled bags for removal by waste disposal contractor. Spillage area should be well washed with detergent and water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting.Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff has been inhaled.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if the skin area affected is large.

# Chloroethane

Alternative name: ethyl chloride

Description: Colourless, very volatile liquid or gas with pungent ether-like smell.

## Hazards

Extremely flammable. Severe explosion hazard when air mixtures exposed to flame (explosive range 3.6 – 15.4). Category 2 carcinogen. Mild acute toxicity by inhalation. Irritates the eyes, skin and mucous membranes. In high concentrations causes narcosis. In general this compound is too volatile to be a useful example of a chlorinated hydrocarbon. Use less volatile homologues.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chloroethane | Danger | Flammable gas Cat 1<br>Carcinogen Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 3 | H220: Extremely flammable gas.<br>H351: Suspected of causing cancer<br>H412: Harmful to aquatic life with long lasting effects. |    |

## Incompatibility

Oxidising agents and reactive metals e.g. potassium. A mixture with the latter is shock-sensitive.

## Handling

In fume cupboard. Remove sources of ignition before handling. Wear nitrile gloves and eye protection.

FF – F, DP, CO2 or VL.

## Storage

Flammables store. Protect from sunlight. Never in open laboratory.

## Disposal

Wear eye protection and nitrile gloves. Turn off all sources of ignition. Unavoidable discharges, e.g. small quantities such as washings from glassware etc. should be emulsified with detergent and water and washed to waste. It can be hydrolysed to the relatively harmless ethanol by refluxing with 2M sodium hydroxide (CORROSIVE). Small quantities can be allowed to evaporate in a fume cupboard. For larger amounts store in waste bottle for halogenated hydrocarbons for disposal by waste disposal contractor.

## Spillage

Turn off all sources of ignition. Wear eye protection and nitrile gloves. Turn off sources of ignition, open windows to thoroughly ventilate the room and absorb in sand or inert absorbent. If amounts spilled are small evaporate in open air. For larger spillages package absorbent in labelled bags for removal by waste disposal contractor. Wash spillage area thoroughly with detergent and water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical advice/attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff has been inhaled.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if the skin area affected is large.

# Chloromethylbenzene

Alternative names: benzyl chloride, α-Chlorotoluene

Description: Colourless to brown-yellow liquid with acrid smell.

## Hazards

Extremely flammable. Severe explosion hazard when air mixtures exposed to flame (explosive range 3.6 – 15.4). Category 2 carcinogen. Mild acute toxicity by inhalation. Irritates the eyes, skin and mucous membranes. In high concentrations causes narcosis. In general this compound is too volatile to be a useful example of a chlorinated hydrocarbon. Use less volatile homologues.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chloromethylbenzene | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 3 (inhalation)<br>Eye damage Cat 1<br>Skin irritant Cat 2<br>Carcinogen Cat 1B<br>Specific target organ toxin on repeated/prolonged exposure Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H302: Harmful if swallowed.<br>H331: Toxic if inhaled.<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H350: May cause cancer<br>H335: May cause respiratory irritation.<br>H373: May cause damage to organs |  |

## Incompatibility

Oxidising agents. Can decompose violently if heated with metals. Violent reactions or explosions can occur if acidity is allowed to build up during reactions.

## Handling

Wear nitrile gloves and eye protection; use fume cupboard.

FF WS, CO2, DP

## Storage

Flammables store. Never in laboratory.

## Disposal

Wear nitrile gloves and eye protection. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified with detergent and washed to waste. Otherwise store in halogenated hydrocarbon bottle for disposal by contractor.

## Spillage

Wear eye protection, open windows and turn off all sources of ignition. Add water and detergent and brush into an emulsion. Wash to waste with plenty of running water. Alternatively absorb on sand and label/store for disposal by contractor. Wash area of spillage well with water. and detergent.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if a large area of skin has been affected or if irritation persists.

# Chloromethylbenzene

Alternative names: benzyl chloride, α-Chlorotoluene

Description: Colourless to brown-yellow liquid with acrid smell.

## Hazards

Extremely flammable. Severe explosion hazard when air mixtures exposed to flame (explosive range 3.6 – 15.4). Category 2 carcinogen. Mild acute toxicity by inhalation. Irritates the eyes, skin and mucous membranes. In high concentrations causes narcosis. In general this compound is too volatile to be a useful example of a chlorinated hydrocarbon. Use less volatile homologues.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chloromethylbenzene | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 3 (inhalation)<br>Eye damage Cat 1<br>Skin irritant Cat 2<br>Carcinogen Cat 1B<br>Specific target organ toxin on repeated/prolonged exposure Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H302: Harmful if swallowed.<br>H331: Toxic if inhaled.<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H350: May cause cancer<br>H335: May cause respiratory irritation.<br>H373: May cause damage to organs |  |

## Incompatibility

Oxidising agents. Can decompose violently if heated with metals. Violent reactions or explosions can occur if acidity is allowed to build up during reactions.

## Handling

Wear nitrile gloves and eye protection; use fume cupboard.

FF WS, CO2, DP

## Storage

Flammables store. Never in laboratory.

## Disposal

Wear nitrile gloves and eye protection. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified with detergent and washed to waste. Otherwise store in halogenated hydrocarbon bottle for disposal by contractor.

## Spillage

Wear eye protection, open windows and turn off all sources of ignition. Add water and detergent and brush into an emulsion. Wash to waste with plenty of running water. Alternatively absorb on sand and label/store for disposal by contractor. Wash area of spillage well with water. and detergent.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if a large area of skin has been affected or if irritation persists.

# Chloropropanes

Alternative names: n-propyl chloride & sec-propyl chloride.

Description: Colourless liquids with chloroform-like smell.

## Hazards

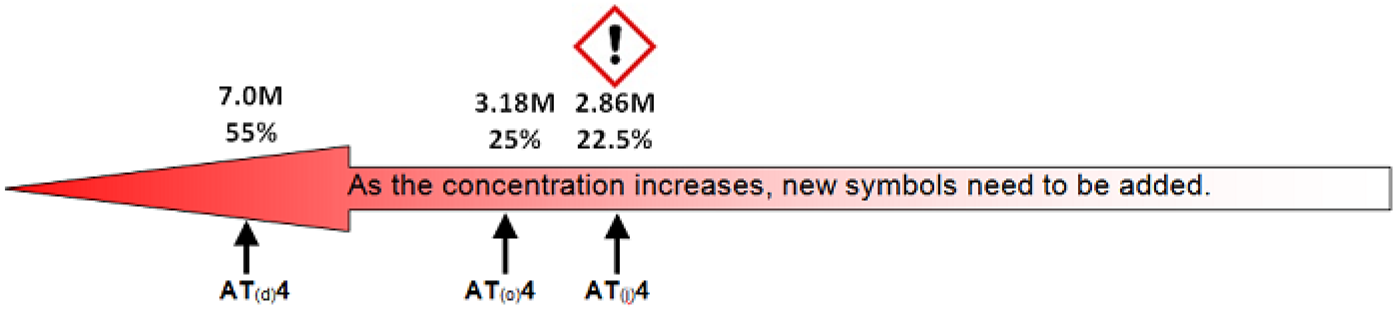
1-chloropropane is harmful and an irritant to skin, eyes and lungs. In high concentration both isomers cause narcotic effects. Both are highly flammable liquids and present a dangerous fire hazard when exposed to sources of heat and ignition. Vapour/air mixtures are explosive (Explosive ranges 2.6 – 11.1% & 2.8 – 10.7% for 1- & 2-isomers).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 1-chloropropane | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation) | H225: Highly flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled. |  |
| 2-chloropropane | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation) | H225: Highly flammable liquid and vapour.<br>H290: May be corrosive to metals.<br>H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled. |  |

## Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.*



## Incompatibility

Both can react violently with oxidising agents and are dangerous when heated to decomposition giving carbonyl chloride (phosgene).

## Handling

Wear nitrile gloves and eye protection. In well-ventilated place, preferably a fume cupboard away from any sources of ignition.

## Storage

Flammables store in a cool, dry place away from heat, light and any sources of ignition.

FF – F, DP, CO2 , WS or VL.

## isposal

Wear nitrile gloves and goggles (BS EN 166 3) and remove sources of ignition. Unavoidable discharges, e.g. small amounts such as washings from glassware etc. should be emulsified with detergent and washed to waste. Do not pour directly down the drain as explosive mixtures may collect there. Small quantities can be absorbed on to paper towels and evaporated in the fume cupboard. Alternatively reflux with 2M sodium hydroxide (CORROSIVE) to form relatively harmless water soluble propanols. Larger amounts should be stored in a halogenated hydrocarbons bottle to await licensed disposal.

## Spillage

Turn off all flames, hot plates, ovens, etc. Evacuate room, open windows and allow small spillages to evaporate. Wearing eye protection and nitrile gloves, emulsify with water and detergent. Mop up and transfer to bucket. If quantity is large cover quickly with absorbent and carry to fume cupboard or spread out in an open area outside for evaporation. Wash the spillage area thoroughly.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff has been inhaled.

### Skin

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if a large area of skin is involved.

# Chlorosulphonic acid

Alternative name: Chlorosulphuric acid.

Description: Colourless-brown fuming liquid with acrid smell.

## Hazards

A corrosive irritant which can cause severe acid burns on the skin, eyes and respiratory and digestive tracts whether in liquid or vapour form. Inhalation of the fumes can cause rapid unconsciousness.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chlorosulphonic acid | Danger | Skin corrosive Cat 1A<br>Specific target organ toxin on single exposure Cat 3 | H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation.<br>EUH014 Reacts violently with water |  |

## Incompatibility

Reacts explosively with water giving sulphuric acid and fumes of hydrogen chloride. A similar reaction takes place with alcohols and acids. It reacts violently with phosphorus, silver nitrate and diphenyl ether. It is incompatible with a wide range of combustible materials including metals as well as organics and inorganics including ethanoic acid, ethanoic anhydride, ethyl ethanoate, sodium hydroxide, ethane-1,2-diol, hydrogen peroxide, ethenyl ethanoate etc.

## Handling

Handle only In a fume cupboard. Wear rubber gloves and face shield.

## Storage

Acids store, never in the laboratory. Keep away from aqueous solutions, combustible material and organic solvents.

## Disposal

Working in the fume cupboard and wearing face shield and rubber gloves, add small portions to a large volume of water with stirring. Allow time for cooling. Neutralise with anhydrous sodium carbonate and wash to waste with lots of water.

## Spillage

DO NOT ADD WATER. Open windows to completely ventilate the area. Wearing face shield and rubber gloves spread anhydrous sodium carbonate over the spillage. Shovel up if a very small amount and carefully wash to waste otherwise store for disposal by a licensed waste disposal contractor. Wash spillage area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if a large area is affected or if irritation persists.

# Chromates VI

There are many chromate salts but the only ones commonly encountered in school science are potassium and sodium chromates and perhaps barium.

These chromates are yellow, crystalline solids which dissolve readily in water. The sodium salt is hygroscopic. Chromates react with acids to form dichromates.

## Hazards

Very Toxic; severely irritating and corrosive to eyes, skin and respiratory system. Category 1B carcinogens and mutagens. May cause heritable genetic damage. The sodium and barium compounds are also a skin Sensitiser via both inhalation (probably sodium only) & skin, a reproductive toxin and is Toxic(Cat 3) by ingestion. (Potassium chromate is classified as being less hazardous but should still be handled with care) Very toxic to aquatic organisms and may cause long term adverse effects to the aquatic environment.

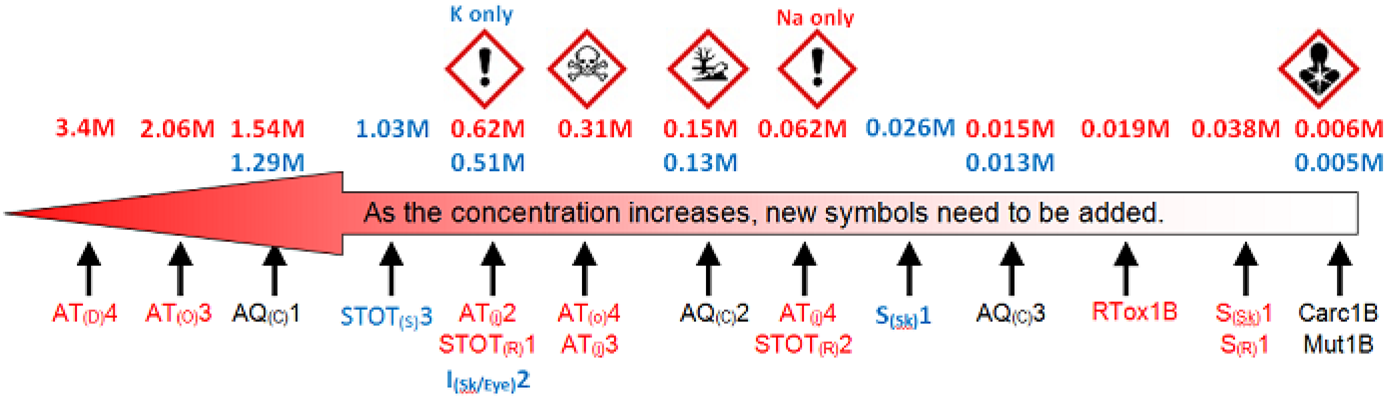
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium chromate(VI) | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Skin corrosive Cat 1B<br>Respiratory sensitiser Cat 1<br>Skin sensitiser Cat 1<br>Mutagen cat 1B<br>Carcinogen Cat 1B<br>Reproductive toxin Cat 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed<br>H312: Harmful in contact with skin.<br>H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction.<br>H360: May damage fertility or the unborn child<br>H340: May cause genetic defects<br>H350: May cause cancer<br>H335: May cause respiratory irritation.<br>H372: Causes damage to respiratory tract by inhalation<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| potassium chromate(VI) |  | Skin irritant Cat 2<br>Skin sensitiser Cat 1<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3<br>Mutagen cat 1B<br>Carcinogen Cat 1B<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H315: Causes skin irritation<br>H317: May cause an allergic skin reaction<br>H319: Causes serious eye irritation<br>H335 May cause respiratory irritation.<br>H340: May cause genetic defects<br>H350: May cause cancer<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| barium chromate(VI) |  | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 4 (dermal)<br>Skin sensitiser Cat 1<br>Carcinogen Cat 1B<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H301: Toxic if swallowed<br>H312: Harmful in contact with skin.<br>H317: May cause an allergic skin reaction<br>H350: May cause cancer<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.*

*Sodium chromate in* ***red****, potassium chromate in* ***blue****. Classifications at the same point are the same % concentration but different molarities.*



## Incompatibility

The salts are powerful oxidising agents and they react violently with reducing agents in general and with several organic compounds, carbon, sulphur, phosphorus, metals (especially if finely divided), hydrazine and derivatives, hydroxylamine, ethane-1,2-diol, a mixture of ethanol or ethanoic anhydride with sulphuric acid.

## Handling

Wear eye protection and rubber or nitrile gloves. Potassium, sodium and barium chromates are usually in the form of fine crystals; thus, as long as reasonable precautions are taken, solutions can be made up without raising dust or forming an aerosol.

## Storage

In general store.

## Disposal

Wear eye protection and rubber gloves. Run washings from glassware to waste. If larger amounts are involved :-
Solid – store for collection by waste disposal contractor.
Solutions – either soak on mineral absorbent and store for collection or acidify to approximately pH 2 and add sodium hydrogensulphite to reduce to Cr(III). Precipitate the $Cr^{3+}$ as hydroxide, filter and keep for disposal by a licensed contractor.

## Spillage

Wear eye protection and rubber gloves. Moisten with water, shovel into bucket and if amounts are small wash to waste with a large volume of water. Otherwise treat as for Disposal. Could be dangerous if traces of carbonaceous dust had become mixed with it; in this event wet immediately, dissolve, reduce to $Cr^{3+}$and proceed as above. Wash the area well and mop with a little hydrogensulphite solution.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth carefully with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route is unlikely. Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash skin well. If area of skin affected is large and solution had been concentrated or if irritation persists, obtain medical attention.

# Chromium compounds (other)

## Hazards

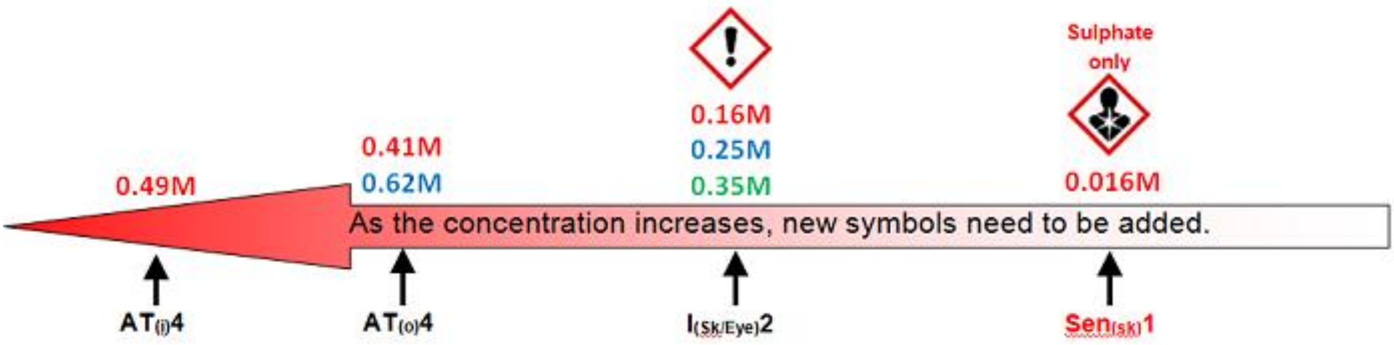
All chromium(III) salts are irritating to skin, eyes and respiratory system, harmful if ingested in quantity and very harmful if inhaled. Powdered metal may act as a human carcinogen and is very harmful if inhaled as dust. Prolonged contact with salts or powdered metal cause skin ulcerations. Anhydrous salts are corrosive. Chromium(II) and chromium(III) salts are considerably less toxic than chromium(VI) compounds.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chromium(II) chloride, anhydrous, chromium(III) chloride-6-water | Warning | Acute toxin Cat 4 (oral)<br>Skin / Eye Irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H302 Harmful if swallowed.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335 May cause respiratory irritation. |  |
| chromium(III) nitrate-9-water | Warning | Oxidising solid Cat 3<br>Acute toxin Cat 4 (oral)<br>Skin / Eye Irritant Cat 2 | H272 May intensify fire; oxidiser.<br>H302 Harmful if swallowed.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation. |   |
| chromium(III) oxide.$2H_2O$ | Danger | Acute toxin Cat 4 (oral)<br>Skin Sensitiser Cat 1<br>Skin / Eye irritant Cat 2<br>Reproductive toxin Cat 1B | H302: Harmful if swallowed.<br>H319 Causes serious eye irritation.<br>H317: May cause an allergic skin reaction.<br>H360: May damage fertility. |   |
| chromium(III) sulphate-15-water | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin Sensitiser Cat 1<br>Skin / Eye irritant Cat 2 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage. |   |
| chromium(III) sulphate, (basic) | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Skin corrosive Cat 1B | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage. |   |
| chromium(III) potassium sulphate | Warning | Skin / Eye irritant Cat 2 | H315 Causes skin irritation.<br>H319 Causes serious eye irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. **Red** = sulphate , **blue** = Nitrate, **green** – potassium chromium sulphate.



## Incompatibility

The metal, in powdered form, reacts violently with nitrates, especially ammonium nitrate, even at low temperatures. If finely divided, it incandesces in sulphur dioxide and nitrogen oxides. Chromium(III) nitrate reacts violently with finely divided metals and with carbon, sulphur and with many organic compounds.

Chromium(II) compounds are strong reducing agents; solutions of salts or hydrates can reduce water to hydrogen with a consequent build-up of pressure in containers – open carefully.

## Handling

Wear goggles (BS EN 166 3) and avoid contact with skin. Wear rubber gloves. Most salts are crystalline, but avoid raising dust with any of the powdered forms. For environmental reasons, reduce scale of use where possible.

## Storage

With general chemicals apart from the nitrate; store latter with oxidising agents.

## Disposal

Wear goggles (BS EN 166 3) and rubber gloves. Small quantities such as washings from glassware can be run to waste. Otherwise store for disposal by licensed disposal contractor.

**Solutions** – precipitate as hydroxide or sulphide and store for disposal by contractor.

## Spillage

Wear goggles (BS EN 166 3) and rubber gloves. Carefully sweep up solids and treat as above. Soak up solutions on mineral absorbent and store for disposal by contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes and longer in the case of anhydrous salts. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. If irritation persists seek medical attention.

# Chromium VI oxide (chromic acid)

Description: Very hygroscopic red crystalline solid. Used to be available in 85% w/v sulphuric acid solution as ‘Cleaning Mixture’ for cleaning glass. This is not recommended.

## Hazards

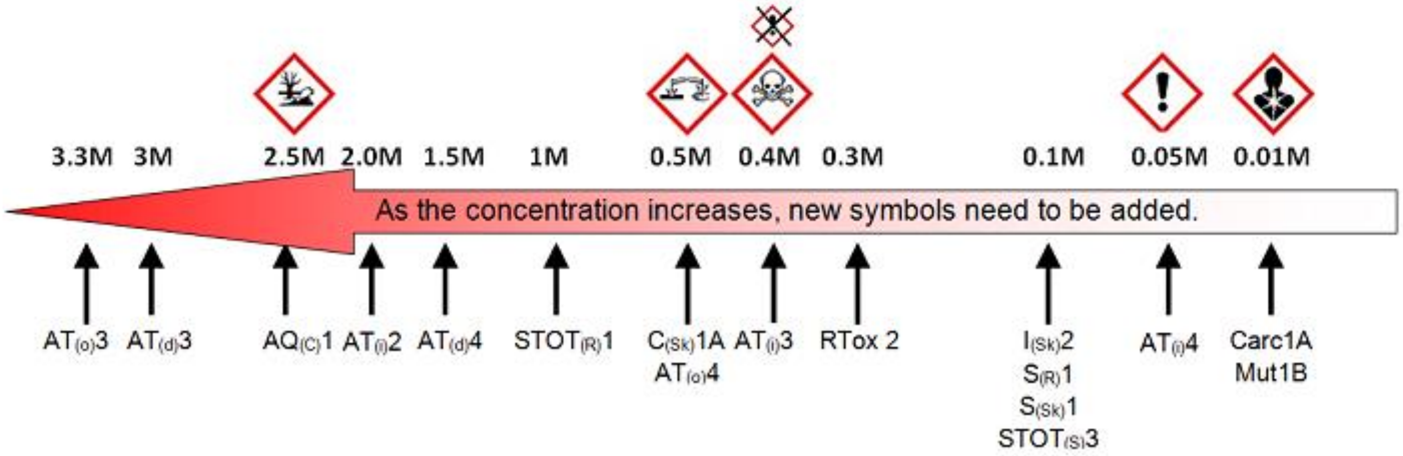
Highly corrosive, very toxic and is a respiratory and skin sensitiser. It is severely irritating to the respiratory system leading to chronic rhinitis, laryngitis and pharyngitis. Nasal irritation can occur at a concentration of only 0.06 mg/m-3. Both solid and solution cause severe burns to eyes, skin and mouth. Chronic effect: long exposure causes skin ulcers, dermatitis and eczema. Ingestion causes violent internal irritation an toxic reactions of bloody vomiting, diarrhoea, pain, dizziness, shock. It is fatal in quantities as low as 1 g. Recognised Category 1A carcinogen by inhalation, Category 1B mutagen and Category 2 reproductive toxin which may cause heritable genetic damage and impaired fertility, and is a confirmed teratogen in animal studies. Contact with combustible material may cause fire. (See also Sulphuric acid if the chromium(VI) oxide is in a cleaning mixture solution).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| chromium(VI) oxide | Danger | Oxidising solid Cat 1<br>Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Skin corrosive Cat 1A<br>Skin Sensitiser Cat !<br>Respiratory sensitiser Cat 1<br>Mutagen Cat 1B<br>Carcinogen Cat 1A<br>Reproductive Toxin Cat 2<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic enviroment with long-lasting effects Cat 1 | H271: May cause fire or explosion; strong oxidiser.<br>H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction.<br>H340: May cause genetic defects<br>H350: May cause cancer<br>H335: May cause respiratory irritation<br>H372: Causes damage to skin & lungs through prolonged or repeated exposure<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

A very powerful oxidising agent which is very dangerous in contact with reducing agents, organic compounds and combustible materials (ignition possible with paper) as violent reactions or explosions are possible e.g. with propane-1,2,3-triol, phosphorus, potassium hexacyanoferrate(III) (heated to 196°C), methanol, propanone, cyclohexanol, diethyl ether etc.

## Handling

Wear protective clothing, nitrile gloves (not rubber/neoprene/pva or polythene) and goggles (BS EN 166 3). Use fume cupboard.

## Storage

Keep away from reducing agents, organic or combustible materials. Protect against damage to containers and ingress of moisture or dust and organic matter. Once in solution it will have the same hazards as a solution of a chromate(VI) or dichromate(VI). Store minimum quantities.

SSL – 3 years maximum. Store minimum quantities. Is sensitive to the presence of dust or contaminants. Such mixtures can ignite or detonate if exposed to friction.

## Disposal

Wear goggles (BS EN 166 3) and nitrile gloves. Very small quantities such as washings from glassware can be run to waste. Otherwise store for disposal by licensed disposal contractor.

## Spillage

Wear goggles (BS EN 166 3) and nitrile gloves. Moisten slightly and carefully lift and keep for uplift by disposal contractor. Wash the spillage area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Lungs

(Inhalation is extremely unlikely as the crystals are hygroscopic) Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if area affected is large or feeling unwell.

# Cobalt metal and compounds

## Hazards

Metal harmful by ingestion. Irritating to eyes, skin and upper respiratory tract. May cause skin/respiratory sensitisation. Evidence (not conclusive) that it may be an experimental animal carcinogen. The finely divided metal is pyrophoric(highly flammable).

Chloride, carbonate, ethanoate nitrate and sulphate listed as Category 2 carcinogens by inhalation as well as category 1B mutagens and reproductive toxins.  Most of the compounds are sensitisers by skin contact and several by inhalation.

## Hazard Statements

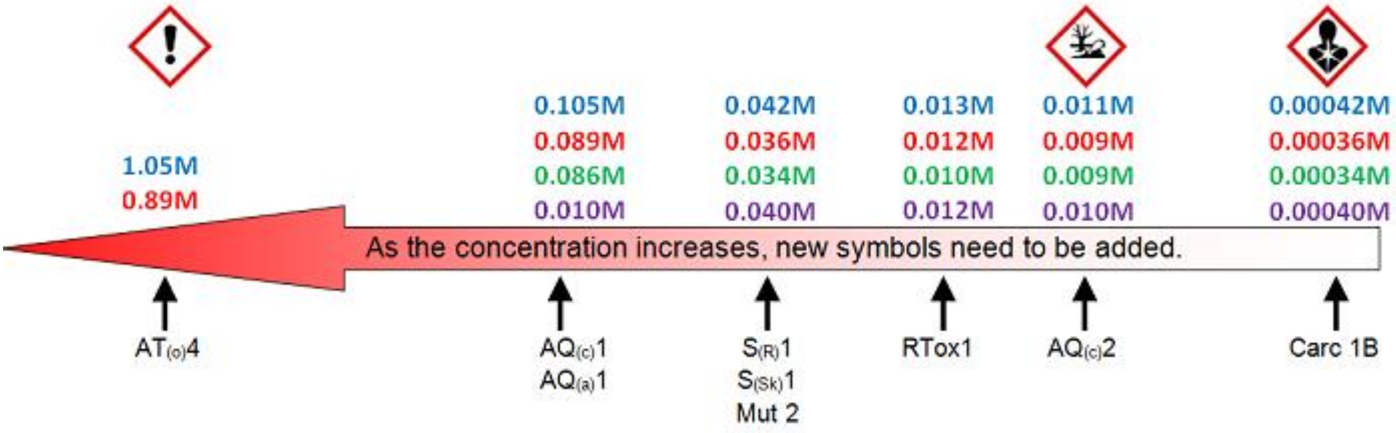
| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Cobalt metal | Danger | Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 4 | H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction<br>H413: May cause long lasting harmful effects to aquatic life. |  |
| Cobalt chloride & sulphate | Danger | Acute toxin Cat 4 (oral)<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 1B<br>Reproductive toxin Cat 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction<br>H360: May damage fertility<br>H341: Suspected of causing genetic defect<br>H350: May cause cancer by inhalation.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| Cobalt oxide | Warning | Acute toxin Cat 4 (oral)<br>Skin sensitiser Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H317: May cause an allergic skin reaction.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| Cobalt carbonate, nitrate, ethanoate | Danger | Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 1B<br>Reproductive toxin Cat 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction.<br>H360: May damage fertility.<br>H341: Suspected of causing genetic defects.<br>H350: May cause cancer by inhalation.<br>H400: Very toxic to aquatic life. |  |
| Cobalt sulphide | Warning | Skin sensitiser Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H317: May cause an allergic skin reaction.<br>H400: Very toxic to aquatic life. |  |

| | | | | |
|---|---|---|---|---|
| | | | H410: Very toxic to aquatic life with long lasting effects. | |
| Cobalt thiocyanate | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

(**red** = sulphate, **blue** = chloride, **green** = nitrate, **purple** = ethanoate)



## Incompatibility

In powder form the metal reacts vigorously with oxidising agents, e.g. ammonium nitrate. The nitrate can interact explosively with charcoal and with hexacyanoferrates. The oxide is very active catalytically in decomposing hydrogen peroxide; likewise solutions of salts in alkaline solutions.

## Handling

Wear eye protection and pvc or rubber gloves. Avoid raising dust from the carbonate and oxide which are powdery.

## Storage

In general store for chloride, oxide and carbonate; nitrate with oxidising agents.

## Disposal

Wear eye protection and rubber gloves. Washings from glassware can be run to waste. Larger quantities should be stored for disposal by contractor. Avoid raising dust. Solutions can be treated with sodium carbonate and the precipitate stored for disposal by contractor.

Spillage

Wear eye protection and rubber gloves. Carefully sweep up solids and treat as above. Soak up solutions on mineral absorbent and store to await uplift by disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Exposure by this route only likely for oxide and carbonate. Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Carefully brush off most of the solid. Wash well with soap and copious amounts of water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Copper metal and compounds

## Hazards

In general copper compounds are harmful by swallowing or inhalation of the dust with the chromate(VI) and chloride having greater toxicity. They are all moderate to severe eye and skin irritants. The chromate(VI) in particular may cause cancer and is a skin sensitiser. Allergic skin and eye reactions to the chloride and sulphate have been reported. The nitrate is an oxidising agent and contact with combustible material may cause fire. Many salts are decomposed by strong heat to give off fumes. e.g. $SO_3$ for $CuSO_4$ or $NO_2$ for nitrates

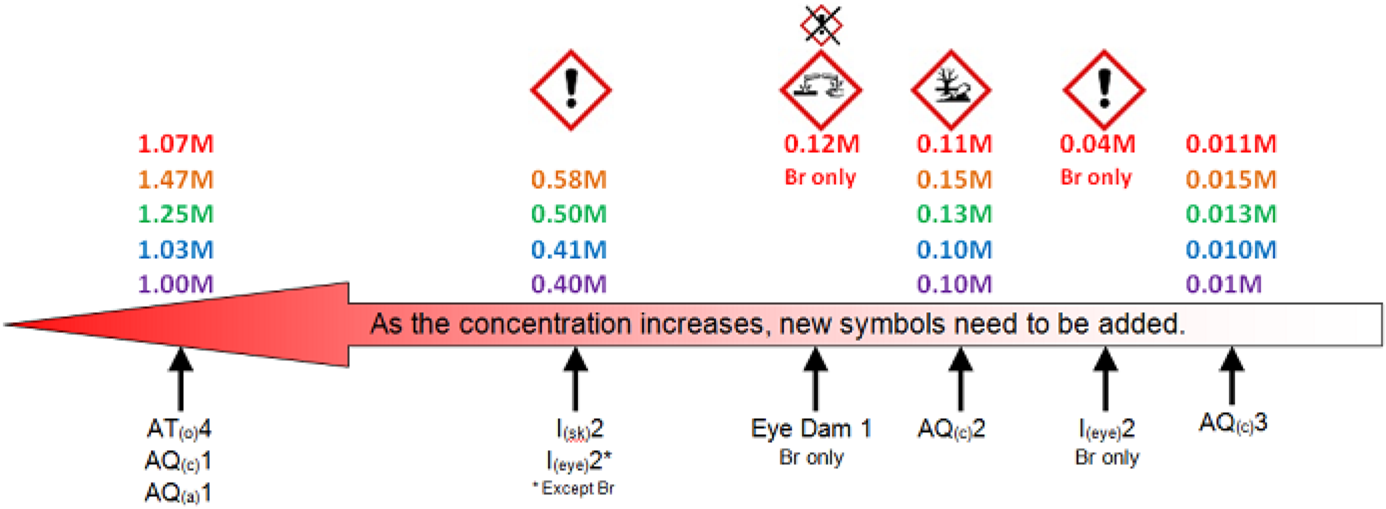
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| copper metal | | No significant hazard | | |
| copper(II) bromide, | Danger | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| copper(II) carbonate (basic) | Warning | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin (Single Exposure) Cat 3<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation<br>H553: May cause respiratory irritation<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| copper(II) oxide,<br>copper (I) oxide,<br>copper (I) chloride,<br>copper carbonate | Warning | Acute toxin Cat 4 (oral)<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| copper (II) chloride-2-water, copper(II) ethanoate-1-water, copper(II) nitrate-3-water, copper (II) sulphate-5-water | Danger | Oxidising Solid Cat 3 (Nitrate Only)<br>Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye Damage Cat 1<br>Specific target organ toxin on single exposure Cat 3<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H302 Harmful if swallowed.<br>H315 Causes skin irritation.<br>H318 Causes serious eye damage.<br>H335 May cause respiratory irritation.<br>H400 Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| copper(II) chromate(VI) | Danger | Acute toxin Cat 4 (oral)<br>Skin sensitiser Cat 1<br>Carcinogen Cat 1B<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H302 Harmful if swallowed.<br>H317: May cause an allergic skin reaction.<br>H350: May cause cancer.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Concentration Effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

Copper (II) bromide (**red**), chloride (**orange**), ethanoate (**green**), nitrate (**blue**), sulphate (**purple**)



## Incompatibility

Many copper salts form unstable ethynides (acetylides) with ethyne (acetylene). Copper(II) chloride can react violently with potassium or sodium. The chromate ignites on contact with hydrogen sulphide gas. The oxides can form explosive mixtures with aluminium or magnesium. They are incompatible with many metals and reducing agents. Copper itself ignites on contact with chlorine even at ambient temperatures and is incompatible with 1-bromo-2-propyne.

## Handling

If handling compounds in large quantities or for any length of time, wear goggles (BS EN 166 3) and nitrile gloves (though these should always be worn when handling the chromate). Avoid raising dust from compounds in the solid state e.g. oxide, carbonate and sulphide. Lengthy electrolysis of a solution could produce harmful aerosol. Wash hands after use.

## Storage

Securely in store. Keep nitrate and chromate(VI) with oxidising agents.

## Disposal

If quantities are large, wear goggles (BS EN 166 3) and nitrile gloves. Washings – very small rinsings from glassware can be greatly diluted and washed to waste. Larger amounts should be stored for uplift by a licensed contractor or recycled as below.

Recycle Solutions – Collect and warm to approx. 40°C, adding a little dilute sulphuric acid to clarify the solution. Separate the copper as metal deposit by electrolysis (Use iron nail as cathode and graphite anode) running at 2 V until the solution is practically colourless. The recovered copper can be filtered off, washed, dried and re-used.

Disposal of solids – dissolve in water or in dilute acid and treat as above. Metallic copper can be put in the bin.

Disposal of Chromates(VI)- retain for collection by a licensed disposal contractor or reduce to Cr3+ and precipitate as for chromium(VI) oxide.

## Spillage

If quantities are large, wear nitrile rubber gloves and goggles (BS EN 166 3) and avoid raising dust.

For spillage of very small amounts of soluble solid copper salts dissolve in water and wash to waste with a large amount of water. For larger amounts of solid carefully scoop up and recycle as in **Disposal**.

For spillage of solutions cover with dry soda ash and mix carefully and keep for disposal by waste contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

# Cyanides

Sodium & potassium and the only ones likely to be encountered. If professional medical help is remote do not handle cyanides.

**CYANIDES SHOULD ONLY BE USED BY EXPERIENCED TEACHERS OR TECHNICIANS**

Appearance: White crystalline powder/lumps with almond smell. Soluble in water.

## Hazards

Solids, vapour or solutions are Fatal (Cat1/2) by inhalation, swallowing and in contact with the skin. Skin sensitisers. Early warning of poisoning is by weakness and heaviness of arms and legs, difficulty in breathing, headache, dizziness. These may be followed by pallor, unconsciousness and death. Experimental teratogen with reproductive effects. Hydrogen cyanide, an Extremely flammable, very toxic gas (flash point -18°C) evolved by reaction with acids. Keep pH of all solutions high. Avoid release to the environment.

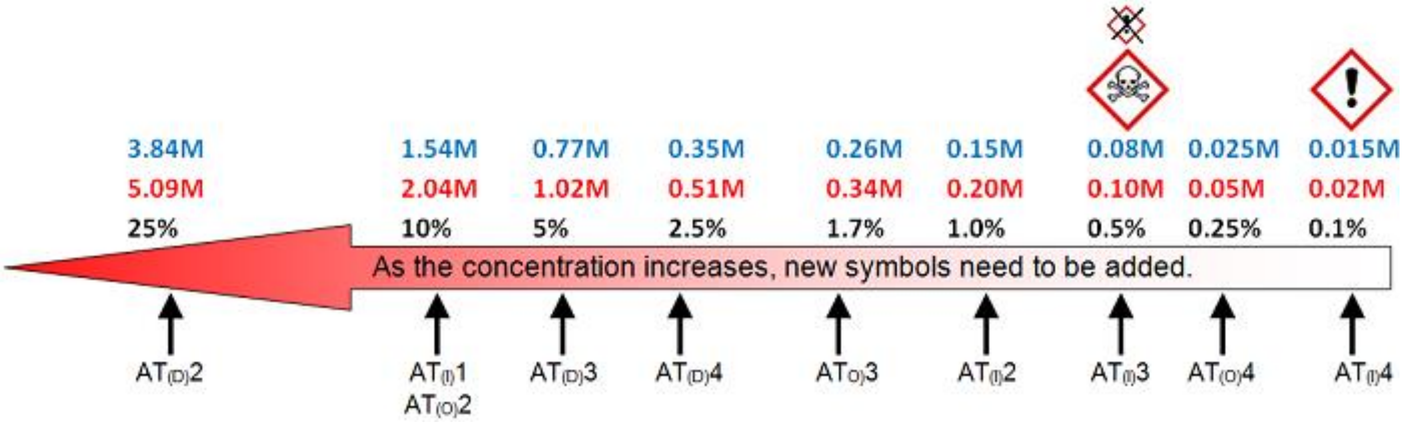
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium cyanide | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 1 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Specific target organ toxin on single exposure Cat 1<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H300: Fatal if swallowed.<br>H310: Fatal in contact with skin.<br>H330: Fatal if inhaled.<br>H370: Causes damage to brain, heart & testes.<br>H372: Causes damage to thyroid.<br>H400: Very toxic to aquatic life.<br>EUH032: Contact with water liberates very toxic gas. |  |
| Potassium cyanide | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 1 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Specific target organ toxin on single exposure Cat 1<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H300: Fatal if swallowed.<br>H310: Fatal in contact with skin.<br>H330: Fatal if inhaled.<br>H370: Causes damage to brain, heart & testes<br>H372: Causes damage to thyroid<br>H410: Very toxic to aquatic life with long-lasting effects.<br>EUH032: Contact with water liberates very toxic gas. |  |

## Concentration Effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

**red** = Sodium cyanide, **Blue** = potassium cyanide)



## Incompatibility

Heat, moisture and acid cause emission of hydrogen cyanide gas which is extremely TOXIC and HIGHLY FLAMMABLE. Carbon dioxide from the air, being acidic, liberates hydrocyanic acid from solids and solutions. Violent reactions with magnesium, nitric acid, nitrites, nitrates, iodine or fluorine.

## Handling

Never in the open laboratory, always in fume cupboard. Wear rubber gloves and eye protection.

## Storage

Securely in store.

## Disposal

Wear face shield, rubber gloves and apron. Work in a fume cupboard. **Do not release down the drain**. Oxidise to the relatively harmless cyanate – for up to 3 g dissolve the cyanide in a large volume of water in a bucket, add excess sodium chlorate(I) (hypochlorite) and leave for 24 hours in a secure fume cupboard. Check for an excess of chlorate(I), greatly dilute and run to waste. **For larger amounts or if in poor condition, do not open container, but arrange for disposal by a licensed contractor.**

## Spillage

Evacuate the room and open windows. For small spillages of solutions, scatter bleaching powder (or sodium chlorate(I) solution (CORROSIVE)), transfer to container and treat as in Disposal. For solids, moisten with water and continue as for small spillages. For large spillages contact the emergency services.

## Remedial Measures

In all cases of exposure it is important to get the casualty to hospital as soon as possible.

Rescuers must wear respirators since there is a risk of vapour inhalation from contaminated clothing.

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

First-Aiders should avoid direct mouth-to-mouth contact – use resuscitation bag.

### Lungs

Move patient from area of exposure. Rest and keep warm. First-Aiders should avoid direct mouth-to-mouth contact – use resuscitation bag.

### Skin

Wash well with soap and water. Remove all contaminated clothing and place in the open air. Avoid breathing any vapours from contaminated clothing.

# Cyclohexane

Alternative name: hexahydrobenzene

Description: Volatile, colourless liquid with characteristic smell. Immiscible in water. Was the major chemical involved in the Flixborough disaster of 1974

## Hazards

Highly flammable liquid which presents a dangerous fire risk and forms explosive mixtures with air at room temperature (1.3 – 8.4%). Keep away from sources of ignition. Vapour is of low acute and chronic toxicity via all routes of entry. It does however act as an irritant and depresses the central nervous system causing drowsiness, nausea, dizziness, vomiting and depression. Narcotic effects at high concentrations lead to coma and death due to respiratory failure. May cause damage to lungs if swallowed. Irritating to skin. Very harmful to the aquatic environment with long-lasting effects.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| cyclohexane | Warning | Flammable liquid Cat 2<br>Aspiration toxin Cat 1<br>Skin irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation.<br>H304: May be fatal if swallowed and enters airways.<br>H336: May cause drowsiness or dizziness by inhalation<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Oxidising agents. Explosive reaction occurs on the addition of liquid dinitrogen tetroxide to hot cyclohexane.

## Handling

Wear nitrile gloves and eye protection. Keep away from flames, hot plates, ovens, etc. Handle in well-ventilated area or fume cupboard.

**FF** – F, DP, CO2 or VL.

## Storage

Flammables store in well ventilated place away from sources of ignition and direct sunlight.

## Disposal

Wear nitrile gloves and eye protection. Turn off all sources of ignition. Unavoidable discharges, e.g. small amounts such as washings from glassware etc. should be emulsified with detergent and washed to waste. Small quantities can be absorbed on to paper towels and evaporated in the fume cupboard or outside in secure, safe place. Do not pour directly down the drain as it is very toxic to aquatic organisms and explosive mixtures may collect there.

## Spillage

Turn off all sources of ignition and open windows to ventilate the area. Wear nitrile gloves and face shield, evacuate the room and absorb spillage on dry sand, shovel into a bucket and take to open area for evaporation. Alternatively treat small spillages as for Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical advice/attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Turn off all sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Cyclohexanol

Alternative name: hexahydrophenol

Description: Viscous liquid with menthol-like smell. Fairly soluble in water.

## Hazards

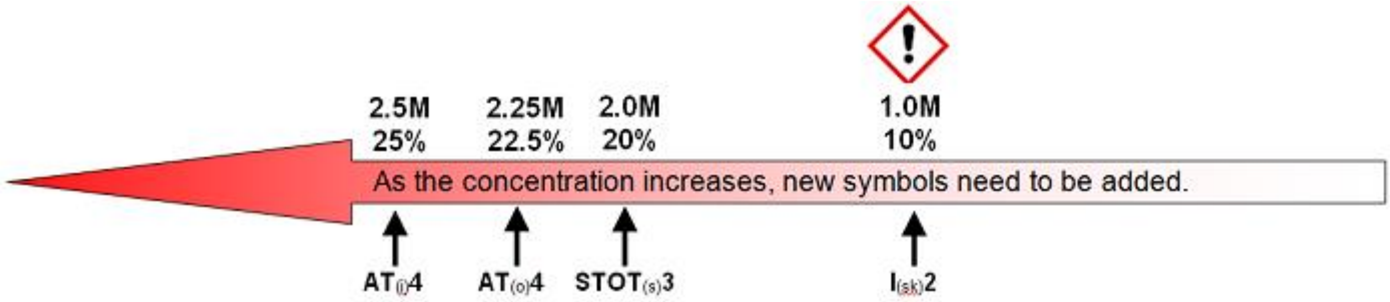
Vapour and liquid harmful to eyes, lungs, skin, and if swallowed. Irritates and is absorbed through the skin and may produce tremors and hypothermia. Produces narcotic effects in high concentrations. Flammable. (lel 2.4%)

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| cyclohexanol | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H302: Harmful if swallowed.<br>H332: Harmful if inhaled.<br>H315: Causes skin irritation.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Strong oxidising agents. It can react with nitric acid to form violently explosive materials, especially if the acid is in large excess, and ignites on contact with chromium trioxide. Incompatible with alkali metals or phosphorus(V) chloride.

## Handling

Keep away from sources of ignition. Wear gloves (nitrile or neoprene) and eye protection and if quantity is more than small scale, work in fume cupboard.

**FF** – F, DP, CO2 or WS.

## Storage

In store, away from oxidising agents and reactive metals.

## Disposal

Wear eye protection and neoprene gloves. Unavoidable discharges, e.g. small amounts such as washings from glassware etc. should be emulsified with detergent and washed to waste. Up to 10 cm3 at a time can be dissolved in a large volume of water and washed to waste.

## Spillage

Switch off all sources of ignition, then as for Disposal. Can also be absorbed on sand and placed in secure open area for evaporation. Alternatively absorb on to mineral absorbent which is then washed with water.

## Remedial Measures

**Eyes**

Irrigate with water for at least 10 minutes. Obtain medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. If irritation persists obtain medical attention.

# Cyclohexanone

Description: Colourless liquid. Somewhat soluble in water and very soluble in alcohols and ethers.

## Hazards

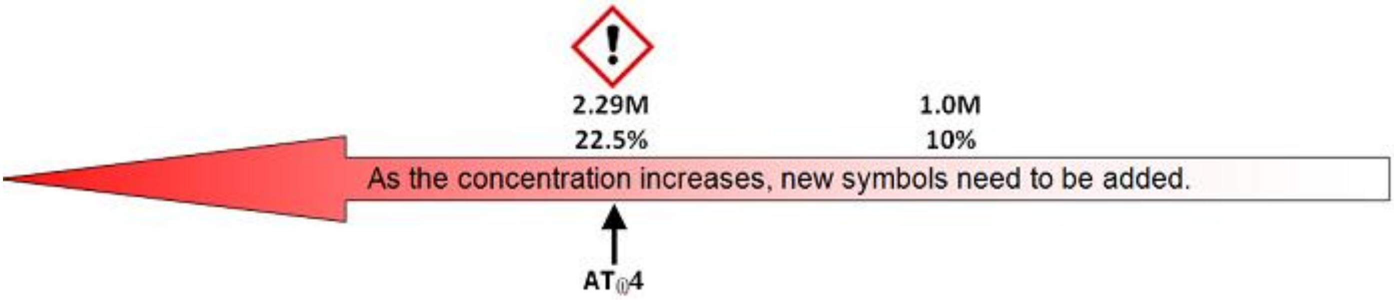
Harmful vapour is severely irritant to eyes, skin and respiratory & digestive system and may cause damage to the lungs, liver and central nervous system. Acute toxic effects may include salivation, hypothermia, decreased breathing rate and anaesthesia. Flammable liquid which presents a fire risk, especially when heated. Keep away from sources of ignition. (explosive range 1.1-9.4%)

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| cyclohexanone | Warning | Flammable liquid Cat 3<br>Acute toxin Cat 4 (inhalation) | H226: Flammable liquid and vapour.<br>H332: Harmful if inhaled. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents. Explosive reaction when added to nitric acid. Explosive peroxides produced on mixing with hydrogen peroxide.

## Handling

Wear rubber or LLDPE gloves and eye protection. Keep away from flames, hot plates, ovens, etc. Handle in well-ventilated area or fume cupboard.

**FF** – F, DP, CO2 or WS.

## Storage

Flammables store.

## Disposal

Wear eye protection and nitrile gloves. Turn off all sources of ignition. Unavoidable discharges, e.g. small amounts such as washings from glassware etc. should be emulsified with detergent and washed to waste. Small quantities can be evaporated in the fume cupboard. Do not pour down the drain as explosive mixtures may collect there.

## Spillage

Turn off all sources of ignition, open windows and evacuate room. Wearing nitrile gloves and face shield, absorb spillage on dry sand or mineral absorbent, shovel into bucket and take to secure open area or fume cupboard for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice if irritation persists.

# Cyclohexanone

Alternative name: 1,2,3,4-tetrahydrobenzene

Description: Colourless liquid with ether-like smell.

## Hazards

Highly flammable liquid which presents a dangerous fire risk, especially when heated. Forms explosive mixtures in air (lel 1.2%). Keep away from inadvertent sources of ignition. Vapour is moderately toxic to eyes, skin and respiratory system. Harmful if liquid swallowed. Unstable peroxides may form if the product of cyclohexanol dehydration experiments is stored.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| cyclohexene | Danger | Flammable liquid Cat 1<br>Aspiration toxin Cat 1<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 3 (dermal) | H225: Extremely flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H304: May be fatal if swallowed and enters airways.<br>H311; toxic in contact with skin. |  |

## Incompatibility

Oxidising agents.

## Handling

Wear nitrile gloves and eye protection. Keep away from flames, hot plates, ovens, etc. Substance quite volatile and it is important to handle in well-ventilated area or fume cupboard. **FF** – F, DP, CO2 or VL.

## Storage

Flammables store in well ventilated place away from sources of ignition and direct sunlight.

**SSL** – 3 years maximum, less if frequently opened. Can form explosive peroxides in storage (rate of formation increased by exposure to light and air).

## Disposal

Wear nitrile gloves and eye protection. Unavoidable discharges, e.g. very small amounts such as washings from glassware etc. should be emulsified with detergent and washed to waste. Small quantities can be absorbed on to paper towels and evaporated in the fume cupboard. Do not pour directly down the drain as explosive mixtures may collect there. Up to 100 cm3 can be placed outside in a secure place and allowed to evaporate.

## Spillage

Turn off all sources of ignition and open windows and evacuate the room. Wear nitrile gloves and face shield, soak up spillage on absorbent, shovel into bucket and take to open area for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Turn off all sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if feeling unwell.

# Decane

Description: Colourless liquid with characteristic smell. Immiscible in water.

## Hazards

Flammable. An asphyxiant, narcotic in high concentration. Slightly harmful by inhalation but very dangerous if swallowed and then aspirated into the lungs. Irritating to eyes. Degreases skin. Repeated contact may cause dermatitis.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| n-decane | Danger | Flammable liquid Cat 3<br>Aspiration toxin Cat 1 | H226: Flammable liquid and vapour.<br>H304: May be fatal if swallowed and enters airways. |  |

## Incompatibility

Reacts with oxidising agents.

## Handling

Wear eye protection and nitrile gloves. Keep away from flames. Good ventilation is needed: if using more than small amounts, use a fume cupboard.

FF – F, DP, CO2 or VL

## Storage

Flammables store.

## Disposal

Wear eye protection and nitrile gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified with detergent and washed to waste. Store larger quantities for disposal by contractor.

## Spillage

Wear eye protection and nitrile gloves. Add water and detergent, mop and wash to waste with large amount of water. Alternatively soak up on mineral absorbent and allow to evaporate in a safe place outside or in a fume cupboard.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Decanedioyl dichloride

Alternative name: sebacoyl chloride

Description: Colourless, fuming liquid. Sold in ampoules or as 5% solution in cyclohexane.

## Hazards

Corrosive and damaging to skin, eyes, mucous membranes and upper respiratory tract. Can be absorbed via skin, ingestion and inhalation routes. Absorption can lead to pulmonary oedema, inflammation, spasm then death. Solutions in cyclohexane are highly flammable.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| decanedioyl dichloride | Danger | Acute Toxin Cat 4 (oral)<br>Acute Toxin Cat 2 (dermal)<br>Skin corrosive Cat 1B | H302: Harmful if swallowed<br>H310: Fatal in contact with skin<br>H314: Causes severe skin burns and eye damage. |  |

## Incompatibility

With water a slight exothermic reaction.

## Handling

Avoid contact with skin or eyes and avoid breathing vapours or dust. Wear rubber gloves and goggles (BS EN 166 3) and handle in a well ventilated laboratory or in a fume cupboard. Though not very volatile, it reacts with moisture in the air to give fumes of hydrochloric acid and the heat generated carries some of the substance over. Pressure may build up in a stoppered vial or bottle after it has been opened in moist air. Open carefully and replace stopper immediately to avoid ingress of moisture.
**FF** – Do not use water to extinguish fires – use $CO_2$ or dry chemical powder.

## Storage

Stored securely with fuming corrosives. If purchased as small ampoules one of these can be opened to prepare each 100 cm3 of solution for the nylon rope trick. Alternatively it is available as ready-made 5% solutions in tetrachloroethene (Cat. 2 CARCINOGEN) or in cyclohexane (HIGHLY FLAMMABLE).

**SL** – 2 years. Deteriorates to form decanedioic acid and becomes less effective. Can then give confusing results.

## Disposal

Wear rubber gloves and goggles (BS EN 166 3). Work in a fume cupboard. Add small amounts slowly to a large volume of water containing detergent and stir vigorously keeping the solution alkaline. Wash the relatively harmless salt to waste. If cyclohexane is used, then it will have to be disposed of by a licensed disposal contractor.

## Spillage

Wear rubber gloves and goggles (BS EN 166 3). Open windows if spillage is in the open lab. If it is the pure substance without solvent and amounts are small, soak up on mineral absorbent and treat as in *Disposal*. If spillage is large store absorbent for disposal by licensed contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# di(benzenecarbonyl) peroxide

Alternative names: benzoyl peroxide, dibenzoyl peroxide.

Description: White, granular crystals, normally supplied moistened with 25-30% water. Insoluble in water. Soluble in methylbenzene and chlorinated hydrocarbons. Used as catalyst in the plastics industry as polymerisation initiator.

## Hazards

Must be kept wet – risk of explosion by shock, friction, fire or other sources of ignition. It is irritating to the eyes, skin and respiratory system. May cause sensitisation by skin contact as well as dermatitis and asthmatic effects. Flammable. May cause fire (powerful oxidising agent). Burns readily if lit and decomposes explosively if heated above its m.p. and at lower temperatures if in bulk. Self-accelerating decomposition occurs at 49ºC. Possible carcinogen. A safer alternative for catalysing polymerisations, (di)dodecanoyl peroxide (lauroyl peroxide) is available. Beware of contamination of screw threads on the neck of the container as friction can ignite it.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| di(benzenecarbonyl) peroxide | Danger | Organic peroxide Cat B<br>Eye Irritant Cat 2<br>Skin sensitiser Cat 1 | H241 Heating may cause a fire or explosion.<br>H319 Causes serious eye irritation.<br>H317 May cause an allergic skin reaction. |  |

## Incompatibility

Mixtures with reducing agents, with a wide range of organic compounds and combustible substances, including dust, are **explosive**. Various organic and inorganic acids, metals, metal oxides, ethene + tetrachloromethane, alcohols, amines, phenylamine, methyl methacrylate, dimethyl sulphide, metallic naphthenates, N,N-dimethylphenylamine (N,N-dimethylaniline). Violent reaction with charcoal when heated above 50°C.

## Handling

Wear nitrile gloves and eye/face protection. Keep quantities small. Keep lid on jar and dispense away from flames and hot-plates. Dispense carefully avoiding spillages. Any spilt accidentally on the neck of the jar may acquire some dust and will be subject to friction whenever the lid is removed. This can cause fire or explosions. Never return unused peroxide to the jar. Handle away from flames, hot plates etc. Do not attempt to grind to small particles or recrystallise.

**FF** – WS.

## Storage

General store. Keep wet in bottle away from both oxidising agents and reducing agents in store – tightly closed in a cool, well ventilated place.

**SSL** – one year maximum. Deteriorates to form a shock sensitive explosive.

## Disposal

Wear face shield and gloves. Add up to 5 g in small portions slowly with continuous agitation to 200 cm3of 2M sodium hydroxide (CORROSIVE). Leave stirring for 2 hours and standing for a day. Then greatly dilute and wash to waste with copious amounts of water. Alternatively, outside add small portions i.e. 10 cm3 at a time and add to a small fire of burning wood shavings at distance. The reaction goes off remarkably tamely when unconfined.

## Spillage

Wear nitrile gloves and eye protection. Spray on water and mix with wet absorbent. Carefully lift into a bucket and treat with excess alkali as above, finally decanting the supernatant and washing to waste with large amounts of water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice/attention.

### Lungs

Exposure unlikely by this route but if inhaled, rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## di(dodecanoyl) peroxide

Alternative names: dilauroyl peroxide.

Description: Supplied as moistened white powder. Insoluble in water or ethanol. Soluble in methylbenzene and chlorinated hydrocarbons.

### Hazards

Powerful oxidising agent like other organic peroxides. The powder is irritant to the respiratory system and skin. It can cause burns on the eyes and mucous membranes. Explosive and shock-sensitive when heated to dryness. Experimental evidence that it may be a carcinogen. Less dangerous than di(benzenecarbonyl) peroxide(benzoyl peroxide). Beware contamination of screw threads or bottle caps as friction can cause fires. Self-accelerating decomposition can occur at 49°C.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| di(dodecanoyl) peroxide | Danger | Organic peroxide Cat D | H242: Heating may cause a fire. |  |

### Handling

Wear eye protection and rubber or plastic gloves. Handle away from flames and heat. Use spatula and avoid raising dust. Treat as explosive substance.

**FF** – WS or F.

### Storage

General store with inorganics (from which strong reducing agents and oxidising agents have been removed). Keep as cool as possible but always below 27°C. Keep moist in bottle. Store away from both oxidising agents and flammables.

**SSL**– 3 years maximum. Avoid contamination and heat. Either can result in the release of hazardous decomposition products which are flammable and may autoignite.

### Disposal

Wear face shield and gloves. Add up to 5 g in small portions slowly with continuous agitation to 200 cm3of 2M sodium hydroxide solution (CORROSIVE). Leave stirring for 2 hours and standing for a day. Then greatly dilute and wash to waste with copious amounts of water. Alternatively, outside remove small portions i.e. 10 cm3 at a time, replace lid and add to burning wood shavings at a distance. The reaction goes off remarkably tamely when unconfined.

### Spillage

Wear face shield, moisten with water, mix with mineral absorbent and carefully shovel into bucket. Treat as in Disposal. Wash the contaminated area several times with water.

### Remedial Measures

**Eyes**

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Move patient from area of exposure. Exposure by this route is however unlikely. Rest and keep warm. Obtain medical attention.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation continues.

# Diazonium salts

Description: Unstable crystalline solids, many of which are explosive when dried out

## Hazards

Because they are explosive in the dry state or in concentrated solution, no attempt should be made to isolate the diazonium salts. They are normally used in dilute solutions immediately after being prepared. For associated hazards in their preparation and uses see the hazard sheets for phenylamine, dyestuffs and sodium nitrate(III) (sodium nitrite). Many azo dyes are toxic or harmful as well as being suspected carcinogens and therefore no pupil should be permitted to carry out coupling reactions using unknown compounds.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| diazonium salts | Danger | Explosive solid Cat 1.1<br>Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation) | H201: Explosive; mass explosion hazard<br>H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled. |   |

## Incompatibility

Oxidising agents.

## Handling

Wear nitrile gloves and eye protection. Only small scale work desirable. The product should be completely washed away after use.

## Storage

Prepare when needed and **use immediately or dispose of**.

## Disposal

Wear nitrile gloves and face shield. Add water to the excess of the prepared solution and warm gently until reaction is complete. Wash to waste with water.

## Spillage

Wear nitrile gloves and face shield. Mop up either with a solution of potassium iodide or with copper(I) chloride in dilute hydrochloric acid (IRRITANT) Warm up the suspension when decomposition of the diazonium salts is complete, wash to waste.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention.

# Dihalogenoethanes

Alternative names: ethylene dibromide, ethylene dichloride & ethylene diiodide.

**1,2-dibromoethane is Banned in schools – It is included here merely for the sake of completeness**

Description: Bromo and chloro compounds are colourless liquids. Iodo- compound is a light brown, crystalline solid.

## Hazards

As the MW of the halogens increases, the hazards decrease. The bromo derivative is toxic by all routes and it, along with the chloro compound, is highly carcinogenic and should not be used in schools. All three are skin / eye / respiratory irritants.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 1,2-dibromoethane | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Skin / eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3<br>Carcinogen Cat 1B<br>Hazardous to the aquatic environment with long lasting effects Cat 2 | H301: Toxic if swallowed<br>H311: Toxic in contact with skin<br>H331: Toxic if inhaled<br>H315: Causes skin irritation<br>H319: Causes serious eye irritation<br>H335: May cause respiratory irritation<br>H350: May cause cancer<br>H411: Toxic to aquatic life with long-lasting effects |  |
| 1,2-dichloroethane | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Skin / eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3<br>Carcinogen Cat 1B | H225: Highly flammable liquid and vapour<br>H302: Harmful if swallowed<br>H315: Causes skin irritation<br>H319: Causes serious eye irritation<br>H335: May cause respiratory irritation<br>H350: May cause cancer |  |
| 1,2-diiodoethane | Warning | Skin / eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H315: Causes skin irritation<br>H319: Causes serious eye irritation<br>H335: May cause respiratory irritation |  |

## Incompatibility

Incompatible with, reactive metals, liquid ammonia, organic peroxides, reducing agent and strong oxidizers (possibly leading to explosion). Mixtures of the chloro compound with nitric acid are easily detonated by heat, impact, or friction. There is little data on the iodo compound but it would be prudent to assume the same incompatibilities

## Handling

Wear nitrile gloves and eye protection and work in fume cupboard. Keep chloro compound well away from any source of ignition.

## Storage

General store with other organics. Away from incompatibles.

## Disposal

Wear eye protection and nitrile gloves. Unavoidable discharges of very small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Larger amounts should be stored to await uplift by licensed contractor.

## Spillage

In case of spillage of chloro compound, avoid raising sparks from electrcal equipment. Wear nitrile gloves and eye protection. If the amount is small, soak up on mineral absorbent. Scoop into a bucket, rinse well with a mixture of water plus emulsifying agent and run washings to waste. If spillage is large open windows and soak up on mineral absorbent and store for uplift by disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical advice.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Seek medical attention if area affected is large or irritation persists.

# Dichloromethane

Alternative name: methylene dichloride

Description: Colourless, volatile liquid with chloroform-type smell. Slightly soluble in water.

## Hazards

Category 2 carcinogen. At its most harmful if inhaled causing narcosis, anaesthesia and tiredness. Very volatile. Mildly toxic on swallowing with little permanent organic damage. Higher concentrations of the vapour lead to headaches, respiratory irritation and breathing problems. It is irritant to the eyes and skin and can cause dermatitis and burns on repeated contact. Decomposes at high temperatures giving toxic phosgene and hydrogen chloride fumes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| dichloromethane | Warning | Carcinogen Cat 2 | H351: Suspected of causing cancer |  |

## Incompatibility

Reacts violently with strong oxidising agents e.g. liquid oxygen, dinitrogen tetroxide or pentoxide and with alkali metals and hot aluminium. Dissolves endothermically in concentrated nitric acid to give explosive solutions. Mixtures with alkali metals are shock sensitive.

## Handling

In well-ventilated area, wearing nitrile gloves and eye protection if exposure is just for a short time, otherwise use fume cupboard. May be found in adhesives, paint strippers etc.

## Storage

Flammables store, not because of flammability but because of high volatility.

## Disposal

Unavoidable discharges, e.g. very small quantities such as washings from glassware, etc. should be emulsified and washed to waste. After extractions wash with appropriate reagent, dry and redistil. Store larger amounts in waste halogenated hydrocarbons bottle for disposal.

## Spillage

Evacuate room and open doors and windows if possible. Wear face shield and nitrile gloves. If spillage is small then allow to evaporate. For larger amounts absorb on dry sand and remove in a bucket to open area for evaporation. Try to avoid evaporation where possible and consider recycling.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected or if more than a whiff is inhaled.

### Skin

Wash well with soap and water. Much will evaporate quickly because of its high volatility. Avoid breathing vapours. Remove and wash contaminated clothing. Obtain medical attention if a large area is exposed or if irritation occurs.

# Dichromates

Sodium and potassium salts are the only ones likely to be encountered in schools.

Dichromates(VI) of calcium, strontium, zinc, barium, copper are all insoluble in water and are CARCINOGENIC by inhalation. Chromates react with acids to form dichromates. Sodium & potassium dichromate(VI) are orange crystals, soluble in water.

## Hazards

Very Toxic; severely irritating and corrosive to eyes, skin and respiratory system. Category 1B carcinogens and mutagens. Sensitisers via both inhalation & skin. Toxic by ingestion. May cause heritable genetic damage. Very toxic to aquatic organisms and may cause long term adverse effects to the aquatic environment.

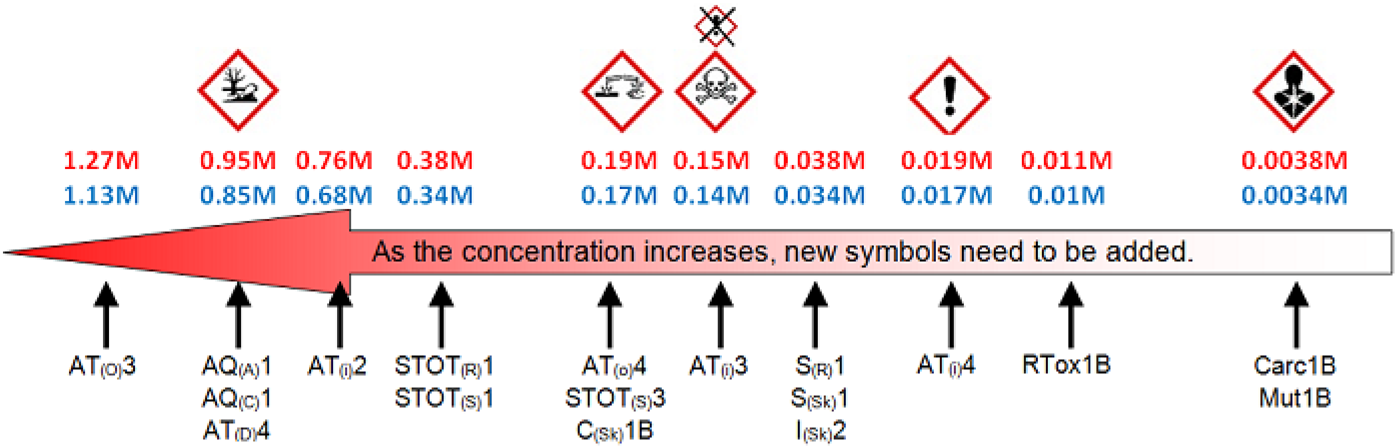
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium dichromate(VI),<br>potassium dichromate(VI) | Danger | Oxidising solid Cat 2<br>Acute toxin Cat 3 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Skin corrosive Cat 1B<br>Respiratory sensitiser Cat 1<br>Skin sensitiser Cat 1<br>Mutagen cat 1B<br>Carcinogen Cat 1B<br>Reproductive toxin Cat 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Harmful to the aquatic environment with long-lasting effects Cat 1 | H272: May intensify fire; oxidiser.<br>H301: Toxic if swallowed<br>H312: Harmful in contact with skin.<br>H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H317: May cause an allergic skin reaction.<br>H360: May damage fertility or the unborn child<br>H340: May cause genetic defects<br>H350: May cause cancer<br>H335: May cause respiratory irritation.<br>H372: Causes damage to respiratory tract by inhalation<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

Sodium dichromate in **red**, potassium dichromate in **blue**.



## Incompatibility

The dichromates are powerful oxidising agents and they react violently with reducing agents in general and with several organic compounds, carbon, sulphur, phosphorus, metals (especially if finely divided), hydrazine and derivatives, hydroxylamine, ethane-1,2-diol, a mixture of ethanol or ethanoic anhydride with sulphuric acid. Small sparks are created if acidified dichromate(VI) is accidentally run too rapidly into propan-2-ol rather than added dropwise.

## Handling

Wear eye protection and rubber or nitrile gloves. Potassium and sodium dichromates are usually in the form of coarse crystals; thus solutions can be made up without forming an aerosol. The chromates are also crystalline, though finer.

## Storage

With oxidising agents. Keep away from reducing agents.

## Disposal

Wear eye protection and rubber gloves. Run washings from glassware to waste. If larger amounts are involved :-

**Solid –** store for collection by waste disposal contractor.
**Solutions –** either soak on mineral absorbent and store for collection or acidify to approximately pH 2 and add sodium hydrogensulphite to reduce to Cr(III). Precipitate the Cr3+ as hydroxide, filter and keep for disposal by a licensed contractor.

## Spillage

Wear eye protection and rubber gloves. Moisten with water, shovel into bucket and if amounts are small wash to waste with a large volume of water. Otherwise treat as for **Disposal**. Could be dangerous if traces of carbonaceous dust had become mixed with it; in this event wet immediately, dissolve, reduce to Cr3+and proceed as above. Wash the area well and mop with a little hydrogensulphite solution.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth carefully with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route is unlikely. Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash skin well. If area of skin affected is large and solution had been concentrated or if irritation persists, obtain medical attention.

## Diethylamine

Description: Colourless liquid with ammonia-type smell.

### Hazards

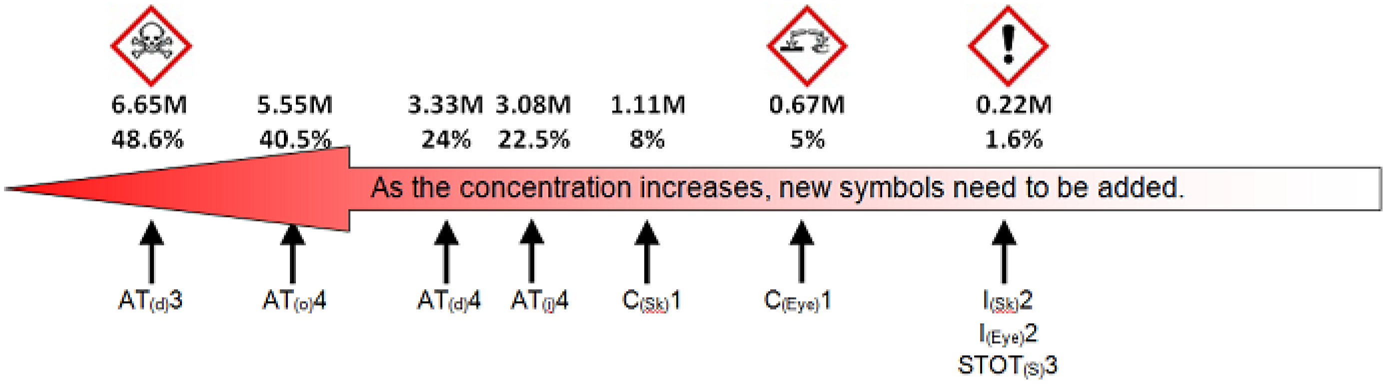
Highly flammable, forms explosive mixture in air (explosive range 1.8 – 10.1%) – keep away from sources of ignition. The vapour irritates eyes and respiratory system. Liquid irritates eyes and skin. The solution in water is safer to use and store.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| diethylamine | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Skin corrosive Cat 1A | H225: Highly flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H311: Toxic in contact with skin.<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Oxidising agents or strong mineral acids.

### Handling

In fume cupboard. Wear nitrile gloves and goggles (BS EN 166 3). Open carefully as pressure may build above the volatile liquid.

**FF** – F, DP, CO2, WS.

### Storage

Flammables store.

### Disposal

Remove all sources of ignition. In fume cupboard and wearing nitrile gloves and goggles (BS EN 166 3), greatly dilute up to 50 cm3 at a time by adding to large volume of water, neutralise with 1M hydrochloric acid (IRRITANT) and run down drain with plenty of water.

## Spillage

Evacuate room, open doors and windows if possible and wear face shield and nitrile gloves. Turn off sources of ignition. Mop up with water and wash to waste with running water. Alternatively soak up on mineral absorbent and transfer to fume cupboard or secure outside site for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Remove contaminated clothing. Wash well with soap and running water. Obtain medical attention if irritation persists.

# Diiodine hexachloride

Alternative name: iodine trichloride

Description: Fuming, deliquescent, orange-red crystals with pungent smell.

## Hazards

Vapour has a pungent odour and is very damaging to the eyes. It may be harmful in contact with the skin and via the respiratory system. Solid is corrosive and burns the skin and eyes. Severe internal damage occurs if swallowed. May evolve toxic fumes in fire.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| diiodine hexachloride | Danger | Oxidising solid Cat 2<br>Skin corrosive Cat 1B | H272 May intensify fire; oxidiser.<br>H314 Causes severe skin burns and eye damage. |   |

## Incompatibility

Reacts and decomposes vigorously with water, steam, acid or acid fumes to give highly toxic fumes. Ignites phosphorus.

## Handling

In fume cupboard. Wear nitrile gloves and goggles (BS EN 166 3).

## Storage

Not usually purchased but synthesised as required and then disposed of.

## Disposal

Wear goggles (BS EN 166 3) and nitrile gloves. Mix with sodium carbonate. Add water carefully, allow time for reaction to be completed and finally wash to waste with running water.

## Spillage

Wear face shield and nitrile gloves. Mix with sodium carbonate over the spillage and carefully mop up with water. Carefully, and slowly, add to water to allow time for reaction and run to waste with running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Remove contaminated clothing. Wash with plenty of running water. Burns require immediate medical attention.

# Dimethylamine

Description: Colourless gas or colourless solution in water with fishy smell. 40% solution is 7.9M

## Hazards

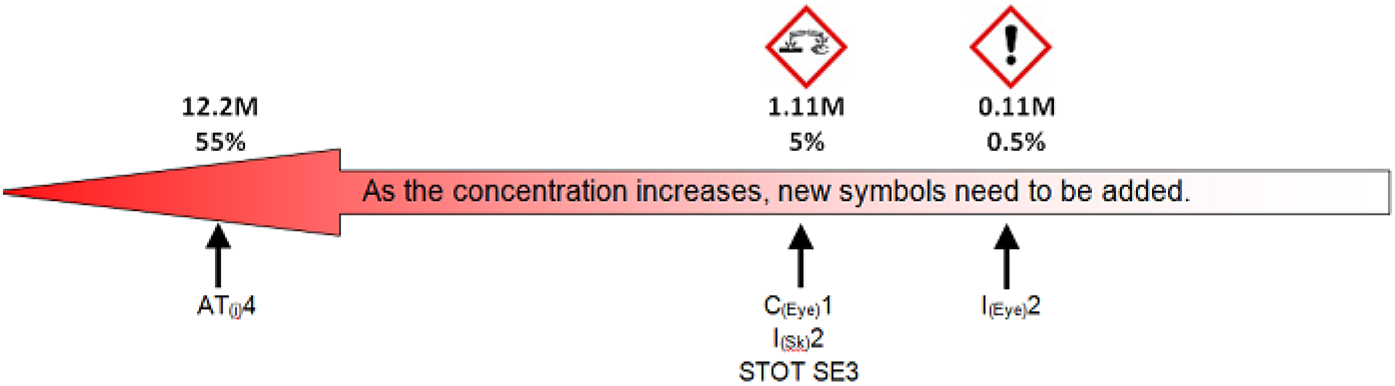
Vapour, liquid and solutions of high concentration are extremely flammable (explosive range 2.8 – 14.4%) and is strongly irritant to eyes, lungs and skin, causing serious eye damage. Poisonous if swallowed. Carcinogenic properties in conjunction with sodium nitrite in some animal studies due to the formation of dimethylnitrosamine in the body. Diluting with an equal volume of water raises the flash point to above 6°C.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| dimethylamine gas | Danger | Flammable gas Cat 1<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Acute toxin Cat 4 (inhalation)<br>Specific target organ toxin on single exposure Cat 3 | H220: Extremely flammable gas.<br>H332: Harmful if inhaled.<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H335: May cause respiratory irritation. |  |
| dimethylamine solution, 60% in water or 33% in abs. ethanol | Danger | Flammable liquid Cat 2<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Acute toxin Cat 4 (inhalation)<br>Specific target organ toxin on single exposure Cat 3 | H224: Extremely flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

(Aqueous solution) Find the concentration of your solution – the symbols (and classifications) to the **RIGHT** of it are the ones that apply.



## Incompatibility

Very dangerous when exposed to flame or hot surfaces and emits fumes of nitrogen oxides when heated to decomposition. Can react vigorously with oxidising agents. Incandesces on contact with fluorine.

## Handling

Wear nitrile gloves and goggles (BS EN 166 3), handle in fume cupboard. Open carefully as the gas will be at pressure above its solution or liquid, especially on warm days.

**FF** – F, DP, CO2, WS.

## Storage

Flammables store. Like ammonia the concentration will reduce as the gas gradually leaves the solution. Use until typical reactions are not clearly given.

## Disposal

Ensure absence of sources of ignition. Wear goggles (BS EN 166 3) and nitrile gloves. In a fume cupboard, small quantities can be dissolved in a large volume of water, neutralised and washed to waste with water.

## Spillage

Turn off all flames and sources of ignition, e.g. hot plates. Wear face shield and gloves, mop up small spillages with plenty of water and wash to waste with large volume of water. For larger spills cover with mineral absorbent, vent the room and wait for fumes to die down. Then treat as for Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed, obtain medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Turn off sources of ignition. Remove contaminated clothing. Wash well with soap and running water. Obtain medical attention if irritation persists.

## Dimethylbenzenes

Other names: Xylene, xylol.

Description: Colourless liquid with benzene-type smell. Common solvent for woodstains and Hammerite type paints.

### Hazards

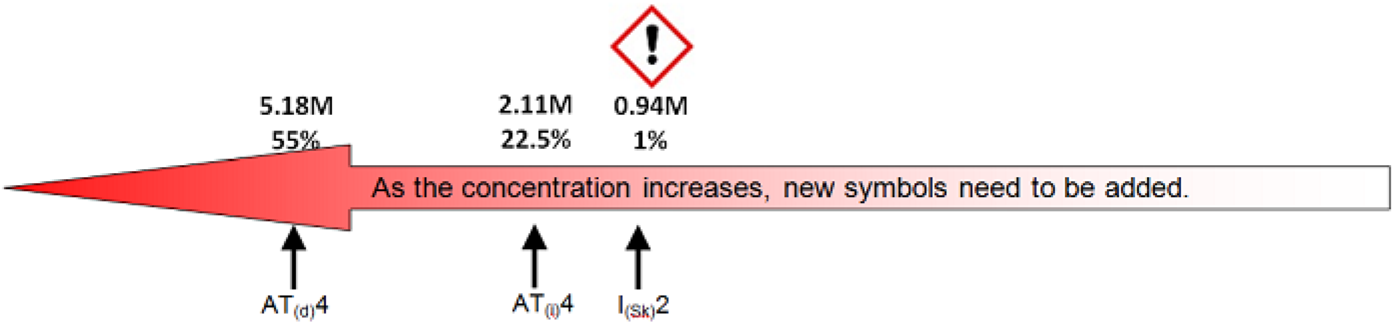
Vapour is harmful to eyes and respiratory system where it can produce narcotic effects. Liquid is harmful by skin absorption, to eyes, and if swallowed. All the xylene isomers have similar toxicity. Commercial xylene can contain benzene as an impurity and this can cause damage to the blood system. Moderately flammable (explosive ranges 1 - 7%).

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| dimethylbenzenes | Warning | Flammable liquid Cat 3<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Skin irritant Cat 2 | H226: Flammable liquid and vapour.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H315: Causes skin irritation. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Oxidising agents. Take care during oxidation of p-xylene to terephthalic acid with nitric acid.

### Handling

Wear nitrile gloves and eye protection. Work in well ventilated area, away from flames. Even nitrile gloves are rapidly degraded and need changing. Viton gloves are preferable but expensive.

**FF**– F, DP, CO2, VL.

### Storage

Keep in well ventilated flammables store. Never in laboratory.

### Disposal

Turn off all sources of ignition. Wear nitrile gloves and face shield. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified with detergent and washed to waste. Alternatively, absorb on to paper towel or mineral absorbent and evaporate in fume cupboard or outside in a secure, safe place.

### Spillage

Wear nitrile gloves and a face shield. Turn off all sources of ignition. For small spills add water and detergent and emulsify, finally washing to waste with running water. Alternatively absorb on sand or mineral absorbent, and remove to fume cupboard or a secure, safe outdoors site for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Turn off all sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Dimethyldichlorosilane

Other names: dichlorodimethylsilane

Description: Colourless to pale yellow, fuming liquid..

## Hazards

Highly flammable liquid (explosive range 3.4 – 9.5%). Keep away from sources of ignition. Dangerous when heated. Products of combustion include hydrogen chloride and oxides of carbon. Corrosive liquid. Harmful vapour, irritates eyes, respiratory system and skin.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| dimethyldichlorosilane | Danger | Flammable liquid Cat 2<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure cat 3 | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation |  |

## Incompatibility

Dangerous in contact with oxidising agents. Decomposes violently with water or steam and other hydroxylic compounds, eg alkanols, to produce heat and toxic and corrosive fumes of hydrogen chloride.

## Handling

In fume cupboard, away from flames, heat and all sources of ignition. Wear eye protection and nitrile gloves. Do not return unused dimethyldichlorosilane to the bottle.

**FF** – DP, CO2.

## Storage

Flammables store, but away from alkanols.

**SL** – If ampoule or bottle is opened – maximum of 1 year.

## Disposal

Wear nitrile gloves and face shield. In a fume cupboard, add a few drops at a time to a large volume of water, allow the reaction to complete, neutralise and wash to waste with water.

## Spillage

Wear nitrile gloves and face shield and open windows. Absorb on dry sand, shovel into dry bucket, using a plastic shovel if on rough surface, e.g. concrete. Leave in a secure open area for evaporation for a few hours or treat as in **Disposal**.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## 2,4-dinitrophenol

Description: Yellow crystals, sold with 15-30% water content. Solutions often used as pH indicators. Slightly soluble in water. Soluble in alkalis, propanone and ethyl ethanoate.

### Hazards

Toxic by ingestion, by inhalation of dust and by skin absorption. Prolonged exposure to low concentrations very dangerous as there are likely to be cumulative effects. Explodes when heated or if dried. Presents a significant fire hazard if heated with flammable materials.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 2,4-dinitrophenol | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H301 Toxic if swallowed.<br>H311 Toxic in contact with skin.<br>H331 Toxic if inhaled.<br>H373 May cause damage to organs through prolonged or repeated exposure.<br>H400 Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long-lasting effects. |    |

### Incompatibility

Explosive reactions possible with oxidising agents, alkalis and ammonia. Forms explosive salts with most metals.

### Handling

Wear rubber or plastic gloves and eye protection. Keep moist. Handle in well-ventilated laboratory or fume cupboard.

**FF** – WS.

### Storage

Securely in store. Keep moist with at least 20% by weight of water.

### Disposal

If the substance appears to have dried out, seek specialist advice. Very small amounts such as washings of glassware can be washed to waste with running water. If amounts are larger than this, store for disposal by contractor.

### Spillage

Wear rubber or plastic gloves and face shield. Ensure that solid is slightly damp and carefully lift with a plastic shovel into large beaker. If quantity is very small, aid dissolution by addition of sodium hydroxide solution (CORROSIVE) and wash to waste. If large, add some water and arrange for disposal by contractor.

### Remedial Measures

In all cases of exposure take casualty to hospital as soon as possible.

**Eyes**

Irrigate with water for at least 10 minutes.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting.

**Lungs**

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and running water. Remove and wash contaminated clothing.

# 2,4-dinitrophenylhydrazine

Description: Red crystalline powder. Sold wetted with water and used as the soluble chloride or sulphate.

Dangerously explosive when dry. Keep wetted with up to 33% water and keep the contact area between container and lid clean to avoid solid getting trapped there and drying out. Avoid heating or shocking this chemical

## Hazards

In addition to the explosive hazards outlined above, 2,4-DNPH is harmful if swallowed, by skin absorption and by inhalation of dust (the latter is unlikely as the substance is kept moist). Symptoms may be delayed by several hours. Dermatitis can occur.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 2,4-dinitrophenylhydrazine moistened with water (50%) | Danger | Flammable solid Cat 1<br>Acute toxin Cat 4 (oral) | H228: Flammable solid<br>H302: Harmful if swallowed |  |

## Incompatibility

Explosive reactions may occur with oxidising agents or metal oxides.

## Handling

Store moist and use minimum quantity for experiment. Do not dry unless really necessary. Best used in solution by pupils. Wear rubber or plastic gloves and eye protection.

**FF** – WS.

## Storage

General store as a toxic chemical away from oxidising agents. Have minimal quantity in store and keep wetted.

## Disposal

Wear rubber or plastic gloves and face shield. Small quantities such as washings of the soluble salt from glassware can be run to waste. Store larger quantities for collection by waste disposal contractor. If there is any evidence of the substance having dried out seek specialist advice.

## Spillage

**For small spills of solution** – if used as Brady's reagent with concentrated sulphuric acid (CORROSIVE) – soak up in sodium carbonate and wash to waste. If made up in hydrochloric acid (CORROSIVE) then treat similarly.

**For solids** – moisten and mix with mineral absorbent. Scoop up carefully. If small quantity rinse the absorbent with 2M hydrochloric acid (CORROSIVE) and place washed absorbent in solid refuse. For larger quantities place in jar with water, label and store to await collection by disposal contractor. Wash area of spillage well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting. Obtain medical attention.

### Lungs

Exposure is very unlikely by this route. Move patient from area of exposure. Rest and keep warm. If exposure is large obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice if a large area of skin is involved.

# 1,4-dioxane

Alternative name: diethylene oxide

Description: Clear liquid with a characteristic odour. Miscible with water, alkanols, propanone, and many organic solvents

## Hazards

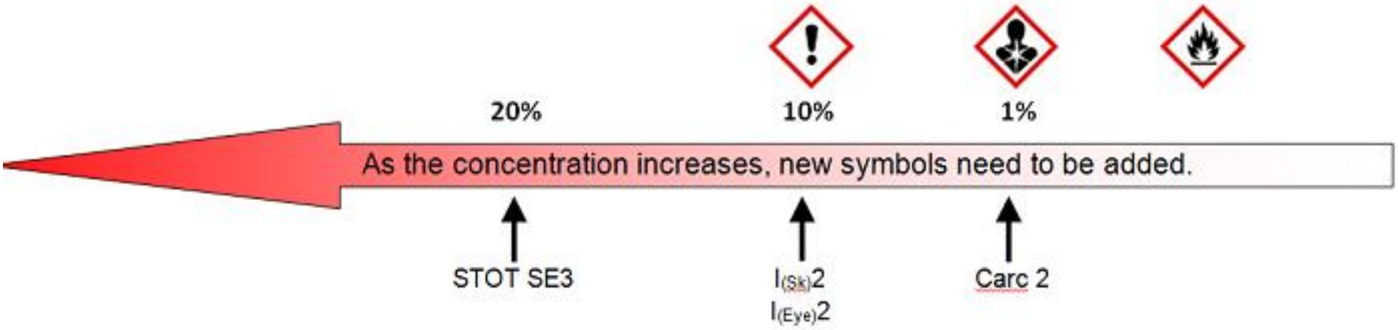
Highly Flammable, forming explosive mixtures in air (Explosive range 2-22%). Readily forms unstable peroxides on standing; hence the likely danger of explosion if the solvent is evaporated to dryness. Harmful by all routes of entry, though its lowish volatility reduces the amount likely to be inhaled.. Category 2 Carcinogen. Inhalation of vapour at 200 -300 ppm leads to irritation of eyes and nose, respiratory system & skin. Higher concentrations lead to headaches, drowsiness and vomiting. Ingestion of large amounts can give rise to the same symptoms. Absorption via the skin can lead to a loss of coordination, narcosis, erythema and eventually liver and kidney damage.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| dioxane | Danger | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Carcinogen cat 2<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H351: Suspected of causing cancer by ingestion<br>H335: May cause respiratory irritation. |  |

## Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. (NB No data available as to the point at which it ceases to become flammable)*



## Incompatibility

Reacts violently with oxidising agents, Raney nickel catalyst. Forms an addition compound with sulphur trioxide which explodes at ambient temperatures.

## Handling

Wear eye protection and rubber, nitrile or LLDPE gloves. If amounts other than small or if above ambient temperatures it should be handled in a fume cupboard. Turn off all sources of ignition. Do not evaporate to dryness.

**FF** – WS, DP, CO2

## Storage

Flammables store. Store in amber coloured bottles and out of light in a cool, dry, well ventilated store.

**SSL –**2 years max. Can form explosive peroxides in storage (rate of formation increased by heating, evaporation or exposure to light).

## Disposal

Turn off all sources of ignition. Wear face shield and rubber gloves. Up to 20 cm3 can in small portions be mixed with 100 volumes of water and run to waste.

## Spillage

Turn off all sources of ignition and open windows. Wear face shield and rubber gloves. Avoid inhaling the vapour. Cover with cat-litter or mineral absorbent. Lift the absorbent and wash well in running water. Small spillages can be soaked up on paper towels or on cloths and washed to waste. Wash spill site afterwards.

## Remedial Measures

### Eyes

Irrigate with copious amounts of water for at least 15 minutes. Obtain medical attention if irritation persisits.

### Mouth

Wash out mouth thoroughly with water. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected or feeling unwell.

### Skin

Turn off all sources of ignition. Immediately wash skin and flood affected area. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# disulphur dichloride

Alternative name: sulphur monochloride

Description: Yellow/brown fuming liquid.

## Hazards

Corrosive causing severe burns to skin, eyes and digestive system. Vapour is extremely irritating and very harmful if inhaled. Reacts violently with water and decomposes to give hydrogen chloride (acidic and extremely destructive to the respiratory system), thiosulphuric acid and sulphur.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| disulphur dichloride | Danger | Acute toxin cat 4 (inhalation)<br>Skin corrosive Cat 1A<br>Hazardous to the aquatic environment Cat 1 | H301: Toxic if swallowed.<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage. |  |

## Incompatibility

Reacts violently with oxidising agents, chromium(IV) dichloride dioxide (chromyl chloride), water (to give off sulphur dioxide and hydrogen chloride), sodium peroxide, phosphorus(III) oxide (phosphorus trioxide), unsaturated compounds, mercury(II) oxide (mercuric oxide). Potassium, antimony and sulphides of some metals.

## Handling

Wear goggles (BS EN 166 3) and rubber or plastic gloves. Avoid breathing vapour. Work in fume cupboard and use small scale. Open carefully as pressure may have built up due to the reaction with atmospheric moisture. Remove stopper for the minimum of time.

## Storage

Only in small amounts with flammables.

**SSL** – Maximum of 3 years. Water reactive and over time reacts with moisture from the air to generate sulphur, hydrogen chloride, sulphur dioxide, and hydrogen sulphide.

## Disposal

Wear rubber or plastic gloves and face shield. Allow to evaporate in a fume cupboard or from a safe outside place. Alternatively in a fume cupboard, slowly add small portions to a large volume of water. When reaction complete, neutralise and run to waste.

## Spillage

Ventilate and evacuate room. Turn off all sources of ignition. Wear rubber or plastic gloves and face shield. Soak into dry sand, transfer to fume cupboard or safe outdoor site and treat as in *Disposal*. Wash spillage site well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention.

# EDTA

Ethylenediaminetetraacetic acid and its sodium salts. (Potassium salts also exist but are much less commonly used)

Description: Colourless crystalline /powdery solids.

## Hazards

These compounds are not of great hazard. They are in varying degrees corrosive/irritant and have mild toxicity, Category 4.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| EDTA | Warning | Eye Irritant Cat 2 | H319 causes serious eye irritation |  |
| Na$_4$-EDTA, (& hydrates) | Danger | Acute toxin Cat 4 (oral)<br>Eye Damage Cat 1 | H302 Harmful if swallowed<br>H314 causes serious eye damage |   |
| Na$_2$-EDTA (& hydrate) | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Skin/Eye Irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H302 harmful if swallowed<br>H312 harmful in contact with skin<br>H332 harmful if inhaled<br>H315 causes skin irritation<br>H319 causes serious eye irritation<br>H335 may cause respiratory irritation |  |

## Incompatibility

Strong oxidising agents.

## Handling

Wear eye protection (goggles (BS EN 166 3 for the tetrasodium salts) and possibly gloves. Avoid raising dust.

**FF** – WS, DP & VL.

## Storage

EDTA can be stored with organics in the general store. If being stored for a long time, solutions should be stored in plastic bottles.

## Disposal

Wear eye protection (goggles (BS EN 166 3 for the tetrasodium salts) and possibly rubber gloves. Dilute up to 50g with 50 volumes of water, neutralise with 2M hydrochloric acid (IRRITANT) and wash to waste with running water.

## Spillage

Wear eye protection (goggles (BS EN 166 3 for the tetrasodium salts) and possibly rubber gloves. Sweep up powder carefully and dispose as above. Mop up solutions into bucket or soak up on adsorbent. Add water to dissolve, neutralise carefully with dilute hydrochloric acid (IRRITANT) and wash solution to waste with running water

## Remedial Measures

**Eyes**

Remove contact lenses, if present and easy to do. Irrigate with water for at least 15 minutes. Obtain medical attention: as soon as possible if tetrahydrate is involved or if irritation persists for the others.

**Mouth**

Wash out mouth with water. Don’t induce vomiting. Obtain medical attentionif feeling unwell or if large amounts have been swallowed..

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large or if irritation persists.

# esters (aliphatic)

Description: Colourless liquids of varying solubility in water, but soluble in most organic solvents.

## Hazards

Aliphatic esters tend to be flammable, highly flammable in some cases. Their health hazards other than this are generally (though not always) of fairly low hazard. They may cause slight irritation to eyes and skin, even if not classified as such, and in large concentrations can cause nausea, dizziness, headache and narcosis. Prolonged or repeated exposure can sometimes cause dermatitis.

## Hazard Statements

*For butyl ethanoate, ethenyl ethanoate (vinyl acetate), ethyl ethanoate, methyl 2-methylpropenoate (methyl methacrylate), pentyl ethanoate and propyl ethanoate, see their individual entries.*

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 3-(methylbutyl) ethanoate | Warning | Flammable liquid Cat 3 | H226: Flammable liquid and vapour<br>EUH066: Repeated exposure may cause skin dryness or cracking |  |
| methyl methanoate | Warning | Flammable liquid Cat 2<br>Acute toxin (oral) Cat 4<br>Acute toxin (inhalation) Cat 4<br>Skin irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H302: Harmful if swallowed<br>H302: Harmful if inhaled<br>H315: causes skin irritation<br>H3335: May cause respiratory irritation |   |
| ethyl carbamate | Danger | Carcinogen Cat 1B | H350 may cause cancer |  |

## Incompatibility

Varies a little but in general they are incompatible with – strong oxidising or reducing agents, strong acids, and alkalis.

## Handling

Wear nitrile or pvc gloves and eye protection. Avoid heat, flames and sparks when handling.

**FF** – WS, DP & VL.

## Storage

If not highly flammable, with organics in general store. Methyl methanoate should be in the flammable liquids cabinet

## Disposal

Methyl methanoate, up to 20 cm$^3$ can be mixed with 2 l of water and run to waste. Large quantities of this or water insoluble esters (or the carcinogenic) ethyl carbamate should be stored for collection by a specialist contractors.

## Spillage

Wear eye protection and nitrile gloves. For flammables, turn off all sources of ignition and open windows. Cover with mineral absorbent, lift and wash the absorbent well with water. Run washings to waste and place absorbent in refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth with water. Don’t induce vomiting. Seek medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Obtain medical attention if irritation persists or area affected is large.

# esters (aromatic)

Description: Colourless liquids or white solids that are generally only slightly soluble or insoluble in water, but soluble in most organic solvents.

## Hazards

These esters are generally of fairly low hazard. They may cause slight irritation to eyes and skin, even if not classified as such, and in large concentrations can cause nausea, dizziness, headache and narcosis. Prolonged or repeated exposure can sometimes cause dermatitis. Dibutyl benzene-1,2-dicarboxylate (dibutyl phthalate) however, is a reproductive toxin and experimental teratogen. There is also some suggestion, unsupported by good evidence, that parabens (4-hydroxybenzenecarboxylate esters) may be linked to infertility and breast cancer due to their oestrogenic activities (especially the longer chain ones).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethyl benzoate, ethyl 3-phenylpropenoate, methyl 3-nitrobenzenecarboxylate | | No significant hazard | | None |
| methyl benzolate, n-phenyl ethanamide, phenyl benzenecarboxylate | Warning | Acute toxin (oral) Cat 4<br>Skin irritant Cat 2 | H302: Harmful if swallowed<br>H319: causes serious eye irritation |  |
| methyl 4-hydroxybenzoate, phenyl-2-hydroxybenzoate | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H315: causes skin irritation<br>H319: causes serious eye irritation<br>H3335: May cause respiratory irritation |  |
| methyl 2-hydroxybenzoate | Warning | Acute toxin (oral) Cat 4<br>Skin irritant Cat 2<br>Eye irritant Cat 2 | H302: Harmful if swallowed<br>H315: causes skin irritation<br>H319: causes serious eye irritation |  |
| dibutyl benzene-1,2-dicarboxylate | Warning | Reproductive toxin (Cat 1B)<br>Hazardous to the aquatic environment (cat 1) | H360: May damage fertility or the unborn child<br>H400: Very toxic to aquatic life |   |
| cholesteryl esters | | No significant hazard | | None |

## Incompatibility

Varies a little but in general they are incompatible with – strong oxidising or reducing agents, strong acids, and alkalis.  dibutyl benzene-1,2-dicarboxylate can explode in contact with chlorine.Acid chlorides, Acid anhydrides

## Handling

Wear nitrile or pvc gloves and eye protection.

**FF** – WS, DP & VL.

## Storage

With organics in general store.

## Disposal

Due to the insolubility of these compounds, and the inability to easily convert them to compounds that can be simply disposed of, the only real option is to store for collection by a specialist contractors.

## Spillage

The solids can just be swept up. The others should be absorbed onto mineral absorbent and then they in turn can be swept up. The solid, other than that containing dibutyl benzene-1,2-dicarboxylate, (which should be kept for disposal by licensed contractors) can be placed in the domestic waste bin.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth with water. Don’t induce vomiting. Seek medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Obtain medical attention if irritation persists or area affected is large.

## ethanal (and its oligomers)

Alternative names: acetaldehyde, paraldehyde (ethanel trimer) and metaldehyde (ethanal tetramer)

Descriptions: Ethanal -Very volatile, colourless, ethereal liquid with pungent smell. Product when ethanol is oxidised. Intermediate in the production of ethanoic acid and used in the synthesis of many organic compounds. Miscible with water or alcohol.

Ethanal trimer – Colourless liquid with aromatic odour formed by the action of concentrated sulphuric acid on ethanal. Used in the manufacture of many other organic compounds. moderately soluble in water.

Ethanal tetramer – Colourless crystalline powder prepared by polymerisation of ethanal at low temperatures with hydrochloric and sulphuric acids. It is used as a portable fuel in compressed form as meta-fuel and as slug/snail poison.

### Hazards

Ethanal and the trimer are extremely flammable – highly volatile. Keep away from any possible sources of ignition. They forms explosive mixtures with air (ethanal: explosive range 4 – 6%, ethanal trimer: lel 1.3%). Do not pour into drains. The tetramer is merely flammable. Precautionary measures should be taken to avoid the build-up of static charges.

Ethanal is a Category 2 carcinogen – limited evidence of carcinogenic effects – experimental mutagen and teratogen. Vapour is severely irritant to eyes, skin and respiratory system. Narcotic action in high concentrations. Liquid, if swallowed, causes severe irritation of stomach. Continued exposure to low concentration of vapour is dangerous. For the trimer, Analgesic and hypnotic effects vary according to dose with larger amounts depressing the nervous and respiratory systems leading ultimately to coma and death. May have addictive properties. The tetramer is very harmful by inhalation. Swallowing causes high temperature, vomiting, diarrhoea, drowsiness, convulsions and coma – also can result in kidney and liver damage.

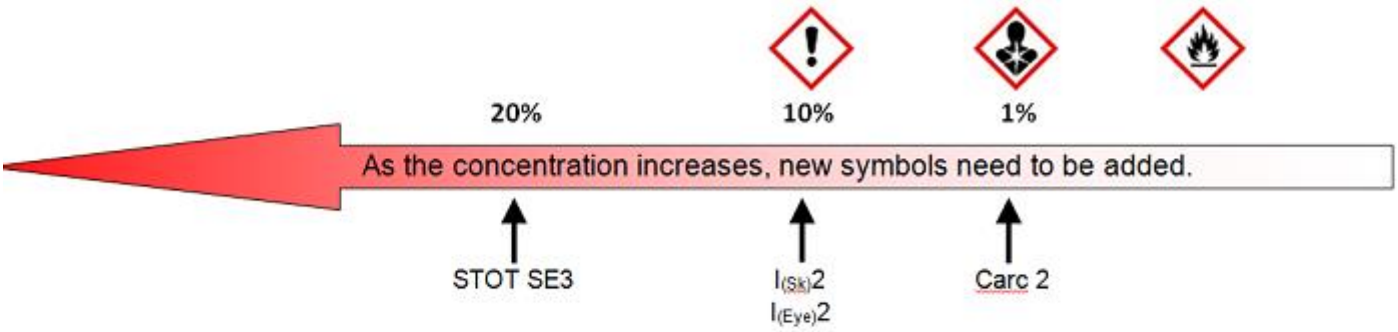
### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethanal | Danger | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Carcinogen Cat 2 | H224: Extremely flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation.<br>H351: Suspected of causing cancer |  |
| ethanal trimer | Warning | Flammable liquid Cat 3 | H226:  Flammable liquid and vapour. |  |
| ethanal tetramer | Danger | Flammable solid Cat 2<br>Acute toxin Cat 4 (oral) | H228 Flammable solid<br>H302 Harmful if swallowed. |  |

### Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.* (**NB** *No data available as to the point at which it ceases to become flammable)*

**Ethanal**



## Incompatibility

Ethanal and tetramer – Strong oxidising agents, alkalis, acid anhydrides, amines, ammonia, alcohols, alkanones, halogens, phenols, phosphorus, hydrogen cyanide, hydrogen sulphide, conc. sulphuric acid and isocyanates. Explosive products formed in the reactions with mercury(II) perchlorate, cobalt chloride, mercury(II) chlorate. Polymerises violently when metals, alkalis or acids are present. Detonation may result in the reaction with oxygen. Emits acrid smoke and fumes when heated to decomposition.

Trimer – Produces toxic fumes when heated. Reacts with strong oxidising agents. Incompatible with alkalis, nitric acid, hydrocyanic acid and iodides.

## Handling

In fume cupboard, or a well-ventilated lab for small amounts) wear nitrile, neoprene or pvc gloves and eye protection. Keep well away from any sources of ignition. Ethanal is very volatile, cool bottle before opening.

**FF** – WS, DP, VL.

## Storage

Store ethanal – Flammables store.

**SSL** – (ethanal) 2 years maximum. Can form explosive peroxides in storage. Also deteriorates and become less effective once bottle is opened.

Trimer and tetramer – Keep containers closed securely in store in a well ventilated place.

## Disposal

Wear eye protection and nitrile, plastic or rubber gloves and ensure absence of ignition sources.

Ethanal – In a fume cupboard absorb on to paper towelling and allow to evaporate. Up to 10 cm3 at a time can be dissolved in 100 volumes of water and run to waste.

Trimer and tetramer – Very small amounts such as washings of glassware can be run to waste. Larger amounts should be stored to await uplift by disposal contractor.

## Spillage

Evacuate and ventilate the room. Turn off all sources of ignition. Wear eye protection (face shield for ethanal) and nitrile, plastic or rubber gloves.

For ethanal – If spillage is in the fume cupboard then allow to evaporate if the amount is small. and cover larger volumes (>10 cm3) with mineral absorbent and shovel into a large volume of water in a large beaker or bucket. If this occurs in the laboratory, rapidly cover with absorbent, open windows and ensure absence of sources of ignition.

Trimer and tetramer – Soak up on sand or mineral absorbent and transfer to fume cupboard. treat as in *Disposal*.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention. (if irritation persists for ethanal).

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention. (for ethanal and tetramer if breathing is affected or if feeling unwell).

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists. (as soon as possible for tetramer).

# ethanamide

Alternative name: acetamide

Description: White deliquescent crystalline powder with ‘mousy’ smell. Soluble in water. Decomposes in hot water.

## Hazards

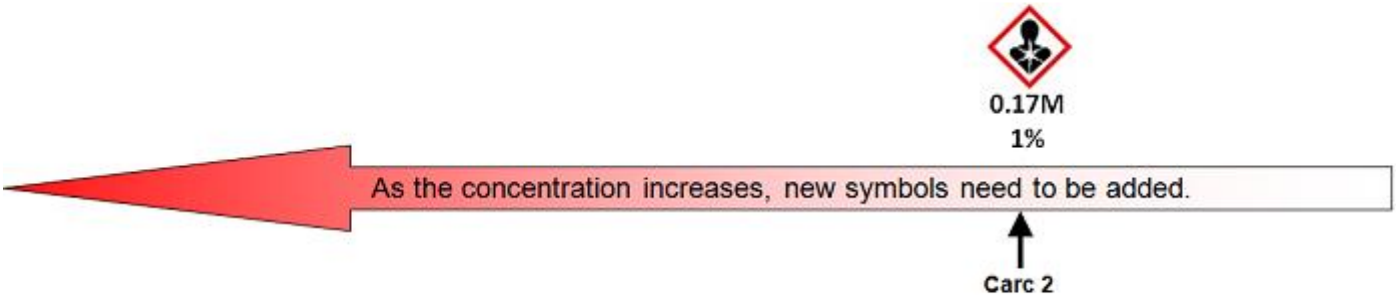
Harmful if ingested in quantity. Category 2 carcinogen. Some evidence of mutagenic and reproductive effects. Can be irritating to eyes and skin. Toxic fumes (NOx) given off when heated to decomposition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethanamide | Warning | Carcinogen Cat 2 | H351: Suspected of causing cancer |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents.

## Handling

Wear eye protection and pvc gloves.

## Storage

In general store.

## Disposal

Wear eye protection and pvc gloves. Small amounts, such as washings from test tubes, can be dissolved in water and washed to waste.

## Spillage

Wear eye protection and pvc gloves. Carefully sweep up into a large plastic bucket and treat as in **Disposal**. Wash the contaminated area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice if irritation persists.

# Ethanedioic acid and ethanedioates

Alternative names: oxalic acid & salts of oxalic acid

## Hazards

The acid and its salts are harmful and severely irritating by swallowing or in contact with the skin or eyes. Solutions can have serious systemic effects if ingested – the acid removes calcium from the blood, forming insoluble calcium oxalate – this can block the kidneys leading to their failure. Dust irritates the respiratory system.

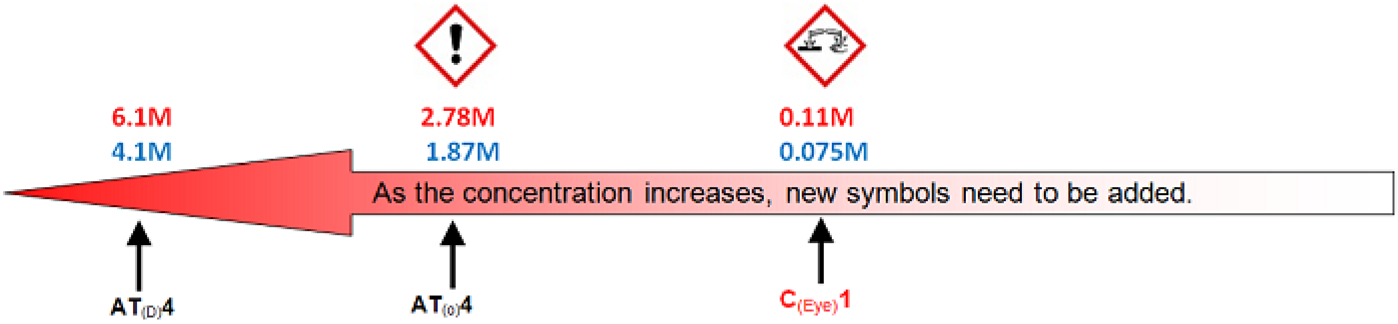
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethanedioic acid-2-water<br>ethanedioates (including trioxalatoferrate) | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal) | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

Ehanedioic acid in **Red**, sodium ethanedioate in **blue**.



## Incompatibility

Oxidising agents. Mercury salts and silver salts decompose vigorously on heating. Violent reaction of the acid with furfuryl alcohol. Mixtures of the acid with sodium chlorate(III) can explode on the addition of water.

## Handling

Wear eye protection and rubber or plastic gloves. Avoid contact with hands, wash at once if contaminated with solid or solution.

## Storage

Securely in store.

## Disposal

Wear rubber or plastic gloves and eye protection. Small amounts of the acid in dilute aqueous solutions (<5%) can be neutralised with 1M sodium carbonate solution and washed to waste. Small amounts of salts can be diluted to less than 3% (3g in 100cm3 of water) and washed to waste with plenty of running water. Retain larger quantities for disposal by waste disposal contractor.

## Spillage

Wear rubber or plastic gloves and face shield, add calcium chloride solution, mop up with plenty of water and wash to waste with lots of running water.

## Remedial Measures

If swallowed, a large area of skin is involved, breathing is affected or if the eyes are irritated take casualty to hospital as soon as possible.

**Eyes**

Irrigate with water for at least 10 minutes. Obtain medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

# Ethanoic acid

Alternative names: acetic acid.

Description: Miscible with water, alcohol or ethers. Clear, colourless liquid with pungent, acrid odour. Synthesised from ethyne; also by the destructive distillation of wood or the oxidation of ethanol.

## Hazards

The concentrated acid (glacial) (17M, S.G.1.05) is corrosive and vapour is severely irritating to the skin and eyes causing severe burns and ulcers. Poisonous if swallowed. Lachrymatory. Experimental reproductive effects and mutagenic data.

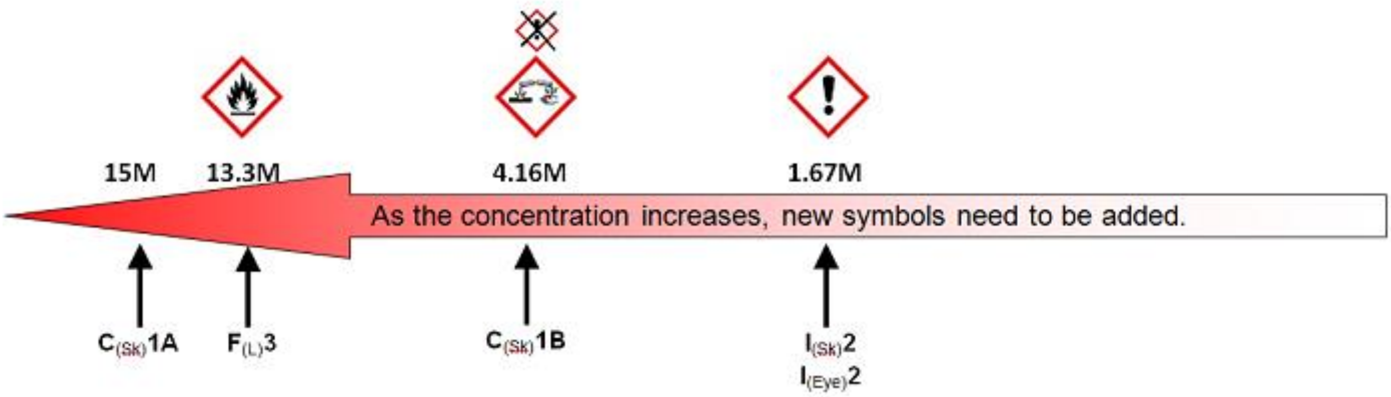
Flammable – presents a moderate fire/explosion hazard when exposed to heat or flame (explosive range 5.4 – 16%). Emits toxic fumes when heated to decomposition. Dilute ethanoic acid (1.5 to 4M) is irritating to the skin and eyes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethanoic acid | Danger | Flammable liquid Cat 3<br>Skin corrosive Cat 1A | H226: Flammable liquid and vapour.<br>H314: Causes severe skin burns and eye damage. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



(Vinegar is approximately 0.65M and so has no classification.)

## Incompatibility

Strong oxidising agents, polyhydric alcohols, chromic(VI) oxide, ethane-1,2-diol (ethylene glycol), hydroxyl-containing compounds, nitric acid, chloric(VII) acid (perchloric acid), manganates(VII) (permanganates), peroxides.

## Handling

Wear nitrile or pvc gloves and eye protection, goggles (BS EN 166 3) for > 4M. Handle in a fume cupboard.

**FF** – WS, DP & VL.

## Storage

With acids in general store.

## Disposal

Wear goggles (BS EN 166 3) and pvc gloves. In fume cupboard slowly add, with stirring, up to 100 cm3 of ethanoic acid to 5 litres of water. Neutralise by adding 2M sodium carbonate (IRRITANT), adding 2M hydrochloric acid (IRRITANT) if neutralisation overshot, and run to waste with lots of water.

## Spillage

If large evacuate room; turn off all sources of ignition; wear protective clothing, face shield and nitrile gloves. Neutralise with solid sodium carbonate or sodium hydrogen carbonate and transfer mixture to a plastic bucket. Test for neutrality, adding 2M sodium carbonate (IRRITANT) or 2M hydrochloric acid (IRRITANT) as necessary. Wash to waste with x1000 the volume of running.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or area affected is large.

# Ethanoic anhydride

Alternative names: acetic anhydride

Description: Colourless liquid with strong acetic smell. Used to prepare cellulose acetate and as acetylating agent.

## Hazards

Corrosive – the liquid irritates and burns the eyes and skin severely – lachrymatory. Damage to the skin and eyes can occur before visible blistering or burning pain is felt. The vapour irritates the respiratory system and may cause bronchial and lung injury. Poisonous if swallowed, causing immediate irritation, pain and vomiting. Flammable – moderate fire and explosion hazard (explosive range 3- 10%). When heated to decomposition it emits toxic fumes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethanoic anhydride | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin corrosive 1B | H226: Flammable liquid and vapour.<br>H302: Harmful if swallowed<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage. |  |

## Incompatibility

Acids, oxidising agents and water. Incompatible or potentially explosive with chromic(VI) oxide, chloric(VII) acid (perchloric acid), sodium peroxide, sodium hydroxide, oleum, manganates(VII), glycerol, phenylamine, chlorosulphonic acid, nitrates, nitric acid and many more inorganic and organic compounds. Reacts violently with steam on contact and with water (sometimes delayed).

## Handling

Use a fume cupboard away from sources of ignition. Wear nitrile gloves and eye protection, goggles (BS EN 166 3)> 25%. Ensure water does not get into reagent and keep the stopper off for the minimum time necessary.

**FF** – VL, DP, WS.

## Storage

Flammables store.

**SSL** – 3 years maximum but less if frequently opened. Will absorb moisture from the air. Can have a delayed violent reaction with water.

## Disposal

Wear nitrile gloves and goggles (BS EN 166 3). In fume cupboard add up to 50 cm3 slowly in 2 cm3portions with stirring to 4 litres of water with 10 minutes wait between additions. Allow to stand for 12 hours then add sodium carbonate until approximately neutral. Wash to waste.

## Spillage

Open windows and doors. Add dry soda ash or sodium hydrogencarbonate and mix thoroughly, adding water where necessary. Scoop into plastic bucket and leave for 10 hours in a fume cupboard neutralise with 2M sodium carbonate or hydrochloric acid. (CORROSIVE) Wash to waste with x1000 the volume of running water. Wash the site of any spillage well with water and detergent.

## Remedial Measures

If swallowed, a large area of skin is involved, breathing is affected or if eyes are involved take casualty to hospital as soon as possible.

**Eyes**

Irrigate with water for at least 10 minutes.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting.

**Lungs**

Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and copious amounts of water. Remove and wash contaminated clothing.

## Ethanol (and methylated spirits)

Alternative names: ethyl alcohol

Methylated spirits (blue) – Mineralised & denatured alcohol (mainly ethanol) which contains methanol (TOXIC). Miscible with water.

Industrial methylated spirits (IMS) – Denatured alcohol (ethanol) which can contain methylbenzene, alkanones or pyridines making it unfit for human consumption.

### Hazards

Highly flammable, vapour/ air mixtures can explode (explosive range 3.3 – 19%). Absolute alcohol is mildly toxic by inhalation and severely irritant by skin contact. Moderately toxic by swallowing leading to the broadly known symptoms which can result from imbibing too much proprietary alcohol! – hallucinations, poor sleeping patterns & motor activity, depression of the nervous system, nausea, vomiting etc. High concentrations can lead to alcohol poisoning and repeated exposure to alcoholism. Experimental carcinogen by swallowing and teratogen.

Methylated spirits / IDA is Toxic by inhalation, swallowing and skin contact. The liquid and vapour are dangerous to the eyes because of the methanol content. It has a specific destructive effect on the optic nerve and retina and can lead to blindness. The denaturing substances present in industrial spirit (see ethanol) and in the blue mineralised methylated spirits increase the toxicity over that of ethanol (see also the hazard sheets for methanol and pyridine).

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethanol | Danger | Flammable liquid Cat 2 | H225: Highly flammable liquid and vapour. |  |
| methylated/industrial spirits | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Specific target organ toxin on single exposure Cat 2 | H225 Highly flammable liquid and vapour.<br>H302 Harmful if swallowed.<br>H371 May cause damage to organs. |  |

### Incompatibility

Reacts vigorously with strong oxidising agents, concentrated acids such as sulphuric and nitric, phosphorus(V) chloride, and with alkali and alkali earth metals. Ignites and then explodes with ethanoic anhydride + sodium hydrogensulphate or ammonia + silver nitrate.

### Handling

Well away from any sources of ignition. Wear eye protection and rubber or plastic gloves.

**FF** – DP, VL, WS.

### Storage

Flammables store.

### Disposal

Turn off all sources of ignition. Add up to 200 cm3 at a time to 5 litres of water and run this down the drain with copious amounts of water.

### Spillage

Turn off all sources of ignition and open windows to ventilate the area thoroughly. For small amounts absorb on to paper towel and place in the fume cupboard or a safe open area till evaporated. Larger amounts can be absorbed on sand or vermiculite and treated as in *Disposal*. Wash the area of the spillage.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if intoxication is apparent or as soon as possible if methylated spirits has been ingested.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Turn off sources of ignition. Soak in water to reduce fire risk. Wash well with soap and water. Remove and wash contaminated clothing. For methylated spirits, Obtain medical attention as soon as possible.

# Ethanoyl chloride

Alternative names: acetyl chloride

Description: Colourless, fuming liquid with pungent smell.

## Hazards

Highly flammable – dangerous fire and explosion hazard (lel 5%) – keep away from sources of ignition. The liquid is corrosive – irritates and burns the eyes and skin severely – lachrymatory. The vapour irritates the respiratory system and causes systemic injury. Poisonous if swallowed or the vapours inhaled. Violent reaction with water. When heated to decomposition it emits highly toxic fumes (phosgene).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethanoyl chloride | Danger | Flammable liquid Cat 2<br>Skin corrosive 1B | H225: Highly flammable liquid and vapour.<br>H314: Causes severe skin burns and eye damage. |  |

## Incompatibility

Violent reaction with oxidising agents, acids, bases, water and lower alcohols. Can decompose during preparation. Explosive reaction with di-methyl sulphoxide or ethanol. Also incompatible with phosphorus(III) chloride.

## Handling

Wear nitrile gloves and goggles (BS EN 166 3). Use only in fume cupboard.

**FF** – CO2, DP. When opened, moisture from the air can enter and react to form hydrogen chloride. Keep the stopper off the bottle for the minimum time needed.

## Storage

Flammables store. Keep container in well ventilated place.

**SL** – 2 years. Deteriorates and thereby become less effective. Can give confusing results. No increased hazard.

## Disposal

Wear faceshield and nitrile gloves. Pour slowly, with stirring, up to 50 cm3 into 4 litres of water. Allow 3 hours for the reaction to go to completion, neutralise and wash to waste with water.

## Spillage

Small spillages can be absorbed on to paper towels or mixed with sand and removed to a safe open area or a fume cupboard for evaporation. If a larger amount has been spilled then turn off all sources of ignition and evacuate/ventilate the area. Wear nitrile gloves, goggles (BS EN 166 3). Add dry sodium carbonate or hydrogencarbonate and mix thoroughly, adding water where necessary. Scoop into plastic bucket and neutralise with 4M ammonium hydroxide or hydrochloric acid (CORROSIVE). Wash to waste with x1000 the volume of running water. Wash site of any spillage well with water and detergent.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible if breathing is affected.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or area affected is large.

## Ethenyl ethanoate

Alternative names: vinyl acetate

Description: Colourless liquid with pleasant smell. Slightly soluble in water (1 g/50 ml). Often stabilised with benzene-1,4-diol. When polymerised is used in sheeting, hoses, adhesives, paints, belts etc

### Hazards

Highly flammable – serious fire hazard and explosion risk (range 2.6 – 13.4%) when exposed to heat or flame. Vapour is heavier than air. Take measures to prevent build up of static charges. Vapour is harmful by inhalation and the vapour or liquid irritates the eyes and skin. Skin may be sensitised. Harmful if swallowed.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Ethenyl ethanoate | Danger | Flammable liquid Cat 2 | H225: Highly flammable liquid and vapour. |  |

### Incompatibility

Reacts with strong oxidising agents eg hydrogen peroxide.. Vigorous reaction with water or air to form peroxides which can catalyse an explosive polymerisation reaction (exothermic). Polymerisation with di(benzenecarbonyl) peroxide + ethyl ethanoate may release highly flammable and explosive gases which can react with drying agents such as alumina or silica gel. Incompatible with nitric acid, ethane-1,2-diamine, oleum, sulphuric acid, hydrogen chloride, hydrogen fluoride, 2-amino ethanol and chlorosulphonic acid. When heated to decomposition it emits acrid fumes.

### Handling

Wear nitrile gloves and eye protection. Handle in a fume cupboard away from flames or any other sources of ignition. Keep cool.

**FF** – F, DP, CO2, VL.

### Storage

Flammables store yet not in the flammables cupboard because an accidental, vigorous, spontaneous polymerisation can occur whilst stored resulting in a release of much heat. Keep cool.

**SSL** – 1 year maximum if stored in a cool place. Can readily polymerize due to warming or under the influence of light with fire or explosion hazard.

### Disposal

Unavoidable discharges e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. For larger quantities spread on metal tray and stir in organic peroxide catalyst. When completely polymerised dispose of in normal refuse.

### Spillage

Wear nitrile gloves and a face shield. Open doors and windows and turn off all sources of ignition. Absorb on to mineral absorbent and transfer to a safe open area for evaporation. Wash any spillage area thoroughly with detergent and water.

### Remedial Measures

**Eyes**

Irrigate with water for at least 10 minutes. Obtain medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed, obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Ethoxyethane

Alternative names: diethyl ether

Description: Clear, very volatile liquid with sweet pungent, smell. Slightly soluble in water. Miscible with lower alcohols & chlorinated hydrocarbons. Usually sold stabilised with a few ppm of BHT. Formerly used as an anaesthetic but is thought unsafe nowadays. Used as solvent for oils, fats, waxes, perfumes, gums, alkaloids etc. and as important reagent in organic syntheses (Grignard and Wurtz type) reactions.

## Hazards

Extremely flammable and therefore poses a serious fire and explosion risk (range 1.9 – 36%). Flash point and autoignition temperature are very low with result that even black heat can ignite an air/ether mixture. Take precautionary measures against static discharges. Danger of explosion when liquid is evaporated to dryness due to the presence of unstable peroxides. Use only peroxide-free ethoxyethane for experiments involving evaporation. Narcotic and anaesthetic effects by inhalation can lead to intoxication, drowsiness and unconsciousness. Repeated exposure or high concentrations of the vapour can lead to heart failure. Mildly harmful by ingestion. A mild skin and eye irritant. Absorption through skin is minimal because of high evaporation rate.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethoxyethane | Danger | Flammable liquid Cat 1<br>Acute toxin Cat 4 (oral)<br>Specific target organ toxin on single exposure cat 3 | H224: Extremely flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H336: May cause drowsiness or dizziness. |  |

## Incompatibility

Strong oxidising agents, e.g. nitric acid, hydrogen peroxide, sodium peroxide, ozone and liquid air. Also incompatible with **sulphur** and its compounds, halogens and interhalogens.

## Handling

All sources of ignition should be turned off. Wear nitrile gloves and eye protection. The vapour (more dense than air) can travel along a bench and be ignited by a flame or hot surface.

**FF** – DP, CO2, VL.

## Storage

Flammables store. Store in an amber-coloured bottle in a well ventilated place away from direct light. It can auto-oxidise to form explosive peroxides.

**SSL** – 2 years maximum if stored in cool, dark place. Can form explosive peroxides in storage (rate of formation increased by exposure to light and air).

## Disposal

Ensure there are no sources of ignition. Wear face shield and nitrile gloves.
**If no sodium present** – Spread out 100 cm3 portions and allow to evaporate in a safe, open place.

**Very old samples may contain** sodium wire to dry the ethoxyethane – great care must be taken as it would ignite if added to water. Decant off as much of the ethoxyethane as possible and allow to evaporate. Add dry propan-2-ol to the residue until no further effervescence of hydrogen takes place, leave for a day and shake occasionally, a loose cotton wool plug being used as stopper. The mixture can be added to a large volume of water to decompose the sodium propoxide formed. This is then neutralised with dilute hydrochloric acid before washing to waste.

## Spillage

Turn off all possible sources of ignition. Wear face shield and nitrile gloves. If sodium not present, apply water and detergent, transfer to a bucket and spread in open place for evaporation. If sodium is present, a dry brush should be used and the liquid transferred to a bucket which has a lid. The liquid should then be treated as described in *Disposal*. Ensure no sodium is left on the brush.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed, obtain medical attention.

### Lungs

Move patient from area of exposure. Obtain medical attention if breathing is affected. Rest and keep warm.

### Skin

Turn off all sources of ignition. Remove and wash contaminated clothing. Wash well with soap and water.

# Ethyl ethanoate

Alternative names: ethyl acetate

Description: An ester which is a colourless liquid with sweet-smelling odour. Fairly soluble in water (1 cm$^3$ in 10 cm$^3$ of water). Miscible with alcohols, propanone and ethers. Used as a solvent in cleaning fluids, artificial fruit flavours and perfumes, varnish, lacquer etc.

## Hazards

Highly flammable liquid and vapour presents a dangerous fire and explosion risk (range 2.2 – 11.5%)- keep away from all sources of ignition and take precautionary measures against static discharges. The vapour gives narcotic effects by inhalation and is irritant to the respiratory tract, mucous membranes, eyes and gums. Repeated or prolonged exposure can cause corneal cloudiness, anaemia and dermatitis. Possible sensitiser of mucous membranes and skin. Liquid is mildly toxic if swallowed producing symptoms of drunkenness and congestion of the liver and kidneys. Harmful if taken in quantity. Possible mutagen.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethyl ethanoate | Danger | Flammable liquid cat 2<br>Eye irritant cat 2<br>Specific target organ toxin single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H336: May cause drowsiness or dizziness.<br>EUH066: Repeated exposure may cause skin dryness or cracking |  |

## Incompatibility

Strong oxidising agents. Ignites on contact with potassium tert-butoxide and reacts violently with chlorosulphonic acid, oleum and lithium aluminium hydride + 2-chloromethyl furan. Heated to decomposition acrid smoke & irritating fumes are evolved.

## Handling

Wear nitrile gloves and eye protection. Use in a well-ventilated area.
**FF** – CO2, F, DP, WS.

## Storage

Flammables store.

## Disposal

Wear eye protection and nitrile gloves and extinguish sources of ignition. Small quantities (up to 20 cm3) can be dissolved in a large volume of water (at least 2 litres) further diluted and run to waste.

## Spillage

Wear eye protection and nitrile gloves. Turn off all sources of ignition and open windows. Cover with mineral absorbent, lift and wash the absorbent well with water. Run washings to waste and place absorbent in refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

**Skin**

Turn off sources of ignition and soak with water to reduce flammability. Wash well with soap and copious amounts of water. Remove and wash contaminated clothing. Obtain medical advice if irritation persists or a large area is affected.

# Ethylamine

Alternative names: ethanamine, aminoethane

Description: Colourless gas or liquid with ammonia-like smell. Used in making resins, latex rubber, dyes, medicines, refining oil and syntheses of organic compounds. Often supplied as aqueous solution (70%) or in ims.

## Hazards

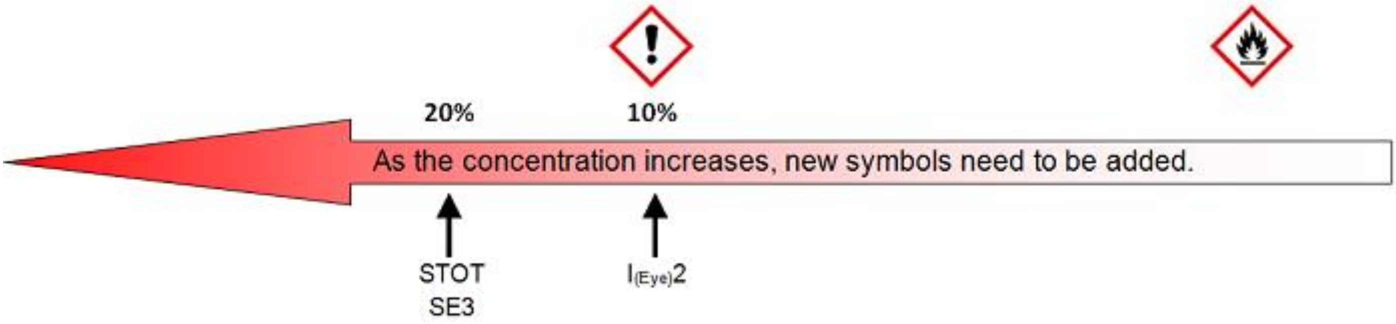
The gas is Extremely flammable and the 70% solution highly flammable. Serious risk of fire or explosion (range 3.5-14%) if exposed to heat or flame. Harmful if inhaled, swallowed or by skin contact. Poisonous. Severely irritating to the eyes, mucous membranes and respiratory system. The recent harmonised classification downgrades the solution from Corrosive 1A to Irritant 2 but it should still be handled with caution. When heated to decomposition it emits toxic fumes. Possible skin sensitiser.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ethylamine, anhydrous | Danger | Flammable gas Cat 1<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H220: Extremely flammable gas.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |
| ethylamine solution (70% in water) | Danger | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the* **RIGHT** *of it are the ones that apply. (***NB** *No data available as to the point at which it ceases to become flammable)*



## Incompatibility

Oxidising agents, e.g. chlorates(I) (hypochlorites). Anhydrous ethylamine is incompatible with cellulose nitrate as it can spontaneously ignite.

## Handling

Avoid breathing vapour and use in well-ventilated area or fume cupboard and well away from flames, other ignition sources and hot surfaces. Wear nitrile gloves and goggles (BS EN 166 3) (the eyes can be seriously damaged by this chemical).

**FF** – WS, DP. Take care when opening, especially in hot weather, as the pressure build up of the gas will be considerable.

## Storage

Flammables store. Keep container tightly closed in a cool position. As the gas slowly escapes, the effectiveness of the solution as a chemical reagent will gradually decrease. Dispose of and replace when expected reactions are not obtained.

## Disposal

Wear goggles (BS EN 166 3) and nitrile gloves and work in a fume cupboard. Ensure ignition sources are absent. Dissolve in large quantity of water (50 cm3 to 100 cm3). Neutralise with 1M or 2M hydrochloric acid (IRRITANT), greatly dilute and wash to waste.

## Spillage

Wear nitrile gloves and face shield. Turn off all sources of ignition. Open windows and evacuate the room if spillage is other than small. Cover with mineral absorbent and either :-

**transfer to fume cupboard** (or outside) for evaporation **or**

**wash the absorbent well with dilute hydrochloric acid and then water.** The well washed absorbent can be placed with ordinary refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

### Skin

Turn off all sources of ignition. Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Fluorides

ammonium fluoride – white granular powder

potassium fluoride – colourless crystals. Anhydrous salt is deliquescent.

sodium fluoride – colourless, lustrous crystals or crystalline powder.

## Hazards

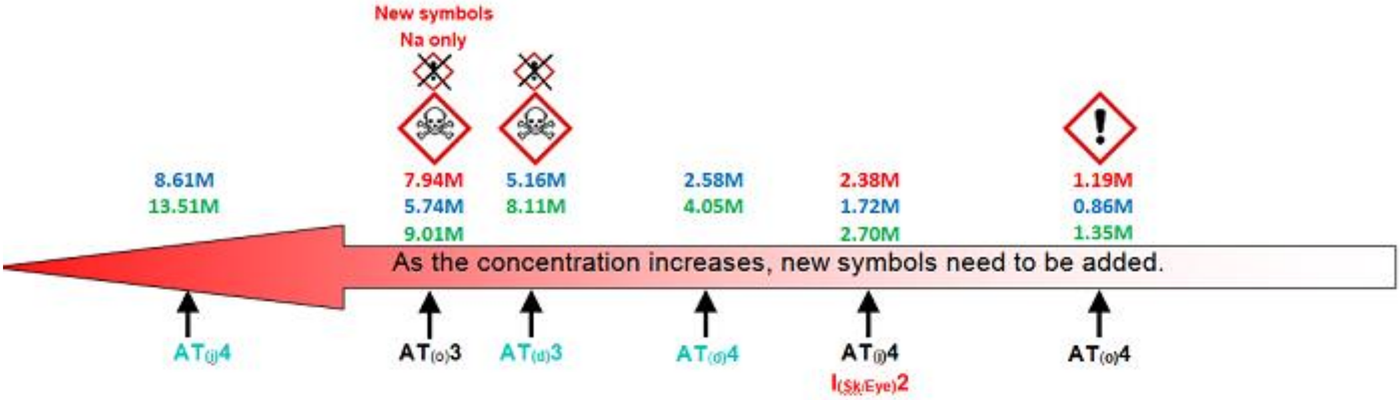
Inorganic fluorides are generally toxic by inhalation, in contact with the skin at high concentrations and if swallowed. They are corrosive irritants to eyes, skin and respiratory system. Chronic poisoning results in nausea, vomiting, asthmatic attacks, bone disorders, anaemia, anorexia and dental defects.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium fluoride | Danger | Acute toxin Cat 3 (oral)<br>Skin / Eye irritant Cat 2 | H301: Toxic if swallowed.<br>H315: Causes skin irritation<br>H319: Causes serious eye irritation. |  |
| potassium fluoride, ammonium fluoride | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation) | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. **red = sodium**, **blue = potassium** and **green = ammonium**. (Below the arrow: black applies to all three, red to sodium only and cyan to potassium and ammonium)



## Incompatibility

When heated or in contact with acids or acid vapour, highly toxic fumes are produced.

## Handling

Wear rubber or plastic gloves and eye protection when working with the solids or solutions. Avoid producing dust by careful use of the spatula.

## Storage

Keep locked up securely in store.

## Disposal

**Solid –** Store securely and use licensed contractor.

**Solutions –** Add calcium hydroxide or calcium nitrate solution. Allow the precipitate of calcium fluoride to settle – discard the supernatant. Mix precipitate with sand and store to await uplift by disposal contractor.

## Spillage

Add solution or solid to bucket of water. Add excess of dry soda ash carefully. Add some calcium hydroxide. Leave to stand for a day. Using indicator neutralise with 2M hydrochloric acid (IRRITANT) and wash to waste with lots of running water. Small quantities can be washed to waste with water.

## Remedial Measures

If swallowed, a large area of skin is involved with a highly concentrated solution, breathing is affected or if the eyes are irritated, take the casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

### Lungs

Remove patient from area of exposure to the fresh air. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

# Heptane

Description: Colourless liquid with characteristic smell.

## Hazards

Highly flammable; forms explosive mixture (range 1.05 – 6.7%) with air – keep away from flames and all sources of ignition. Vapour is an aspiration toxin, quite irritant and harmful by inhalation. It has a narcotic effect in high concentrations, causing drowsiness. Chronic exposure at low levels seems not to be as problematic as for hexane but should still be minimised. Skin contact can lead to dermatitis.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| heptane, n- | Danger | Flammable liquid Cat 2<br>Aspiration toxin Cat 1<br>Skin irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Hazardous to the aquatic environment with long-lasting effects Cat1 | H225: Highly flammable liquid and vapour.<br>H304: May be fatal if swallowed and enters airways.<br>H315: Causes skin irritation.<br>H336: May cause drowsiness or dizziness.<br>H411: Toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Vigorous reactions occur with strong oxidising agents e.g. dinitrogen tetroxide.

## Handling

In well-ventilated area, wearing nitrile gloves and eye protection.

**FF –** F, DP, CO2, VL

## Storage

Flammables store. Keep away from oxidising materials. Keep lid tightly closed.

## Disposal

Wear eye protection and nitrile gloves. Turn off all sources of ignition. Do not pour directly down drains as potentially explosive concentrations may develop. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Alternatively, small quantities, up to about 30 $cm^3$, may be absorbed on to paper towels and evaporated in a fume cupboard.

## Spillage

Turn off all sources of ignition and open windows. Wearing gloves and face shield, soak up on mineral absorbent and carry to fume cupboard or secure place outside for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected large or if irritation persists or if feeling unwell.

# Hex-1-ene

Description: Volatile, colourless liquid.

## Hazards

Highly flammable – presents a very dangerous fire and explosion risk (range 1.6 – 6.9%) when exposed to ignition sources or oxidising agents. When heated to decomposition it produces acrid smoke and fumes. Moderately toxic liquid and vapour which are harmful to eyes, skin and respiratory system.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hex-1-ene | Danger | Flammable liquid Cat 2<br>Aspiration toxin Cat 1 | H225: Highly flammable liquid and vapour.<br>H304:May be fatal if swallowed and enters airways.<br>EUH066: Repeated exposure may cause skin dryness or cracking. |  |

## Incompatibility

Oxidising agents.

## Handling

In well-ventilated area or in a fume cupboard if the amount is other than small, using nitrile gloves and eye protection. Keep well away from flames and any other sources of ignition.

**FF** – DP, CO2, VL.

## Storage

Flammables store.

## Disposal

Wear nitrile gloves and eye protection. Ensure absence of ignition sources. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Up to 100 cm3 can be evaporated in a fume cupboard or outside in a safe place.

## Spillage

Wear nitrile gloves and eye protection. Turn off all sources of ignition and ventilate room. Add mineral absorbent to soak up the spillage. Transfer absorbent to outside for evaporation. Clean spillage area with water and detergent. Emulsify, mop up and run to waste with running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical advice/attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed, obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

### Skin

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Hexachloroplatinic acid and hexachloroplatinates

Description: Acid brownish yellow crystals very soluble in water, used for platinising electrodes (for electrochemical measurements) and supports such as pumice or mineral wool for use as catalysts. Ammonium salt orange red, less soluble in water, has similar application. Available as solid hydrate ($H_2PtCL_6.xH_2O$) or an 8% solution. It is expensive but it can be reused repeatedly.

## Hazards

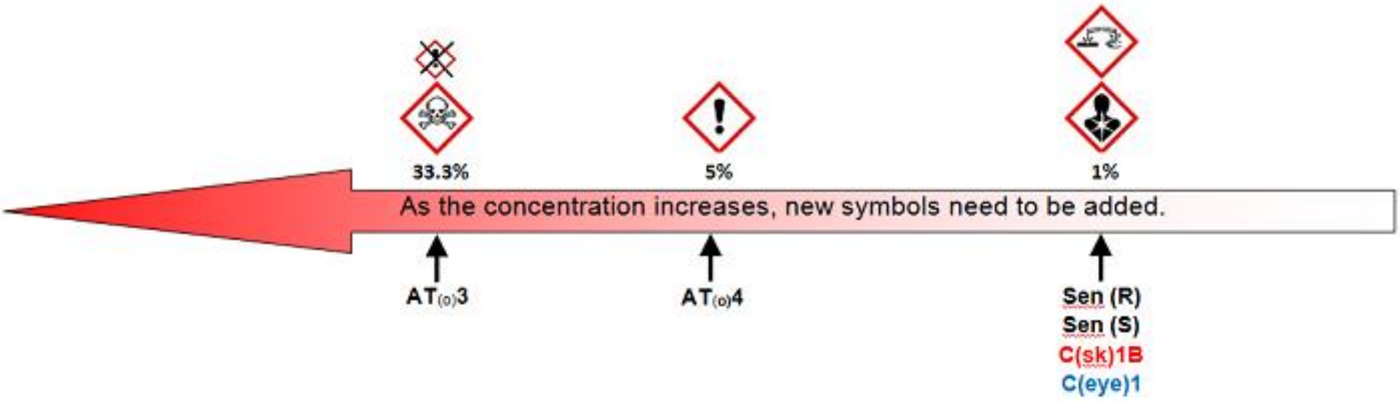
Very toxic by ingestion. Harmful by inhalation or skin absorption. Can burn eyes and is very destructive of mucous membranes. The acid is more corrosive than the salts. Sensitiser – may cause allergic respiratory and skin reactions.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hexachloroplatinic(IV) acid | Danger | Acute toxin Cat 3 (oral)<br>Skin corrosive Cat 1B<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat1 | H301 Toxic if swallowed.<br>H314 Causes severe skin burns and eye damage.<br>H317 May cause an allergic skin reaction.<br>H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. |  |
| ammonium and potassium hexachloroplatinate(IV) | Danger | Acute toxin Cat 3 (oral)<br>Eye damage Cat 1<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat1 | H301 Toxic if swallowed.<br>H318 Causes serious eye damage.<br>H317 May cause an allergic skin reaction.<br>H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. **Red** = **acid**, **Blue** = **salts**. Although the classification of corrosivity is technically different, the labelling is the same).



## Incompatibility

The product from boiling with alkali can, after drying and heating either alone or with combustible materials, explode.

## Handling

Wear eye protection and rubber gloves.

## Storage

In tightly closed containers as crystals are very deliquescent.

## Disposal

Keep replatinising solution for re-use. Otherwise use licensed disposal contractor.

## Spillage

Wear eye protection and heavy rubber gloves.

**Solid –** very carefully sweep up to avoid raising dust. Impure solid can be cleaned by dissolving in water and filtering off the impurities. Wash spillage site and ventilate area.

**Solution –** cover with soda ash and carefully collect. Store for disposal by licensed contractor unless the quantities are small. Wash the spillage area well.

## Remedial Measures

### Eyes

Irrigate with copious amounts of water for at least 15 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Obtain medical attention immediately.

### Lungs

In the unlikely event of exposure by this route Move patient from area of exposure. Rest and keep warm. If experiencing breathing difficulties, obtain medical advice immediately.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Hexane-1,6-diamine

Alternative name: hexamethylene diamine

Description: Colourless leaflet shaped crystals with a smell of piperidine. Absorbs water and carbon dioxide from the air. Very soluble in water.

## Hazards

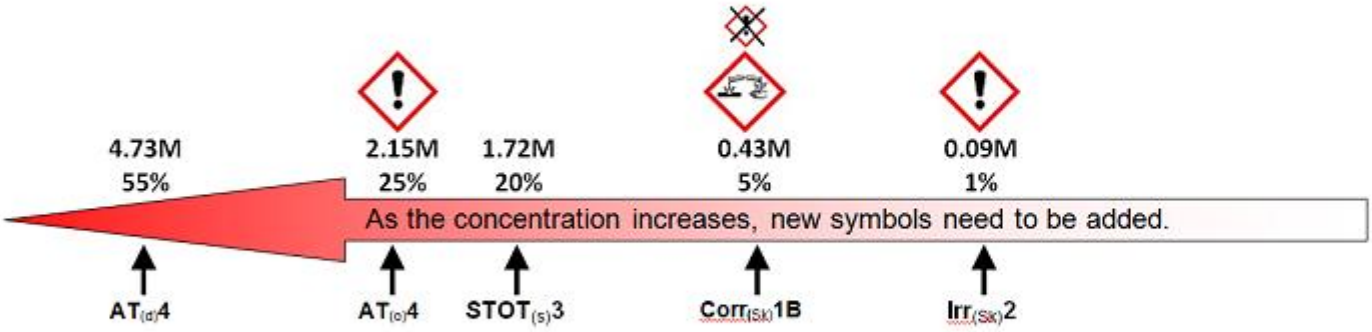
Harmful and corrosive, which will burn eyes, skin and respiratory system. Moderately toxic by ingestion, inhalation and in contact with the skin. An experimental teratogen. Combustible when exposed to heat or flame.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hexane-1,6-diamine | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Skin corrosive Cat 1B<br>Specific target organ toxin on single exposure Cat 3 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents.

## Handling

In well-ventilated area. Use rubber or plastic gloves and goggles (BS EN 166 3).

**FF** – W.

## Storage

Wear goggles (BS EN 166 3) and rubber gloves. General store with alkalis. Keep lid tightly closed.

## Disposal

Ventilate room. Wear goggles (BS EN 166 3) and rubber gloves. Dilute up to 50 cm3 with 50 volumes of water, neutralise with 2M hydrochloric acid (IRRITANT) and wash to waste with running water.

## Spillage

Ventilate room. Wear goggles (BS EN 166 3) and rubber gloves. Mop up into bucket or soak up on adsorbent. Add water to dissolve, neutralise carefully with dilute hydrochloric acid (IRRITANT) and wash solution to waste with running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and plenty water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Hexane

Description: Colourless liquid with characteristic smell.

## Hazards

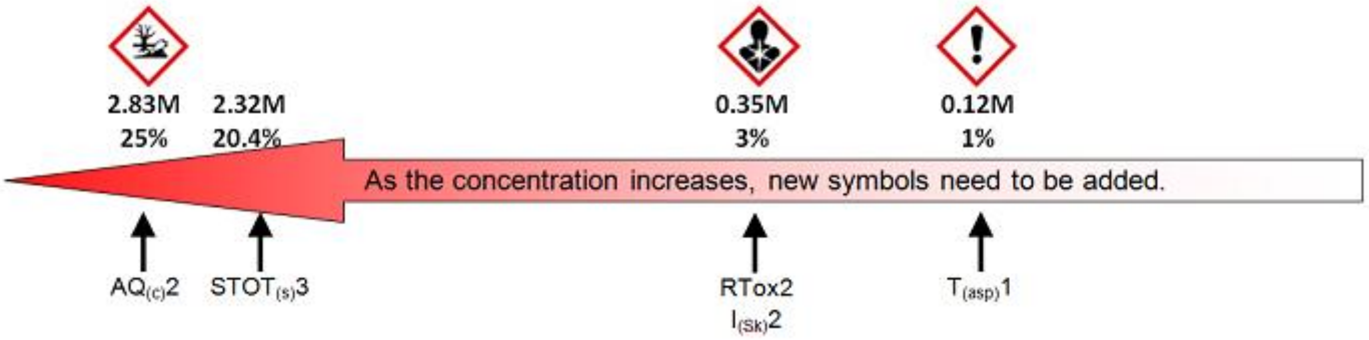
Harmful and corrosive, which will burn eyes, skin and respiratory system. Moderately toxic by ingestion, inhalation and in contact with the skin. An experimental teratogen. Combustible when exposed to heat or flame.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hexane, n- | Danger | Flammable liquid Cat 2<br>Aspiration toxin Cat 1<br>Skin irritant Cat 2<br>Reproductive toxin Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H225: Highly flammable liquid and vapour.<br>H304: May be fatal if swallowed and enters airways.<br>H315: Causes skin irritation.<br>H361: Suspected of damaging fertility or the unborn child<br>H336: May cause drowsiness or dizziness.<br>H373: May cause damage to the nervous system through prolonged or repeated exposure.<br>H411: Toxic to aquatic life with long lasting effects. |  |
| hexane, mixture of isomers | | Flammable liquid Cat 2<br>Aspiration toxin Cat 1<br>Skin irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H225: Highly flammable liquid and vapour.<br>H304: May be fatal if swallowed and enters airways.<br>H315: Causes skin irritation.<br>H336: May cause drowsiness or dizziness.<br>H411: Toxic to aquatic life with long lasting effects. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



Remember these hazards will have to be added to those of the solvent in which hexane is dissolved/mixed.

## Incompatibility

Vigorous reactions occur with strong oxidising agents e.g. dinitrogen tetroxide.

## Handling

In well-ventilated area, wearing nitrile gloves and eye protection.

**FF –** F, DP, CO2, VL

Storage

Flammables store. Keep away from oxidising materials. Keep lid tightly closed.

## Disposal

Wear eye protection and nitrile gloves. Turn off all sources of ignition. Do not pour directly down drains as potentially explosive concentrations may develop. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Alternatively, small quantities may be absorbed on to paper towels and evaporated in a fume cupboard.

## Spillage

Turn off all sources of ignition and open windows. Wearing gloves and face shield, soak up on mineral absorbent and carry to fume cupboard or secure place outside for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected large or if irritation persists or if feeling unwell.

# Hydrobromic acid and hydrogen bromide

Description: Acid is a faintly yellow liquid which darkens on exposure to light. Colourless, corrosive gas with acrid smell which fumes in moist air forming clouds of hydrobromic acid. Acid sold at 62% and 48% concentrations as well as a 33% solution in ethanoic acid.

## Hazards

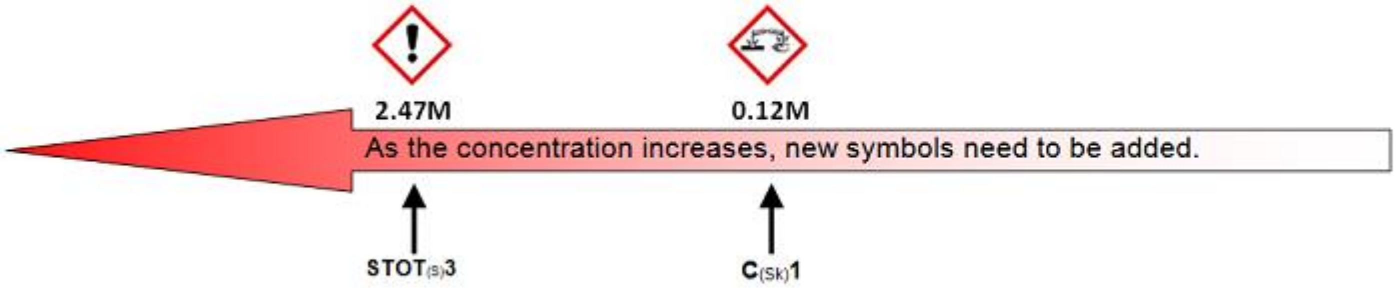
Extremely irritant and corrosive vapour. Vapour and acid are extremely destructive causing severe burns to eyes, lungs, skin and also if swallowed. Prolonged exposure to low concentrations is dangerous.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hydrobromic acid | Danger | Skin corrosive Cat 1B<br>Specific target organ toxin on single exposure Cat 3 | H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation. |  |
| hydrogen bromide | Danger | Skin corrosive Cat 1A<br>Specific target organ toxin on single exposure Cat 3 | H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents. Reacts violently with fluorine, iron(III) oxide, ammonia or ozone. Reacts vigorously with alkalis and some metals. When heated to decomposition, or when reacting with water/steam, toxic fumes are evolved.

## Handling

In fume cupboard. Wear nitrile gloves and goggles (BS EN 166 3).

## Storage

With acids in secure general store. Keep bottles tightly closed and in a well ventilated area.

## Disposal

Wear nitrile gloves and goggles (BS EN 166 3). In a fume cupboard dilute fourfold and neutralise with sodium hydrogencarbonate and wash to waste with a large excess of running water.

## Spillage

Ventilate room and, if spillage large, evacuate. Wear nitrile gloves and face shield. Spread soda ash / calcium hydroxide (50:50) carefully over the spillage to neutralise. Beware the heat generated during this neutralisation. Wait 5 minutes then scoop into plastic bucket and wash to waste with a large excess of running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Hydrochloric acid and hydrogen chloride

Description: Acid is colourless liquid, usually sold at up to 37% concentration – 12M (fuming hydrochloric acid). Colourless, corrosive gas with pungent smell, fumes in moist air forming clouds of hydrochloric acid.

Used to manufacture organic & inorganic chlorides.

## Hazards

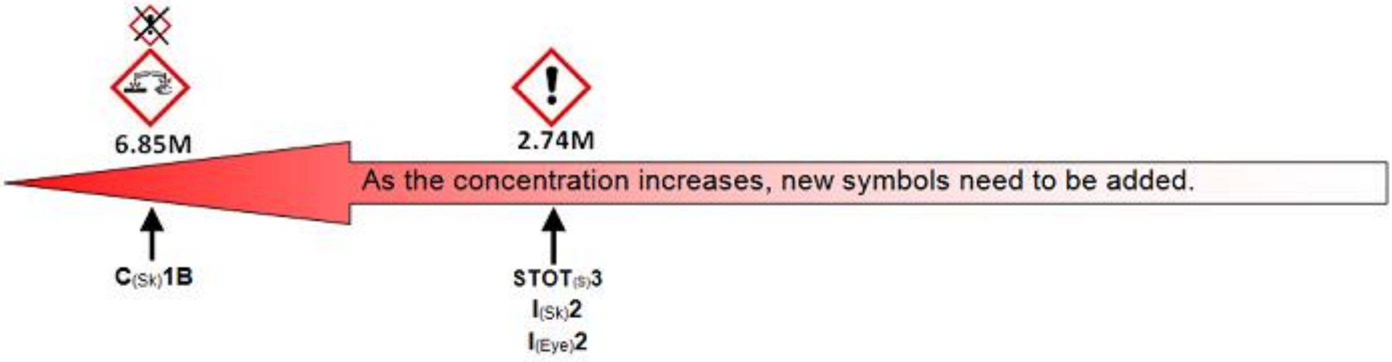
Extremely irritant and corrosive vapour. Vapour and higher concentrations of the acid (6.5M upwards) are extremely destructive causing severe burns to eyes, lungs, skin and also if swallowed. Lower concentrations 2.74-6.85M are classified by GHS as irritant (rather than corrosive) to eyes, lungs, skin and if swallowed. However it may be prudent to treat such concentrations in the same way as those afforded to higher concentrations. Dermatitis and photosensitisation can result after prolonged or repeated contact.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Hydrochloric acid | Danger | Skin corrosive Cat 1B<br>Specific target organ toxin on single exposure Cat 3 | H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation. |  |
| hydrogen chloride | Danger | Skin corrosive Cat 1B<br>Specific target organ toxin on single exposure Cat 3 | H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Explosion possible with potassium manganate(VII) (permanganate). Violent reaction with reactive metals e.g. potassium, sodium, calcium, magnesium releasing hydrogen gas. Also with other concentrated acids releasing hydrogen chloride gas e.g. sulphuric or phosphoric(V) acid. Vigorous exothermic decomposition with 1,1-difluoroethene. Ignites on contact with fluorine. Chloromethoxy chloromethane (bis-chloromethyl ether), a very potent carcinogen may be formed with methanal (formaldehyde) vapour in damp air.

## Handling

Wear nitrile gloves/gauntlets and goggles (BS EN 166 3). Fuming hydrochloric acid should only be handled in a fume cupboard.

## Storage

With acids in general store in a cool, well ventilated situation away from oxidising agents and protected from physical damage.

## Disposal

Wear nitrile gloves and goggles (BS EN 166 3). In a fume cupboard dilute fourfold and neutralise with sodium hydrogencarbonate and wash to waste with a large excess of running water.

## Spillage

Evacuate the area and ensure maximum ventilation possible. Wear gloves, face shield, acid-proof footwear and protective apron. If fuming acid has been spilled use a water spray to cut down the fumes. Spread soda ash / calcium hydroxide (50:50) carefully over the spillage to neutralise. Beware the heat generated during this neutralisation. Wait 5 minutes then wash the slurry to waste with a large excess of running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## Hydrofluoric acid and hydrogen fluoride

THIS GAS AND ACID SHOULD ONLY BE USED WITH GREAT CARE & BY EXPERIENCED TEACHERS

Available also as fluorinating agent – 70% solution in pyridine or 2% pyridine polymer bound. Colourless liquid. Colourless, corrosive gas which fumes in moist air forming clouds of hydrofluoric acid. Acid generally sold as aqueous solutions at 40, 48 and 60% concentrations.

### Hazards

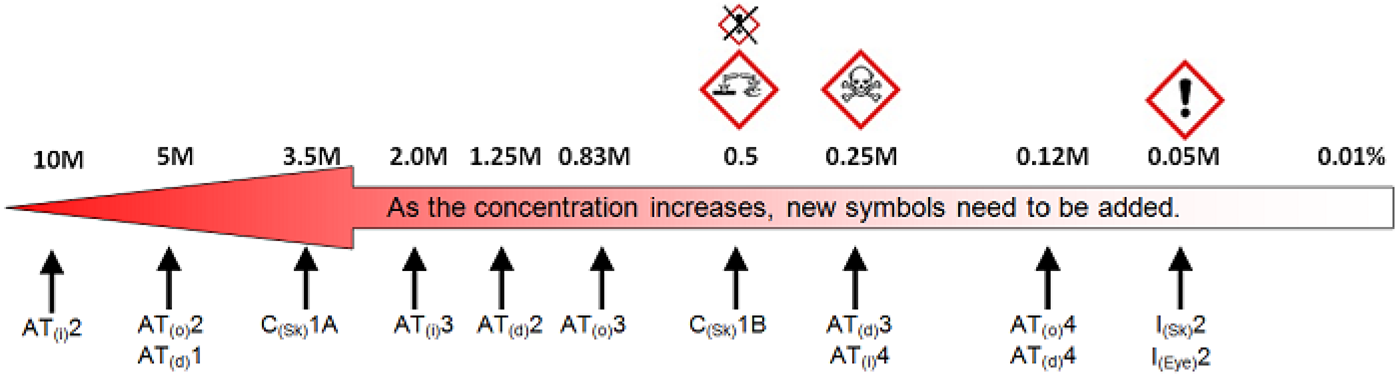
Gas and acid are very toxic by inhalation, in contact with the skin and if swallowed causing permanent damage or death. Vapour or acid are extremely corrosive irritants and cause severe burns to the eyes, skin and respiratory system. Experimental teratogen, mutagen with reproductive effects. Even very slight contact is dangerous as pain and visual indications of damage may not occur until up to a day later.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Hydrofluoric acid | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 1 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Skin corrosive Cat 1A | H300: Fatal if swallowed.<br>H310: Fatal in contact with skin.<br>H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage. |  |
| Hydrogen fluoride | Danger | Skin corrosive Cat 1B<br>Specific target organ toxin on single exposure Cat 3 | H300: Fatal if swallowed.<br>H310: Fatal in contact with skin.<br>H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Reacts explosively with sodium, with N-phenylazopiperidine, and in the polymerisation of cyanogen fluoride. Violent exothermic reaction with potassium manganate(VII) (permanganate). Polishing solutions containing HF are unstable and should not be stored.

### Handling

Maximum care is required. It is essential to wear rubber (neoprene) gloves, protective clothing and face shield. Handle only in a fume cupboard. Even dilute acid is very dangerous. Keep calcium gluconate gel for the treatment of hydrofluoric acid burns.

## Storage

Within a polythene vessel in general store with acids, away from glass (becomes etched). Keep container tightly closed in a well ventilated area. **DO NOT STORE IN GLASS CONTAINERS– use polythene or polypropylene**. Keep locked up and out of reach of children.

## Disposal

Wear rubber (neoprene) gloves, respirator, protective clothing and face shield and carry out in a fume cupboard. For up to 5 $cm^3$ neutralise with sodium hydrogencarbonate and wash to waste with a large excess of running water. Larger amounts – store for disposal by licensed contractor.

## Spillage

Evacuate the area and ensure maximum ventilation possible. Wear rubber (neoprene) gloves, face shield, acid-proof footwear and protective clothing. Spread soda ash / calcium hydroxide (50 : 50) carefully over the spillage to neutralise. Beware the heat generated during this neutralisation. If very small wait 5 minutes then wash the slurry to waste with a large excess of running water. Otherwise store for disposal by licensed contractor.

## Remedial Measures

In all cases of exposure take casualty to hospital as soon as possible

### Eyes

Irrigate with water for at least 10 minutes then saline for 30 minutes or until medical attention has been obtained. Do NOT use calcium gluconate on the eyes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wearing protective clothing and rubber (neoprene) gloves remove contaminated clothing immediately and rub calcium gluconate gel into affected areas until any pain completely subsides. Alternatively wash well with soap and water for at least 30 minutes.

# Hydrogen gas

Description: Colourless, odourless, tasteless and lighter than air gas.

## Hazards

Extremely flammable – very dangerous fire and explosion hazard (range 4 – 74%) when exposed to sources of ignition or oxidising agents. Mixtures with air, oxygen or chlorine explode readily if ignited, especially inside the restricted space of glassware. This has been a common cause of explosions in school laboratories. The air is probably flushed out more thoroughly from apparatus if supply is from a cylinder than from chemical generation. Mishandling of a cylinder of any compressed gas can be very dangerous. See also Gas cylinders. Toxicity is low but the gas can act as a simple asphyxiant. The inhalation of hydrogen to distort the voice as a substitute for helium is not recommended.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hydrogen gas | Danger | Compressed gas<br>Flammable gas Cat 1 | H280 Contains gas under pressure; may explode if heated. (if in cylinder)<br>H220 Extremely flammable gas |  |

## Incompatibility

Oxygen or air in presence of ignition sources or platinum and other catalysts, bromine, iodine, fluorine, nitrogen dioxide, vegetable oils + catalysts, calcium carbonate + magnesium, ethyne + ethene, hydrogen peroxide + catalysts, copper(II) oxide. Incompatible with chlorine in the presence of sunlight or ultraviolet light.

## Handling

See **Gas cylinders**. Use eye protection, and explosion screens for demonstrations. Good ventilation needed. When used in school, cylinders should be fixed securely by bench clamp or on cylinder trolley using a valve guard. A regulator needle valve should be fitted on a left hand thread for flow control. Check for any suspected leaks with a dilute solution of Teepol. Do not use undue force to fit regulator or to close valves. Open valve slowly to avoid build up of static, and a suitable flow should be obtained before attaching the apparatus. Apparatus connected to cylinders should have a special blow-out device fitted. **To start flow**; Ensure needle valve and outlet valve are closed (turn central knob outwards in an anticlockwise direction until it is ‘free’). Then open the spindle valve (usually half a turn or perhaps three-quarters is sufficient) to show the pressure on the inlet gauge. Then open the inlet valve (turn central knob clockwise a little) until the outlet gauge shows some pressure. Only then open the needle valve slowly to obtain the desired flow rate.

**FF** – If the burning flare from a jet of hydrogen is too large, turn off gas cylinder at source.

## Storage

Cylinders well-secured in cool, ventilated store away from flammables and fire risks. School janitor/tress should have details of their location to inform the Fire Service in case of emergencies.

## Remedial Measures

If breathing is affected take casualty to hospital as soon as possible

### Lungs

Move patient from area of exposure. Rest and keep warm.

# Hydriodic acid and hydrogen iodide

Description: Acid is colourless liquid – ages to yellow with acrid smelling fumes. Sold in 57 and 67% aqueous solutions.

## Hazards

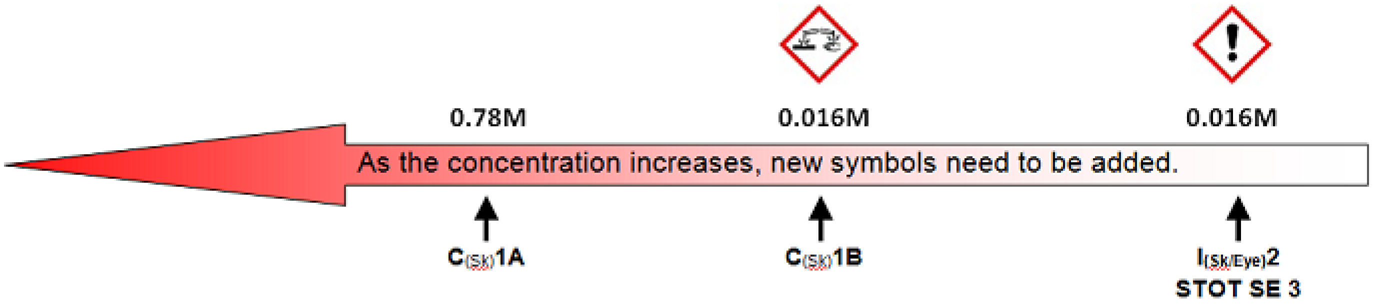
Acid solution is corrosive and burns eyes and skin and if swallowed is very harmful. Very irritant vapour, harmful to eyes, lungs and skin.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hydriodic acid | Danger | Skin corrosive Cat 1A | H314: Causes severe skin burns and eye damage. |  |
| hydrogen iodide | Danger | Skin corrosive Cat 1A | H314: Causes severe skin burns and eye damage. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents. Violent ignition with magnesium. Anhydrous liquid explodes violently with potassium metal. Gas ignited by molten potassium chlorate(V). Potentially violent reaction with phosphorus.

## Handling

In fume cupboard. Wear pvc gloves and goggles (BS EN 166 3).

## Storage

Acids store. Not near nitric or sulphuric acid.

## Disposal

Wear gloves and goggles (BS EN 166 3), dilute fourfold, neutralise with sodium carbonate and wash to waste with running water.

## Spillage

Wear pvc gloves and face shield. Ventilate room, spread soda ash (i.e. anhydrous sodium carbonate) over the spillage then add water and mop up, wash to waste with running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if experiencing breathing difficulty.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## Hydrogen peroxide

Description: Colourless, unstable, heavy liquid. Used as bleaching agent in food and in mixtures with fuel for rocket propulsion. Sold in aqueous solutions of 20-100 volume concentrations.

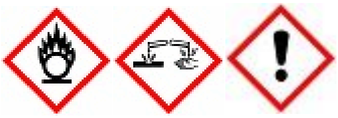
### Hazards

At high concentrations (>50%) the solution and vapour are corrosive, causing burns to eyes, lungs, mouth and skin. Even 8% solutions can cause serious eye damage. In the stomach the sudden evolution of oxygen can cause injury by acute swelling of stomach, producing nausea, vomiting and bleeding. Suspected carcinogen and mutagen. A powerful oxidising agent in concentrated form. Contact with combustible material e.g. flammable vapours, paper, wood dust and gases may cause fire. Schools have little need for higher concentrations than 30% (100 vol).

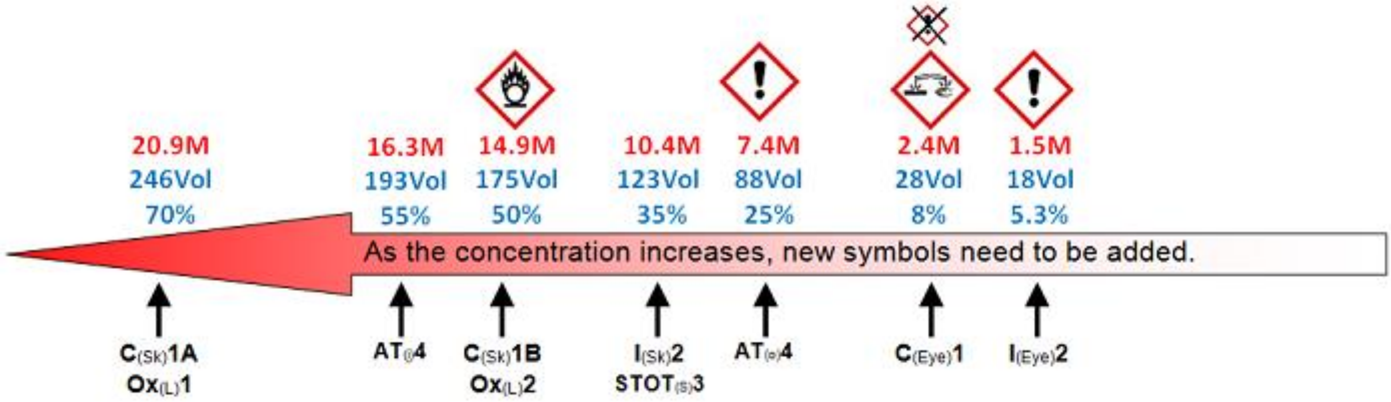
### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hydrogen peroxide | Danger | Oxidising liquid Cat 1<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhaled)<br>Skin corrosive Cat 1A | H271: May cause fire or explosion; strong oxidiser.<br>H302: Harmful if swallowed.<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage. |  |

### Concentration effects

| % w/v (approx.) | 'Volume' | Molarity (approx.) | Indication of danger |
|---|---|---|---|
| >=50% | >=178 | >=15 |  |
| 30% | 100 | 8.8 |  |
| 15% | 53 | 4.5 |  |
| 12% | 44 | 3.6 |  |
| 6% | 21 | 1.8 |  |

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Reacts vigorously or explosively with a wide range of organic and inorganic substances – e.g. alcohols + sulphuric acid, alkanones + nitric acid, finely divided metals and their oxides, propane-1,2,3-triol, wood, charcoal, coal, phosphorus(V) oxideand tin(II) chloride etc. Even though some materials may not spontaneously explode on contact with hydrogen peroxide they are then very susceptible to detonation by shock or by catching fire.

## Handling

Great care is required with concentrated solutions from 18 volume (1.5M or 5%) upwards.Wear nitrile gloves and eye protection. Use in well-ventilated area, well away from incompatible materials. On receiving bottle from supplier loosen screw cap carefully as pressure can build up on storage. Unless the cap has a small vent leave it slightly loose. It is economically worthwhile to purchase 100 volume hydrogen peroxide; this can be diluted when weaker solutions are required and if stored, itn should be stored in bottles with loosely screwed-on tops. ‘Volume’ number denotes the number of unit volumes of oxygen a given volume of hydrogen peroxide solution can produce.

## Storage

In dark bottle situated in a cool dark place away from reducing agents, transition metal compounds (likely catalysts) and other incompatible materials. Diluted solutions have a short useful shelf life. Dispose of when expected reactions fail to ‘work’ correctly.

## Disposal

Eliminate all sources of ignition. Work in a well ventilated lab wearing nitrile gloves, lab coat and face shield. Add slowly to a bucket or sinkful of water and wash to waste with running water. If quantity is large, first reduce with iron(II) sulphate or with sulphite (Some sulphur dioxide (TOXIC) may be evolved) in a fume cupboard).

## Spillage

Eliminate all sources of ignition. Ventilate the area. Wear nitrile gloves, lab coat and face shield. Soak up on mineral absorbent. Wash absorbent well and wash to waste with lots of running water. Mop up spillage area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Skin

Drench well with water. Remove and wash contaminated clothing. If a large area of skin is affected, blistering occurs or continues to be painful then obtain medical attention.

## Hydrogen sulphide

**The smell of hydrogen sulphide is an inadequate guide to its concentration as sensory fatigue can occur**

Description: Gas with rotten-egg smell. Produced by the reaction of dilute sulphuric or hydrochloric acid on iron sulphide. Very soluble in cold water. Used to make chemicals, in the study of metals and as an analytical reagent. The gas is usually prepared rather than purchased in cylinders.

### Hazards

Very toxic gas. High concentrations cause immediate unconsciousness and can be fatal because of respiratory failure. Even low concentrations cause severe irritation of the eyes, causing headaches and weakness. There is an insidious danger because, after exposure for some time, the sense of smell becomes impaired.

Extremely flammable, forming explosive mixtures with the air (explosive range 4-44%). Very dangerous fire hazard when exposed to heat or flame. Sulphide impurities in iron filings may release small amounts of the gas into the open lab during reactions with acids. Ensure maximum ventilation during these experiments and avoid directly sniffing the gas given off.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hydrogen sulphide | Danger | Flammable gas Cat 1<br>Acute toxin Cat 2 (inhalation)<br>Hazardous to the aquatic environment Cat 1 | H220: Extremely flammable gas.<br>H330: Fatal if inhaled.<br>H400: Very toxic to aquatic life. |  |

### Incompatibility

Oxidising agents. Explosive when heated or ignited, with peroxides, nitric acid, fluorine. Ignites on contact with metal oxides e.g. those of barium, copper, chromium, lead, silver, mercury, rust etc. Soda-lime and other alkali metal hydroxides used to absorb hydrogen sulphide can later ignite – saturate these well with water before disposal. Vigorous reaction with powdered metals.

### Handling

If generating the gas or carrying out a reaction in which the gas is a principal product, then do so only in a fume cupboard. Make sure there are no flames or other sources of ignition. Wear eye protection.

### Storage

Prepare only when required. Cylinders of the gas are not recommended.

### Disposal

Eliminate all sources of ignition. Bubble small quantities through a water filled gas wash bottle filled with iron(III) chloride solution (or other suitable oxidising agent) in the fume cupboard. Reactants from gas preparation should be left in fume cupboard until no further gas is evolved. Residues can then be diluted with a large quantity of water and put down the drain. The residue of unreacted iron(II) sulphide should be rinsed well and retained for re-use.

### Spillage

Open windows and evacuate the area. Escaping gas from a leaking cylinder can be bubbled through a solution of iron(III) chloride. An empty wash bottle with the connections reversed, inserted between the cylinder and the iron solution, can be used as an anti-suck back trap.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Lungs

Move patient from area of exposure. If lungs are congested place conscious casualty with breathing difficulties in a sitting position. Rest and keep warm.

Obtain medical attention immediately if more than a brief whiff of the gas has been inhaled

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention.

# Hydroxybenzoic acid and derivatives

Alternative names: 2-hydroxybenzoic acid = salicylic acid; acetylsalicylic acid = 2-acetoxybenzoic acid or aspirin.

Description: both are colourless crystals. Slightly soluble in water. 2-hydroxybenzoic acid is used as skin softener and antiseptic and is an important intermediate in the manufacture of aspirin (acetylsalicylic acid).

## Hazards

Harmful by ingestion, causing nausea, vomiting, etc. A severe skin irritant and damaging to eyes. Skin contact can produce ear tinnitus. An experimental teratogen and possible mutagen. Slight fire hazard. When heated to decomposition it produces acrid smoke and irritating fumes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 2-hydroxybenzoic acid | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Eye damage Cat 1 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin<br>H318: Causes serious eye damage. |  |
| acetylsalicylic acid | Warning | Acute toxin Cat 4 (oral)<br>Skin Irritant Cat 2<br>Eye Irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H302: Harmful if swallowed.<br>H315: Causes skin irritation<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |

## Incompatibility

Strong oxidising agents, iron salts, lead ethanoate and iodine.

## Handling

Wear pvc gloves and eye protection.

## Storage

General store. Never in laboratory. In moist air, acetylsalicylic acid is slowly hydrolysed into salicylic and acetic acids. (2-hydroxybenzoic and ethanoic acids)

## Disposal

Wear eye protection and pvc gloves. Dissolve up to 10 g in a litre of warm water and run to waste with copious amounts of water. Larger amounts, store to await uplift by disposal contractor.

## Spillage

Wear eye protection and pvc gloves. Mop up and treat as in Disposal. Avoid raising dust.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Hydroxylamine

Description: Both salts are hygroscopic white crystals, very soluble in water. Used as a corrosion inhibitor in piped water heaters by scavenging oxygen.

**Use the above salts instead of the free hydroxylamine.**

## Hazards

Harmful by ingestion. Very harmful by inhalation, but this is most unlikely, owing to the crystalline nature of the salts. Very damaging to the mucous membranes, respiratory tract, eyes and skin. Prolonged contact can sensitise the skin. Very toxic to aquatic organisms.

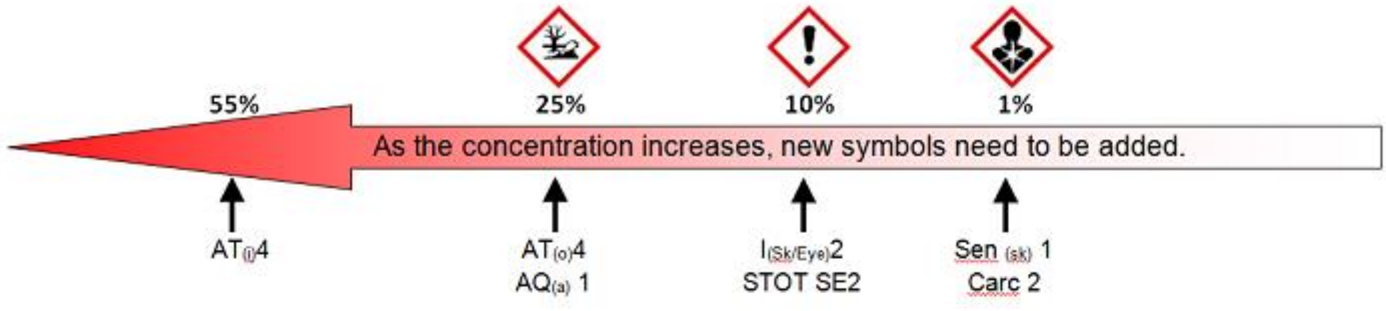
Do not heat as the salts decompose violently on heating to temperatures a little over 100ºC, producing a mixture of gases – carbon monoxide,  nitrogen oxides and either hydrogen chloride or sulphur dioxide.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| hydroxylamine hydrochloride and sulphate | Danger | Corrosive to metals Cat 1<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Skin / Eye irritant Cat 2<br>Skin sensitiser Cat 1<br>Carcinogen Cat 2<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to aquatic life Cat 1 | H290 May be corrosive to metals.<br>H302 Harmful if swallowed.<br>H312 Harmful in contact with skin.<br>H315 Causes skin irritation.<br>H317 May cause an allergic skin reaction.<br>H319 Causes serious eye irritation.<br>H351 Suspected of causing cancer.<br>H373 May cause damage to organs through prolonged or repeated exposure.<br>H400 Very toxic to aquatic life. |  |

## Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the* ***RIGHT*** *of it are the ones that apply.*



## Incompatibility

Reacts violently with bases, oxidising agents such as halates, and phosphorus halides. Reacts with hydrogen peroxide to release ammonia and oxygen. The hydrochloride is air and moisture sensitive. The sulphate is incompatible with copper, copper alloys and nitrates. Reaction with alkali would release the more volatile free base (bp 56ºC); the latter inflames in contact with sodium or chlorine. The nitrate is very unstable; do not react with nitric acid.

## Handling

Wear eye protection and rubber, nitrile, neoprene or pvc gloves.

## Storage

Away from oxidising agents. Ensure container is tightly closed and kept in a cool, dry place.

## Disposal

Wear eye protection. **Very small quantities** such as washings of flasks and glassware can be run to waste. Larger volumes of solution can be oxidised to dinitrogen monoxide (by iron(III) salts) before running the remaining solution to waste. In a fume cupboard up to 20 g can be dissolved in water and then oxidised with 20 vol. hydrogen peroxide (IRRITANT); check reaction is complete by testing with starch/iodide before running to waste. Otherwise store solid for disposal by licensed contractor.

## Spillage

Wear eye protection and gloves.

**Small quantities** – mop up and run to waste.

**Larger quantities –** react in solution with a slight excess of hydrogen peroxide (IRRITANT) (check for excess with starch/iodide) before running to waste. Iron(III) salts are an alternative. Depending on the scale carry out preferably in a fume cupboard as these oxidations of hydroxylamine salts will release some ammonia.

Ventilate area and wash site afterwards.

## Remedial Measures

### Eyes

Irrigate with copious amounts of water for at least 15 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Obtain medical attention if feeling unwell.

### Lungs

inhalation is unlikely nut if it happens, move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is wheezy or difficult.

### Skin

Flood affected area of skin for at least 15 minutes with water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Iodopropanes

Alternative names: n-propyl iodide & iso-propyl iodide

Description: Colourless-yellow liquids with slight smell.

## Hazards

Both isomers are flammable. Keep away from sources of ignition. They are harmful by inhalation and swallowing and irritate eyes & skin, particularly the 1- isomer. There is evidence that they may be experimental carcinogens (though not sufficient for classification).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 1-iodopropane | Warning | Flammable liquid Cat 3<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H226 Flammable liquid and vapour.<br>H302 Harmful if swallowed.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H332 Harmful if inhaled.<br>H335 May cause respiratory irritation. |  |
| 2-iodopropane | | Flammable liquid Cat 3<br>Acute toxin Cat 4 (oral) | H226 Flammable liquid and vapour.<br>H302 Harmful if swallowed. |  |

## Incompatibility

Oxidising agents. Can react with water and steam to produce toxic fumes.

## Handling

In well-ventilated area, with nitrile gloves and eye protection.

**FF** – DP, $CO_2$, VL.

## Storage

Flammables store well away from any sources of ignition.

## Disposal

Wear eye protection and nitrile gloves and ensure absence of ignition sources. Unavoidable discharges, e.g. very small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Store larger quantities in halogenated hydrocarbons waste container for collection by licensed waste disposal contractor. Alternatively reflux with alcoholic alkali to convert to the relatively harmless water soluble propanols.

## Spillage

Wear nitrile gloves and eye protection and ensure absence of ignition sources. Add water and detergent and emulsify as for disposal but if quantity is larger than about 10 $cm^3$ absorb on sand and transfer to an open area for evaporation. Store larger quantities in sealed container for disposal by licensed contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff has been inhaled or if feeling unwell.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large or if irritation persists.

# Iodates

Sodium and potassium salts are the only ones that are likely to be encountered.

Description: White odourless crystals or powder. Potassium iodate used as a primary standard in iodometry. Both used as antiseptics. Iodates (VII) are used in a variety of organic reactions and in a test for manganese.

## Hazards

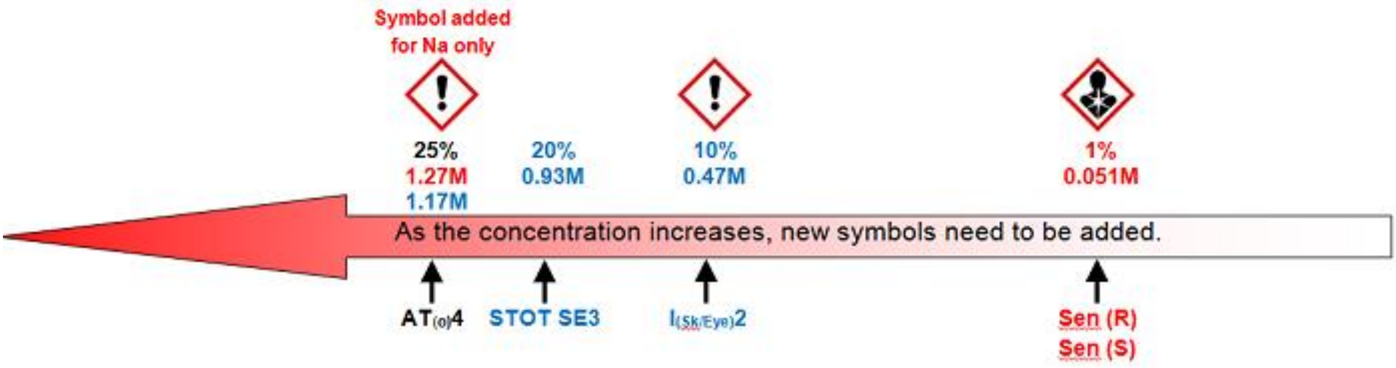
All of these, especially the VII salts, are powerful oxidising agents. May cause fire in contact with combustible material, including clothing, giving off iodine and the metal oxide fumes. Sodium iodate (V&VII) are highly irritating (and potassium salts marginally less so) to the eyes, skin, mouth and respiratory system and may cause allergic or asthma symptoms. Avoid raising dust. Sodium iodate(VII) is toxic if swallowed and the others are harmful.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium iodate(V) | Danger | Oxidising solid Cat 2<br>Acute toxin Cat 4 (oral)<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1 | H272 May intensify fire; oxidiser.<br>H302 Harmful if swallowed.<br>H317 May cause an allergic skin reaction.<br>H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. |  |
| potassium iodate(V) | Danger | Oxidising solid Cat 2<br>Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H272 May intensify fire; oxidiser.<br>H302 Harmful if swallowed<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |
| sodium iodate(VII) | Danger | Oxidising solid Cat 2<br>Acute toxin Cat 3 (oral)<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H272 May intensify fire; oxidiser.<br>H301 Toxic if swallowed.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |
| sodium iodate(VII) | Danger | Oxidising solid Cat 2<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H272 May intensify fire; oxidiser.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

***Iodates(V) only.*** *Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. (**Red = sodium**, **blue = potassium**, black applies to both)*



## Incompatibility

Reducing agents. Violent reactions with aluminium and other finely divided metal powders, carbon, arsenic, copper, potassium, sulphur, hydrogen peroxide, metal sulphides and hydrides, phosphorus, combustible materials, thiocyanates, cyanides, impure manganese(IV) oxide or organic matter.

## Handling

Wear nitrile rubber or plastic gloves and eye protection. Avoid raising dust.

## Storage

With oxidising agents and away from combustible material and reducing agents. Not in laboratory.

## Disposal

Up to 5 g can be dissolved in water, greatly diluted and washed to waste. Up to 20 g can be dissolved in 5 litres of water in a fume cupboard cupboard and reduced to iodide. Add 100 cm3 of 1M sulphuric acid (IRRITANT) and sodium sulphite or metabisulphite in approximately 5 g amounts until the colour of the iodine, which forms initially, is removed.  Sulphur dioxide (TOXIC) is evolved. If large amounts are involved package and label jars of these chemicals and arrange for removal by a licensed contractor.

## Spillage

Wear nitrile rubber gloves and eye protection and avoid raising dust. Open windows and spread a reducing agent over the spill e.g. sodium thiosulphate, sodium metabisulphite or an iron(II) salt (the latter two require the addition of 2M sulphuric acid to help reduction. Sulphur dioxide (TOXIC) is evolved). Mix thoroughly, spray with water and transfer to a plastic bucket. Treat as in **Disposal**. The spillage area should be repeatedly washed with water. Contaminated dried-out materials and clothing are easily ignited.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure to the salt is unlikely. If iodine is inhaled Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Iodic, bromic and chloric acids

Bromic and chloric (V) acids are unstable and decompose readily, though chloric acid is relatively stable in cold aqueous solutions. Iodic acid is a white solid.

## Hazards

All three of these are powerful oxidising agents which can be dangerous if in contact with combustible material or is subjected to heat, fire or other source of ignition. The liquid (and any fumes) are corrosive and cause severe burns to the eyes, skin, mouth and respiratory system.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| bromic(V) acid | Danger | Bromic acid is only stable in dilute aqueous solutions.<br>It does not have any ECHA classification but is best considered as a powerful oxidiser and as corrosive. |  |  |
| chloric(V) acid | Danger | Oxidising liquid Cat 1<br>Skin corrosive 1B | H271: May cause fire or explosion; strong oxidiser<br>H314: Causes severe skin burns and eye damage. |  |
| iodic(V) acid | Danger | Oxidising solid Cat 2<br>Skin corrosive 1B | H272: May intensify fire; oxidiser.<br>H314: Causes severe skin burns and eye damage. |  |

## Incompatibility

Can cause fire or explosion when in contact with reducing agents, a wide range of organic and inorganic substances and finely divided metals. Heavy metal chlorates(V) are explosive. When heated to decomposition toxic fumes are given off.

## Handling

Care required for more than very dilute solutions of bromic(V) and chloric(V) acids. Wear goggles (BS EN166 3) and nitrile gloves. Keep away from incompatible materials, including paper tissues, cloth dusters and wood. Bromic(V) and chloric(V) acids decompose to prelease bromine and chlorine respectively so should be handled in a fume cupboard. Iodic acid is stable and can be handled in the open lab with goggles and gloves (as above). It too, should be kept away from combustible materials.

## Storage

Bromic(V) and chloric(V) acids do not store well and are best prepared as needed. Iodic(V) acid is stable and should be stored with other oxidisers.

## Disposal

Wear nitrile gloves and goggles (BS EN 166 3). Small quantities can be added to a large volume of water, neutralised with sodium carbonate and washed to waste with running water. Larger amounts should be packaged and labelled and disposed of by a licensed contractor.

## Spillage

Wear nitrile gloves and goggles (BS EN 166 3). Open windows and doors if bromic(V) or chloric(V) acids are involved. Spread a reducing agent over the spill e.g. sodium thiosulphate, sodium metabisulphite or an iron(II) salt (the latter two require the addition of a little 2 Mol $l^{-1}$ sulphuric acid (CORROSIVE) to help reduction – sulphur dioxide (TOXIC) evolved, dangerous for asthmatics – ensure good ventilation).

Mix thoroughly, spray with water and transfer to a plastic bucket. Neutralise with soda ash and wash to waste with large quantity of running water. The spillage area should be repeatedly washed with water, since contaminated wood, paper and cloth are easily ignited at a later time. If spillage is large absorb on to sand and dispose of via a licensed contractor.

## Remedial Measures

If swallowed or the skin is burned, if breathing is affected or if eyes are irritated take the casualty to hospital immediately.

**Eyes**

Irrigate with water for at least 15 minutes. Seek medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Seek medical attention as soon as possible.

**Lungs**

Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

# Iodine

Description: Violet-black rhombic crystals with a metallic sheen. Sparingly soluble in water but soluble in potassium iodide solution to give yellow-brown solutions. In organic solvents, dissolved to give a purple solution. When heated, it sublimes to a purple vapour.

## Hazards

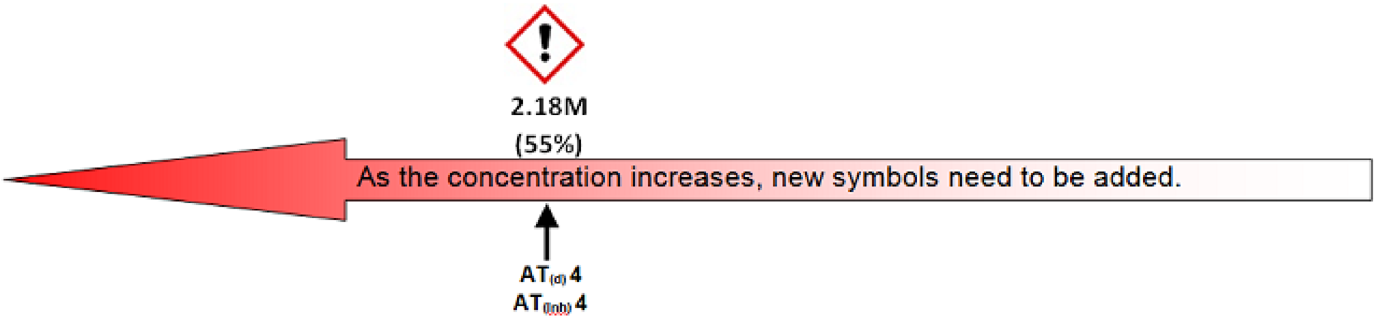
Vapour is harmful to respiratory system. Vapour and solid irritate the eyes. Solid burns the skin. If swallowed internal irritation is severe. Prolonged exposure to low concentrations of vapour or contact with skin or eyes is dangerous. When heated gives large amount of iodine vapour.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| iodine | Warning | Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Hazardous to the aquatic environment Cat 1 | H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H400: Very toxic to aquatic life. |  |

## Concentration Effects

Iodine vapour is irritating to the respiratory system at very low concentrations, anything above 0.1ppm. For toxic effects to occur, however, the concentration would have to be many times that which is tolerable to breathe.



## Incompatibility

Reducing agents, metal ethynides, ethanol, ammonia solution (explosive nitrogen triiodide formed), phosphorus and alkali metals. Can react violently with aluminium, zinc or magnesium powders.

## Handling

In storage, quite a high concentration of vapour may build up in the container so care should be taken when opening. Use solutions in well-ventilated area. For solids or situations where iodine is vaporised or may escape, use a fume cupboard. Keep 0.2M sodium thiosulphate handy for spillages on skin. Nitrile gloves and eye protection should be worn. Avoid release to the environment.

## Storage

General store with oxidising agents. Keep away from incompatible chemicals.

## Disposal

If possible collect residues and recycle. Depending on the final state this may involve extracting the iodine into a solvent, washing that organic solution with the appropriate aqueous reagent to remove other impurities present and then drying and distilling. Very small amounts may be dissolved in sodium thiosulphate solution and washed to waste with running water.

## Spillage

If the spillage is large wear gloves and a face shield. Sweep up, add to excess sodium thiosulphate solution and wash to waste with plenty of running water. Wash area with 5% sodium thiosulphate solution, allowing time for the reaction to occur. Then wash with water. If amounts are large attempt to recover.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Remove contaminated clothing. Swab with 1% solution of sodium thiosulphate. Wash with 0.2M sodium thiosulphate and then wash with plenty of running water and soap. Obtain medical attention if irritation persists.

# Iodine monochloride

Not commonly encountered in the school laboratory except as a solution in ethanoic acid – Wij's solution for determination of iodine value of fats. It is a black solid with a pungent odour that melts at a low temperature to form a red/brown liquid.

## Hazards

Iodine monochloride is strongly corrosive solid or liquid and the fumes cause respiratory sensitisation. Some classifications consider it toxic by ingestion and/or skin contact.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| iodine monochloride | Danger | Skin corrosive Cat 1A<br>Respiratory Sensitiser Cat 1 | H314: Causes severe skin burns and eye damage.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled |  |
| Wij's reagent | Danger | Flammable liquid Cat 3<br>Skin corrosive Cat 1A | H226; Flammable liquid and vapour<br>H314: Causes severe skin burns and eye damage. |  |

## Incompatibility

Strong bases, Oxidizing agents, Metals, Amines, Organic materials, Alcohols, Peroxides, permanganates, e.g. potassium permanganate, Soluble carbonates and phosphates, Hydroxides. It also reacts with air to form iodine pentaoxide ($I_2O_5$), which decomposes into iodine ($I_2$) and oxygen ($O_2$), with heat beginning at 275°C and proceeding rapidly at 350°C. Reacts with water or steam to produce toxic and corrosive fumes of iodine, chlorine and iodic acid.

## Handling

Prepare and handle iodine monochloride in a fume cupboard. Wear pvc gloves and goggles (BS EN 166 3). Wij's reagent should also be handled in a fume cupboard but once it has been added to the oil and the container capped, it can be used in the open laboratory. Gloves and goggles (BS EN166 3) should be worn.

## Storage

General store. (Wij's reagent is flammable but unless you store your ethanoic acid ina flammable cabinet, there is no need to do so for this)

## Disposal

For large quantities keep for disposal by a licensed contractor. For small quantities, wear gloves and goggles (BS EN 166 3). In a fume cupboard, slowly add, with stirring, up to 100 cm3  to 5 litres of water. Neutralise by adding 2M sodium carbonate (IRRITANT). Add sodium thiosulphate solution until the solution is clear and wash to waste with lots of running water.

## Spillage

Iodine monochloride – If the spillage is large wear gloves and a face shield. Sweep up, add to excess sodium thiosulphate solution and wash to waste with plenty of running water. Wash area with 5% sodium thiosulphate solution, allowing time for the reaction to occur. Then wash with water

Wij's solution – If large evacuate room; turn off all sources of ignition; wear protective clothing, face shield and nitrile gloves. Neutralise with solid sodium carbonate or sodium hydrogen carbonate and transfer mixture to a plastic bucket. Add sodium thiosulphate solution to react with the iodine and chlorine. Then wash to waste with copious quantities of water.

## Remedial Measures

### Eyes

Irrigate with water continuously for at least 10 minutes. It is important to flush under eyelids also. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if area affected is large.

# Iodobutane

Alternative name: butyl iodide

Description: Colourless to pale orange liquid. Miscible in water.

## Hazards

Flammable – keep away from sources of ignition. Toxic by inhalation. Irritating to eyes, skin and by swallowing and inhalation.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 1-iodobutane | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 3 (inhalation) | H226 Flammable liquid and vapour.<br>H331 Toxic if inhaled. |   |

## Incompatibility

Oxidising agents. Can react with water or steam, or when heated to decomposition, to produce toxic fumes.

## Handling

In well-ventilated area. Wear nitrile gloves and eye protection.

**FF** – F, CO2, VL.

## Storage

Flammables store.

## Disposal

Wear nitrile gloves and eye protection and ensure absence of ignition sources. Unavoidable discharges, e.g. only very small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Store larger quantities in halogenated hydrocarbons waste container. Alternatively reflux with alkali (CORROSIVE) to produce water soluble alkanol.

## Spillage

Wear nitrile gloves and eye protection and ensure absence of ignition sources. Add water and detergent and emulsify as for Disposal but if quantity is larger than about 10 $cm^3$, absorb on sand and transfer to an open area for evaporation. Store larger quantities in sealed container for disposal by licensed contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large or if irritation persists.

# Iodoethane

Alternative name: ethyl iodide

Description: Colourless-brown liquid with ether-like smell. Slightly soluble in water.

## Hazards

Harmful by inhalation, skin absorption and if swallowed. Very destructive to all tissues. Irritating to eyes and skin. May cause asthma by inhalation. Slightly flammable – keep away from sources of ignition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 1- iodoethane | Danger | Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H302 Harmful if swallowed.<br>H315 Causes skin irritation.<br>H317 May cause an allergic skin reaction.<br>H319 Causes serious eye irritation.<br>H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H335: May cause respiratory irritation |  |

## Incompatibility

Oxidising agents. Can react with water or steam to produce toxic and corrosive fumes. Dangerous reaction with silver chlorate(III).

## Handling

In well-ventilated area or preferably a fume cupboard. Wear nitrile gloves and eye protection.

## Storage

Flammables store in well ventilated, cool area.

## Disposal

Wear eye protection and nitrile gloves and ensure absence of ignition sources. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Store larger quantities in halogenated hydrocarbons waste container for collection by licensed waste disposal contractor. Alternatively reflux with alcoholic alkali to convert to the relatively harmless water soluble ethanol.

## Spillage

Wear eye protection and nitrile gloves and ensure absence of ignition sources. Add water and detergent and emulsify as for *Disposal* but if quantity is larger than about 50 cm3, absorb on sand and transfer to an open area for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. If eye irritation occurs, obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. If breathing difficulties occur, obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Iron metal and compounds

## Hazards

Metallic iron is of low hazard though the powder is flammable and may be self-reactive. It can also cause eye irritation due to its reactivity. Both iron(II) and iron(III) salts are harmful if ingested in quantity, with the lower oxidation state being the more harmful of the two. The salts are irritating to the skin and to the eyes. Iron(III) salts are more irritating, especially the anhydrous chloride which is corrosive: solutions of iron(III) salts ($Ka_1$ = 6 x $10^{-3}$) are more acidic than ethanoic acid. Iron filings and iron oxides also irritate the eyes. If the sulphates or sulphide are roasted they will give off sulphur trioxide (CORROSIVE) and sulphur dioxide (TOXIC).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Iron (not powder)<br>iron(III) oxide, iron(II)(III) oxide | | Ni significant hazard | | None |
| Iron (powder) | Danger | Flammable solid Cat 1 | H228: Flammable solid |  |
| iron(II) sulphate -7-water | Warning | Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2 | H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation. |  |
| iron(III) sulphate-water | Warning | Acute toxin Cat 4 (oral)<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H302: Harmful if swallowed.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |
| iron(II) chloride-4-water | Danger | Acute toxin Cat 4 (oral)<br>Skin corrosive Cat 1B | H302: Harmful if swallowed.<br>H314 Causes severe skin burns and eye damage. |   |
| iron(III) chloride-6-water | Danger | Acute toxin Cat 4 (oral)<br>Skin corrosive Cat 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 3 | H302: Harmful if swallowed.<br>H314 Causes severe skin burns and eye damage.<br>H412: Harmful to the aquatic environment with long-lasting effects |    |
| iron(III) chloride (anhydrous) | Danger | Acute toxin Cat 4 (oral)<br>Skin corrosive Cat 1B | H302: Harmful if swallowed.<br>H314 Causes severe skin burns and eye damage. |   |
| iron(II) sulphide | Warning | Hazardous to the aquatic environment Cat 1 | H400 Very toxic to aquatic life.<br>EUH031 Contact with acids liberates toxic gas. |  |

|  |  |  |  |  |
|---|---|---|---|---|
| iron(III) nitrate-9-water | Warning | Oxidising solid Cat 3<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H272 May intensify fire; oxidiser.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335 May cause respiratory irritation. |  |

## Incompatibility

Anhydrous iron(III) chloride reacts exothermically with water, the oxides with finely divided iron, magnesium or aluminium. See Thermit mixture. Iron(II) chloride – avoid contact with strong oxidising agents and with most common metals. Iron(III) chloride reacts violently with sodium or potassium.

Iron(III) nitrate will react vigorously if > 10% organic matter is present.

Very fine iron dust can easily be ignited.

Iron sulphide in powder form will oxidise in air exothermically and may ignite. Purchase sticks and do not isolate and dry prepared powder. Gives off hydrogen sulphide (VERY TOXIC) with acids.

Iron oxide, if reduced by carbon monoxide at low temperatures, may form iron pentacarbonyl which can explode

## Handling

Wear goggles (BS EN 166 3) and pvc gloves and have good ventilation, especially with the anhydrous chlorides. With the crystalline hydrates it is easy to avoid raising a dust. When handling iron filings do not rub eyes.

## Storage

Iron with metals. Iron(III) nitrate with oxidising agents. Rest with general chemicals. Many iron(II) salts are partially oxidised in air.

## Disposal

Iron sulphide, being hazardous for the environment, should be stored for later uplift by a licensed contractor.

For other compounds, wear goggles (BS EN 166 3) and pvc gloves. Washings from glassware can be run to waste. Up to 20 g can be dissolved and run to waste at a time. Reduce to a minimum contact of iron salts with porcelain sinks and stainless steel surfaces. Porcelain will be stained and some stainless steels will be pitted.

## Spillage

Wear goggles (BS EN 166 3) and pvc gloves.

**Solids –** carefully sweep up and treat as in Disposal.

**Solution –** cover with and soak up with approximately 20 parts of absorbent. Seal in bag and dispose of in refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes and longer in the case of anhydrous salts. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting. If swallowed in any quantity above 0.5 g obtain medical attention immediately.

### Lungs

Exposure by this route unlikely with crystalline salts. Move patient from area of exposure. Rest and keep warm. If coughing and wheezing continues then seek medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. If irritation persists seek medical attention.

# Lead metal and compounds

## Hazards

Lead metal, especially in finely divided form and all compounds are either toxic or very toxic by inhalation or swallowing. All lead compounds are Category 1A Reproductive Toxins; they may cause harm to the unborn child and there is a possible risk of impaired fertility. The chromate is a Category 1B carcinogen. Lead is a cumulative poison – small amounts absorbed over a period of time will build up and may eventually lead to organ damage and irreversible disabling effects on the central nervous system. When heated to decomposition toxic lead fumes are given off.

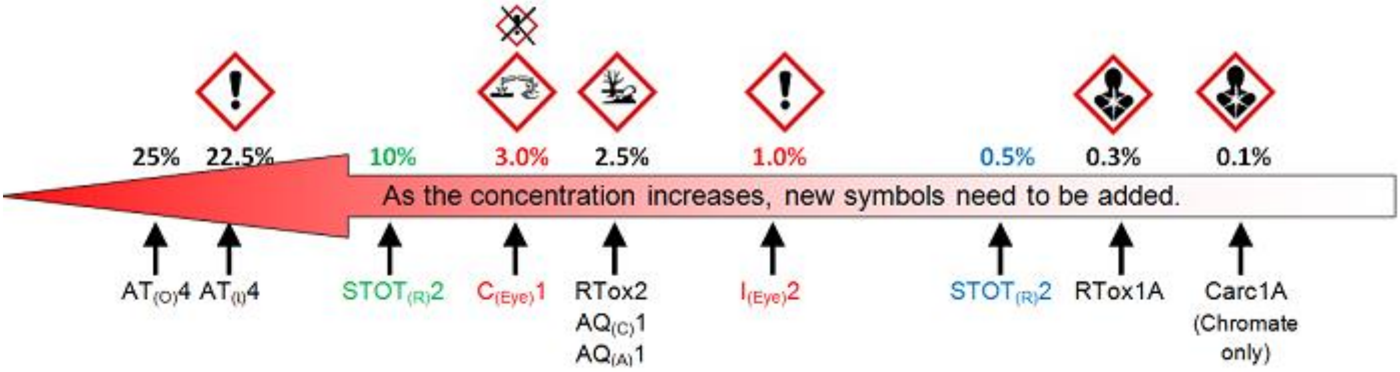
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| lead chromate | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Carcinogen cat 1B<br>Reproductive toxin cat 1A<br>Carcinogen Cat 1B<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302 Harmful if swallowed<br>H332 Harmful if inhaled<br>H350: May cause cancer<br>H360Df May damage the unborn child. Suspected of damaging fertility.<br>H373 May cause damage to organs through prolonged or repeated exposure.<br>H410 Very toxic to aquatic life with long lasting effects. |  |
| lead nitrate | Danger | Oxidising solid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Eye damage Cat 1<br>Reproductive toxin Cat 1A<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H272: May intensify fire; oxidiser.<br>H302: Harmful if swallowed.<br>H332: Harmful if inhaled.<br>H318: Causes serious eye damage.<br>H360: May damage fertility or the unborn child<br>H373: May cause damage to organs<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| lead ethanoate | Danger | Reproductive toxin Cat 1A<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H360: May damage fertility or the unborn child<br>H373: May cause damage to organs<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| lead metal & compounds applicable to lead metal: bromide, carbonate, chloride, citrate, diethyldithiocarbamate, fluoride, iodide, oxides (red & yellow), perchlorate solution, sulphide, sulphate & tartrate. | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Reproductive toxin Cat 1A<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302 Harmful if swallowed<br>H332 Harmful if inhaled<br>H360Df May damage the unborn child. Suspected of damaging fertility.<br>H373 May cause damage to organs through prolonged or repeated exposure.<br>H410 Very toxic to aquatic life with long lasting effects |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

Entries in **black** apply to all compounds. **Blue** applies only to sulphide, sulphate, chromate and oxide(II), **Red** applies to nitrate only, **Green** applies to all except those mentioned.



## Incompatibility

With hydrogen azide (hydrazoic acid), or hydrazine and nitrous acid (nitric(III) acid), may form explosive azides. The oxides act as oxidising agents and will give dangerously vigorous reactions with magnesium, aluminium (especially powder form), sodium, sulphur trioxide and dichloromethylsilane. The ethanoate is incompatible with a wide range of compounds including acids, citrates, tartrates, chlorides, carbonates, alkalis, phenol, sulphites, resorcinol, 2-hydroxybenzoic acid etc.

## Handling

Minimise contact with skin; wear gloves if likelihood of contact is high. Wear eye protection. Avoid raising dust.

## Storage

Keep securely in store. Keep the carbonate away from sources of heat and acids, the chloride away from oxidising agents, the ethanoate away from acids, alkalis etc. (see above), the oxides away from reducing agents and combustible material and the nitrate away from ignition sources and reducing agents.

## Disposal

Wear nitrile gloves and eye protection. Small amounts such as washings from test tubes can be run to waste. For large amounts, package, label and arrange for removal by an approved contractor. Larger amounts of solution can be treated with dilute sulphuric acid (CORROSIVE) to precipitate the lead as sulphate and the latter can be kept for disposal by contractor.

## Spillage

Avoiding raising dust, mix with sand and scoop into suitable container, seal and arrange for removal by an approved contractor. Rinse spillage area well with lots of water and wash to waste. Soak up solutions on mineral absorbent and treat as for Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route is unlikely; if dust created move patient from area of exposure. Rest and keep warm.

### Skin

Wipe as much off as possible with a damp cloth. Avoid raising dust. Flush the affected area for at least 10 minutes with water. Wash well with soap and water. Remove and wash contaminated clothing.

# Lithium compounds

Description: Generally white, crystalline solids. Lithium chloride is used in filling solutions with ethanol for reference electrodes. Lithium fluoride is used in welding fluxes & IR spectrometers.

## Hazards

The oxide, hydroxide and carbonate form strongly corrosive alkaline solutions in water and cause burns to the skin, mouth and eyes. The toxicity of lithium salts is dependent on the solubility – the lithium ion affects the central nervous system and very low level doses are used therapeutically in psychiatry. The ethanoate is toxic by inhalation and if swallowed. The carbonate, phosphate, fluoride and ethanedioate are relatively insoluble in water. Initial symptoms of exposure include nausea, slurred speech, hand tremors, thirst and sluggishness. Long term exposure may damage kidneys and cause seizures, memory impairment, oedema, shock, coma or death. See also hazard sheets on lithium hydrides. There is some slight evidence of teratogenesis in animal studies but nothing in epidemiological studies supports this effect in humans.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| lithium bromide, lithium chloride | Warning | Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2 | H302 Harmful if swallowed.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation. |  |
| lithium carbonate | Danger | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Reproductive toxin Cat 1B<br>Specific target organ toxin on single exposure Cat 3<br>Specific target organ toxin on repeated exposure Cat 1 | H302 Harmful if swallowed.<br>H315: Causes skin irritation<br>H318 Causes serious eye damage.<br>H360: May damage fertility or the unborn child.<br>H335: May cause respiratory irritation.<br>H372: Causes damage to organs on prolonged or repeated exposure |  |
| lithium sulphate, lithium sulphate-1-water | Warning | Acute toxin Cat 4 (oral) | H302 Harmful if swallowed. |  |
| lithium hydroxide, lithium fluoride | Danger | Acute toxin Cat 3 (oral)<br>Skin / Eye irritant Cat 2<br>Reproductive toxin Cat 1A<br>Specific target organ toxin on single exposure Cat 3 | H301 Toxic if swallowed.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335 May cause respiratory irritation.<br>H360: May damage fertility or the unborn child. |  |
| lithium hydroxide | Danger | Acute toxin Cat 4 (oral)<br>Skin corrosive Cat 1A<br>Reproductive toxin Cat 1A | H302: Harmful if swallowed.<br>H314: Causes severe skin burns and eye damage.<br>H360: May damage fertility or the unborn child. |  |

| | | | | |
|---|---|---|---|---|
| lithium nitrate | Warning | Oxidising solid Cat 3<br>Acute toxin Cat 4 (oral)<br>Eye irritant Cat 2 | H272 May intensify fire; oxidiser.<br>H302: Harmful if swallowed.<br>Eye irritant Cat 2 |  |

## Incompatibility

Depends on the anion present. The chromate(VI), chlorates(I)-(VII), nitrate and peroxide are incompatible with reducing agents. Carbonate is incompatible with fluorine. Chloride reacts violently with bromine trifluoride.

## Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3). Avoid raising dust.

## Storage

Keep the chromate, chlorate(I), chlorate(VII), nitrate and peroxide with oxidising agents.

## Disposal

Wear goggles (BS EN 166 3). Apart from fluoride, up to 20 g of a lithium salt can be dissolved in a large volume of water and run to waste.

## Spillage

Wear rubber or plastic gloves and goggles (BS EN 166 3). Treatment depends on the anion. For the hydroxide, oxide, carbonate or nitrate add carefully to a large volume of water in a bucket. Where necessary, neutralise with 2M sulphuric acid (CORROSIVE) and wash to waste with a large excess of water. For spillages of solutions soak up on mineral absorbent and treat as above.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists. In case of hydroxide irrigate continuously and take to hospital as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure unlikely as salts are deliquescent. Move patient from area of exposure. Rest and keep warm. Obtain medical attention if irritation persists.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Lithium hydrides

**Should only be used by experienced teachers or technicians.**

Description: Lithium hydride – white, translucent crystals. Darken rapidly in light. Lithium aluminium hydride – important reducing agent in organic & inorganic chemistry. Usually supplied as powder in sealed bags.

## Hazards

Highly flammable – The hydride, or aluminium hydride produce the extremely flammable gas hydrogen in contact with water or moist air and this can ignite spontaneously. They can also cause extreme damage to exposed skin or eyes because of the corrosive lithium hydroxide formed (see lithium compounds). Toxic and corrosive/irritating to eyes skin and respiratory tract. Damage the central nervous system. Large doses cause dizziness and loss of consciousness.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| lithium hydride | Danger | Water reactive Cat 1<br>Acute toxin Cat 3 (oral)<br>Skin corrosive Cat 1B | H260: In contact with water releases flammable gases which may ignite spontaneously.<br>H301: Toxic if swallowed.<br>H314: Causes severe skin burns and eye damage.<br>EUH014: Reacts violently with water. |  |
| lithium aluminium hydride | Danger | Water reactive Cat 1<br>Skin corrosive Cat 1B | H260 In contact with water releases flammable gases which may ignite spontaneously.<br>H314 Causes severe skin burns and eye damage. |  |

## Incompatibility

Explosive reaction of hydride, nitride or aluminium hydride with moisture – incompatible with oxidising agents or acids.

## Handling

Only in a fume cupboard behind the sash or safety screen as old containers may develop pressure in the absence of air. Also make sure there are dry conditions away from water and sources of ignition. Wear rubber gloves and eye protection.

**FF** – Use soda ash, sodium chloride or graphite. **DO NOT USE $CO_2$ or water extinguishers**.

## Storage

General store with reducing agents – in dry, airproof tin with silica gel. Store only in small quantities in an isolated, cool, dry area protected against physical damage. Both hydrides have a short shelf life.

**SSL** – 1 year maximum. Water reactive and over time reacts with moisture from the air to form highly flammable hydrogen. If the lid becomes cemented, the container can explode from the increase in pressure.

## Disposal

Wear rubber gloves and goggles(BS EN 166 3) and eliminate all sources of ignition.

**Lithium hydride** – Add the solid in small amounts at a time to propan-2-ol and leave 24 hours. Neutralise and wash to waste with a large amount of running water.

**Lithium aluminium hydride** – At the end of any reaction stir in suitable solvent under nitrogen using an ice-bath. Slowly add 11 $cm^3$ of ethyl ethanoate (HIGHLY FLAMMABLE) for each gramme of lithium aluminium hydride. When reaction is complete add an equal volume of water and separate the organic and aqueous layers. Discard the aqueous layer directly. Mix small portions of the ester layer with large volumes of water and run the solution to waste.

**Sodium tetrahydroborate** is a good substitute for LiH in the reductions of some carbonyl compounds. See 3 in Uses and Control Measures. Slowly add to water (100 cm3 for every 3 g) and for each 100 cm3 add 1 cm3 of 10% ethanoic acid with stirring under nitrogen.

## Spillage

Wear rubber gloves and face shield. It is essential to keep the spillage dry. Mix with dry sand, shovel into dry container, remove to open space and add a little at a time to large volume of water. Leave to stand for 24 hours then wash to waste with lots of running water.

## Remedial Measures

**If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.**

### Eyes

Irrigate with water continuously (see note above). Obtain medical attention as soon as possible. Continue irrigation in ambulance until the hospital is reached.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if respiratory system is irritated.

### Skin

Brush off loose particles. Wash well with soap and lots of cold water. Remove and wash contaminated clothing. Obtain medical attention if area affected is other than small or if irritation persists.

# Lithium metal

Description: Silvery coloured metal. Reacts with air and water. Sold stored under oil.

## Hazards

Very similar to potassium and sodium. Stored in liquid paraffin since it reacts with oxygen and water but less violently than sodium. Reacts with moisture on skin to give lithium hydroxide which is corrosive. Compounds are harmful by ingestion (see Lithium compounds), inhalation and skin contact. Highly flammable– Metal may explode when heated on porcelain.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| lithium metal | Danger | Water reactive Cat 1<br>Skin corrosive Cat 1B | H260 In contact with water releases flammable gases which may ignite spontaneously.<br>H314 Causes severe skin burns and eye damage. |  |

## Incompatibility

Carbon dioxide, water, mercury, nitric acid, oxidising agents, halogenated hydrocarbons. Molten lithium will attack glass, sand and concrete.

## Handling

Never touch the metal: use gloves, goggles (BS EN 166 3) and tongs. Do not expose dry metal to air for more than a few seconds. If heating metal in air, use spatula or deflagrating spoon rather than porcelain lid.

**FF** – Allow to burn out or cover with graphite or sodium chloride. **Do not use a CO2 extinguisher.**

## Storage

General store with reducing agents, immersed in liquid paraffin.

## Disposal

Wear goggles (BS EN 166 3)and plastic gloves. Dispose of small quantities (up to 1 g) by reacting small pieces with water, diluting, neutralising and then washing to waste.

## Spillage

Wear rubber or plastic gloves and face shield. Cover with dry sand, shovel into dry container and transport to safe open area. In a ventilated room with ignition sources absent add in small quantities to a large excess of water in a plastic bucket placed in a sink. Leave for 30 minutes and run to waste with excess running water.

## Remedial Measures

**If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.**

### Eyes

Irrigate with water continuously (see above). Remove contact lenses if present and continue rinsing. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure and make comfortable. Rest and keep warm. Obtain medical attention immediately.

### Skin

Brush off loose pieces from skin and drench with water. Remove and wash contaminated clothing. Obtain medical attention if irritation area affected is large.

# Magnesium compounds

Description: generally white powders or crystals. Magnesium sulphate-7-water is commonly known as Epdom salts.

## Hazards

In general these magnesium compounds are of low hazard. Many of them are moderate to severe eye and skin irritants. The nitrate is an oxidising agent and contact with combustible material may cause fire. Under CLP/GHS, most magnesium compounds are not classified as Harmful to the Aquatic Environment

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| magnesium carbonate (heavy/light),<br>magnesium oxide,<br>magnesium sulphate,<br>magnesium sulphate-7-water | | No significant hazard | | None |
| magnesium bromide-6-water, magnesium iodide | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H315: Causes skin irritation<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation |  |

## Incompatibility

Nitrate should be kept away from combustible materials.

## Handling

Avoid raising dust from compounds in the solid state.

## Storage

Securely in store. Keep nitrate with oxidising agents.

## Disposal

Wear goggles (BS EN 166 3) where appropriate. Unless stated otherwise, low hazard compounds can be placed with domestic waste or, if in solution, run to waste with copious quantities of water.

## Spillage

Form most, wear plastic gloves and eye protection as appropriate. Moisten with water, shovel into bucket and treat as for **Disposal**.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

## Magnesium metal

Description: Grey or silvery powder, ribbon, turnings or wire. Do not use powder if it is not needed. Burns with a brilliant white flame, which contains significant amounts of uv – do not look at it directly.

Do not use water or carbon dioxide based fire extinguishers on burning metal; USE DRY POWDER OR GRAPHITE

### Hazards

Metal is highly flammable. Burns from burning magnesium are very severe. Very dangerous especially in form of powder or flakes. Can be ignited by a spark. May ignite spontaneously in air when the powder is damp, particularly with water/oil emulsion. Inhalation of fumes of freshly sublimed magnesium oxide may cause metal fume fever. MgO has a WEL of 4mg.m$^{-3}$ of the inhalable dust. Particles of metallic magnesium or alloy entering the skin may produce a local lesion which is slow to heal. Do not look at magnesium burning as eye injury can result.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| magnesium – pyrophoric powder | Danger | Pyrophoric solid Cat 1<br>Water reactive Cat 1 | H250: Catches fire spontaneously if exposed to air.<br>H260: In contact with water releases flammable gases which may ignite spontaneously. |  |
| magnesium – ribbon/turnings | Danger | Water reactive Cat 2 | H228: Flammable solid.<br>H261: In contact with water releases flammable gases. |  |

### Incompatibility

Moisture, acids, alcohols (long induction period), oxidising agents, bromine, chlorine, sulphur, phosphorus, halogenated alkanes and Teflon. Explosive mixtures with nitrates, sulphate and several oxides including metal oxides and moist silicon dioxide. **Reactions are violent if heated and if metal is finely divided. A trace of water can equally initiate several of these reactions.**

### Handling

Wear eye protection and gloves  and keep well away from flames and other sources of heat. Use ribbon or turnings wherever possible. Open carefully and replace lid as soon as sample of metal powder is removed from bottle. Keep containers tightly closed. Wear leather gloves if possible.

**FF** – Dry sand, graphite or powder. Allow small fires to burn out.

### Storage

General store, with reducing agents and away from halogens, acids and all possible sources of ignition. Containers of fine powder may develop pressure due to the reaction with atmospheric moisture.

**SSL** – 3 years maximum for fine powder. Fine powder can react exothermically with moisture in the air to produce flammable hydrogen gas. Danger of pressure build up.Can ignite spontaneously with damp materials.

### Disposal

Wear eye protection and ensure ignition sources are absent. Add up to 10 g at a time to 0.5M hydrochloric acid in well-ventilated space in a large beaker and wash to waste with water.

### Spillage

Wear gloves and face shield. Carefully brush into suitable container and transport to open space for addition to acid.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes. Make sure all particles are removed. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice.

### Lungs

Move patient from area of exposure. Rest and keep warm. If exposure is severe obtain medical attention.

### Skin

Wash well with soap and water. Immerse in cold water. Remove and wash contaminated clothing. Obtain medical attention if exposure is severe.

# Machine-made mineral fibres

Formerly called man-made mineral fibres. These are a variety of ceramic fibrous materials used, amongst other things, as safer alternatives to asbestos.

They vary in their properties and hence in their uses and health hazards.

## Hazards

The health hazards are related to several factors i.e. the :-

- Diameter and length of fibres – The diameters of the wools are variable owing to the method of manufacture (spinning or centrifuging) and a small fraction of the fibres will have low diameters. On the other hand the filaments are “drawn” and control of fibre diameter is good. Low diameters of 1 µm and below are more likely to be carcinogens and also to have the aerodynamic properties to enable them both to create an aerosol and also to reach the alveoli (air sacs) in the lungs,
- Durability and lifetime of the fibre in the lungs – This depends on the chemical composition. The more recently produced CMS low alumina/ high alkali fibres are very soluble in lung fluid and disappear before they cause damage. Studies have shown these to be non-carcinogens. On the other hands the RCFs, which are high in alumina, are virtually insoluble in lung fluid and are carcinogens (Category 1B).
- Other well validated studies rank ceramic fibres as being a more potent carcinogen than white asbestos. The same studies place the wools much lower and the filaments almost at the bottom. Note that what is sold as wool by most laboratory suppliers is often filament manufactured by drawing rather than spinning. This ensures a consistency of diameter of the fibres; hence there is no risk of some of the fibres being the same diameter as those of some asbestos minerals.
- Superwool, one of the CMS fibres recently made available to schools, has not yet been assigned official risk and safety phrases. Filaments and wools are irritants to the skin and eyes and are experimental animal carcinogens of low potency. Refractory ceramic fibres are more potent animal carcinogens than the other fibres.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| mineral wool | Warning | Carcinogen Cat 2 | H351: Suspected of causing cancer |  |
| refractory ceramic fibres | Warning | Carcinogen Cat 1B | H350i: May cause cancer by inhalation |  |
| Superwool (Heat resistant paper) | | No significant hazard | | None |
| glass wool | | No significant hazard | | None |

## Handling

Wear gloves and eye protection. Avoid raising dust. Use CMS Superwool unless it is unsuitable for the application.

## Disposal

Wear gloves and eye protection. After use dampen before removal. For small amounts, e.g. from Arculus reactions, dampen before removal. This is especially true for ceramic fibres which have been heated. Seal in bag, moisten and place with ordinary refuse.

## Remedial Measures

### Eyes

Wash in slow running water. If irritation persists then seek medical attention.

### Mouth

Wash out mouth thoroughly with water. If much swallowed the seek medical attention.

### Lungs

If irritation continues then seek medical advice.

### Skin

Wash well. Wools and filaments cause irritation. If this continues then seek medical advice.

## Manganese compounds

Descriptions:

bromide – rose red slightly deliquescent crystals, soluble in water or alcohol

carbonate – near-white powder becoming brown, insoluble in water

ethanoate – pale red crystals, soluble in water or alcohol

nitrate – pink deliquescent crystals, soluble in water or alcohol

sulphate – slightly efflorescent pale red crystals, soluble in water & insoluble in alcohol

### Hazards

Harmful if ingested or inhaled in quantity. Irritates eyes, skin and respiratory system. Low acute toxicity, but chronic exposure can seriously damage the central nervous system, leading to headaches and loss of motor control. Harmful to aquatic organisms.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| manganese(II) bromide-4-water | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation) | H302 Harmful if swallowed.<br>H312 Harmful in contact with skin.<br>H332 Harmful if inhaled. |  |
| manganese(II) carbonate |  | No significant hazard |  | None |
| manganese(II) chloride-4-water | Warning | Acute toxin Cat 4 (oral) | H302 Harmful if swallowed. |  |
| manganese(II) ethanoate-4-water | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on repeated exposure Cat 2<br>H302 Harmful if swallowed. | H332 Harmful if inhaled.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335 May cause respiratory irritation. |  |
| manganese(II) nitrate-4-water | Warning | Oxidising solid Cat 2<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H272: May intensify fire; oxidiser.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation.<br>H411: Toxic to aquatic life with long-lasting effects. |    |
| manganese(II) sulphate-4-water | Warning | Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H373: May cause damage to organs through prolonged or repeated exposure .<br>H411: Toxic to aquatic life with long lasting effects. |   |

## Incompatibility

Anhydrous forms of halides can react violently with zinc foil and dust. The nitrate assists fire and can react violently if heated with metals, reducing agents, thiosulphates, organic compounds, especially if finely divided.

## Handling

Wear eye protection and possibly gloves when handling bulk. Avoid raising dust; this is easy as the salts, apart from the carbonate are crystalline and tend to be deliquescent or hygroscopic. Carry out reactions which may produce an aerosol, e.g. the action of dilute acid on manganese carbonate or electrolysis of manganese compounds if on other than a small scale.

## Storage

In general store away from reducing agents. The nitrate with oxidising agents. Keep tightly stoppered.

## Disposal

Washings of glassware can be run to waste. Otherwise store for disposal by licensed contractor.

## Spillage

Carefully sweep into dustpan. If quantity is small, wash to waste. Otherwise store for licensed contractor; store nitrate covered with water if it may have been contaminated by organic material.

## Remedial Measures

### Eyes

Flush eyes well for 15 minutes and obtain medical attention.

### Mouth

If swallowed obtain medical attention immediately.

### Lungs

Leave contaminated area. If a large quantity has been breathed in or wheezing persists obtain medical attention.

### Skin

Wash well for several minutes. If irritation persists, seek medical advice.

# Manganese IV oxide

Alternative name: (manganese dioxide) pyrolusite

Description: Dark brown or black powder / granules. Insoluble in water.  Commonly used as a component of batteries.

## Hazards

Harmful by ingestion or if inhaled as dust. Eyes and skin can be irritated.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| manganese(IV) oxide | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation) | H302: Harmful if swallowed.<br>H332: Harmful if inhaled. |  |

## Incompatibility

Reacts violently with metal powders, especially if finely divided, e.g. aluminium. It can react violently if dropped into concentrated hydrogen peroxide or if mixed with powerful oxidising agents, e.g. chlorates(V). May ignite in contact with hydrogen sulphide or potassium azide.

## Handling

Wear eye protection and rubber or pvc gloves. Do not rub or grind with either powerful oxidising agents or with finely divided metals and other reducing agents. Avoid raising dust.

## Storage

In general store away from both oxidising and reducing agents.

## Disposal

Wear eye protection and rubber or pvc gloves. Small quantities such as washings from glassware can be run to waste; for larger amounts, recycle (See Uses & Control Measures – 1) or store for disposal by licensed contractor.

## Spillage

Wear eye protection and rubber or pvc gloves. Carefully sweep up as much as possible and treat as in Disposal. Wash affected area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if irritation persists.

### Skin

Wipe off as much as possible with a damp cloth. Wash well with soap and water. Remove and wash contaminated clothing.

# Mercury compounds

Much less frequently encountered nowadays. In the past, organic mercury compounds were encountered as fungicides in seed dressings, swimming pools and many other places.

Description: Mercury(II) chloride – white granules, crystals or powder. Important reagent in analytical chemistry. Fairly soluble in water. Mercury(II) iodide is a key component of Nessler's reagent for testing for ammonia.

**Do not use mercury or its compounds unless there is no suitable alternative.**

## Hazards

Inorganic and organic mercury compounds are very toxic by inhalation, if swallowed and by contact with the skin. Mercury(II) compounds are generally more toxic than the mercury(I) compounds. As with elemental mercury there is a danger of cumulative and systemic effects – headaches, tinnitus, dermatitis, anorexia, fever etc. Avoid raising dust. Alkyl mercury compounds are highly toxic. Some organic mercury compounds are ten times less toxic than alkyls i.e. on a par with metallic mercury. These include aryl compounds (particularly the phenyls) and organomercurials used in therapeutics. All inorganic compounds and in particular the soluble salts are skin, eye and respiratory irritants (mercury(II) chloride is corrosive). Continuous or continual exposure to small concentrations of these chemicals is harmful. Compounds emit toxic mercury fumes when heated. Very toxic to the aquatic environment

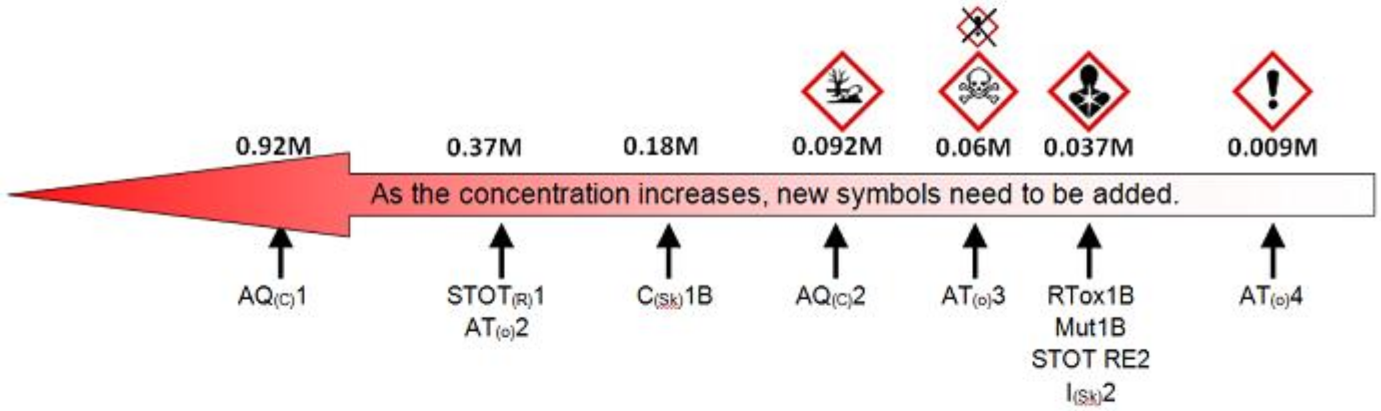
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| mercury(II) chloride | Danger | Acute toxin Cat 2 (oral)<br>Skin corrosive Cat 1B<br>Mutagen Cat 2<br>Reproductive toxin Cat 2<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H300 Fatal if swallowed.<br>H314 Causes severe skin burns and eye damage.<br>H341 Suspected of causing genetic defects.<br>H361f Suspected of damaging fertility.<br>H372 Causes damage to organs through prolonged or repeated exposure.<br>H410 Very toxic to aquatic life with long lasting effects. |  |
| mercury(II) oxide | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 1 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H300 Fatal if swallowed.<br>H310 Fatal in contact with skin.<br>H330 Fatal if inhaled.<br>H373 May cause damage to organs through prolonged or repeated exposure.<br>H410 Very toxic to aquatic life with long lasting effects. |  |
| other mercury compounds (inorganic) | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 1 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H300 Fatal if swallowed.<br>H310 Fatal in contact with skin.<br>H330 Fatal if inhaled.<br>H373 May cause damage to organs through prolonged or repeated exposure.<br>H410 Very toxic to aquatic life with long lasting effects. |  |

## Concentration effects

**For mercury II chloride only.**

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.*



## Incompatibility

Ethanol, hydrocarbons, ethyne (acetylene), ethanedioic acid (oxalic acid). Aluminium becomes extremely hot and powder may ignite. Mercury(II) chloride is incompatible with methanoates (formates), sulphites, sulphides, phosphates, alkalis, ammonia, lime water, albumin, gelatin, carbonates, bromides and salts of iron, copper, lead and silver. Mercury(II) nitrate is an oxidising agent and forms the fulminate (a percussion explosive) with ethanol.

## Handling

Wear plastic or rubber gloves and eye protection and work in a fume cupboard if the process is likely to produce mercury fumes.

## Storage

Securely in store.

## Disposal

Solids should be labelled and stored until disposed of by licensed contractor. Solutions containing mercury should not be washed down the sink. Soluble mercury salts or their waste solutions can be reduced to mercury metal with acidified sodium hypophosphite. Dissolve up to 20 g of the mercury salt in water, acidify and stir in 2/5ths of the weight of sodium hypophosphite. Decant off the solution and store the mercury formed for re-use or place with the ‘thermometer graveyard’. See 4. of the Uses and Control Measures for a similar reaction.

## Spillage

Wear plastic or nitrile rubber gloves and eye protection. Ventilate the room. Cover the compound with a large amount of sand and place carefully in a container for later disposal by licensed contractor.

## Remedial Measures

If swallowed, a large area of skin is involved, dust or vapour has been breathed in or if eyes are irritated take casualty to hospital as soon as possible.

### Eyes

Irrigate for water for at least 15 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

# Mercury metal

Alternative name: quicksilver

Description: Heavy, silvery, mobile metallic liquid. Used as solvent for other metals and in the making of amalgams. Commonly found in laboratory thermometers but these have been banned for sale since 2011. There is no requirement to dispose of existing stick but no replacements will be available – use spirit thermometers (or thermocouples) instead.

## Hazards

Toxic by inhalation with a danger of cumulative and systemic effects – headaches, tinnitus, dermatitis, anorexia, fever etc. Experimental carcinogen, teratogen and human mutagen with reproductive effects. Poisonous vapour and liquid. However mercury has a low volatility at room temperature and the concentrations of vapour will not come close to the WEL from an uncovered spillage as long as it is cleared up relatively quickly. Nevertheless clear up immediately as described in spillage below. Continuous or continual exposure to small concentrations of vapour are harmful. Frequent contact with the skin is harmful as a result of skin absorption.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| mercury | Danger | Acute toxin Cat 2 (inhalation)<br>Reproductive toxin 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H330: Fatal if inhaled.<br>H360D: May damage fertility or the unborn child<br>H372: Causes damage to organs<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Oxidising agents. Ethyne (acetylene), ammonia, hydrogen, ethanedioic acid (oxalic acid), bromine, 3-bromopropyne, alkynes + silver perchlorate, metals incl. lithium, aluminium, calcium, potassium, sodium, rubidium etc., methylsilane + oxygen. Corrodes metals by amalgamation. Can damage jewellery – wear rubber or plastic gloves. When heated to decomposition it emits toxic fumes.

## Handling

In a well ventilated area. Wear plastic or rubber gloves. Use a large plastic spillage tray containing water when handling mercury. Don't leave open containers of mercury in the lab for any length of time – keep tightly closed. Don't heat mercury unless in a well maintained fume cupboard. Avoid handling over wooden floors or in areas where spilt mercury may run into crevices.

If gold jewellery has been attacked and amalgamated, remove and, in a fume cupboard, heat with a gentle bunsen flame to volatilise the mercury. Low quality gold will become pitted.

## Storage

Securely in store. Set polythene containers of mercury in beaker as secondary spillage container.

## Disposal

Wear rubber or plastic gloves. Mercury liquid should be cleaned by approved contractors for re-use. Distillation should not be attempted. Small quantities may be cleaned either with Sellotape or dilute nitric acid (CORROSIVE). Broken thermometers should be placed in a sealed polythene bag to prevent the vapour escaping and then kept for disposal by licensed contractors.

## Spillage

Ventilate the area. Wear rubber or plastic gloves. Any spillage however small should be dealt with. The mercury can be sucked up by using a plastic syringe. Any remaining specks can be covered with flowers of sulphur/lime $Ca(OH)_2$ paste (Made up as a 1:1 mixture with hot water). For inaccessible drops in cracks in floor or bench etc, apply the sulphur/lime mix dry. Leave for a few hours and sweep into a container for disposal by licensed contractor. *(An alternative in the literature is to cover with zinc dust which forms an amalgam with the mercury. (Evidence suggests, however, that this reduces the level of mercury vapour to a lesser degree than the* *S/*$Ca(OH)_2$ *paste).***Do not use both zinc and the sulphur / lime mixture together).**

## Remedial Measures

### Eyes

Irrigate with water at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Little mercury is absorbed when swallowed and should present minimal risk. Obtain medical attention however.

### Lungs

Move patient from area of exposure. rest and keep warm. If exposed to high concentrations resulting from heated mercury fumes obtain medical attention immediately.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice.

## Metals, other

A series of metals of typically metallic appearance and properties, except got gallium which has such a low melting point it can liquify when held in the hand.

The page includes two compounds – ceric ammonium sulphate,  commonly used as a reagent in redox titrations. and titanium dioxide.

### Hazards

In general these metals are of fairly low hazard, though all of them can cause some degree of problems if fume or dust is inhaled in any quantity. when finely divided, some of them are quite flammable. The exception to this is selenium which is quite toxic and, in cases of large or long-term exposure, can cause damage to the central nervous system (and less commonly heart, lungs and liver). It is not uncommon for some individuals to suffer irritation on exposure to some of these metals, even if they are not classed as such.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| germanium, niobium, titanium, titanium dioxide | | No significant hazard | | None |
| cerium, rhenium, tantalum, tungsten | Danger | Flammable solid Cat 1<br>Self Heating Cat 2 (Ta and W only) | H228: Flammable solid<br>H251: Self-heating in large quantities: may catch fire |  |
| gallium | Danger | Skin corrosive Cat 1B | H314: causes severe skin burns and eye damage |  |
| selenium | Danger | Acute toxin by ingestion Cat 3<br>Acute toxin by inhalation Cat 3<br>Specific Target Organ Toxin on Repeated exposure Cat 2<br>Harmful to the aquatic environment with long-lasting effects cat 4 | H301: Toxic if swallowed<br>H331; Toxic if inhaled<br>H373: Causes damage to organs through prolonged or repeated exposure<br>H402: Harmful to aquatic life with long lasting effects |  |
| manganese | Danger | Flammable solid Cat 2<br>Specific Target Organ Toxin on single exposure Cat 3 | H228: Flammable solid<br>H335: May cause respiratory irritation |  |
| strontium | Danger | Water reactive Cat 1<br>Skin Irritant Cat 2<br>Reacts violently with water | H260: In contact with water releases flammable gases which may ignite spontaneously<br>H315: causes skin irritation<br>EUH014: reacts violently with water |  |
| Tin | Danger | Eye Irritant Cat 2<br>Specific Target Organ Toxin on single exposure Cat 3 | H319: Causes serious eye irritation<br>H335: May cause respiratory irritation |  |

|  |  |  |  |  |
|---|---|---|---|---|
| cerium ammonium sulphate-2-water | Warning | Skin Irritant Cat 2<br>Eye Irritant Cat 2<br>Specific Target Organ Toxin on single exposure Cat 3 | H315: Causes skin irritation<br>H319: Causes serious eye irritation<br>H335: May cause respiratory irritation |  |

## Incompatibility

These metals are not very reactive though, not surprisingly, they become more so if in the form of a fine powder – some of them becoming quite flammable or self-heating. Most reactions proceed quite slowly, especially at room temperature, but caution should be exercised if using concentrated acids/alkalis or strong oxidising agents.

## Handling

Most of these metals can be handled safely with no specific precautions. Gallium is corrosive so it is best handled with gloved and goggles (BS EN166 3).

## Storage

Securely in store.

## Disposal

Large amounts should be kept for uplift by a licensed contractor. Residues after reactions can be washed to waste with copious quantities of cold running water.

## Spillage

Spillages can be carefully swept up, avoiding raising dust as far as possible (wearing gloves and goggles (BS EN166 3) for gallium) and placed in the domestic waste. Larger amounts should be kept for disposal as above.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes. Seek medical attention for gallium. For the others, obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. If swallowed, don’t induce vomiting. Obtain medical attention if selenium is involved otherwise monitor and seek medical advice if feeling unwell.

### Lungs

Unless fume or dust is being produced, inhalation is very unlikely. In the event theough, move patient from area of exposure. Obtain medical attention for inhalation of selenium or if feeling unwell..

### Skin

wash area affected with soap and water. Obtain medical attention if irritation persists or large area is involved.

## Methanal

Alternative names: formaldehyde, formalin.

Description: Clear, very slightly acid gas or liquid. Not available in pure form because it tends to polymerise. Sold as solution containing 37-50% methanal by weight with varying amounts of methanol as a stabiliser to prevent polymerisation. 37% is 13.3M.

### Hazards

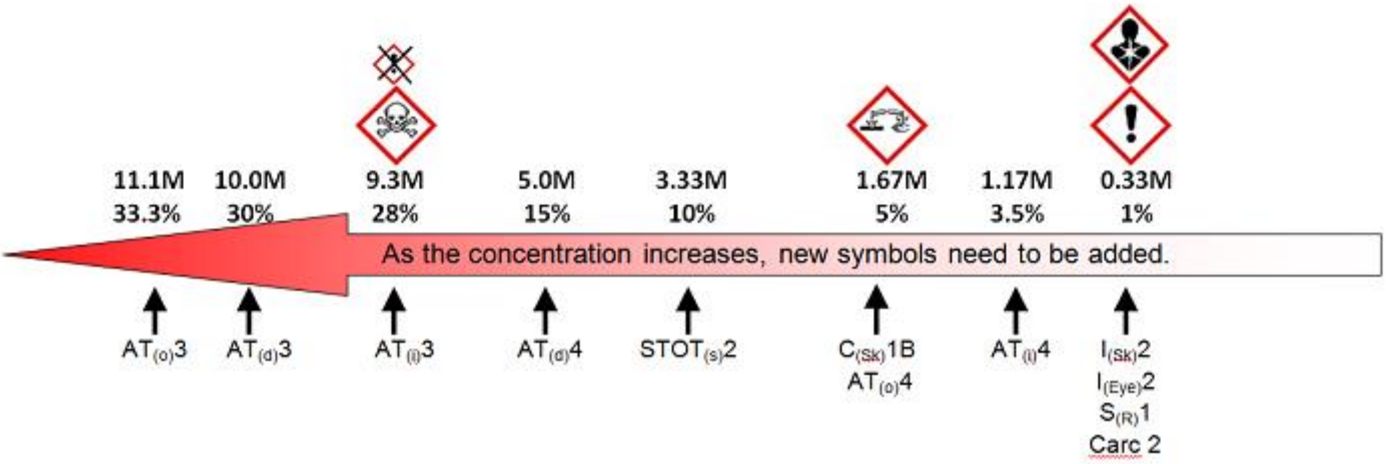
The vapour is toxic and very irritant to the eyes and lungs. The solution (Formalin) is a corrosive. It causes skin sensitisation and splashes in the eye can result in permanent damage. Solution is toxic if swallowed. Possible risk of irreversible effects. Vapour and concentrated solutions are flammable. Explosion hazard when aqueous solutions are heated above their flash points (explosive range 7 – 73%). Prolonged exposure can cause hypersensitivity, damage to lungs, and cracking of skin. Category 1B carcinogen and a suspect teratogen.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| methanal | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Skin corrosive Cat 1B<br>Skin sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 1B | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H317: May cause an allergic skin reaction.<br>H341: Suspected of causing genetic defects.<br>H351: May cause cancer |  |

### Concentration effects

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.*



### Incompatibility

The solution is a powerful reducing agent. Incompatible with strong oxidising agents – See **Uses and Control Measures** for alternatives.

**FF** – DP, VL & WS.

### Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3) when handling concentrated solution and keep well away from flames and hot surfaces. Handle very small quantities in well-ventilated area but large quantities in fume cupboard. Take care to exclude hydrogen chloride vapour from areas where biological specimens preserved in Formalin are stored or examined. Possible sources of hydrogen chloride in a biology laboratory are its use as a component of several chromatographic solvents, as a solvent for some stains, e.g. phloroglucinol (benzene-1,3,5-triol) and in mammalian gut. See **Uses and Control Measures** for alternatives.

FF- DP, VL & WS.

## Storage

Flammables store ideally at temperature between 21 and 25°C. The HSE advise that it is not stored near hydrochloric acid or those chlorides which can be hydrolysed by moist air, eg aluminium trichloride, tetrachlorides of tin and silicon, several acid chlorides such as ethanoyl chloride, hexanedioyldichloride (adipoyl chloride), benzenecarbonyl chloride(benzoyl chloride)

## Disposal

Turn off all sources of ignition. Wear eye protection and rubber gloves. Wash small quantities to waste with plenty of running water. Otherwise store for specialist contractor.

## Spillage

Turn off all sources of ignition. Wear rubber or plastic gloves, face shield and open windows. Soak up on mineral absorbent. Wash absorbent well and place in ordinary refuse. Ventilate the contaminated area thoroughly.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention immediately.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. If large area is affected obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. If allergic asthma is brought on pupils can use their inhalers/nebulisers e.g. *Ventolin* if prescribed. Obtain medical attention as soon as possible.

# Methane

Alternative names: natural gas, fire-damp, marsh gas

Description: Colourless, odourless gas which is the main constituent of the domestic gas supply in UK. Virtually insoluble in water. Soluble in alcohol and ethoxyethane.

## Hazards

Extremely flammable gas – very dangerous fire and explosion hazard (expl range 5 – 15%) when exposed to heat and sources of ignition. Although methane is non-toxic it is a simple asphyxiant and can produce narcotic effects in high concentrations. Domestic gas has an odour added.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| methane | Danger | Flammable gas Cat 1 | H220: Extremely flammable gas. |  |

## Incompatibility

Reacts violently with powerful oxidising agents – halogens, bromine (especially in UV and sunlight), pentafluoride, chlorine trifluoride, iodine heptafluoride, liquid oxygen etc.

## Handling

Keep away from sources of ignition. Take precautionary measures against static discharges.

**FF** – Turn off the gas supply and all sources of ignition. Ventilate the area. Do not extinguish unless leak can be stopped safely.

## Disposal

Turn off all sources of ignition. Ventilate the area.

## Spillage

If there is a leak from gas taps, or if taps are accidentally left on, turn off the gas supply and any other sources of ignition. Do not turn light switches either on or off. Open windows to ventilate the area and allow the gas to disperse.

## Remedial Measures

If breathing is affected take casualty to hospital as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm.

# Methanoic acid

Alternative name: formic acid

Description: Colourless, fuming liquid with pungent smell, miscible with water, ether, alcohol & glycerol. Sold as 70-98% acid.

## Hazards

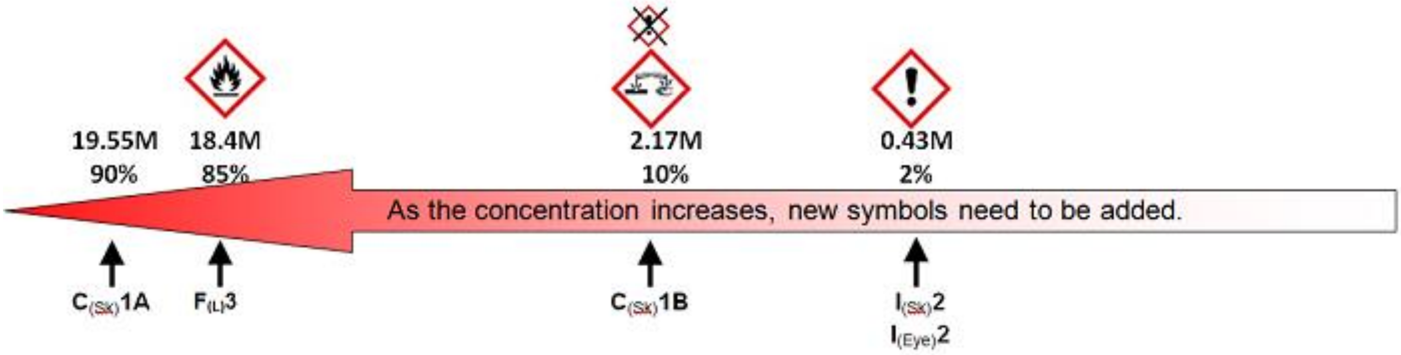
Corrosive liquid and vapour causing severe burns to eyes, skin and respiratory system. Inhalation can lead to difficulty in breathing and swallowing. Very irritant poison if swallowed. Flammable– may form explosive mixtures with the air.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Methanoic acid | Danger | Skin corrosive Cat 1A | H314: Causes severe skin burns and eye damage |  |

Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Can react vigorously with oxidising and dehydrating materials. Explosive reaction with hydrogen peroxide and metaboric acid. Explosive reaction with sodium chlorate(I) at 55°C.

## Handling

Wear gloves (neoprene or pvc) and goggles (BS EN 166 3). Work with small quantities in a well-ventilated area but it is preferable to use a fume cupboard.

**FF** – DP, VL & WS.

## Storage

In a cool, well ventilated position away from sources of heat, sulphuric acid and other oxidising materials. Bottles can burst due to freezing, heat expansion or to decomposition resulting in the evolution of carbon monoxide.

## Disposal

Wear goggles (BS EN 166 3) and pvc gloves. Ensure good ventilation and absence of sources of ignition. Cover with sodium hydrogencarbonate or dry soda ash. Mix thoroughly. add water and neutralise with 4M ammonium hydroxide (CORROSIVE) until neutral. Wash to waste with plenty of running water.

## Spillage

Evacuate area, wear pvc gloves and face shield. Neutralise with soda ash spread liberally over the spillage. Test with pH paper. Dilute with water and wash to waste with plenty of running water. Do not pour directly down drains as explosive concentrations may result.

## Remedial Measures

If swallowed, the skin is burned, breathing is affected or if eyes are irritated then take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if large area is affected or if irritation persists.

# Methanol

Alternative name: methyl alcohol

Description: Colourless, volatile liquid with characteristic smell. Miscible with water.

## Hazards

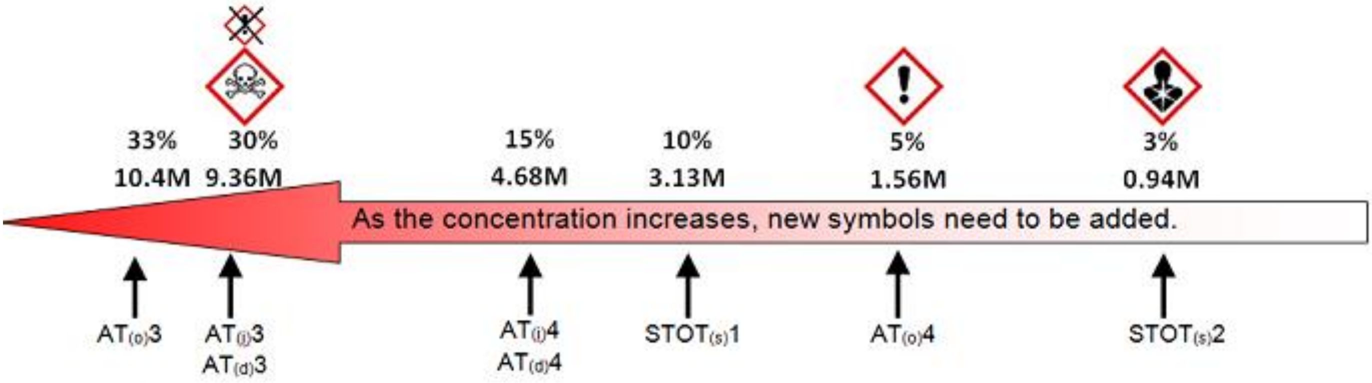
Toxic by ingestion, inhalation and skin absorption, the effects sometimes appearing several hours later. Liquid and vapour are damaging to the lungs, skin and other organs. High concentrations may damage the central nervous system and impair vision. The liquid and vapour are particularly dangerous to the eyes as methanol has a specific effect on the optic nerve and retina. Prolonged exposure to low concentrations can cause serious illness as it is a cumulative poison. Although not classified as such, there is some evidence from animal studies that methanol is an experimental teratogen and mutagen and can cause damage to the developing embryo. Highly flammable (explosive limits 6 – 37% in air) keep away from flames and all sources of ignition. Pressure can build up in bottles.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Methanol | Danger | Flammable liquid Cat 1<br>Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Specific target organ toxin on single exposure Cat 1 | H225: Highly flammable liquid and vapour.<br>H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H370: Causes damage to Optic Nerve & CNS |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents, e.g. bromine, hydrogen peroxide, chlorates(I) (hypochlorites). Explosive reaction with trichloromethane + heat, sodium or sodium hydroxide. Also incompatible with phosphorus(V) chloride, alkali metals, aluminium. Can ignite in contact with potassium tert-butoxide.

## Handling

In very well-ventilated area normally but in fume cupboard for large quantities or prolonged working with the compound. Use rubber or plastic gloves and eye protection. Beware repeated exposure

**FF** – VL & WS.

## Storage

Flammables store.

## Disposal

Wear eye protection and rubber gloves. Dilute up to 100 cm3 with 5 litres of water and wash to waste with running water. Do not pour directly down drain as explosive concentrations may build up.

## Spillage

Evacuate the room. Turn off all sources of ignition. Wearing eye protection and rubber or plastic gloves cover with mineral absorbent. Wash the absorbent and dispose of it in the ordinary refuse. Mop up spillage area with plenty of water and wash to waste with running water. Ventilate area thoroughly.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical advice.

### Skin

Turn off all sources of ignition. Soak with water to reduce fire risk. Wash well with soap and large amounts of water. Remove and wash contaminated clothing. If area affected is large or if feeling unwell, obtain medical attention.

# Methoxides and ethoxides

Alternative names: potassium/sodium ethanolate/methanolate.

Description: White /yellowish hygroscopic powders. Dissolve in water with reaction and in absolute alcohol without reaction.

## Hazards

Corrosive solids, cause burns and affects skin and eyes and respiratory tract if dry and dusty. Highly flammable. May ignite in moist air, giving off fumes of sodium oxide (CORROSIVE).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium ethoxide, potassium methoxide, sodium ethoxide sodium methoxide | Danger | Self heating solid Cat 1<br>Skin corrosive Cat 1B | H251 : Self-heating: may catch fire.<br>H314 : Causes severe skin burns and eye damage<br>EUH014 : Reacts violently with water. |  |

## Incompatibility

React exothermically and violently with aqueous solutions to produce corrosive, alkaline products. React vigorously with acids.

## Handling

Wear pvc gloves and goggles (BS EN 166 3). This chemical will rarely be bought and stored, but may be prepared in the laboratory.

**FF –** Small fires are best smothered with dry sand. Alternatively use dry powder or carbon dioxide.

## Storage

Best not stored, but used or disposed of after preparation.

## Disposal

Wear pvc gloves and face shield. Add in small portions to a large quantity of water. When reaction is complete wash to waste diluting greatly with water.

## Spillage

Wear pvc gloves and face shield. Turn off sources of ignition. Cover with dry sand and shovel carefully into a dry bucket. Remove to a safe area and add, a little at a time, to a large quantity of water. When the reaction is complete, wash solution to waste with water.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water continuously (see note above). It is important to flush under eyelids also. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing. Obtain medical attention if area affected is large.

# Methyl ethanoate

Alternative name: methyl acetate

Colourless, volatile liquid with pleasant smell. Soluble in water and miscible with alcohol and ethers.

## Hazards

Highly flammable – forms explosive mixtures with air at room temperature. Range 3.1 – 16%. Harmful to eyes, lungs, skin, and if swallowed. Irritates the eyes and respiratory tract and can have a narcotic effect, causing drowsiness. Higher concentrations of the vapour can produce dizziness and laboured breathing. Prolonged inhalation may cause liver and kidney damage.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| methyl ethanoate | Danger | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H336: May cause drowsiness or dizziness. |  |

## Incompatibility

Oxidising agents, acids, bases, nitrates and lithium aluminium hydride.

## Handling

In well-ventilated area away from flames and other sources of ignition. Wear nitrile gloves and eye protection.

**FF** – F, DP, CO2, WS.

## Storage

Flammables store.

## Disposal

Wear eye protection and nitrile gloves and ensure ignition sources are absent. Dilute 100 cm3of methyl ethanoate with 10 litres of water and wash to waste with lots of running water. Do not put directly down the drains as explosive mixtures can result.

Spillage

Turn off all sources of ignition. Wear nitrile gloves and face shield. Soak up on mineral absorbent. Wash absorbent well in running water and place in ordinary refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

### Skin

Soak with water to reduce flammability and turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Methyl-2-methylpropenoate

Alternative name: methyl methacrylate

Description: Colourless liquid with lachrymatory odour. The monomer polymerises to make Perspex. Usually sold with 0.01% quinol or hydroquinone as stabiliser. Immiscible in water.

## Hazards

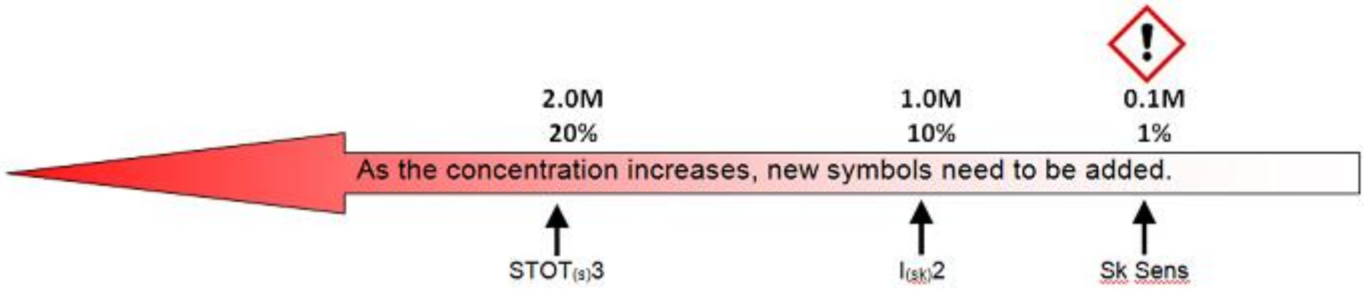
Highly flammable – dangerous fire hazard when exposed to heat or flame, forms explosive mixtures with air (2.1 – 12.5%). Take precautionary measures against static discharges. Liquid and vapour irritate the eyes, skin and respiratory system. Lachrymatory. May cause sensitisation by inhalation and by skin contact. Mildly toxic if swallowed and may cause liver and kidney damage. A suspected carcinogen, experimental teratogen/mutagen with reproductive and systemic/narcotic effects by inhalation.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| methyl 2-methylpropenoate | Danger | Flammable liquid Cat 2<br>Skin irritant Cat 2<br>Skin sensitiser Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation.<br>H317: May cause allergic skin reaction.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents. If unstabilised can polymerise explosively in air or oxygen, especially if exposed to light, heat or peroxides. When heated to decomposition produces acrid smoke and irritating fumes.

## Handling

Wear nitrile gloves and goggles (BS EN166 3). Avoid breathing vapour. Handle in a fume cupboard well away from any sources of ignition. Only use the small quantities of initiator recommended; otherwise polymerisation can be violent or even result in the ignition of the monomers.

**FF** – F, DP, CO2, WS.

## Storage

Flammables store in cool, well-ventilated situation away from the light. Purchase only with inhibitor. **Do NOT** store any excess of the monomers after the stabiliser has been removed ( See **Uses** tab**)**

**SSL** – Maximum of 2 to 3 years if stored unopened in a cool place – less if frequently opened (1 year or less).

## Disposal

Wear eye protection and nitrile gloves and remove all sources of ignition. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified with detergent and washed to waste with a large excess of water.

**Larger amounts –** spread in a thin layer on a tray and mix in some of the catalyst. Once it has polymerised place with ordinary refuse.

## Spillage

Wear nitrile gloves and face shield. Ventilate the area and ensure all sources of ignition are absent. If the spillage is small add water and detergent. Mop to emulsion and wash to waste with lots of running water. Alternatively soak up on sand and move to safe outdoor area for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

### Skin

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Methylamine

Alternative name - aminomethane

Description: (aminomethane) Colourless gas or solutions with powerful ammoniacal odour. Usually supplied as solutions in water from 25 to 45%.

## Hazards

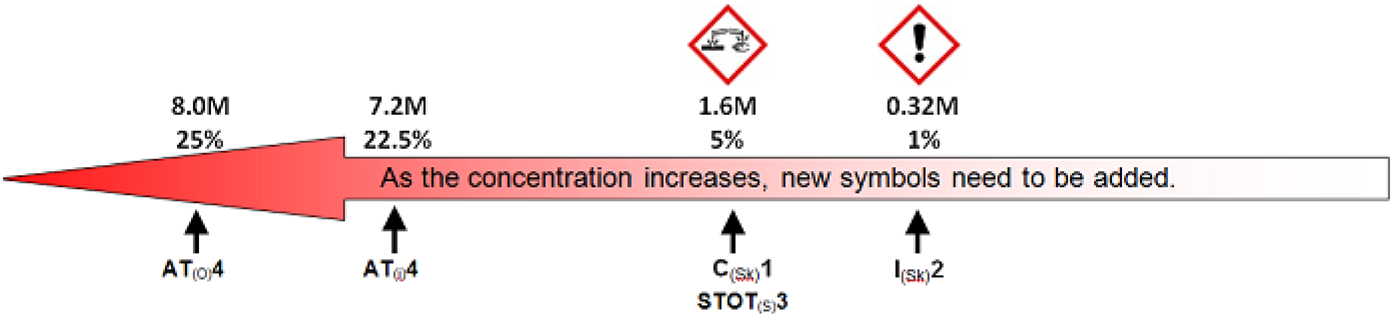
Methylamine is extremely flammable, forming explosive mixtures in air – keep away from sources of ignition. Unless greatly diluted, aqueous solutions are still flammable. The unpleasant fishy smell is a deterrent to inhaling the harmful gas which irritates the respiratory system. The aqueous solutions are less flammable (have higher flashpoints) but are corrosive and dangerous to the eyes. Possible mutagen.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| methylamine | Danger | Flammable gas Cat 1<br>Acute toxin Cat 4 (inhalation)<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H220: Extremely flammable gas.<br>H332: Harmful if inhaled.<br>H315: Causes skin irritation<br>H318: Causes serious eye damage.<br>H335: May cause respiratory irritation (and of stomach, intestines) by inhalation |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Reacts with oxidising agents.

## Handling

Handle solution in fume cupboard if amounts other than small. Take care, especially during warm weather, when opening bottle because of the pressure build-up of the gas above the solution. Wear nitrile gloves and goggles (BS EN 166 3). Remove all sources of ignition.

**FF** – F, DP, CO2, WS.

## Storage

Flammables store. No unsafe aspect of storage apart from the pressure build up. Solution gradually becomes more dilute with time. Replace when reactions fail to give expected observations.

## Disposal

Wear goggles (BS EN 166 3) and nitrile gloves. Very small quantities, up to 20 cm3, can be well diluted and then neutralised with hydrochloric acid (IRRITANT) in fume cupboard. This diluted, neutralised solution can then be washed to waste with water. Do not dispose of directly into drains because of explosion risk.

## Spillage

Evacuate the room. Wear nitrile gloves and face shield and open windows. Ensure sources of ignition are absent. If the gas only is involved, ventilate room thoroughly. If in solution, neutralise with dilute hydrochloric acid (IRRITANT), mop up with water and wash to waste with running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

### Skin

Soak with water to reduce fire risk. Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Methylbenzene

Description: Colourless liquid with petrol-like smell. Insoluble in water. Miscible in alcohols, ethers & propanone. Alternative name: toluene.

## Hazards

Highly flammable, can form explosive mixtures in air. – keep away from sources of ignition. Harmful vapour causing dizziness, headache and nausea. Vapour and liquid irritate eyes and respiratory system. Harmful by skin absorption. Chronic effects include anaemia and dermatitis.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| methylbenzene | Danger | Flammable liquid Cat 2<br>Skin irritant Cat 2<br>Aspiration toxin Cat 1<br>Reproductive toxin Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Specific target organ toxin on repeated exposure Cat 2 | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation.<br>H304: May be fatal if swallowed and enters airways.<br>H361: Suspected of damaging the unborn child<br>H336: May cause drowsiness or dizziness.<br>H373: May cause damage to CNS |  |

## Incompatibility

Reacts vigorously with strong oxidising agents – bromine trifluoride, dinitrogen tetroxide etc. Explosive range 1.3 – 7.0%. Explosive reaction can occur if the nitration of methylbenzene with nitric and sulphuric acids is not properly controlled.

## Handling

Wear nitrile gloves and eye protection. Do not inhale and handle generally in fume cupboard. Keep away from sources of ignition such as flames and hot plates.

**FF** – F, DP, CO2, VL.

## Storage

Flammables store.

## Disposal

Wear nitrile gloves and eye protection. Turn off all sources of ignition. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. A few cm3can be evaporated on paper towels in the fume cupboard. Store larger amounts to await disposal by licensed contractor.

## Spillage

Wear nitrile gloves and face shield. Turn off all sources of ignition. Add water and detergent, emulsify and wash to waste with running water. Alternatively sand or mineral absorbent can be added to absorb the liquid and the mixture spread out in an open area for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected or if feeling unwell.

**Skin**

Turn off sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing if necessary. Obtain medical attention if a large area of skin is involved.

# 3-methylbutan-1-ol

Alternative name: iso-amyl alcohol

Description: Colourless liquid. Fairly soluble in water.

## Hazards

Harmful if swallowed, causing headache, vomiting etc. Vapour is irritant to eyes, lungs and skin. Flammable – keep away from flames and other sources of ignition. More toxic than ethanol, but only slowly absorbed. Extended exposure can be dangerous.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 3-methylbutan-1-ol | Warning | Flammable liquid Cat 3<br>Acute toxin Cat 4 (inhalation)<br>Specific target organ toxin on single exposure Cat 3 | H226: Flammable liquid and vapour.<br>H332: Harmful if inhaled.<br>H335: May cause respiratory irritation.<br>EUH066 Repeated exposure may cause skin dryness or cracking. |  |

## Concentration effects

Warning symbol (exclamation mark) is applicable to all solutions over 20%

## Incompatibility

Can react vigorously with oxidising agents.

## Handling

Wear rubber or plastic gloves and eye protection. Use in well-ventilated area and well away from open flames, hot plates, etc.

**FF** – DP, VL, WS.

## Storage

Flammables store.

## Disposal

Wear eye protection. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Dissolve up to 20 cm3 in 5 litres of water and wash to waste.

## Spillage

Turn off all sources of ignition. Wearing gloves and face shield, apply water and detergent, brush to form emulsion and wash to waste with water. Alternatively soak up on mineral absorbent and wash off the alkanol with copious amounts of water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if a large area is affected.

## Methylphenols

Alternative name: cresol mixed isomers

Description: Colourless to brown liquid with phenol-like smell

### Hazards

Toxic by ingestion, by skin absorption or by inhalation. Corrosive and irritating to skin (leading to dermatitis) and mucous membranes. Causes severe burns Can damage the liver, kidneys and nervous system. All three isomers are suspect carcinogens. Flammable – the vapour is slightly explosive when exposed to heat or flame. Produces very toxic fumes when heated to decomposition.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| methylphenols | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Skin corrosive Cat 1B | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H314: Causes severe skin burns and eye damage |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

### Incompatibility

Oxidising agents. Violent reactions with oleum, nitric acid or chlorosulphonic acid.

### Handling

Wear nitrile gloves and eye protection.

**FF** – F, DP, $CO_2$ or VL.

### Storage

Securely in store.

### Disposal

Wear nitrile gloves and eye protection. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified with detergent and washed to waste with a large excess of water. Otherwise store for disposal by licensed contractor.

## Spillage

Ventilate the area and turn off all sources of ignition. Wear nitrile gloves and eye protection. For volumes up to $5cm^3$ absorb on to paper towel and evaporate in a fume cupboard. For larger spills spread on mineral absorbent and scoop into plastic buckets. Remove to open area and spread out for evaporation. Wash area of spillage thoroughly with detergent and water.

## Remedial Measures

If swallowed, a large area of skin is involved, breathing is affected or if eyes are irritated take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Gently rub glycerol or PEG (polyethylene glycol) on affected area. Remove and wash contaminated clothing.

# 2-methylpropanes (halogenated)

Alternative names: t-butyl bromide & chloride . Description: Colourless, volatile liquids with distinctive smells. Immiscible in water

## Hazards

Highly flammable liquids which form explosive mixtures with the air. Keep away from sources of ignition. 2-bromo-2-methylpropane is more harmful than the chloro- if swallowed. Both irritate the eyes, skin and respiratory system. The vapours are narcotic in high concentrations.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 2-bromo-2-methylpropane | Danger | Flammable liquid Cat 2 | H225: Highly flammable liquid and vapour. |  |
| 2-chloro-2-methylpropane | Danger | Flammable liquid Cat 2 | H225: Highly flammable liquid and vapour. |  |

## Incompatibility

Oxidising agents.

## Handling

Wear nitrile gloves and eye protection. Keep away from sources of ignition.
**FF** – F, DP, $CO_2$ or VL.

## Storage

Flammables store.

## Disposal

Wear eye protection and nitrile gloves. Eliminate all sources of ignition. Washings from glassware etc. can be emulsified and washed to waste. In a fume cupboard add up to 50 cm3 slowly in small portions to water. Tertiary halogenoalkanes are hydrolysed reasonably rapidly by water. Allow 24 hours with occasional stirring for the reaction to go to completion. Run to waste with copious amounts of running water.

## Spillage

Eliminate all sources of ignition and ventilate the area. Wear eye protection and nitrile gloves. Absorb small spillages on to paper towel or mineral absorbent. Move to a safe open area and allow to evaporate. Wash the spillage area with detergent and water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Remove patient from exposure to fresh air. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## Methylpropanols

Alternative names: iso-butyl alcohol & tert-butyl alcohol.

In colder weather, the -2-ol isomer is frequently in solid form.

### Hazards

Both are harmful by inhalation, in contact with the skin and if swallowed. The -1-ol isomer is more damaging to skin and eyes. The -2-ol has evidence of reproductive effects and mutagenic data. The -2-ol is the more highly flammable of the two. Keep both away from sources of ignition. ( Expl. ranges 1.7 – 10% & 2.4 -8%)

High concentrations of vapour cause drowsiness.

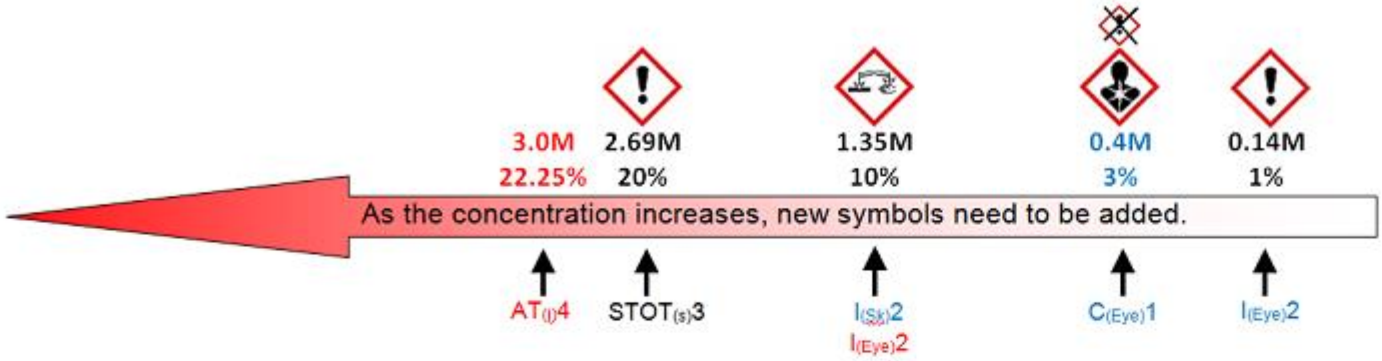
### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 2-methylpropan-1-ol (iso-butanol) | Danger | Flammable liquid Cat 3<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H226: Flammable liquid and vapour.<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage<br>H335: May cause respiratory irritation.<br>H336: May cause drowsiness or dizziness. |  |
| 2-methylpropan-2-ol (t-butanol) | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (inhalation)<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H226: Flammable liquid and vapour.<br>H332: Harmful if inhaled.<br>H319: Causes serious eye irritation<br>H335: May cause respiratory irritation. (oral, dermal or inhaled) |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

**Blue** = -1-ol, **Red** = -2-ol, **Black** = both



### Incompatibility

Oxidising agents. The -2-ol reacts with aluminium at 100°C to give hydrogen gas (EXTREMELY FLAMMABLE); it also ignites on contact with chromium trioxide. The -1-ol ignites on contact with potassium/sodium alloys.

## Handling

Wear rubber or plastic gloves and eye protection. In fume cupboard preferably, otherwise on small scale in well-ventilated room away from all sources of ignition.

**FF** – F, DP, CO2, WS.

## Storage

Flammables store.

## Disposal

Do not pour directly down drains as explosive vapour/air mixtures can form. Unavoidable small discharges, e.g. washings from glassware, should be emulsified and washed to waste. Up to 50 cm3 can be diluted in 5 litres of water and run to waste.

## Spillage

Remove all sources of ignition and ventilate room. Wear rubber or plastic gloves and faceshield. Emulsify with detergent and water and run to waste. Alternatively absorb on sand or mineral absorbent and lift into bucket. Either transfer to open air for evaporation or wash the absorbent free of the alkanol.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes then obtain medical attention. The -1-ol isomer is more damaging to the eyes and should receive immediate medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice/attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if feeling unwell.

### Skin

Soak in water and extinguish all sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if the area affected is large or if irritation persists.

# Millon’s Reagent

Millon’s Reagent contains mercury(II) nitrate & nitric acid. Its use is not recommended. **Only use if there is no suitable alternative.**

Description: Used as a test for proteins (tyrosine) and phenols. Coagulated proteins form a dark red to pink precipitate when heated. Alternative and safer tests include the Xanthoproteic, Biuret, Cole’s modification and Sakaguchi – see Uses tab for formulations.

## Hazards

This formulation which comprises the very toxic mercury(II) nitrate(17%) and the corrosive nitric acid(34% w/v). This combined with the fact that it is frequently boiled with the substance being tested makes its use extremely hazardous. It is a very toxic and corrosive irritant by inhalation, in contact with the skin and if swallowed. There is also a danger of cumulative effects. See also the hazard sheets on mercury compounds and nitric acid. Proteins containing tyrosine give a positive test with Millon’s reagent.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Millon’s Reagent | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 1 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Skin corrosive 1A<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H300 Fatal if swallowed.<br>H310 Fatal in contact with skin.<br>H330 Fatal if inhaled.<br>H314 Causes severe skin burns and eye damage.<br>H373 May cause damage to organs through prolonged or repeated exposure<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Reacts violently with many organic compounds, combustible materials, most metals and powerful reducing agents. Ethyne (acetylene), ethanedioic acid (oxalic acid), ethanol, hydrocarbons, sulphur, propanone (acetone).

## Handling

Wear high grade pvc gloves and goggles (BS EN 166 3).

## Storage

Keep securely in store.

## Disposal

Solutions and solids should be labelled and stored until disposed of by licensed contractor. Solutions containing mercury should not be washed down the sink. Keep residues and any contaminated lab absorbent for subsequent disposal by contractor.

## Spillage

Wear high grade pvc gloves, full protective clothing and goggles (BS EN 166 3). Cover the compound with a large amount of sand or mineral absorbent and place carefully in a container for later disposal by licensed contractor.

## Remedial Measures

If swallowed, skin is blistered, breathing is affected or eyes splashed take casualty to hospital IMMEDIATELY.

### Eyes

Irrigate with water for at least 10 minutes.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting.

**Lungs**

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

# Molybdenum and compounds

Description: Only the molybdates are commonly encountered. They are white to yellowish crystalline solids that are used particularly for the analysis of phosphates in aqueous solutions

## Hazards

Molybdenum compounds generally exhibit a low order of toxicity. The trioxide and molybdates are more toxic than the metal. Long term exposure, especially at high levels can cause gout, anaemia and pneumoconiosis and there is evidence that molybdenum compounds can cause cancer in animals though this has not yet been shown in humans.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium molybdate-7-water*, sodium molybdate-2-water | | No significant hazard | | None |
| ammonium molybdate, sodium molybdate | Warning | Acute toxin (oral) Cat 4 ($NH_4$) only)<br>Acute toxin (inhalation) Cat 4 (Na only)<br>Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H302 Harmful if swallowed. (NH4) only)<br>H332 Harmful if inhaled (Na only)<br>H315 Causes skin irritation<br>H319 Causes serious eye irritation<br>H335 May cause respiratory irritation |  |
| Molybdenum trioxide | Warning | Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3<br>Carcinogen Cat 2 | H319 Causes serious eye irritation<br>H335 May cause respiratory irritation<br>H351 Suspected of causing cancer |  |
| Molybdenum metal | Danger | Flammable solid Cat 1<br>Reproductive toxin Cat 2 | H228 Flammable solid<br>H361 Suspected of damaging fertility of the unborn child |  |

* This is the most common form of ammonium molybdate.

## Incompatibility

Keep metal and compounds away from strong oxidising agents. Trioxide and molybdates should be kept away from strong acids. Molybdenum metal is also incompatible with fluorine and interhalogens containing fluorine and also lead oxides.

## Handling

Wear eye protection and gloves as required. Avoid raising dust.

## Storage

In general store.

## Disposal

Small amounts can be diluted with water to less than 0.05M and washed to waste with copious quantities of water. Larger amounts should be kept for disposal by licensed contractors.

## Spillage

Wear eye protection and gloves. Sweep up solids carefully and treat as for disposal above.

## Remedial Measures

### Eyes

Remove contact lenses if worn. Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Seek medical advice if feeling unwell. If unconscious obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical advice if feeling unwell.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Naphthalene-1-ol and -2-ol

Alternative names: 1-naphthol & 2-naphthol

Description: White to off-white crystalline powders, phenol-like smell, darken on exposure to light. Slightly soluble in water. Soluble in alcohols and ethers and in strongly alkaline solutions.

FOR ALL USES OF PHENOLS AS SOLIDS OR OF THEIR SOLUTIONS MORE CONCENTRATED THAN 1% HAVE PEG or PROPANE-1,2,3-TRIOL HANDY FOR TREATING ANY SPILLAGES ON SKIN.

## Hazards

Naphthalen-2-ol is harmful by inhalation or by ingestion and is slightly less toxic than naphthalen-1-ol. The latter is harmful through contact with the skin and if swallowed. Absorption of either through skin may cause irritation of the kidneys and contact with the eyes causes injury to cornea and lens. Prolonged skin contact can cause burns. When heated to decomposition naphthalen-1-ol emits acrid and irritating fumes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| naphthalen-1-ol | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H302 Harmful if swallowed.<br>H312 Harmful in contact with skin.<br>H315 Causes skin irritation.<br>H318 Causes serious eye damage.<br>H335 May cause respiratory irritation. |  |
| naphthalen-2-ol | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Hazardous to the aquatic environment Cat 1 | H302 Harmful if swallowed.<br>H332 Harmful if inhaled.<br>H400 Very toxic to aquatic life. |  |

## Incompatibility

Strong oxidising agents.

## Handling

Use rubber or plastic gloves and eye protection. Handle in well-ventilated area.

**FF** – DP, CO2, VL.

## Storage

General store.

## Disposal

Keep for disposal by licensed contractor.

## Spillage

Wear eye protection and rubber gloves. Moisten and store for disposal by licensed contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. If swallowed, don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Rub with propane-1,2,3-triol (glycerol) or polyethylene glycol (PEG) and obtain medical attention as soon as possible.

# Naphthalene

Description: White crystals or crystalline marbles, with a characteristic smell. Insoluble in water. Soluble in alcohols, ether and methylbenzenes.

## Hazards

Harmful and readily absorbed by inhalation, ingestion and by skin contact. Category 2 carcinogen. Suspect mutagen and teratogen. Irritates the eyes and skin. Flammable – fire hazard moderate when heated or on contact with flames (explosive range 0.9 – 6%). When heated to decomposition it emits acrid smoke and irritating fumes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| naphthalene | Warning | Acute toxin Cat 4 (oral)<br>Carcinogen Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H351: Suspected of causing cancer by inhalation<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Strong oxidising agents – explosive reaction with dinitrogen pentoxide, and violent reaction with chromium(VI) oxide; benzoyl chloride + aluminium chloride.

## Handling

Avoid contact with skin; wear eye protection and rubber or plastic gloves.

**FF** – S, DP, VL, WS.

## Storage

General store or laboratory.

## Disposal

Small quantities such as washings from glassware can be washed to waste. Solidified melt from cooling curve measurements should be retained for re-use. Larger quantities should be stored to await uplift by waste disposal contractor.

## Spillage

Wear eye protection and rubber gloves. Wet with water or smother with sand and place in polythene bag to await uplift by waste disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large.

# Nessler's Reagent

Alternative name: mercuric potassium iodide.

Description: Yellow tinted caustic solution with slight sediment. Used in the detection of ammonia and ammonium compounds.

**Do not use if avoidable. There are other valid methods for testing for ammonia.**

## Hazards

Hazardous components are the mercury(II) iodide (very toxic), and the 4-5M sodium hydroxide (corrosive causing burns to skin and eyes). Very toxic by inhalation, in contact with the skin and if swallowed. There is a danger of cumulative effects. Extremely dangerous to eyes as damage can occur long after the initial pain has subsided.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Nessler's reagent | Danger | Acute Toxin Cat 2 (oral)<br>Acute Toxin Cat 1 (dermal)<br>Acute Toxin Cat 2 (inhalation)<br>Skin Corrosive Cat 1A<br>Specific Target Organ Toxin (on repeated exposure) Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H300: Fatal if swallowed<br>H310: Fatal in contact with skin<br>H330: Fatal if inhaled<br>H314: Causes severe skin burns and eye damage.<br>H373: May cause damage to organs through prolonged or repeated exposure.<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Ethyne (acetylene). ethanedioic acid (oxalic acid), ethanol and hydrocarbons. Very toxic fumes are evolved if heated to decomposition.

## Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3).

## Storage

Securely in store.

## Disposal

Arrange for disposal by a licensed contractor.

## Spillage

Wear goggles (BS EN 166 3) and rubber gloves. Small amounts may be neutralised with dilute sulphuric acid and washed to waste with a large volume of water. If amounts more than small cover and mix with sand or mineral absorbent. Collect into a container and arrange for removal by a licensed contractor.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached & thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water continuously (see note above). It is important to flush under eyelids also. Obtain medical attention as soon as possible.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing. Obtain medical attention.

# Nickel metal and compounds

## Hazards

Nickel metal and its compounds are poisonous (toxic) and carcinogenic mainly by the inhalation route as dust. Many cause sensitisation and/or dermatitis by inhalation or by skin contact. Dust containing elemental nickel or as the tetracarbonyl, carbonate or sulphate may cause irreversible effects. The halides, carbonate, sulphate and nitrate irritate the eyes, skin and respiratory system.

The oxide, nitrate, carbonate, sulphate and sulphides are Cat 1A carcinogens by the inhalation route. Nickel carbonyl is carcinogenic and highly irritating to the respiratory system and can cause asphyxia due to the formation of carbon monoxide in the lungs. It may cause harm to the unborn child. It is also highly flammable and poses a dangerous fire hazard when exposed to sources of ignition or oxidising agents. The nitrate is a powerful oxidising agent. Finely divided metal is highly flammable.

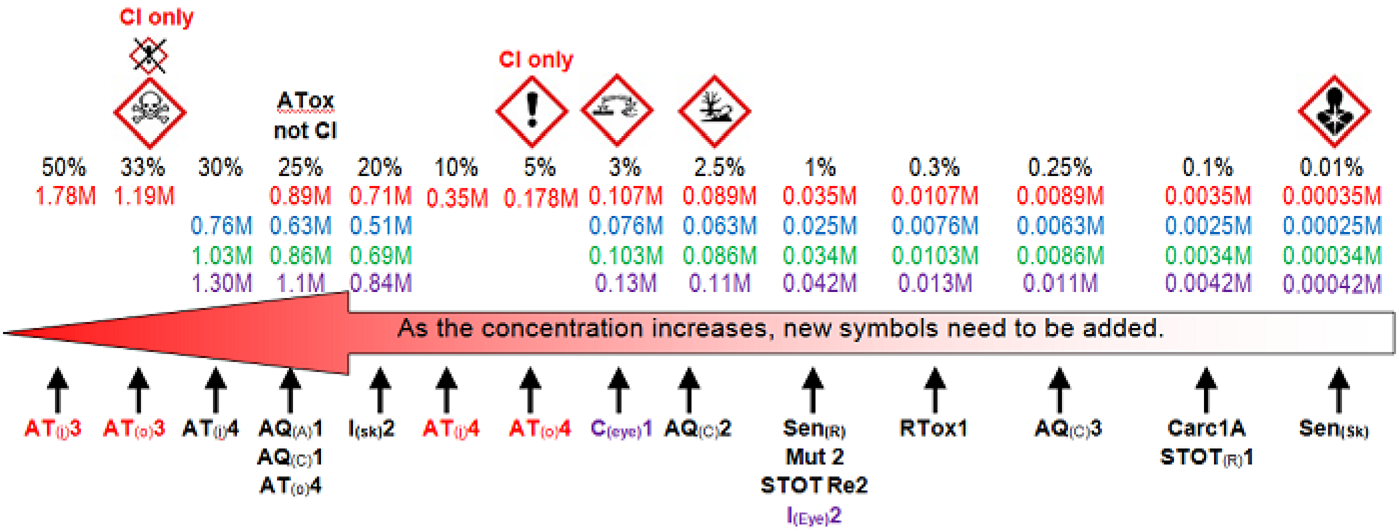
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| nickel(II) nitrate, nickel(II nitrate-6-water | Danger | Oxidising solid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Skin sensitiser cat 1<br>Respiratory sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 1A<br>Reproductive toxin Cat 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H272 : May intensify fire; oxidiser.<br>H302 : Harmful if swallowed.<br>H332: Harmful if inhaled<br>H315 : Causes skin irritation.<br>H318:causes serious eye damage<br>H317 : May cause an allergic skin reaction.<br>H334: Respiratory sensitiser<br>H341: Suspected of causing genetic defects.<br>H350i : May cause cancer by inhalation.<br>H360D: May damage the unborn child<br>H400 : Very toxic to aquatic life.<br>H410 : Very toxic to aquatic life with long lasting effects. |  |
| nickel(II) carbonate, nickel(II)sulphate-7-water, nickel ammonium sulphate-6-water | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin irritant Cat 2<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 1A<br>Reproductive toxin Cat 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302 : Harmful if swallowed.<br>H332: Harmful if inhaled<br>H315 : Causes skin irritation.<br>H317 : May cause an allergic skin reaction.<br>H334: Respiratory sensitiser<br>H341: Suspected of causing genetic defects.<br>H350i : May cause cancer by inhalation.<br>H360D: May damage the unborn child<br>H400 : Very toxic to aquatic life.<br>H410 : Very toxic to aquatic life with long lasting effects. |  |

|  |  |  |  |  |
|---|---|---|---|---|
| nickel(II) bromide | Danger | Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 1A<br>Reproductive toxin Cat 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H317 : May cause an allergic skin reaction.<br>H334: Respiratory sensitiser<br>H341: Suspected of causing genetic defects.<br>H350i : May cause cancer by inhalation.<br>H360D: May damage the unborn child<br>H400 : Very toxic to aquatic life.<br>H410 : Very toxic to aquatic life with long lasting effects. |  |
| nickel(II) chloride, nickel(II) chloride-6-water | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (inhalation)<br>Skin irritant Cat 2<br>Skin sensitiser cat 1<br>Respiratory sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 1A<br>Reproductive toxin Cat 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302 : Toxic if swallowed.<br>H332: Toxic if inhaled<br>H315 : Causes skin irritation.<br>H317 : May cause an allergic skin reaction.<br>H334: Respiratory sensitiser<br>H341: Suspected of causing genetic defects.<br>H350i : May cause cancer by inhalation.<br>H360D: May damage the unborn child<br>H400 : Very toxic to aquatic life.<br>H410 : Very toxic to aquatic life with long lasting effects. |  |
| nickel(II) oxide | Danger | Skin sensitiser cat 1<br>Carcinogen Cat 1A<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H317 : May cause an allergic skin reaction.<br>H350i : May cause cancer by inhalation.<br>H400 : Very toxic to aquatic life.<br>H410 : Very toxic to aquatic life with long lasting effects. |  |
| nickel(II) tetracarbonyl | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 2 (inhalation)<br>Carcinogen Cat 2<br>Reproductive toxin Cat 1B<br>Hazardous to the aquatic environment with long-lasting effects cat 1 | H225: Highly flammable liquid and vapour.<br>H330: Fatal if inhaled.<br>H351: Suspected of causing cancer.<br>H360: May damage fertility or the unborn child.<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Concentration effects

Find the concentration of your substance. The classifications (and labels) to the RIGHT are the ones that apply. **Black** applies to all salts, **Red** to nickel chloride only, **blue** to nickel sulphate only, **green** to nickel ammonium sulphate only and **purple** to nickel nitrate only



## Incompatibility

Nickel metal powder may spontaneously ignite in air and reacts violently with fluorine, hydrazine, ammonia, ammonium nitrate and other oxidising agents. The monoxide reacts violently with fluorine, hydrogen peroxide, hydrogen sulphide, iodine and barium oxide + air. The carbonyl explodes when heated above 60°C and also with liquid bromine, mercury + oxygen, dinitrogen tetroxide, air, oxygen and other oxidising materials.

## Handling

Avoid raising dust and contact of solids or solution with the skin. Wear rubber or plastic gloves and eye protection. The use of the oxide or some of the salts as painting pigments or glazes for ceramics is not recommended. Avoid the possible accidental reaction of nickel with carbon monoxide.

## Storage

General store. Keep the nitrate away from reducing agents. The carbonyl should neither be kept nor prepared in schools. Nickel catalyst should be kept with the ‘fat’ produced for the last hydrogenation – away from oxidising agents.

## Disposal

Some washings from test tubes may be washed to waste.

**Larger amounts** – package, label and arrange for removal by an approved contractor.

## Spillage

Wear gloves and eye protection and avoid raising dust. For spillage of small quantities of soluble solid nickel salts dissolve in water and wash to waste with large quantities of water. If insoluble mix with sand and store for licensed disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

If dust is inhaled Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention.

# Ninhydrin

Alternative name: 2,2-dihydroxy-1,3-indandione

Description: Pale yellow crystals, soluble in water, which turn red at 125°C. Used as locating agent to detect proteins and peptides in chromatography. Commercial spray preparations use butan-1-ol as solvent.

## Hazards

Despite persistent rumours, **there is no evidence that ninhydrin is a carcinogen**. Ninhydrin itself is harmful if swallowed or in contact with the skin. It irritates the eyes, skin and respiratory system. When heated to decomposition it gives off acrid fumes and smoke. This compound is generally used (5% in the solvent butan-1-ol) as aerosol spray. Avoid the accidental spraying of face, hands etc. as it will stain the skin. In use the spray from aerosol atomiser may form a very flammable vapour-air mixture. Keep away from any sources of ignition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ninhydrin | Warning | Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2<br>Single target organ toxin on single exposure Cat 3 | H302 : Harmful if swallowed.<br>H315 : Causes skin irritation.<br>H319 : Causes serious eye irritation.<br>H335 : May cause respiratory irritation. |  |
| ninhydrin in butan-1-ol | Danger | Flammable liquid Cat 3<br>Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2<br>Single target organ toxin on single exposure Cat 3 | H226: Flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage.<br>H335: May cause respiratory irritation.<br>H336: May cause drowsiness or dizziness. |  |

## Incompatibility

Oxidising agents.

## Handling

Use only in a fume cupboard and never spray chromatograms in the open laboratory. Wear rubber or plastic gloves and eye protection when using spray or handling the chemical in making up the solution. If oven-drying chromatograms then ensure adequate ventilation next to the oven.

## Storage

General store. Many canisters are propelled by butane. If they corrode the EXTREMELY FLAMMABLE butane leaks out. As this gas is heavier than air, store in a well ventilated area with flammables. Check for corrosion and do not leave in a fume cupboard.

## Disposal

**Solid** – Up to 1 g can be dissolved in 5 litres of water and washed to waste. Otherwise store to await uplift by disposal contractor.

**Aerosol** – By slow release in a fume cupboard or in the open directed into sand. Wear rubber or plastic gloves and eye protection.

## Spillage

Wearing eye protection and rubber or plastic gloves, mop up with detergent and water and wash to waste with large quantities of water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large.

# Nitrates III

Alternative name: nitrites. (The sodium and potassium salts are the only ones likely to be encountered).

Description; White/yellow crystals or powder. Slowly oxidise to nitrate(V) in air. Deliquescent & very soluble in water.

## Hazards

Strong oxidising agents. Mixtures with combustible material can readily ignite even by friction, thereby causing fire. Toxic if swallowed – serious systemic effects can occur and as little as 1 g can prove fatal. Inhalation of dust is dangerous. Can irritate the eyes and skin, causing burns. Experimental carcinogens and teratogens with reproductive effects. Human mutagen. Suspected carcinogens as organic amines in the body can react to form nitrosamines.

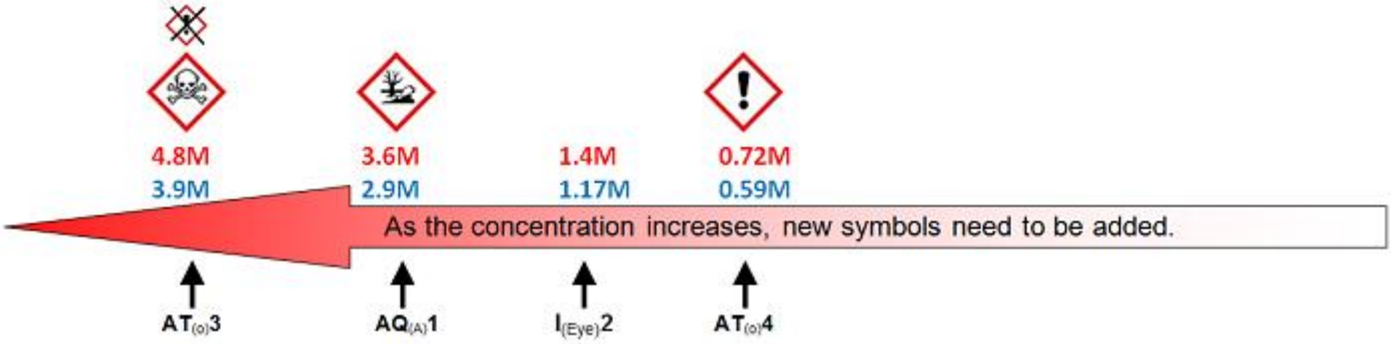
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium nitrate(III),<br>potassium nitrate(III) | Warning | Oxidising solid Cat 3<br>Acute toxin Cat 3 (oral)<br>Hazardous to the aquatic environment Cat 1 | H272: May intensify fire; oxidiser.<br>H301: Toxic if swallowed.<br>H319: Causes serious eye irritation<br>H400: Very toxic to aquatic life. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

Sodium (**red**) and Potassium (**blue**)



## Incompatibility

Vigorous reactions with oxidising and reducing agents. With acids, toxic nitrogen oxides are evolved. Can assist combustion of organic materials e.g. wood, clothes etc., especially if saturated and then allowed to dry out. Do not react with secondary and tertiary amines as carcinogenic nitrosamines formed. Explosive if heated above 530°C and also with cyanides, hexacyanometallates (eg hexacyanoferrates), phenols, phthalic anhydride, phthalic acid, ammonium salts, nitrogen bases, thiosulphates and other reducing agents and urea.

## Handling

Wear rubber gloves and eye protection. Avoid raising dust. Handle preferably in a fume cupboard.

## Storage

Securely in a cool, dry store. Avoid acids, moisture or combustible materials.

## Disposal

Very small amounts such as washings from glassware can be washed to waste with a large excess of running water. Wear rubber gloves and eye protection. In a fume cupboard dissolve up to 20 g of the nitrite and 20 g of sulphamic acid (amidosulphonic acid) (IRRITANT) in a litre of water and acidify with approximately 200 cm3 of 1M sulphuric acid (IRRITANT). Nitrogen is rapidly evolved and the remaining solution can be neutralised and washed to waste. Alternatively dissolve 20 g in a litre of water and add 15 g of ammonium chloride. Bring to the boil and hold it there for several minutes. The nitrite is decomposed to nitrogen.

## Spillage

Remove any combustible materials. Wear rubber gloves and eye protection. Scoop into bucket of water and wash to waste with lots of running water. If quantity large treat with sulphamic acid as in **Disposal**. Wash spillage site well especially if it is an absorbent surface such as wood or nitrite solution has splashed on to clothes.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention immediately.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area involved is large.

# Nitrates V

## Hazards

All are strong oxidising agents. Fire hazard is moderate by spontaneous chemical action. Can irritate the eyes and skin, causing burns. Decompose readily when exposed to heat, flame or shock (especially ammonium nitrate which can explode). Silver nitrate can cause severe burns to eyes and skin. Small repeated doses of nitrates lead to headaches, depression and mental impairment. Large amounts taken by mouth may have serious or even fatal effects. Toxicity is also dependent on the cation.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium nitrate | Danger | Oxidising solid Cat 3<br>Eye irritant Cat 2 | H272: May intensify fire; oxidiser<br>H319: Causes serious eye irritation. |  |
| barium nitrate | Danger | Oxidising solid Cat 3<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation) | H272 May intensify fire; oxidiser.<br>H302 Harmful if swallowed.<br>H332 Harmful if inhaled. |  |
| calcium nitrate-4-water | Danger | Oxidising solid Cat 3<br>Acute toxin Cat 4 (oral)<br>Eye irritant Cat 2 | H272: May intensify fire; oxidiser.<br>H302 Harmful if swallowed.<br>H319: Causes serious eye irritation. |  |
| magnesium nitrate-6-water | Danger | Oxidising solid Cat 3<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H272: May intensify fire; oxidiser.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H335; May cause respiratory irritation. |  |
| lead nitrate | Danger | Oxidising solid Cat 2<br>Acute Toxin Cat 4 (oral)<br>Acute Toxin Cat 4 (inhalation)<br>Eye Damage Cat 1<br>Reproductive Toxin Cat 1A<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H272: May intensify fire; oxidiser.<br>H302 Harmful if swallowed.<br>H332 Harmful if inhaled.<br>H318: Causes serious eye damage.<br>H360: May damage fertility or the unborn child<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| potassium nitrate | Danger | Oxidising solid Cat 3<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H272: May intensify fire; oxidiser.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |

| | | | | |
|---|---|---|---|---|
| sodium nitrate | Danger | Oxidising solid Cat 3<br>Eye irritant Cat 2 | H272: May intensify fire; oxidiser.<br>H319: Causes serious eye irritation. |  |
| silver nitrate | Danger | Oxidising solid Cat 2<br>Skin corrosive Cat 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H272: May intensify fire; oxidiser.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Reducing agents. Explosive reactions with metal powders and dusts e.g. aluminium and with non metals, eg sulphur carbon, phosphorus – also with cyanides, ammonium salts, sulphides, ethanoates, thiosulphates, phenol and urea. With strong acids, toxic nitrogen oxides are evolved. Can assist or initiate combustion of organic materials e.g. wood, clothes etc., especially if saturated then allowed to dry out. Do not mix with ethanol. Carcinogenic nitrosamines may be formed in reaction with secondary and tertiary amines.

## Handling

Wear rubber gloves and goggles (BS EN 166 3). Avoid raising dust or causing friction by grinding these chemicals. Handle preferably in a fume cupboard.

## Storage

With oxidising agents.

## Disposal

Remove any sources of ignition or combustible materials. Wear rubber gloves and goggles (BS EN 166 3).

**Solid** – Excepting silver, lead and barium, up to 20 g at a time can be dissolved in 10 litres of water and run to waste with copious amounts of running water.
**Solutions** – Washings from glassware can be washed to waste with a large excess of running water. Soak up on mineral absorbent. Rinse the absorbent and place with solid waste.

## Spillage

Wear goggles (BS EN 166 3) and rubber gloves.

**Small quantities of solid** – carefully scoop up and treat as in *Disposal*.
**Larger quantities** – Scoop into bucket of water and wash to waste with lots of running water. Wash spillage site well especially if it is an absorbent surface such as wood or if solution has splashed on to clothes or paper.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing well.

# Nitric acid

Description: Colourless or pale yellow, fuming liquid. Miscible with water. Concentrated nitric acid is usually a 68% azeotrope.

## Hazards

The liquid and vapour are highly corrosive and toxic causing severe burns to eyes, digestive & respiratory systems and in contact with the skin. Inhalation of vapour or mist can lead to acute poisoning with delayed onset pulmonary oedema. A strong oxidising agent which can cause the ignition of many substances. Dilute acid irritates the eyes and skin.

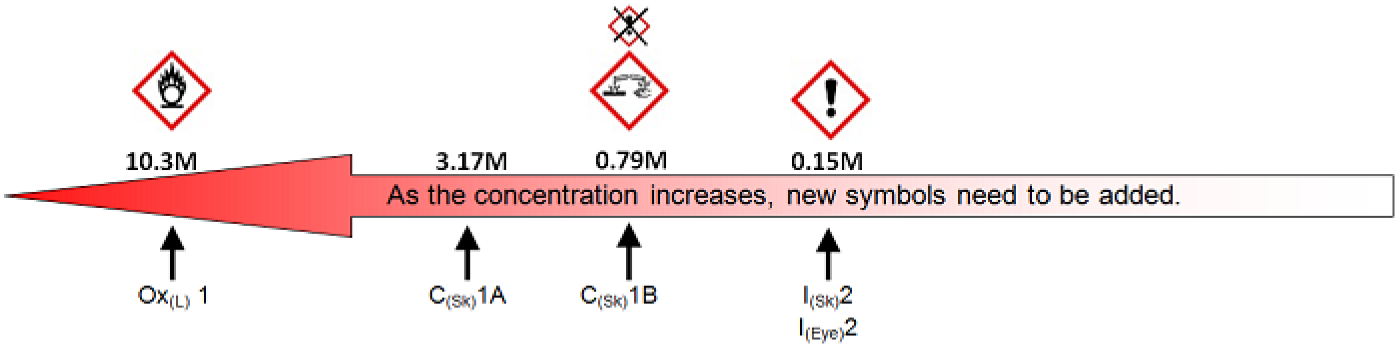
**Fuming nitric(V) acid (100%) should only be made in situ (if at all) and not stored in schools.**

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| nitric acid | Danger | Oxidising liquid Cat 3<br>Skin corrosive Cat 1A | H272: May intensify fire; oxidiser.<br>H290: May be corrosive to metals.<br>H314: Causes severe skin burns and eye damage. |  |

Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Dangerous if mixed with ethanoic acid, ethanoic anhydride, methanoic acid, alcohols, propanone, ammonia, fluorine, metallic powders, alkali metals, carbides, several aromatic and aliphatic amines, hydrocarbons, carbon, phosphorus, sulphur, sodium thiosulphate, thiocyanates, iron(II) oxide, chromic(VI) acid, nitrobenzene, hydrogen sulphide, sulphur dioxide, turpentine, hexacyanoferrates, oxidisable organic materials such as paper, wood, cotton wool (goes to gun cotton), magnesium silicide (do not try to clean stains off crucibles in which magnesium had been burned), some halogenated hydrocarbons, (e.g. 1,1-dichloroethane and dichloromethane) and readily nitrated materials, eg aromatic hydrocarbons and phenols.

The use of Nital (mixtures of ethanol and conc nitric acid for etching metals or cleaning glassware is not recommended. If made by persons experienced in its use, (i) prepare as needed and dispose of immediately afterwards, (ii) keep the concentration of nitric acid below 2% (v/v).

## Handling

Use neoprene or LDPE gloves (pvc at a push and with care) and goggles (BS EN 166 3). Dilute by careful addition of acid to water. The dilute acid should also be handled with great care.

## Storage

With acids in general store, but not close to hydrobromic and hydriodic acids or to organic substances. Dispose of when the acid shows significant signs of decomposition i.e. when it has turned brown. A pale yellow colour can be ignored.

## Disposal

Wear goggles (BS EN 166 3) and pvc gloves. Add up to 1 litre very slowly to 10 litres of water, neutralise with sodium hydrogencarbonate or 50 : 50 mixture of soda ash – calcium hydroxide. Leave until heat dissipates and wash to waste with running water. Store larger quantities to await uplift by disposal contractor.

## Spillage

Wear pvc gloves and face shield and if spillage is large, rubber boots. Cover with sodium carbonate (or hydrogen carbonate) and lift into bucket. Considerable heat will be generated. Run the neutralised acid to waste. Mop the area of spillage thoroughly with water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. If concentrated nitric acid is left on the skin, burns and severe damage will result. Obtain medical attention if area of skin affected is large.

## Nitrobenzene

Description: Yellow crystals or pale yellow liquid with almond odour. Soluble in ethanol and ethers. Immiscible with water.

### Hazards

Toxic by inhalation, in contact with the skin and if swallowed. Vapour causes a burning sensation in the chest, difficulty in breathing and eventually drowsiness then unconsciousness. There is a danger of cumulative effects as it affects the blood and central nervous systems causing cyanosis and anaemia respectively. Prolonged exposure can lead to spleen and liver damage. The toxic effects are increased by the ingestion of alcohol. Moderate explosion hazard exists when exposed to heat or flame in open vessel (lel 1.8%)

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| nitrobenzene | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Carcinogen Cat 2<br>Reproductive toxin Cat 2<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H361: Suspected of damaging fertility (reduced rate of pregnancy) by inhalation<br>H351: Suspected of causing cancer by inhalation<br>H372: Causes damage to organs by inhalation<br>H411: Toxic to aquatic life with long lasting effects. |  |

### Incompatibility

Reacts violently with oxidising agents – nitric acid, dinitrogen tetroxide and sodium chlorate(V) produce explosive compounds. Reacts exothermically with sodium hydroxide or potassium hydroxide producing thermal runaway and explosions. Reacts explosively with aluminium chloride in the presence of phenol.

### Handling

Wear nitrile gloves and goggles (BS EN 166 3). In well-ventilated area away from sources of ignition for small quantities; otherwise in fume cupboard.

**FF** – F, DP, CO2, WS.

### Storage

Flammables store.

### Disposal

Wear eye protection and nitrile gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Small amounts can be allowed to evaporate. Larger amounts should be stored to await uplift by a disposal contractor.

### Spillage

Wear eye protection and nitrile gloves. Evacuate room if spillage large or at high temperature. Use water and detergent on small spills. Mop to emulsify and wash to waste with running water. Alternatively absorb on sand and transfer to open for evaporation.

### Remedial Measures

In all cases of exposure take casualty to hospital as soon as possible.

**Eyes**

Irrigate with water for at least 10 minutes.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting.

**Lungs**

Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

## Nitrogen oxides

Descriptions: NO (nitric oxide) – Colourless gas which is rapidly oxidised in the air to nitrogen dioxide.

$NO_2$ (nitrogen dioxide) – Red-brown gas/liquid with pungent smell. At 35°C 70% of $NO_2$ forms colourless gas dinitrogen tetroxide.

$N_2O$ (nitrous oxide) – Colourless gas with sweetish smell & taste. Also known as laughing gas.

### Hazards

Nitric oxide (NO) is rapidly converted to the brown nitrogen dioxide in contact with air and its toxic effects are thus the same as nitrogen dioxide.

Nitrogen dioxide ($NO_2$) is very irritating to the eyes, skin and respiratory tract. Its main danger comes from a delayed effect (up to 3 days) on then lungs leading to pulmonary oedema (flooding of the lungs with fluid) shown by coldness, dizziness and weakness. High concentrations will produce similar immediate symptoms but these are an unreliable guide to the possible systemic damage done. Particularly dangerous for asthmatics. A second acute phase can follow weeks later with tachycardia, fever, cyanosis, dyspnoea, cough and rapid breathing – bronchitis and pneumonia can complicate recovery.

Dinitrogen tetroxide ($N_2O_4$) is a pale yellow liquid (b.p. 20°C) which evaporates to form the monomer ($NO_2$)

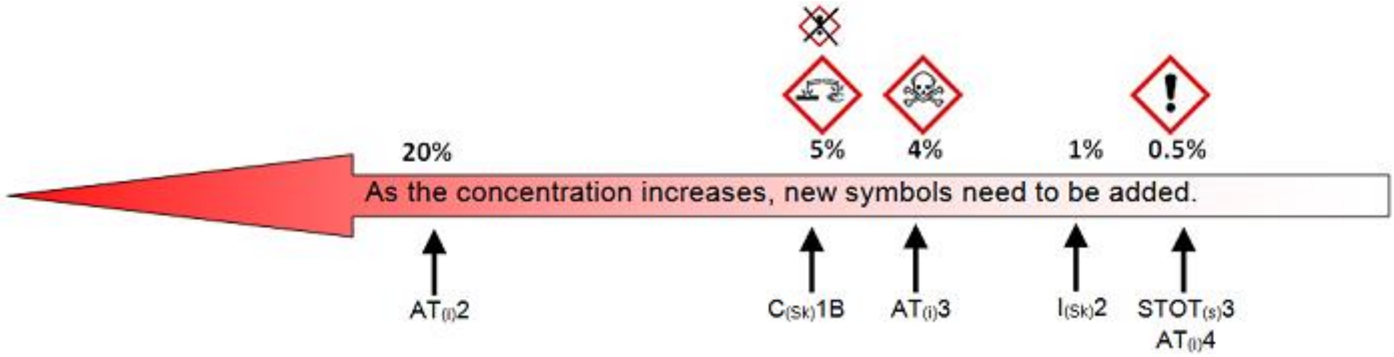
Dinitrogen monoxide ($N_2O$) is used as a general anaesthetic It depresses the pulse rate without a blood pressure or body temperature decrease.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| nitrogen monoxide | Danger | Oxidising gas Cat 1<br>Acute toxin Cat 1 (inhaled)<br>Skin corrosive Cat 1B<br>Eye damage Cat 1<br>Specific target organ toxin on repeated exposure Cat 2<br>May cause or intensify fire; oxidiser. | H331 Toxic if inhaled<br>H314 Causes severe skin burns and eye damage.<br>H318: Causes severe eye damage<br>H332: May cause damage to organs |  |
| nitrogen dioxide, dinitrogen tetroxide | Danger | Oxidising gas Cat 1<br>Acute toxin Cat 2 (inhaled)<br>Skin corrosive Cat 1B | H270 May cause or intensify fire; oxidiser.<br>H330 Fatal if inhaled<br>H314 Causes severe skin burns and eye damage. |  |
| dinitrogen monoxide | Danger | Oxidising gas Cat 1 | H270 May cause or intensify fire; oxidiser. |  |

### Concentration effects (Nitrogen dioxide)

*Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.*



## Incompatibility

Nitrogen monoxide can explode with carbon disulphide, methanol, hydrogen, oxygen + air, fluorine or dienes when ignited. It is also explosive if mixed with ammonia, carbon monoxide, hydrogen or hydrogen sulphide. Violent reactions possible with alkali metals, aluminium or iron, (especially if finely divided), hydrocarbons, ethanoic anhydride, charcoal, phosphorus, propene, trichloroethene or ethene.
Nitrogen dioxide or dinitrogen tetroxide give violent reactions with fluorine, nitrobenzene, methylbenzene, cyclohexane, methanal or petrol. Phosphorus burns more vigorously than in air.

## Handling

Nitrogen monoxide and dioxide should only be handled in a fume cupboard.

## Storage

Nitrogen monoxide and dioxide cylinders are not recommended.

## Disposal

Evacuate and ventilate the area.

## Remedial Measures

If more than just a trace of nitrogen monoxide or dioxide is inhaled or if eyes are irritated then take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes.

### Lungs

Remove patient from exposure to fresh air. Rest and keep warm. Even if symptoms are not not obvious, medical observation for up to 72 hours may be required because of the insidious delayed effect of nitrogen monoxide and nitrogen dioxide. Treat any considerable exposure to nitric oxide or nitrogen dioxide as serious. Obtain medical attention even if symptoms of respiratory irritation have not yet shown themselves.
Dinitrogen monoxide has an anaesthetic effect upon inhalation.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

# Nitrophenols

Description: Pale yellow or yellow crystals/powders used in HPLC and as pH indicators. Soluble in alkalis and alcohols. Slightly soluble in water (4-isomer is the most soluble).

## Hazards

All three isomers are harmful by inhalation, in contact with the skin and if swallowed. Very harmful both by acute dosage and by prolonged exposure to low concentrations. Can cause liver and kidney damage. Human mutagen. Dust and vapour irritate and injure the eyes and skin. Absorption by inhalation of dust, by skin, or by ingestion can lead to headache, drowsiness and cyanosis. Toxic fumes are emitted when heated to decomposition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 2-nitrophenol (o) | Warning | Acute toxin Cat 4 (oral)<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H302: Harmful if swallowed.<br>H411: Toxic to aquatic life with long lasting effects. |  |
| 3-nitrophenol (m) | Danger | Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2 | H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H318: Causes serious eye damage. |  |
| 4-nitrophenol (p) | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Specific target organ toxin on repeated exposure Cat 2 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H373: May cause damage to liver & kidneys by ingestion |  |

## Incompatibility

Reducing agents, nitric acid. Violent reaction with potassium hydroxide. Product from 2-nitrophenol and chlorosulphuric acid decomposed violently. 3- and 4-nitrophenol react violently with diethyl phosphate.

## Handling

Wear eye protection and nitrile gloves. Handle in well-ventilated area or preferably a fume cupboard. Avoid raising dust. **FF** – WS.

## Storage

Keep securely in store.

## Disposal

Wear nitrile gloves and face shield. Small amounts such as washings from glassware may be run to waste.

## Spillage

Wear nitrile gloves and face shield. Collect solid into bucket / large beaker and add a little sodium hydroxide solution to aid dissolution. Wash solution to waste if quantity is small. If large consult local water authority about disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

**Skin**

Remove contaminated clothing. Wash with plenty of running water and soap. Rub with propane-1,2,3-triol (glycerol) or polyethylene glycol (PEG) and seek medical attention immediately if skin is irritated or blistered.

# Oct-1-ene

Description: colourless liquid

## Hazards

Highly flammable – forms explosive mixtures with air; keep away from sources of ignition. May be harmful if swallowed in quantity. Irritating to the eyes and vapour is narcotic in high concentrations.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| oct-1-ene | Danger | Flammable liquid Cat 2<br>Aspiration toxin Cat 1 | H225: Highly flammable liquid and vapour.<br>H304: May be fatal if swallowed and enters airways |  |

## Incompatibility

Oxidising agents.

## Handling

Wear nitrile and eye protection. Handle well away from sources of ignition with good ventilation.

**FF** – F, DP, $CO_2$ or VL.

## Storage

Flammables store.

## Disposal

Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste.

## Spillage

Turn off all sources of ignition. Wearing gloves and eye protection, add water and detergent. Emulsify by mopping and wash to waste with running water if quantity is small. If quantity is large, absorb on sand or mineral absorbent, brush up, collect in a bucket and transfer to open area for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Remove sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Octane

Description: Colourless liquid, petrol-like smell. Insoluble in water. Slightly soluble in alcohols. Soluble in ethers and methylbenzenes.

## Hazards

Highly flammable – forms explosive mixtures with air (limits 1 – 6.5%) – keep away from sources of ignition. Because of its low conductivity it can generate electrostatic charges. Irritating to the eyes, skin (degreasing action) and respiratory system. High concentrations of the vapour can cause asphyxia, narcosis and death.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| octane | Danger | Flammable liquid Cat 2<br>Aspiration toxin Cat 1<br>Skin irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Hazardous to the aquatic environment with long-lasting effects (Cat 1) | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation.<br>H304: May be fatal if swallowed and enters airways.<br>H336: May cause drowsiness or dizziness.<br>H400, Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Strong oxidising agents.

## Handling

Wear neoprene gloves and eye protection and keep away from flames, hot plates, etc. Use in well-ventilated conditions.

**FF** – F, DP, $CO_2$ or VL.

## Storage

Flammables store.

## Disposal

Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Up to 30 cm3 can be allowed to evaporate in a safe place. Do not put directly down drains as explosive mixtures may occur.

## Spillage

Turn off flames and heaters and ventilate the room. Wear neoprene gloves and eye protection. Soak up on to sand or mineral absorbent. Spread out in a safe open area to evaporate.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting. Give pint of water to drink. If unconscious do not give anything to drink. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible if exposure is large.

**Skin**

Eliminate sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if exposure is large or if irritation persists.

# Organic acids (aliphatic, monobasic)

Description: Miscible with water, alcohol or ethers. Butanoic, pentanoic and hexanoic acids are clear, colourless liquid with pungent, unpleasant aromas. Dodecanoic, hexadecanoic and octadecanoic acids are white, waxy solids. Octadec-9-enoic acid is a colourless to yellow/brown oily liquid.

## Hazards

Although they do not dissociate as fully as most inorganic acids, many of these are still highly corrosive and should be treated with care. In addition some have pungent odours – butanoic acid in particular smells strongly of vomit.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| octadecanoic acid,<br>octadec-9-enoic acid | | No significant hazard | | None |
| dodecanoic acid,<br>hexadecanoic acid | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>(Specific Target Organ Toxin of Single Exposure Cat 3 – hexadecanoic acid only) | H315: Causes skin irritation<br>H319: Causes severe eye irritation<br>H335: May cause respiratory irritation |  |
| 2-hydroxypropanoic acid | Warning | Skin irritant Cat 2<br>Eye Damage Cat 1 | H315: Causes skin irritation<br>H318: Causes serious eye damage |  |
| butanoic acid | Danger | Skin corrosive Cat 1B | H314: Causes severe skin burns and eye damage |  |
| pentanoic acid | | Skin corrosive Cat 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 3 | H314: Causes severe skin burns and eye damage<br>H402: Harmful to aquatic life with long lasting effects |   |
| hexanoic acid | | Skin corrosive Cat 1B<br>Acute toxin Cat 3 (dermal) | H314: Causes severe skin burns and eye damage<br>H312: Toxic in contact with skin |   |

## Incompatibility

Strong oxidising agents and reducing agents. Bases. (hexanoic acid is incompatible wtih 2-propenol (allyl alcohol))

## Handling

Wear nitrile or pvc gloves and eye protection, goggles (BS EN 166 3). Handle in a fume cupboard.

**FF** – WS, DP & VL.

## Storage

Butanoic, pentanoic and hexanoic acids should be kept with acids in general store. The others can be stored with general organic reagents.

## Disposal

Wear goggles (BS EN 166 3) and pvc gloves. In fume cupboard slowly add, with stirring, up to 100 cm3 of acid to 5 litres of water. Neutralise by adding 2M sodium carbonate (IRRITANT), (check with litmus) adding 2M hydrochloric acid (IRRITANT) if neutralisation overshot, and run to waste with lots of water.

Alternatively, solid octadecanoic acid and octadec-9-enoic acid can be placed in the normal refuse. The other acids, if not being neutralised as above should be stored for disposalby a licensed contractor.

## Spillage

If the spil is large, evacuate the room; wear protective clothing, face shield and nitrile gloves (for those that are corrosive). Neutralise with solid sodium carbonate or sodium hydrogen carbonate and transfer mixture to a plastic bucket. Test for neutrality, adding 2M sodium carbonate (IRRITANT) or 2M hydrochloric acid (IRRITANT) as necessary. Wash to waste with x1000 the volume of cold running water.

## Remedial Measures

### Eyes

butanoic, pentanoic and hexanoic acids – Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical attention as soon as possible.

Other acids (irritants) – Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or area affected is large.

# Organic acids (aliphatic, polybasic)

Description: White crystalline solids. Miscible with water, alcohol or ethers.

## Hazards

Generally of lower hazard than monobasic acids: most are no more than irritants.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| butanedioic acid, trans butenedioic acid, 2-hydroxy-propan-1,2,3-tricarboxylic acid | Warning | Eye irritant Cat 2 | H319: Causes severe eye irritation |  |
| 2-hydroxybutanedioic acid | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2 | H315: Causes skin irritation<br>H319: Causes severe eye irritation |  |
| 2,3-dihydroxybutanedioic acid | Danger | Eye damage Cat 1 | H318: Causes serious eye damage |  |
| propanedioic acid | Warning | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye irritant Cat 2 | H302: Harmful if ingested<br>H315: Causes skin irritation<br>H319: Causes severe eye irritation |  |
| cis butenedioic acid | Warning | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Skin Sensitiser Cat 1<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H302: Harmful if ingested<br>H315: Causes skin irritation<br>H317: May cause an allergic skin reaction<br>H319: Causes severe eye irritation<br>H335: May cause respiratory irritation |  |

## Incompatibility

Strong oxidising agents and reducing agents. Bases. (trans butanedioic acid is listed as incompatible with amines)

## Handling

Wear eye protection, (goggles BS EN 166 3 for 2,3-dihydroxybutanedioic acid).

**FF** – WS, DP & VL.

## Storage

All can be stored with general organic reagents.

## Disposal

Wear eye protection(BS EN 166 3) slowly add, with stirring, up to 100 cm3 of acid to 5 litres of water. Neutralise by adding 2M sodium carbonate (IRRITANT), (check with litmus) adding 2M hydrochloric acid (IRRITANT) if neutralisation overshot, and run to waste with lots of water.

Alternatively, store for disposal by a licensed contractor.

## Spillage

Sweep up the solids and, if the quantity is not large, place in the refuse bin. If large quantities or a solution is spilled, neutralise with solid sodium carbonate or sodium hydrogen carbonate and transfer mixture to a plastic bucket. Test for neutrality, adding 2M sodium carbonate (IRRITANT) or 2M hydrochloric acid (IRRITANT) as necessary. Wash to waste with x1000 the volume of cold running water.

## Remedial Measures

### Eyes

2,3-dihydroxybutanedioic acid – Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical attention as soon as possible.

Other acids (irritants) – Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or area affected is large.

# Organic acids (aromatic)

Description: White crystalline solids. Generally poorly soluble in water and alcohols.

## Hazards

Mostly of relatively low hazard.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| benzene-1,4-dicarboxylic acid, trans-3-phenylprop-2-enoic acid, ascorbic acid | | No significant hazards | | None |
| benzoic acid | Warning | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye irritant Cat 2 | H302: Harmful if swallowed<br>H315: Causes skin irritation<br>H319: Causes severe eye irritation |  |
| 4-aminobenzoic acid | Danger | Acute toxin Cat 4 (oral)<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H302: Harmful if ingested<br>H319: Causes severe eye irritation<br>H335: May cause respiratory irritation |  |
| 3-nitrobenzoic acid, benzene-1,2-dicarboxylic acid | Warning | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H302: Harmful if ingested<br>H315: Causes skin irritation<br>H319: Causes severe eye irritation |  |
| 3,4,5-trihydroxybenzoic acid | Danger | Skin irritant Cat 2<br>Eye damage Cat 1<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H315: Causes skin irritation<br>H318: Causes serious eye damage<br>H335: May cause respiratory irritation |  |

## Incompatibility

Strong oxidising agents and reducing agents. Bases.

## Handling

Wear eye protection.

**FF** – WS, DP & VL.

## Storage

All can be stored with general organic reagents.

## Disposal

Wear eye protection(BS EN 166 3) slowly add, with stirring, up to 100 cm3 of acid to 5 litres of water. Neutralise by adding 2M sodium carbonate (IRRITANT), (check with litmus) adding 2M hydrochloric acid (IRRITANT) if neutralisation overshot, and run to waste with lots of water.

Alternatively, store for disposalby a licensed contractor.

## Spillage

Sweep up the solids and, if the quantity is not large, place in the refuse bin. If large quantities or a solution is spilled, neutralise with solid sodium carbonate or sodium hydrogen carbonate and transfer mixture to a plastic bucket. Test for neutrality, adding 2M sodium carbonate (IRRITANT) or 2M hydrochloric acid (IRRITANT) as necessary. Wash to waste with x1000 the volume of cold running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or area affected is large.

# Osmium VIII oxide

Alternative names:  osmic acid, osmium tetroxide.

Description: Colourless or yellowish crystals with very unpleasant chlorine-like smell.  Used in pathology labs as a fat stain and as a catalyst in organic syntheses.

**Use in schools is not recommended**

## Hazards

Very toxic and corrosive by inhalation, in contact with the skin and swallowing. Its use in schools is not recommended. Vapour severely irritates the respiratory system. Vapour, solid and solution badly burn the eyes. Acid and solution burn the skin, and continued exposure to vapour causes dermatitis and distortion of vision. Evidence of mutagenic and teratogenic effects. If supplied as a 2.5% solution in 2-methylpropan-2-ol it is also highly flammable.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| osmium(VIII) tetroxide | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 1 (dermal)<br>Acute toxin Cat 2 (inhalation)<br>Skin corrosive Cat 1B | H300 : Fatal if swallowed.<br>H310 : Fatal in contact with skin.<br>H314 : Causes severe skin burns and eye damage.<br>H330 : Fatal if inhaled. |  |

## Incompatibility

When heated emits toxic fumes. Catalytic decomposition of hydrogen peroxide can be hazardous. Explodes on contact with 1-methylimidazole. The amorphous form, prepared by low temperature dehydration, is pyrophoric.

## Handling

Wear nitrile gloves and goggles (BS EN 166 3). Use only ampoules of osmium tetroxide and only in fume cupboard . Follow supplier's instructions when opening ampoules.

## Storage

Securely in store. Keep in sealed containers in a well ventilated position away from dust or other contaminants. Refrigeration (sparkproof) recommended.

**Stock: Its use in schools is not recommended**

## Disposal

Wear nitrile gloves and goggles (BS EN 166 3). Run washings to waste with running water. If larger quantities are involved keep for disposal by contractor.

## Spillage

Wear nitrile gloves and face shield. Cover spill with sodium hydrogen carbonate or a 50 : 50 mixture of soda ash : calcium hydroxide and slowly mix to a slurry (heat produced during neutralisation – take care). Store for disposal by contractor.

## Remedial Measures

In all cases of exposure which are other than very slight take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting.

**Lungs**

Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

# Pentanols

Alternative names: n-amyl alcohol & sec-amyl alcohol.

Description: Colourless liquids which are slightly soluble in water. The -1-ol has a milder smell than the -2-ol.

## Hazards

More toxic than ethanol. Vapour very irritating to eyes and to respiratory system. Harmful by inhalation. Liquid if swallowed is very harmful causing giddiness etc. Prolonged exposure to low concentrations dangerous. Flammable; may form explosive mixtures with air (1 to 10%). Pentan-1-ol is a possible mutagen.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| pentan-1-ol | Warning | Flammable liquid Cat 3<br>Acute toxin Cat 4 (inhalation)<br>Skin irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H226: Flammable liquid and vapour.<br>H332: Harmful if inhaled.<br>H315: Causes skin irritation.<br>H335: May cause respiratory irritation. |  |
| pentan-2-ol | | Flammable liquid Cat 3<br>Acute toxin Cat 4 (inhalation)<br>Specific target organ toxin on single exposure Cat 3 | H226: Flammable liquid and vapour.<br>H332: Harmful if inhaled.<br>H335: May cause respiratory irritation.<br>EUH066: Repeated exposure may cause skin dryness or cracking. |  |

## Concentration effects

Neither isomer is very soluble in water. (1- isomer 2.2% 2-isomer 4.5%) so none of the classifications apply to any solution.

## Incompatibility

Reacts vigorously with strong oxidising agents.

## Handling

In well-ventilated area, away from sources of ignition. Gloves and eye protection advisable.

**FF** – WS, DP, VL.

## Storage

In store away from oxidising agents and with flammables.

## Disposal

Wear eye protection and nitrile gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste.

## Spillage

Turn off all sources of ignition and open windows. Wear nitrile gloves and face shield. Apply water and detergent. Mop to emulsion and wash to waste with running water. Alternatively the liquid can be absorbed in sand or mineral absorbent, shovelled into a bucket and spread out in an open area for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Remove sources of ignition and wet clothing to reduce fire risk. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Pentanones

Alternative names: diethyl ketone & methyl propyl ketone.

Description: Colourless liquids with characteristic smell. Slightly soluble in water, miscible in lower alkanols and alkanones.

## Hazards

Highly flammable liquids; may form explosive mixtures in air (lel 1.6%). Harmful by ingestion and by inhalation. Vapour is irritating to skin, eyes and respiratory system and is narcotic in high concentrations.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| pentan-2-one | Warning | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H226: Flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |
| pentan-3-one | Danger | Flammable liquid Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H335: May cause respiratory irritation.<br>H336: May cause drowsiness or dizziness. |  |

## Concentration effects

Neither isomer is very soluble in water. (1- isomer 2.2% 2-isomer 4.5%) so none of the classifications apply to any solution.

## Incompatibility

Oxidising agents.

## Handling

Wear eye protection and nitrile gloves and work in a well-ventilated area, away from flames, hot gauze, hot plates, etc.

**FF** – DP, VL, WS.

## Storage

Flammables store.

## Disposal

Wear eye protection and nitrile gloves. Ensure sources of ignition are absent. Small unavoidable discharges such as washings from glassware can be emulsified and run to waste. Otherwise store to await uplift by disposal contractor.

## Spillage

Turn off all sources of ignition in the room. Evacuate room if spillage is large. Wear nitrile gloves and eye protection. Soak up on sand or mineral absorbent. Place in safe place to evaporate.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

**Skin**

Remove sources of ignition and soak affected clothing. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if a large area of skin is involved.

# Pentane

Description: Colourless liquid with characteristic smell. Insoluble in water but soluble in alkanols, propanone and methylbenzene.

## Hazards

Extremely flammable. Explosion hazard (limits 1.4 – 8%) if exposed to heat or flame; vapour is more dense than air and is therefore not easily dispersed. Harmful if liquid swallowed, gets into the eyes or is inhaled. Vapour is narcotic if concentration is high.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| pentane, n- | Danger | Flammable liquid Cat 1<br>Aspiration toxin Cat 1<br>Specific target organ toxin on single exposure Cat 3<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H224: Extremely flammable liquid and vapour.<br>H304: May be fatal if swallowed and enters airways.<br>H336: May cause drowsiness or dizziness.<br>H411: Toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Oxygen and powerful oxidising agents.

## Handling

Wear nitrile gloves and eye protection. In well-ventilated area, well away from flames and hot plates etc.

**FF** – F, DP, CO2, VL.

## Storage

Flammables store.

## Disposal

Wear nitrile gloves and eye protection and ensure ignition sources are absent. Unavoidable discharges, e.g. small quantities such as washings from glassware etc. should be emulsified and washed to waste. Up to 100 cm3 may be allowed to evaporate in a safe place.

## Spillage

Turn off all sources of ignition and open windows. Wear nitrile gloves and face shield. Add detergent and water, mop to emulsify and wash to waste with running water. Alternatively the liquid can be absorbed on sand or other absorbent, shovelled into a bucket and spread out in a safe open area for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Pentyl ethanoate

Alternative names: n-amyl acetate

Description: Colourless liquid with pear-like smell. Slightly soluble in water and miscible in ethanol or ethoxyethane.

## Hazards

Flammable. Liquid and vapour are irritants to eyes, lungs, skin and narcotic in high concentrations. Can be harmful if swallowed in quantity. Forms explosive mixtures in air (1 to 7.5%) and dangerous when exposed to heat or flame.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| pentyl ethanoate | Warning | Flammable liquid Cat 3 | H226 : Flammable liquid and vapour.<br>EUH066 : Repeated exposure may cause skin dryness or cracking. |  |

## Incompatibility

Oxidising agents.

## Handling

Wear eye protection and use in well-ventilated area well away from open flames, hot plates, etc.

**FF** – DP, CO2, VL.

## Storage

Flammables store.

## Disposal

Wear eye protection and nitrile gloves and ensure absence of ignition sources. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Up to 50 cm3 can be refluxed with an excess of 2M sodium hydroxide (CORROSIVE). See hydrolysis of Ethyl ethanoate. Cool and wash to waste with large volumes of water.

## Spillage

Turn off all sources of ignition and open windows. Wear nitrile gloves and face shield. If quantity small, add detergent, work to emulsion mop up and wash to waste with running water. Otherwise soak up on absorbent or sand, transfer to bucket and leave outside in safe place to evaporate. Apply water and detergent to wash the spillage area.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Soak affected part of clothing in water and remove sources of ignition. Contaminated clothing should be removed, rinsed well with detergent and then washed.

# Peroxides

Barium and sodium peroxides are the only ones likely to be encountered.

Description: sodium peroxide – white powder – reacts with water, barium peroxide – greyish-white heavy powder

## Hazards

Metal present determines toxicity, e.g. barium peroxide is more toxic than sodium peroxide. Both will react with moisture to form strong alkalis (corrosive) causing severe burns. See below for hazards associated with their oxidising ability and incompatibility with a wide range of substances.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium peroxide | Danger | Oxidising solid Cat 1<br>Skin corrosive Cat 1A | H271: May cause fire or explosion; strong oxidiser.<br>H314: Causes severe skin burns and eye damage. |  |
| barium peroxide* | Danger | Oxidising solid Cat 1<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation) | H272 May intensify fire; oxidiser.<br>H302 Harmful if swallowed.<br>H332 Harmful if inhaled. |  |

* Barium peroxide itself is not corrosive but it will react with moisture (eg in eyes) to form barium hydroxide which is.

## Incompatibility

Fire hazard varies from moderate to very dangerous when in contact with reducing agents and contaminants. Explosion hazard with heat, shock or catalyst. React violently or potentially explosively with metal powders, non-metals, organic substances, cloth, paper, wood, water, steam, acids, carbon dioxide and may emit toxic fumes.

## Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3). Open carefully as pressure may have built up owing to reaction with moisture in air. Keep away from moisture and out of contact with organic materials. Avoid raising dust. Use smallest quantity needed for the experiment and do not return any unused peroxide to the jar. Keep lid off for minimum time.

**FF** – DP, S.

## Storage

With oxidising agents. The stopper should be tight to avoid moisture reaching the chemical. Replace when the reactions fail to work effectively.

## Disposal

Wear rubber or plastic gloves and faceshield.

Sodium or potassium peroxides – Add in small portions up to 50 g at a time to 2 litres of water. When the reaction is complete, neutralise with dilute sulphuric acid (CORROSIVE) and wash to waste with plenty of water.

Barium peroxide – Add excess of dilute sulphuric acid (CORROSIVE) and stir. Decant off solution of hydrogen peroxide, dilute, and reduce with iron (II) salt. Run liquid to waste and place the barium sulphate precipitate in sand with the ordinary refuse.

## Spillage

Wear rubber or plastic gloves and faceshield. Mix with dry sand, shovel into suitable dry container and treat as in Disposal. Wash area of spillage well with acidified iron(II) sulphate solution.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes and continue irrigation on the way to hospital.

### Mouth

Wash out mouth thoroughly with water. Both the barium and sodium comounds can burn and irritate the throat but the barium compound is, in addition, toxic. Don’t induce vomiting. Obtain medical attention.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. If breathing is affected, obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if large area is involved or if irritation persists.

# Peroxodisulphates VI

Alternative name(s): persulphates, peroxydisulphates

Description: White crystalline powders. Sodium salt is very soluble in water – others are less soluble.

## Hazards

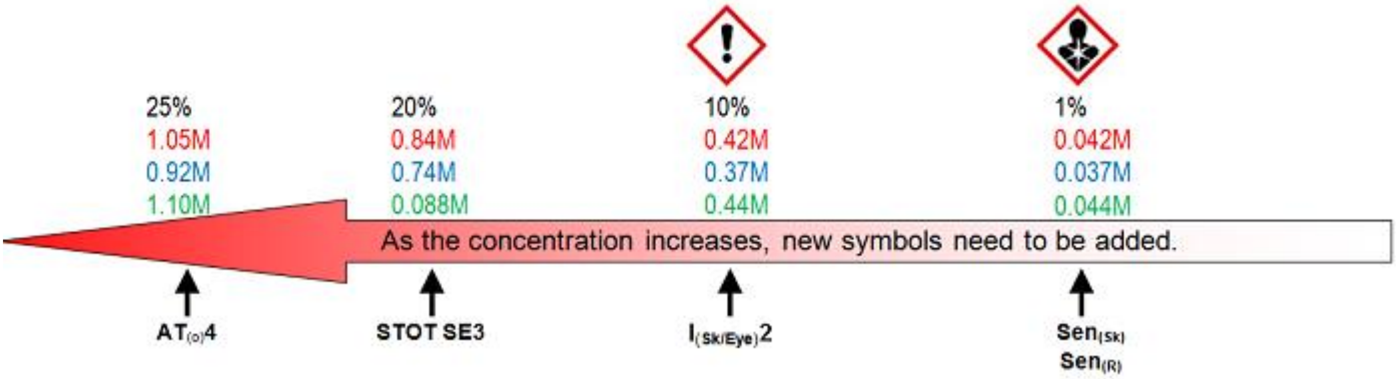
Oxidising agents which may ignite combustible material. All are harmful if swallowed or inhaled as dust. Irritant to the eyes, skin and respiratory system causing skin irritation. Skin and respiratory sensitisers.  Solid and solution readily liberate oxygen on heating (>100°C if dry and below 50°C if damp.) Solid heated to decomposition gives toxic sulphur oxides. Containers may build up pressure.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium, potassium, sodium peroxydisulphate(VI) | Danger | Oxidising solid Cat 3<br>Acute toxin Cat 4 (oral)<br>Skin / Eye irritant Cat 2<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H272: May intensify fire; oxidiser.<br>H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H317: May cause an allergic skin reaction.<br>H319: Causes serious eye irritation.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. **Red** = Sodium, **Blue** = potassium and **Green** = ammonium. The potassium salt is of lower than the others (solubility (5.25% at 20C)



## Incompatibility

Reducing agents (especially metal powders), organic compounds, cloth, paper, wood. Solid may ignite with a flake of alkali.

## Handling

Avoid raising dust. Wear rubber or plastic gloves and eye protection. Open carefully, especially older containers, as pressure may have built up inside. Keep away from sources of ignition.

**FF** – WS.

## Storage

General store, in a cool place, with oxidising agents. Keep away from direct sunlight.

**SL –** Useful lifetime dependent on storage conditions and frequency of opening. Open older jars carefully as pressure may have built up. The peroxodisulphates deteriorate and thereby become less effective. Dispose of and replace when the reactions start to fail or the results become confusing.

## Disposal

Wear rubber or plastic gloves and eye protection.

**Small quantities –** Dissolve up to 10 g in 2 litres of water and wash to waste with plenty of water.
**Larger quantities –** Boil the aqueous solution to decompose the salt to potassium sulphate and liberate oxygen but do not boil to dryness. Alternatively reduce with acidified iron(II) sulphate and wash to waste with plenty of water.

## Spillage

Wear rubber or plastic gloves and eye protection. Moisten well with water, shovel into bucket and treat as for Disposal. Wash spillage area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. If experiencing respiratory symptoms, obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation occurs.

# Petroleum spirit fractions

Alternative name: petroleum ethers.

See Uses page for a recipe for a synthetic crude oil. Check supplier's specification and avoid purchase of fractions with benzene content > 0.1% Naphthas – typical formulations include petroleum ether, rubber solvent, white spirit, VM&P naphtha & Stoddart solvent. May contain many alkanes, alkenes, cyclic & aromatic hydrocarbons.

**Crude oil has >0.1% benzene. This is not now legally banned but there is no good reason to use it in schools.**

## Hazards

Extremely or highly flammable depending on fraction or naphtha formulation; forms explosive mixtures in air (0.8 – 9%). High concentrations of vapour cause respiratory irritation, intoxication and narcosis. Liquids irritate skin and eyes. Harmful by ingestion. Will defat and irritate skin. Acute toxicity is low, but prolonged exposure to low concentrations, especially to the 40-60 and the 60-80 fractions which will contain n-hexane, causes irreversible damage to sensory and motor nerves of hands and feet. Some fractions may contain more than 0.1% benzene; check the specification of purchases (on MSDS). Naphthas are mixtures which vary in toxicity due to the wide range of compounds which may be present but all the ones available from the major suppliers are now classed as Category 1B carcinogens.. Strangely, these substances are now not classed as flammable (even though the classification is now harmonised) in our view, however, they are flammable, especially the low boiling point fractions and should be treated as such. And all fractions have autoignition temperatures close to 250C.

Check supplier's specification and avoid purchase of fractions with benzene content > 0.1%

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Petroleum Ethers | Danger | Aspiration toxin Cat 1<br>Mutagen Cat 1B<br>Carcinogen Cat 1B<br>Flammable liquid Cat 1<br>Specific target organ toxin on single exposure Cat 3<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 2<br>Repeated exposure may cause skin dryness or cracking | H304 May be fatal if swallowed and enters airways.<br>H340 May cause genetic changes<br>H350 May cause cancer<br>H224 Extremely flammable liquid and vapour<br>H336 May cause drowsiness or dizziness.<br>H411 Toxic to aquatic life with long lasting effects.<br>EUH066 Repeated exposure may cause skin dryness or cracking |  |

## Incompatibility

Violent reaction with chlorine or oxidising agents. Latex rubber and some plastics are attacked and permeated. Reaction of naphtha with nitric acid should be carefully controlled.

## Handling

Small quantities in well-ventilated area, larger amounts in fume cupboard if either heated or used in process with much evaporation. Keep well away from sources of ignition. Wear eye protection and nitrile gloves. Where possible avoid the use of hexane containing fractions or use them with extra care. The 80-100°C fraction generally contains little or no hexane and will in addition be less flammable.

**FF** – F, DP, $CO_2$ or VL.

## Storage

Flammables store.

## Disposal

Remove all sources of ignition and wear eye protection and nitrile gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. An authorised, competent person may spread up to 50 $cm^3$ on tray in safe, secure place for evaporation.

## Spillage

Turn off all sources of ignition and open windows. Wear eye protection and nitrile gloves. Soak up on absorbent and carry outside for ventilation. Stir in with emulsifying agent and wash to waste.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed, obtain medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Remove sources of ignition and soak affected area with water. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if area affected is large.

# Phenol

Was known in the past as carbolic acid.

Description: Colourless or pale pink crystals with characteristic antiseptic-like smell. Moderately soluble in water.

## Hazards

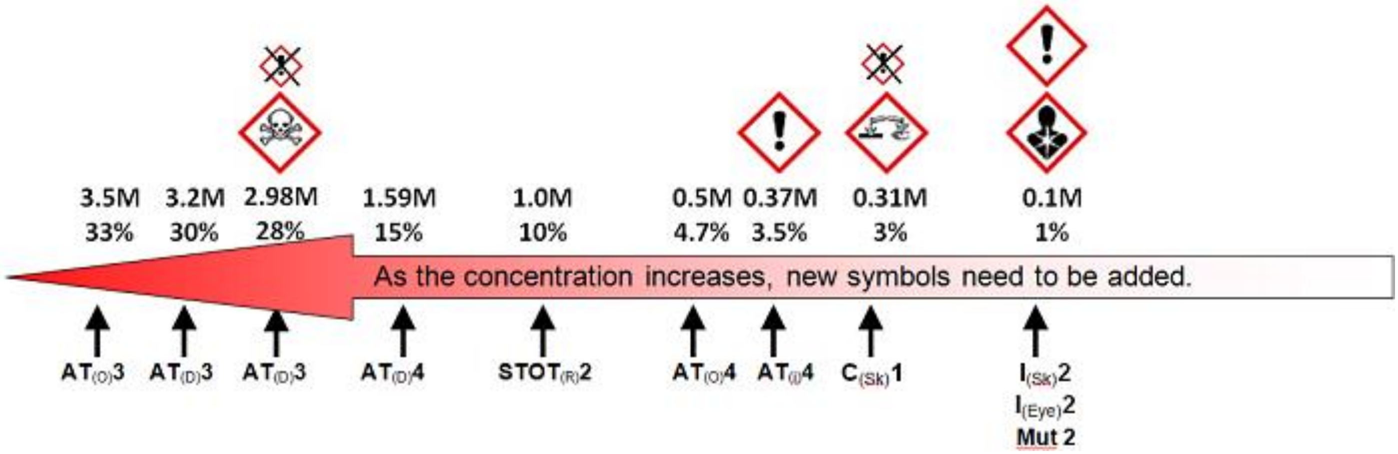
Corrosive – very dangerous to the eyes. Burns skin causing white blisters. Prolonged exposure to low concentrations of mist or vapour very dangerous. Prolonged skin contact even with weak solutions may cause dermatitis. A mutagen, an experimental carcinogen and may cause birth defects. Volatile combustible solid and solution are toxic by inhalation, ingestion and very rapidly by absorption through the skin.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phenol | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Skin corrosive Cat 1B<br>Mutagen Cat 2<br>Specific target organ toxin on repeated exposure Cat 2 | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H341: Suspected of causing genetic defects<br>H373: May cause damage to organs |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents; explodes if heated with sodium nitrite, permono- and perdisulphuric acids(VI).

## Handling

Goggles (BS EN 166 3) and rubber or neoprene (**not** nitrile) gloves must be worn when handling solid or solution. Use in well ventilated room.

**FF** – F, DP, CO2. VL.

## Storage

Securely in store.

**SL** – 5-6 years. Replace when badly discoloured. Air and light sensitive. Deteriorates and becomes less effective. No increased hazard.

## Disposal

Wear goggles (BS EN 166 3) and rubber or neoprene gloves. Wash small unavoidable discharges such as washings from glassware, etc. to waste with running water. Otherwise store to await uplift by disposal contractor.

## Spillage

Remove sources of ignition and open windows. Wear rubber or neoprene gloves and face shield. If spillage is small, carefully scoop solid into a bucket of water and treat as in **Disposal**. If spillage is large, shovel into container, label and store to await uplift by disposal contractor.

## Remedial Measures

In all cases of exposure take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes. Seek medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don't induce vomiting. Seek medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Seek medical advice/attention.

### Skin

It is rapidly absorbed via the skin. Remove contaminated clothing. Wash with plenty of running water and soap. Rub with propane-1,2,3-triol (glycerol) or polyethylene glycol (PEG). Seek medical attention as soon as possible.

## Phenolphthalein

Description: White solid, usually encountered as a colourless solution – usually in propan-2-ol or ethanol. Used as a purgative in medicine.

### Hazards

Phenolphthalein has recently been classified as a category 1B carcinogen. Ingestion is harmful and irritating, causing stomach upset and diarrhoea. It is a solid but generally used in solution in propan-2-ol, ethanol or methanol as an acid/base indicator. Make up solutions to below 1% concentration (0.5% is appropriate for most uses – see Uses section).

Also see Indicators and also the relevant hazard sheets for the organic solvents used (usually highly flammable).

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phenolphthalein Solid and solutions ≥1%<br>*(these statements and symbols are in addition to any belonging to the solvent)* | Danger | Mutagen Cat 2<br>Carcinogen Cat 1B<br>Reproductive toxin Cat 2 | H361: Suspected of damaging fertility or the unborn child by ingestion<br>H341: Suspected of causing genetic defects by ingestion<br>H350: May cause cancer by ingestion |  |
| phenolphthalein Solid and solutions <1% in propan-2-ol | Danger | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H336: May cause drowsiness or dizziness by inhalation or orally. |  |
| phenolphthalein Solid and solutions <1% in methanol | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Specific target organ toxin on single exposure Cat 1 | H225: Highly flammable liquid and vapour.<br>H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H370: Causes damage to Optic Nerve & CNS |  |

### Incompatibility

Strong oxidising agents.

### Handling

The route of exposure for carcinogenicity is not clear so avoid raising dust and wear gloves. However see the relevant hazard sheets for the organic solvents used. If propan-2-ol is the solvent, wear nitrile gloves.

### Storage

General store for solid. Flammables store for solutions.

### Disposal

Wear eye protection and gloves. Ensure ignition sources are absent. Small quantities of solution may be washed to waste with large volumes of water.

### Spillage

Wear eye protection and gloves. Ensure ignition sources are absent. Add water and detergent and mop up. Wash to waste.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Soak affected clothing with water and remove sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing.

## Phenylamine

Alternative name: aniline

Description: Colourless, oily liquid with distinctive smell. Slightly soluble in water. Miscible in ethanol and many organic solvents.

### Hazards

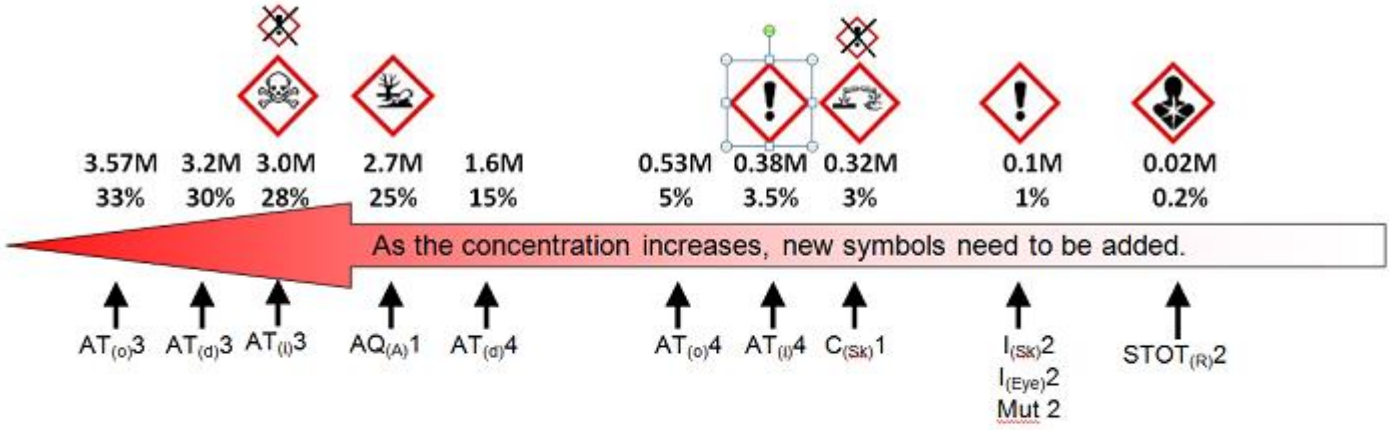
A Category 2 carcinogen. Toxic if inhaled, swallowed or absorbed through skin. Very readily absorbed through the skin and by inhalation. Liquid is harmful to the eyes. Flammable when warmed (lel 1.3%). Long term exposure to low concentrations affects nervous system and blood.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phenylamine | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Eye damage Cat 1<br>Skin sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 2<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment Cat 1 | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H318: Causes serious eye damage.<br>H317: May cause an allergic skin reaction.<br>H341: Suspected of causing genetic defects<br>H351: Suspected of causing cancer<br>H372: Causes damage to blood and hematopoetic system<br>H400: Very toxic to aquatic life. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Oxidising agents – especially hydrogen peroxide and di(benzenecarbonyl) peroxide, alkali metals or fuming nitric acid.

### Handling

Wear nitrile gloves and goggles (BS EN 166 3). Handle well away from flames or hot plates, etc. Distillations and experiments in fume cupboard.

**FF** – F, DP, CO2, VL.

## Storage

Securely in store, away from oxidising agents.

## Disposal

Wear nitrile gloves and goggles (BS EN 166 3).
**Very small quantities** such as washings from glassware should be neutralised with dilute hydrochloric acid, emulsified with water containing a dispersing agent, and put down the drain with lots of running water.
**Larger quantities** – store for disposal by licensed contractor.

## Spillage

Wear nitrile gloves and face shield. Open windows. Soak up in sand or absorbent, shovel into closable container. If quantity small treat as in **Disposal**. Otherwise seal, label and store securely for disposal by contractor. Mop area of spillage first with 0.1M hydrochloric acid and then with water and detergent, neutralise washings and wash to waste with running water.

## Remedial Measures

In all cases of exposure take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Remove contaminated clothing and wash before reuse. Wash the skin at once with water then soap and water. Phenylamine is very rapidly absorbed through skin, but only slowly if present as a salt or in solution of acids. Wash immediately with lots of water. If excess strong acid was present, treat for acid burns, e.g. as for concentrated **sulphuric acid.**

## Phenylammonium chloride

Alternative name: aniline hydrochloride

Description: White crystalline solid which is soluble in water.

### Hazards

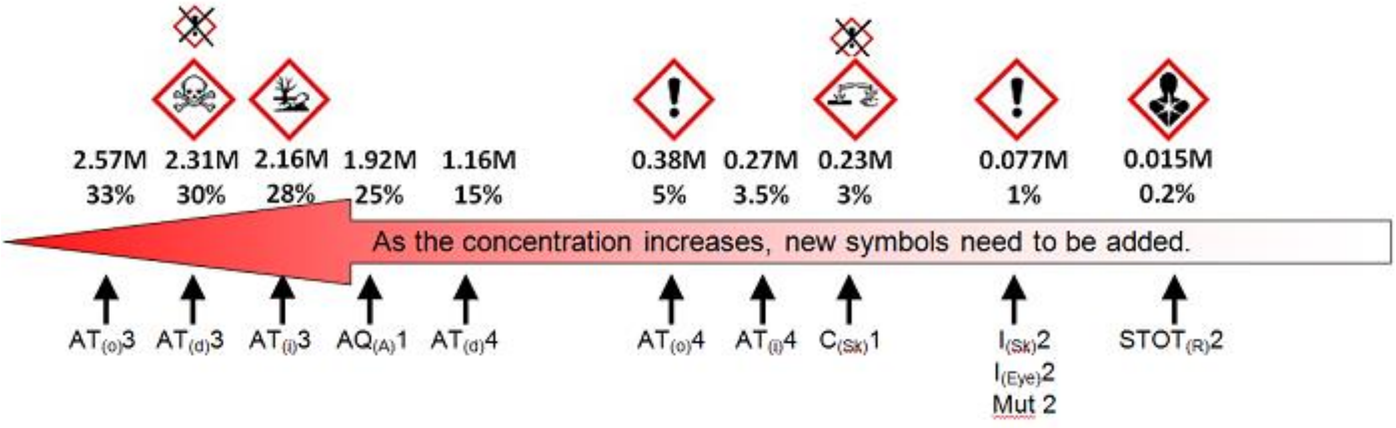
A Category 2 carcinogen. Toxic by swallowing, skin absorption and by inhalation (dust). It is absorbed much more slowly through the skin than phenylamine itself and is less volatile. Acute effects are headache, drowsiness, cyanosis, mental confusion and, in severe cases, convulsions. Exposure over a long period affects the nervous system and the blood. Dangerous to the eyes, partly because of acidity.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phenylammonium chloride | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Eye damage Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 2<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment Cat 1 | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H318: Causes serious eye damage.<br>H317: May cause an allergic skin reaction.<br>H341: Suspected of causing genetic defects<br>H351: Suspected of causing cancer<br>H372: Causes damage to blood and hematopoetic system<br>H400: Very toxic to aquatic life. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Oxidising agents especially hydrogen peroxide, nitric acid. With alkali the volatile, free phenylamine is formed.

### Handling

Wear gloves and eye protection. Generally use in fume cupboard.

**FF** – F, DP, CO2.

### Storage

Securely in store.

## Disposal

Wear pvc gloves and eye protection. Treat rinsings from flasks with 2M hydrochloric acid (IRRITANT) and wash to waste with copious amounts of water. Larger amounts should be disposed of by licensed contractor.

## Spillage

Wear pvc gloves and eye protection. Carefully shovel spilt solid into bucket and treat as in hydrochloric acid (IRRITANT) before transferring to bucket. Store for disposal by licensed contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Remove contaminated clothing. Wash the skin at once with water then soap and water. Seek medical attention if skin is blistered. If present as a salt in solution of acids, it will be more slowly absorbed through the skin than phenylamine. Wash immediately with lots of water. If excess acid was present, treat as for acid burns, e.g. conc. sulphuric acid.

# Phenylethene

styrene stabilised with t-butylcatechol

Description: Colourless or pale yellow oily liquid with penetrating smell. Usually sold with trace of t-butyl catechol (inhibitor). Slowly polymerises to polystyrene when exposed to light. Soluble in alcohols, alkanones & ethers

## Hazards

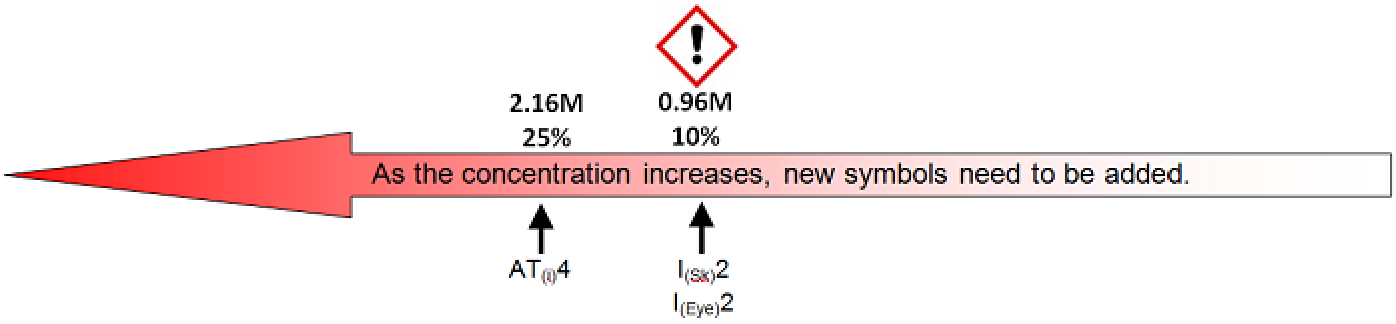
Flammable. Readily forms explosive vapour mixtures with air (1 – 6%). Vapour has disagreeable odour and is harmful if inhaled. Liquid is irritating to the eyes and, on prolonged contact, to skin. Oral toxicity is low. Suspect animal carcinogen and may have effects on reproduction. May violently polymerise with large exothermic reaction if inhibitors are lost.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phenylethene | Danger | Flammable liquid Cat 3<br>Skin / Eye irritant Cat 2<br>Acute toxin Cat 4 (inhalation) | H226: Flammable liquid and vapour.<br>H315 : Causes skin irritation.<br>H319 : Causes serious eye irritation.<br>H332 : Harmful if inhaled. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Unless sufficiently dilute, initiators: peroxides di(dodecanoyl) – and dibenzenecarbonyl, AZBN, organometallic compounds, iron(III) chloride and other transition metal salts can cause a highly exothermic run-away reaction. In absence of inhibitors can polymerise violently. Can form explosive interpolymeric peroxides with oxygen. Heating produces acrid fumes and rapid runaway polymerisation. Reacts vigorously with chlorine and oxidising agents.

## Handling

Wear rubber or plastic gloves and eye protection. Handle in fume cupboard away from sources of ignition.

**FF** – F, DP, CO2, VL.

## Storage

Flammables store.

**SSL** – Maximum of 2 years if stored in a cool place.Sold with stabilisers. As these gradually deteriorate the phenylethene begins to polymerise. Keep a regular check and replace if liquid becomes viscous. (rate of formation increased by exposure to light and air).

## Disposal

Wear rubber or plastic gloves and eye protection and ensure ignition sources are absent. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste. Spread larger amounts in a thin layer on a large tray outside and add appropriate quantity of catalyst and mix. The polymerised product can be broken up and put with ordinary waste.

## Spillage

Turn off all sources of ignition and open windows. Wear gloves and face shield. Soak up on sand or absorbent. Shovel into plastic bucket

**Small amounts –** spread out in open area for evaporation.

**Larger quantities –** seal in container, label and arrange for disposal by contractor. Wash area of spillage well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Remove sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Phenylhydrazine

Phenylhydrazine – colourless to yellow crystals or oily aromatic liquid. Darkens on exposure to light. Sparingly soluble in water, but soluble in alcohols, ethers and methylbenzene.

The hydrochloride is used for the detection of sugar.

## Hazards

The free hydrazine is toxic by contact with skin, by inhalation and by ingestion and is very irritating to the eyes. The hydrochloride is somewhat less toxic. Both are skin sensitisers causing dermatitis. Suspect carcinogens and mutagens. Possible risk of irreversible effects to the spleen, liver, kidneys and bones. Flammable when exposed to heat or flame emitting toxic fumes on decomposition. Very toxic to aquatic organisms.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phenylhydrazine & phenylhydrazine hydrochloride | Danger | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation)<br>Skin / Eye irritant Cat 2<br>Skin sensitiser Cat 1<br>Mutagen Cat 2<br>Carcinogen Cat 1B<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment Cat 1 | H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H317: May cause an allergic skin reaction.<br>H341: Suspected of causing genetic defects<br>H350: May cause cancer<br>H372: Causes damage to organs<br>H400: Very toxic to aquatic life. |  |

## Incompatibility

Can react violently with lead(IV) oxide and oxidising agents. Dangerous when heated to decomposition.

## Handling

On small scale in well-ventilated laboratory, wearing nitrile gloves and eye protection. Best for pupils to handle only the reagent in solution.

## Storage

Securely in general store.

## Disposal

Wear eye protection and nitrile gloves. Wash rinsings to waste. Larger amounts should be disposed of by licensed contractor.

## Spillage

Wear nitrile gloves and face shield. Mix the solid with sand and shovel into plastic bucket. Store for disposal by licensed contractor.

## Remedial Measures

If swallowed, a large area of skin is involved, breathing is affected or if eyes are irritated take casualty to hospital as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

**Lungs**

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

# Phenylmethanol

Alternative name: benzyl alcohol

Description: Colourless liquid with faint aromatic smell. Found in several essential plant oils, e.g. hyacinth, jasmine etc. Soluble in water, ethanol or ether.

## Hazards

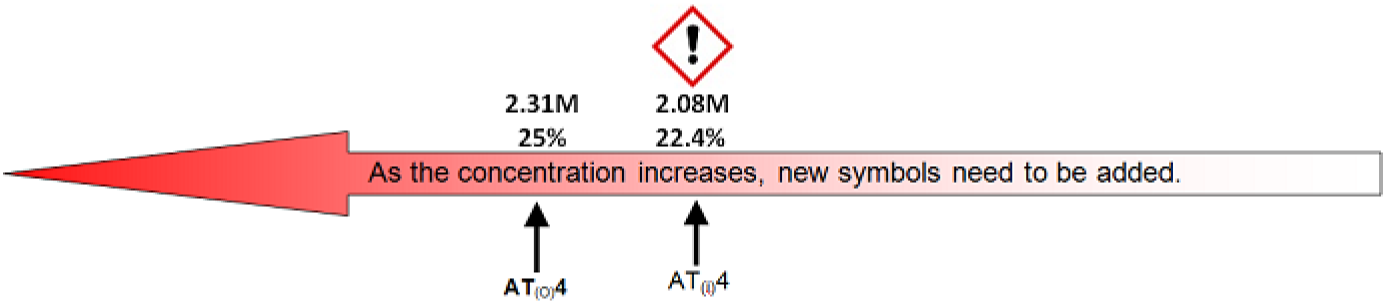
Harmful if inhaled or swallowed. Very irritating to eyes and skin. Can be absorbed through the skin. Fire hazard is slight when exposed to heat or flame.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phenylmethanol | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation) | H302: Harmful if swallowed.<br>H332: Harmful if inhaled. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents. Reacts violently with concentrated sulphuric acid at 180°C.

## Handling

In well-ventilated area. Wear nitrile gloves and eye protection.

FF – DP, VL, WS.

## Storage

In store, away from oxidising agents and sulphuric acid.

## Disposal

Wear nitrile gloves and eye protection. Dissolve in portions up to 10 g in water and wash to waste with lots of running water. Store larger amounts to await uplift by disposal contractor.

## Spillage

Wear nitrile gloves and eye protection. Soak up on absorbent and rinse the latter well with running water. Dispose of washed absorbent with ordinary waste. Mop area of spillage with water and detergent.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Phosphates

**Nomenclature** – there are many phosphates and many variations on their names. For the sake of simplicity we have adopted the following convention: Phosphate refers to a compound with the anion and the phosphate only; hydrogen phosphate refers to a compound with 1 hydrogen per phosphate and dihydrogen phosphate refers to one with 2 hydrogens per phosphate.

## Hazards

In general phosphate compounds are of low hazard. Many of them are moderate to severe eye and skin irritants. Ammonium compounds must not be mixed or ground with strong oxidising agents (such as potassium chlorate V or manganate VII as explosive mixtures can be formed. In addition, most will react with strong acid or alkali to release toxic fumes. Under CLP/GHS, most phosphate compounds are not classified as Harmful to the Aquatic Environment but as release can lead to eutrophication in watercourses care should be taken with disposal.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium phosphate, calcium phosphate, calcium hydrogen phosphate, magnesium hydrogen phosphate, magnesium dihydrogen phosphate, potassium dihydrogen phosphate, potassium hydrogen phosphate-3-water, sodium hydrogen phosphate-1-water, sodium hydrogen phosphate-12-water, sodium dihydrogen phosphate, sodium dihydrogen phosphate-1-water, sodium dihydrogen phosphate-2-water | | No significant hazard | | None  |
| ammonium dihydrogen phosphate, sodium hydrogen phosphate | Warning | Eye irritant Cat 2 | H319 Causes serious eye irritation. |  |
| potassium hydrogen phosphate | Danger | Eye Damage Cat 1 | H318: Causes serious eye damage |  |
| sodium phosphate-12-water | Danger | Skin corrosive Cat 1B | H314: Causes severe burns and eye damage |  |
| potassium phosphate, potassium phosphate-1-water | Danger | Skin irritant Cat 2<br>Eye Damage Cat 1 | H315 Causes serious skin irritation.<br>H318: Causes serious eye damage |  |

| | | | | |
|---|---|---|---|---|
| ammonium hydrogen phosphate, magnesium phosphate, sodium phosphate, sodium hydrogen phosphate-7-water | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin Cat 3 | H315 Causes serious skin irritation.<br>H319 Causes serious eye irritation.<br>H335 Causes respiratory irritation. |  |
| calcium dihydrogen phosphate | Danger | Skin irritant Cat 2<br>Eye Damage Cat 1<br>Specific Target Organ Toxin Cat 3 | H315 Causes serious skin irritation.<br>H318: Causes serious eye damage<br>H335 Causes respiratory irritation. |  |

## Incompatibility

Most phosphates are of low reactivity and will not react in any hazardous manner. Ammonium compoundswill react with strong acid or alkali to release toxic fumes.

## Handling

Avoid raising dust from compounds in the solid state. Wear eye protection to handle any of those classed as irritant  and goggles (BS EN166 3) when handling those that are corrosive to eyes or skin..

FF – no special requirements

## Storage

Securely in store. Unless stated otherwise, low hazard compounds can be placed with domestic waste or, if in solution, run to waste with copious quantities of water.

## Disposal

Wear goggles (BS EN 166 3) where approriate.  Small to moderate amounts can be washed to waste with copious quantities of water. Larger amounts should be kept for disposal by licensed contractor.

## Spillage

Wear plastic gloves and eye protection as appropriate. Moisten with water, shovel into bucket and treat as for **Disposal**.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if feeling unwell.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

# Phosphoric acid

Alternative name : orthophosphoric acid

Description: Colourless, moist crystals when pure – which is very rare. Usually purchased as 85% or 90% (16M) which is a colourless viscous liquid.

## Hazards

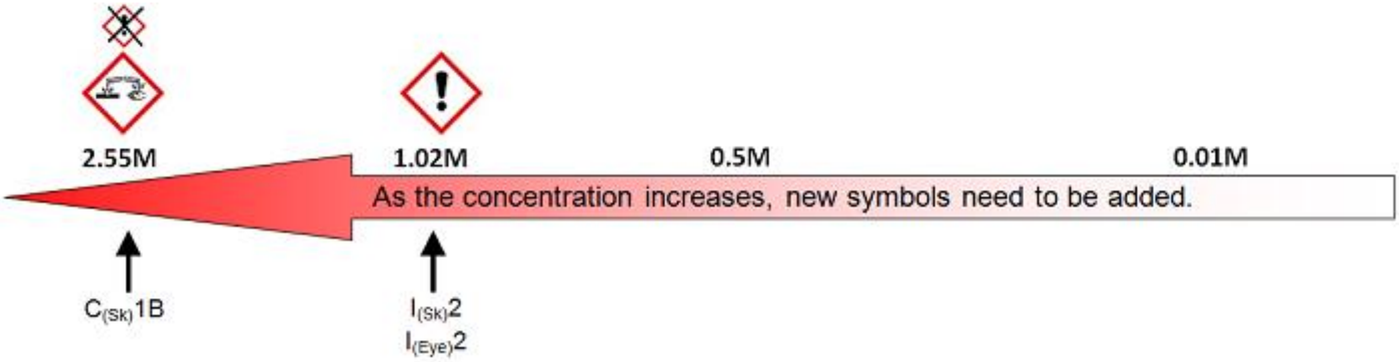
Corrosive – burns and irritates the skin and eyes. A systemic irritant if inhaled. If swallowed causes serious internal injury. Dangerous when heated to decomposition, giving TOXIC oxides of phosphorus.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phosphoric(V) acid | Danger | Skin corrosive 1B | H314: Causes severe skin burns and eye damage. |  |

Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

The concentrated solutions are highly exothermic with water. Violent reactions with alkalis and other metals, and with powerful oxidising agents. Explosive with nitromethane and also sodium borohydride. Will displace hydrogen chloride from chlorides.

## Handling

Wear goggles (BS EN 166 3) and rubber or plastic gloves.

## Storage

With acids in general store.

## Disposal

Wearing goggles (BS EN 166 3) and rubber or plastic gloves add up to 100 cm3 slowly to 2 litres water with stirring. Add sodium carbonate to neutralise, allowing time for heat dissipation, and wash to waste with running water.

## Spillage

Wearing face shield and rubber or plastic gloves spread anhydrous sodium carbonate over the spillage and mop up with plenty of water. Wash to waste with running water. Alternatively soak up on dry sand or absorbent, transfer to bucket and neutralise with sodium carbonate. Rinse absorbent well, running the rinsings to waste and dispose of sand with ordinary waste.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large.

# Phosphorus

Alternative name : white, yellow or red phosphorus

Description:

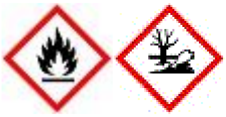
White/yellow – wax-like solid. Darkens on exposure to light. Insoluble in water but very soluble in Carbon Disulphide.

Red- red/violet powder. Insoluble in Carbon Disulphide or water.

## Hazards

All forms are highly flammable, but the white form is very easily ignited at temperatures as low as 30°C in moist air. White phosphorus is corrosive and causes severe burns to skin and eyes and is very toxic if swallowed or if vapour or smoke from burning phosphorus is inhaled. Long term absorption of small amounts by inhalation and by mouth is very dangerous. Red form is of very low toxicity, but the oxide fumes from burning are extremely toxic. Some samples of the red form may contain traces of white phosphorus. Very toxic to aquatic organisms

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Red phosphorus | Danger | Flammable solid cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 3 | H228 Flammable solid.<br>H412 Harmful to aquatic life with long lasting effects. |  |
| White phosphorus | Danger | Pyrophoric solid cat 1<br>Acute toxin Cat 1 (oral)<br>Acute toxin Cat 2 (inhaled)<br>Skin corrosive Cat 1A<br>Hazardous to the aquatic environment Cat 1 | H250: Catches fire spontaneously if exposed to air<br>H300: Fatal if swallowed.<br>H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life. |  |

## Incompatibility

Will form explosive mixtures with oxidising agents, oxy salts, e.g. manganates(VII) (permanganates), chlorates(VII), and metal oxides. Reacts vigorously with sulphur, halogens (reaction of bromine and phosphorus is explosive). Reaction of white allotrope with alkalis releases toxic phosphine gas which ignites in air.

## Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3). Use tongs. Never expose large pieces to air. Cutting must be done under cold water. Keep under cold water till required. Have a solution of 0.1M copper sulphate handy for treating spills on the skin.

**FF** – Water spray.

## Storage

In locked cupboard in general store, away from alkalis, alkali metals, sulphur, oxidising and reducing agents. Must be stored under water. Avoid extremes of temperature to prevent loss by evaporation or by cracking of bottle by frost.

## Disposal

Wear rubber or plastic gloves and face shield. Very small amounts of red or white forms left-over from experiments may be burned off in a crucible in a fume cupboard. It is a little more difficult to ensure the red is completely oxidised. The oxides in the smoke are very toxic. For larger amounts either :-

**a.** during burning, trap the fumes as alkali metal phosphates by passing them through alkali or
**b.** store for disposal by licensed contractor.

## Spillage

Wear rubber or plastic gloves and face shield. Cover with wet sand, shovel phosphorus and sand into a bucket and cover with water. If small, remove to an open area for drying out and burning. Wash area of spillage with copper(II) sulphate (HARMFUL) and water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible, even if only a small amount of oxide smoke has been inhaled.

### Skin

Wash well with water. Swab with 0.1M solution of copper(II) sulphate to form a black copper salt which can be seen and removed. Remove and wash contaminated clothing. In the case of white phosphorus obtain medical attention as soon as possible.

## Phosphorus compounds

Alternative name(s): phosphorus trichloride, di-phosphorus pentoxide and phosphorus pentachloride

Description: Trichloride – Colourless, fuming liquid with acrid odour

Description: Pentachloride – White, fuming powder with yellowish tinge and pungent smell. Used as catalyst as well as chlorinating and dehydrating agent.

Description: Oxide – White deliquescent crystalline powder or granules.

### Hazards

All three are corrosive and will burn skin and eyes. When exposed to air, the chlorides produce corrosive, toxic fumes of hydrogen chloride and oxoacids of phosphorus. Prolonged exposure to such fumes is extremely harmful. Trichloride reacts violently with water to give off hydrogen chloride. If swallowed all of them can cause severe internal damage.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| phosphorus(III) chloride | Danger | Acute toxin Cat 2 (oral)<br>Acute toxin Cat 2 (inhaled)<br>Skin corrosive 1A<br>Specific target organ toxin on repeated exposure Cat 2 | H300: Fatal if swallowed.<br>H330: Fatal if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>H373: May cause damage to respiratory tract by inhalation |  |
| phosphorus(V) chloride | Danger | Acute tox Cat 4 (oral)<br>Acute tox Cat 2 (inhalation)<br>Skin corrosive Cat 1B<br>Specific target organ toxin on repeated exposure Cat 2 | H302 : Harmful if swallowed.<br>H314 ; Causes severe skin burns and eye damage.<br>H330 : Fatal if inhaled.<br>H373 : May cause damage to organs through prolonged or repeated exposure .<br>EUH014 : Reacts violently with water.<br>EUH029 : Contact with water liberates toxic gas. |  |
| phosphorus(V) oxide | Danger | Skin corrosive Cat 1A | H314: Causes severe skin burns and eye damage. |  |

### Incompatibility

All are incompatible with oxidising agents and reducing agents, especially organic compounds. They also react violently with water, steam, alkali and alkaline earth metals, aluminium, and compounds containing the hydroxyl grouping to produce toxic fumes.

**Additional incompatibilities**:

Trichloride – fluorine, dimethyl sulphoxide, oleum, acids

Pentachloride – halogens, magnesium oxide, nitrobenzene , urea, hydroxylamine

Oxide – nitrobenzene, hydrogen peroxide, perchloric acid, sodium carbonate and with iodides. Beware of possible hazardous products formed from dehydration of some compounds, e.g. of amides to nitriles or methanoic acid to carbon monoxide.

## Handling

In fume cupboard (or well-ventilated laboratory for pentachloride or pentoxide). Wear pvc or nitrile gloves and goggles (BS EN 166 3).

Open chlorides carefully as there may be a pressure build up owing to the hydrolysis by atmospheric moisture. Keep away from water, steam, acids and alkalis. Replace stopper immediately.

Avoid raising dust from pentoxide

**FF** – DP, S.

## Storage

With hydrolysable halides, well-ventilated, and tightly stoppered. Only keep minimum quantities. If quantity is small enough store in desiccator. Regularly check any metal fixtures near point of storage for possible corrosion.

Oxide In dry place with corrosives. Store only in small quantities.

**SSL** – 2 years maximum for trichloride,, 3 years for pentachloride as over time they react with moisture from the air.

**SL** – pentoxide 2 years. Water reactive and over time reacts with moisture from the air.

## Disposal

Wear face shield / goggles (BS EN 166 3) and pvc/nitrile gloves. In fume cupboard add small portions at a time (no more than 1g up to 5 g total) to 1 litre of 1M sodium carbonate. Carry out slowly as the reaction produces corrosive gases and heat. Wash to waste with running water.

Old stocks often form a dark, unreactive crust on the top. If this has happened, behind a safety screen run a steady stream of water into the bottle from a rubber tube fitted to a tap. **Do not simply add water and leave to soak** as this has caused violent reactions at the interface because of the lack of mixing.

Alternatively, keep for collection by a licensed disposal contractor.

## Spillage

Open doors and windows and, if necessary, evacuate the room.

Wearing face shield and pvc/nitrile gloves mix with dry sand and shovel into plastic bucket. Remove to an open area and add a little at a time to a large volume of water. Neutralise with sodium carbonate. Wash solution to waste with running water and dispose of washed sand with ordinary waste. Wash area of spillage

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention. . If more than a whiff of pentachloride is breathed in, obtain medical attention immediately.

### Skin

Remove and wash contaminated clothing. Wash skin with water and apply magnesia/glycerol paste. If skin is badly blistered seek medical advice.

# Poly(methanol)

Alternative name(s): paraformaldehyde

White powder or tablets – stabilise cell membranes & preserve cell morphology. Dissolves slowly in cold water but more rapidly in hot with evolution of methanal gas.

## Hazards

Toxic by inhalation, in contact with the skin and if swallowed. A suspected carcinogen and mutagen. Severely irritating to skin and eyes causing burns with the possible risk of irreversible effects and skin sensitisation. May produce asthma like symptoms. Vaporises to toxic methanal gas when heated or when dissolved in hot water. In fine dust form can be an explosion hazard.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| poly(methanal) | Danger | Flammable solid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin irritant Cat 2<br>Skin sensitiser Cat 1<br>Eye damage Cat 2<br>Respiratory sensitiser Cat 1 | H228: Flammable solid.<br>H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H317: May cause an allergic skin reaction.<br>H318: Causes serious eye damage.<br>H332: Harmful if inhaled.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled |  |

## Incompatibility

Strong oxidising agents, liquid oxygen. Reacts with hydrogen chloride to form the carcinogen chloromethoxychloromethane (bischloromethyl ether).

## Handling

Wear gloves and eye protection. Handle preferably in a fume cupboard or in well-ventilated, open laboratory if care is taken to avoid dust rising. Keep away from sources of ignition and hydrogen chloride fumes.

**FF** – F, DP, CO2, WS.

## Storage

In flammables store away from strong oxidising agents and concentrated hydrochloric acid.

## Disposal

Wear eye protection and carry out in fume cupboard.

**Small amounts** – such as washings of glassware: dissolve in water and wash to waste with water.
**Larger amounts** – store to await uplift by licensed contractor.

## Spillage

Carefully scoop into plastic buckets, add and mix a little cold water and leave to stand in a fume cupboard for 2-3 hours. Wash to waste with plenty of running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Move patient from area of exposure. If allergic asthmatic attack is brought on, the casualty can use their own inhaler/nebuliser e.g. Ventolin. Rest and keep warm. Obtain medical attention if breathing difficulty occurs.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if large area is affected.

# Potassium compounds

## Hazards

In general, these potassium compounds are of low hazard, though some of them are moderate to severe eye and skin irritants. And under GHS, most potassium compounds are not classified as Harmful to the Aquatic Environment.

The tables below do NOT include the substances detailed elsewhere. For details of their hazards, follow the links in the table.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium ethanoate, potassium sodium tartrate, potassium chloride | | No significant hazard | | None |
| potassium hydrogen carbonate, potassium molybdate | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335 May cause respiratory irritation. |  |
| potassium bromide, potassium iodide | Warning | Eye irritant Cat 2 | H319 Causes serious eye irritation. |  |
| potassium carbonate | Warning | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye irritant Cat 2 | H302: Harmful if swallowed<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation. |  |

## Incompatibility

Chlorates, nitrate, chromate and dichromate should be kept away from combustible materials. Hexacyanoferrates and thiocyanates release toxic gas when mixed with acids. See individual entries (linked from the table above) for details.

## Handling

Avoid raising dust from compounds in the solid state. Wear eye protection to handle those classed as irritant or harmful (ATox Cat 4)

FF –

## Storage

Securely in store. (Keep chlorates, nitrate, chromate and dichromate with oxidising agents).

## Disposal

Wear goggles (BS EN 166 3) where appropriate. The low-hazard compounds can be washed to waste with copious quantities of water.

## Spillage

Wear plastic gloves and eye protection as appropriate. Moisten with water, shovel into bucket and treat as for **Disposal**.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

# Potassium hexacyanoferrates

Alternative name: Hexacyanoferrate II – potassium ferrocyanide. Hexacyanoferrate III – potassium ferricyanide

Potassium hexacyanoferrate II – Lemon yellow crystals soluble in water to give a yellow solution.

Potassium hexacyanoferrate III -ruby-red crystals or orange-red crystalline powder soluble in water to give a green/yellow solution.

## Hazards

Dangerous if heated or in contact with concentrated acids since it emits very toxic fumes of hydrogen cyanide and even with dilute acids if heated. Low oral toxicity since the cyano groupings are firmly bound. Irritating to eyes and skin. Dangerous if heated to decomposition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium hexacyanoferrate(II)-3-water | None | Hazardous to the aquatic environment with long lasting effects Cat 2 | H411 : Toxic to aquatic life with long lasting effects.<br>EUH032 : Contact with acids liberates very toxic gas. |  |
| potassium hexacyanoferrate(III)-3-water | Warning | Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H315 ; Causes skin irritation.<br>H319 : Causes serious eye irritation.<br>H335 : May cause respiratory irritation.<br>EUH032 : Contact with acids liberates very toxic gas |  |

## Incompatibility

Avoid concentrated and dilute mineral acids. Form explosive mixtures with sodium nitrite copper salts (even when wet), chromium(VI) oxide and in contact with ammonia.

## Handling

Use eye protection and wear rubber or plastic gloves.

## Storage

General store, but away from acids, oxidising agents and ammoniacal solutions.

## Disposal

Flush out drains with water to remove any acid which may be in the sink traps. Dissolve up to 5 g at a time and run to waste with large amounts of water.

Keep large amounts for disposal by a licensed contractor.

## Spillage

Carefully sweep up and treat as in **Disposal**. Soak up solutions on absorbents. Wash through with plenty of water and place washed absorbent in refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. If hydrogen cyanide had been given off accidentally by heating or reaction with acids, treat as for hydrogen cyanide and get the casualty to hospital as soon as possible.

### Skin

Wash well with soap and copious amounts of water. Remove and wash contaminated clothing.

# Potassium hydroxide

Alternative name: caustic potash

Description; White flakes, powder, pellets or sticks which absorb moisture and carbon dioxide from the air.

## Hazards

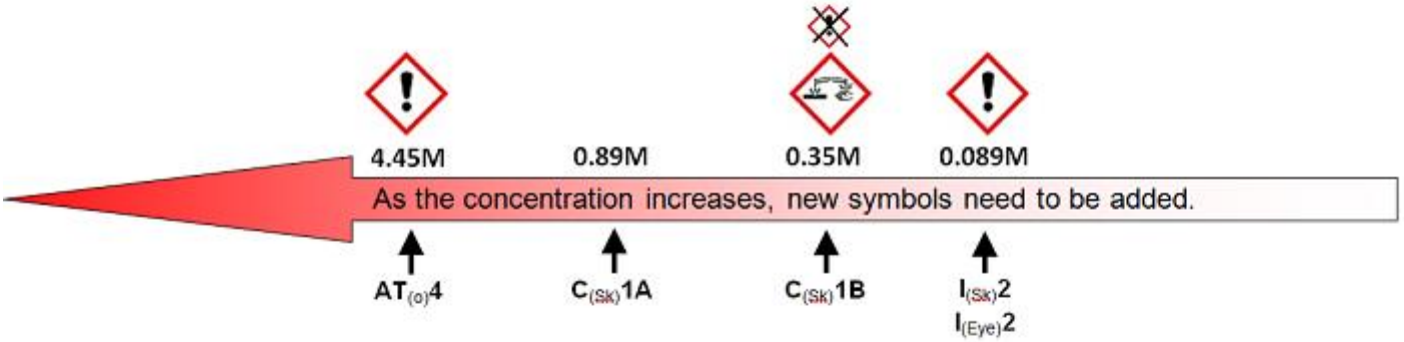
Strongly corrosive solid and solution and very harmful if swallowed. Extremely dangerous to eyes as damage can continue long after the initial pain has subsided. Skin contact causes severe burning with blisters. Skin damage can be deep as even dilute solutions are absorbed.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium hydroxide | Danger | Acute toxin Cat 4 (oral)<br>Skin corrosive Cat 1A | H302: Harmful if swallowed.<br>H314: Causes severe skin burns and eye damage. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Hydrogen gas evolved with aluminium or zinc. Reacts explosively or forms explosive compounds with warm ammoniacal silver nitrate, trichloroethane, trichloroethene, 4-chloro-2-methylphenol, sodium tetrahydroborate, nitrobenzene and tetrahydrofuran. With water, considerable heat is produced and some spattering may occur if the amount of water added is small.

## Handling

Wear rubber gloves and goggles (BS EN 166 3), for solutions over 0.3M.

## Storage

General store. Beware of storing in plastic bottles in a position exposed to sunlight. **Plastic reagent bottle disintegration** – article in SSERC Bulletin.

## Disposal

Wear rubber gloves and face shield. Dissolve up to 50 g in 2 litres of water, neutralise with citric acid or 1M ethanoic acid (test with pH paper) and wash to waste with lots of running water. Store large quantities to await uplift by disposal contractor.

## Spillage

Wear rubber gloves and face shield. Add sand and shovel into dry plastic bucket for transport to safe open area and treat as in Disposal.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water continuously (see note above). It is important to flush under eyelids also. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing.

# Potassium manganate VII

Alternative name: potassium permanganate

Description: Purple crystals soluble in water.

## Hazards

Harmful if swallowed. Strong irritant on skin and eyes. Dust harmful to lungs. Crystals can explode on sudden heating and this is common cause of eye accidents.

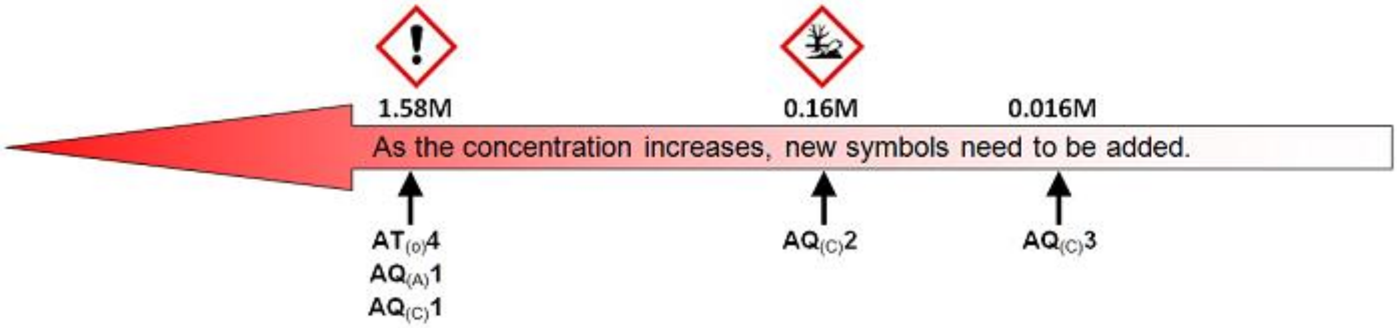
Powerful oxidising agent – see Incompatibility.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium manganate(VII) | Danger | Oxidising solid Cat 2<br>Acute toxin Cat 4 (oral)<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H272: May intensify fire; oxidiser.<br>H302: Harmful if swallowed.<br>H400: Very toxic to aquatic life<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Concentration Effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

It forms an explosive mixture with concentrated sulphuric acid and with ammonium salts. Hydrogen peroxide reacts violently. **Being a powerful oxidising agent, it can cause ignition of** and form explosive mixtures of the solid with:

**a. organic matter** – especially oxygenated compounds like sugars, diols, esters, aldehydes, acids, wood, paper. With several of these there is an induction period, e.g. propane-1,2,3-triol (glycerol).
**b. reducing agents** – including metals, hydroxylamine, sulphur, phosphorus, etc.

## Handling

Wear eye protection and rubber or plastic gloves.

**FF** – WS.

## Storage

General store with oxidising agents.

## Disposal

Because of fire hazard, never in waste bin. Wear eye protection and rubber or plastic gloves. Dissolve up to 10 g in 2 litres of water, acidify with dilute sulphuric acid (IRRITANT) and add iron(II) sulphate, or other suitable reducing agent, with stirring till the purple colour is discharged. Run to waste with copious amounts of water. Larger amounts should be stored to await uplift by disposal contractor.

## Spillage

Wear eye protection and rubber or plastic gloves. Brush up carefully into dustpan as much as possible and treat as in **Disposal**. For solutions soak up on sand or mineral absorbent. Place in bucket and run a slow stream of water through it until no more intense purple colour can be rinsed out. Wash the spillage area with water and a reducing agent.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with water. Remove and wash contaminated part of clothing. A trace of a solution of slightly acidified sulphite or 10 volume hydrogen peroxide will reduce any manganate(VII) stain on clothing remaining to almost colourless manganese(II).

# Potassium metal

Description: Soft, silvery-white metal stored under liquid paraffin.

## Hazards

Corrosive to the skin and by ingestion causing severe thermal and caustic burns then blisters. Extremely damaging to the eyes. Highly flammable. Ignites spontaneously on exposure to moist air producing the extremely flammable hydrogen gas. Metal which has oxidised on storage (yellow in appearance) should be disposed of since it may explode violently when cut.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium metal | Danger | Water reactive solid Cat 1<br>Skin corrosive Cat 1B | H260 : In contact with water releases flammable gases which may ignite spontaneously.<br>H314 : Causes severe skin burns and eye damage<br>EUH014: Reacts violently with water |  |

## Incompatibility

Reacts violently with water (hydrogen evolved) and with carbon dioxide. Therefore **do not use water or carbon dioxide extinguishers** to put out a potassium fire. Also incompatible with oxidising agents, halogenated hydrocarbons, acids and a large number of other substances.

## Handling

Never touch the metal; use rubber or plastic gloves, goggles (BS EN 166 3) and tongs. Do not expose dry metal to air if at all possible. Use a fume cupboard.

**FF** – DP, S. It is best to simply allow small pieces to finish burning if on a heat resistant mat or other suitable surface. Can cover with **anhydrous** sodium carbonate or sodium chloride to exclude air.

## Storage

With water reactive metals. Store under liquid paraffin and keep topped up to exclude air. Keep locked up away from sources of water, high temperatures or risk of damage.

**SSL** – Maximum of 2 years. Deteriorates to form a shock sensitive explosive.

## Disposal

Add small pieces to excess of a mixture (1:1 v/v) of dry 2-methylbutan-2-ol and butan-1-ol (at least 20 cm3for each 1 g of potassium) in a large mortar. If a faster reaction is required reduce the proportion of the 2-methylbutan-2-ol. Should it ignite, extinguish by covering with a heat resistant mat. When reaction is complete wash to waste with large excess of water. Do not cut if yellowed. Very old samples which have become deeply encrusted with the yellow superoxide should not be handled. They should be disposed of by a contractor.

## Spillage

Clear laboratory. Wear rubber or plastic gloves and face shield. Cover with dry sand, shovel into dry container and transport to safe open area. Add in small quantities to excess dry butan-1-ol/2-methylbutan-2-ol mixture and wash to waste with excess running water.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

**Eyes**

Irrigate with water continuously (see note above). It is important to flush under eyelids also. Obtain medical attention as soon as possible.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Exposure to metal is unlikely – more likely to oxide fumes. Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

**Skin**

Turn off sources of ignition. Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing. Obtain medical attention if area affected is large.

# Propanols

Propan-1-ol and propan-2-ol. Alternative names: n-propyl alcohol & iso-propyl alcohol

Colourless liquids miscible in water in all proportions. The 2- isomer has short shelf life.

## Hazards

Both isomers are highly flammable and form explosive mixtures in air (explosive ranges 2 – 13.5% and 2.3 – 13%). Mildly toxic by skin absorption, moderately toxic by ingestion or inhalation, and damaging to the eyes. Propan-2-ol is less toxic but is more volatile. There is some evidence, though not conclusive that propan-2-ol may be a mutagen.

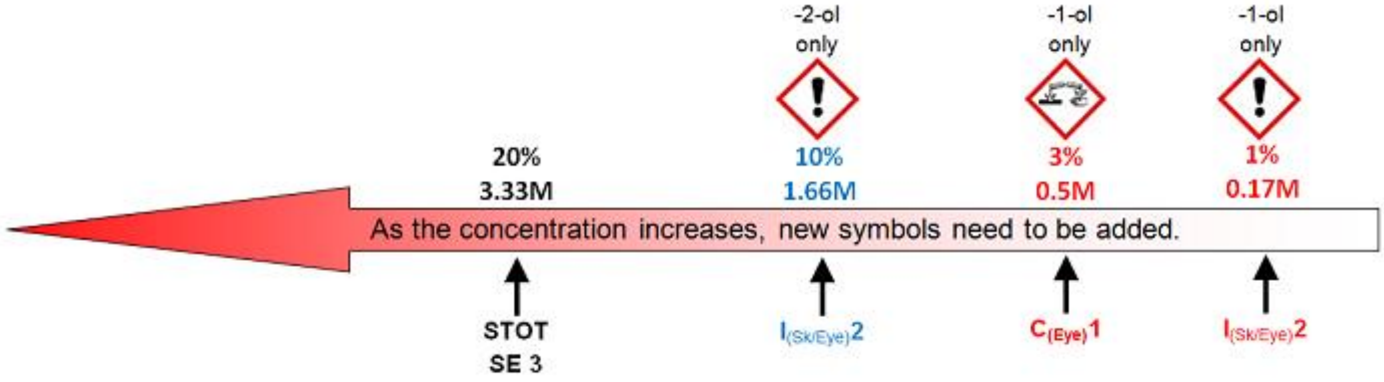
Propan-2-ol forms explosive peroxides by undergoing autoxidation in partly filled bottles.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| propan-1-ol | Danger | Flammable liquid Cat 2<br>Eye damage Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H318: Causes serious eye damage.<br>H336: May cause drowsiness or dizziness. |  |
| propan-2-ol | Danger | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H336: May cause drowsiness or dizziness by inhalation or orally. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. **Red** = -1-ol, **blue** = -2-ol



## Incompatibility

Strong oxidising agents – peroxides, chlorates(VII), chromium(VI) oxide, oxygen, alkali metals, phosphorus pentachloride.

## Handling

In well-ventilated area with all sources of ignition turned off. Do not distil older samples of propan-2-ol. First test propan-2-ol for peroxides (as for **ethoxyethane** ) before distilling. Once treated use immediately as inhibitors will have been removed as well. Wear eye protection and nitrile gloves.

**FF** – DP, VL, WS.

## Storage

Flammables store. **Propan-2-ol** likely to form explosive peroxides. Store in dark bottle as the reaction is accelerated by light.

**SSL –** 2 years maximum for propan-2-ol if it is going to be distilled or evaporated to dryness; it can undergo autoxidation to form explosive peroxides in storage (rate of formation increased by exposure to light and air).

## Disposal

Wear eye protection and nitrile gloves and ensure absence of sources of ignition. Add up to 200 cm3 to 4 litres of water and wash to waste with further amounts of water.

## Spillage

Wear eye protection and nitrile gloves. Turn off all sources of ignition. Open windows and if necessary evacuate room. Small spillages can be mopped up and washed to waste. Larger spillages should be soaked up with absorbent and the latter well rinsed. The washed absorbent can be placed with ordinary refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Soak clothing in water and remove sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing.

# Propanal

Alternative name: propionaldehyde

Colourless liquid with suffocating smell. Miscible with water. Less volatile than ethanal for showing typical properties of the alkanals.

## Hazards

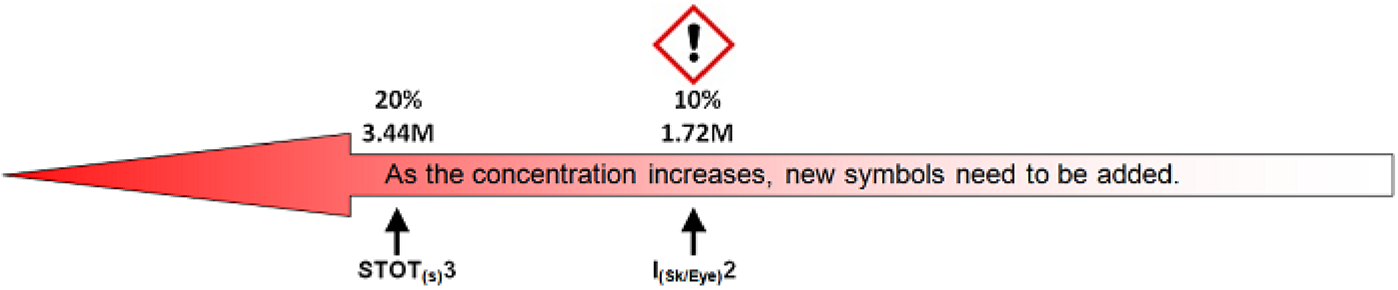
Highly flammable – can form explosive mixtures in air (2.9 – 17%). Liquid is moderately toxic by skin absorption and if ingested. Vapour is very harmful and severely irritant to the eyes, skin and lungs. Lachrymatory. On prolonged storage it may form explosive peroxides.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| propanal | Danger | Flammable liquid Cat 2<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. (nasal cavity) |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Strong oxidising or reducing agents. Alkalis cause vigorous polymerisation with large exotherm.

## Handling

Wear nitrile gloves and eye protection. In a well-ventilated area, preferably a fume cupboard. Turn off all sources of ignition.

**FF** – DP, VL, WS.

## Storage

Flammables store.

**SSL** – Maximum of 2 years. Can form explosive peroxides in storage. May polymerize resulting in hazardous condition.

## Disposal

Wear nitrile gloves and eye protection and turn off all sources of ignition. Up to 30 cm3 can be diluted with 10 volumes of water and washed to waste. Alternatively if a suitable and secure site is available, up to 50 cm3 can be spread out thinly on a tray and allowed to evaporate.

## Spillage

Wear nitrile gloves and eye protection, turn off all sources of ignition, evacuate room and open windows.
**Small spillages** – mix with water containing detergent and wash to waste with water.
**Larger spillages** – soak up on absorbent and carry outside for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Remove sources of ignition and soak clothes in water. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if affected area is large.

# Propanal

Alternative name: acetone

Colourless volatile liquid, miscible with water.

## Hazards

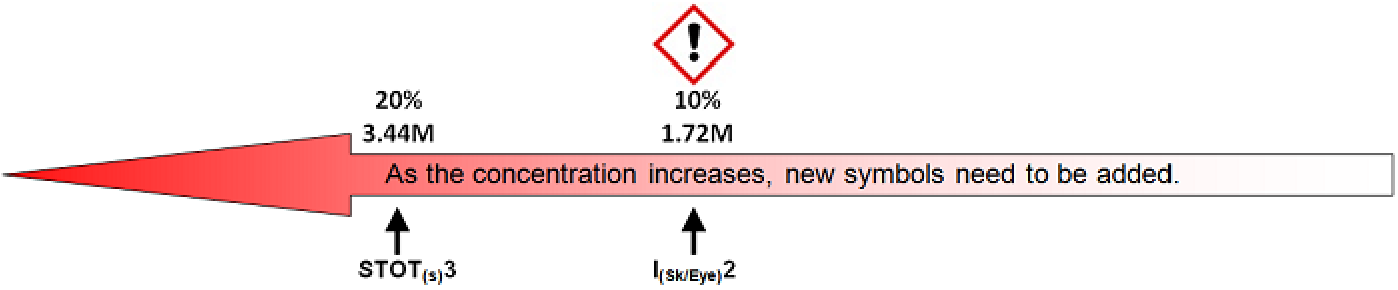
Highly flammable – very low flash point; mixtures of vapour with air (explosive range 2.6 – 12.8%). Vapour is irritant to eyes, skin and lungs and is narcotic in high concentrations. Propanone has comparatively low acute and chronic toxicities. If swallowed liquid is harmful to liver and kidneys.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| propanone | Danger | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H336: May cause drowsiness or dizziness.<br>EUH066: Repeated exposure may cause skin dryness or cracking |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Strong oxidising agents – nitric acid can ignite it, nitration mixture violently decomposes it, chromium(VI) oxide ignites even at ambient temperatures. Hydrogen peroxide and many peroxy compounds will form propanone peroxides which are explosive; do not use the solvent for peroxide oxidations. It reacts violently with trichloromethane (chloroform) if even a trace of a base is present; the surface of new glassware will provide sufficient alkalinity to catalyse this reaction.

## Handling

Use in well-ventilated area well away from flames, hot plates, etc. Wear eye protection and for bulk handling, nitrile gloves.

**FF** – DP, VL, WS.

## Storage

Flammables store.

## Disposal

Wear eye protection plus nitrile gloves and remove possible sources of ignition. Mix up to 200 cm$^3$ in 6 litres of water and run to waste with more water.

## Spillage

Wear eye protection plus gloves and remove possible sources of ignition. Evacuate room if spillage is large. Mop up small spills and wash to waste with water. Soak up larger spillages on absorbent, rinse well and run washings to waste. Ventilate the room thoroughly.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Soak affected part of clothing in water and remove sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing.

# Propanoic acid

Alternative name: propionic acid

Description: Colourless liquid with rancid smell. soluble in water, ethanol, ethers

## Hazards

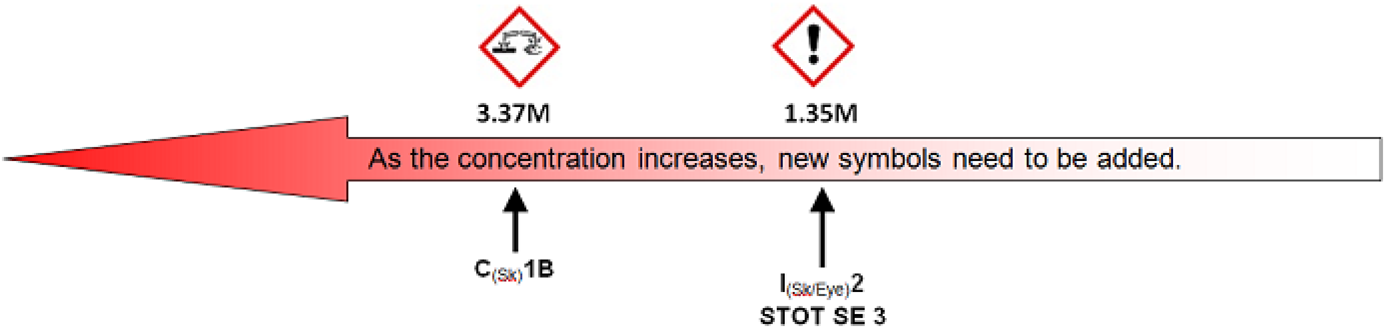
Liquid is corrosive and burns the skin and eyes. Harmful by skin contact and ingestion. The vapour irritates the respiratory system. Moderately flammable (though not sufficiently so to merit classification as such) when exposed to flame, heat (Expl. range 2.1 – 12%) and oxidising agents.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| propanoic acid | Danger | Skin corrosive Cat 1B | H314: Causes severe skin burns and eye damage. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents and reducing agents, alkalis, phosphorus(V) chloride.

## Handling

In fume cupboard, away from any source of ignition. Wear rubber or plastic gloves and goggles (BS EN 166 3).

**FF** – DP, VL, WS.

## Storage

With acids in general store, not beside amines.

## Disposal

Wear rubber or plastic gloves and goggles (BS EN 166 3). Turn off sources of ignition. In a fume cupboard add up to 50 cm3 to 10 volumes of water and wash down drain with plenty of water.

## Spillage

Shut off all sources of ignition and open windows. Evacuate room. Wear face shield and rubber or plastic gloves.
**Small spillages** – mop up and wash to waste with water.
**Larger spillages** – soak up on mineral absorbent. Transfer to bucket and rinse with slow running water. The absorbent can then be placed with ordinary waste.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if area affected is large.

# Propyl ethanoate

Alternative name: n-propyl acetate

Description: Colourless liquid. Soluble in ether, alcohol and partially in water.

## Hazards

Highly flammable forming explosive mixtures with air (2 – 8%). Harmful by inhalation, skin absorption and ingestion. Irritating to eyes, respiratory tract and skin. Degreases skin. Chronic exposure can lead to liver damage.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| propyl ethanoate | Danger | Flammable liquid cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure cat 3 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H336: May cause drowsiness or dizziness. |  |

## Concentration effects

Propyl ethanoate is only slightly soluble in water (1.9% at 20C). Even a saturated solution needs none of the labels above.

## Incompatibility

Strong oxidising agents. Can react violently with strong reducing agents, e.g. lithium tetrahydroaluminate.

## Handling

Wear nitrile gloves and eye protection. In fume cupboard, away from any source of ignition.

**FF** – DP, $CO_2$, VL.

## Storage

Flammables store

## Disposal

Wear eye protection and nitrile gloves. Only slightly soluble in water (16:1000) and washings from glassware, etc. must be emulsified before washing to waste. Alternatively reflux up to 40 g with excess 2M sodium hydroxide (CORROSIVE); when the upper layer has disappeared, allow to cool, neutralise with 2M hydrochloric acid (IRRITANT) and wash to waste.

## Spillage

Turn off all sources of ignition and ventilate room. Wear nitrile gloves and eye protection.
**Small quantities** – mop up, emulsify and wash to waste.
**Larger quantities** – absorb on sand. Remove to open area for evaporation.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. If exposure large and breathing is irregular or weak commence artificial respiration and obtain medical attention as soon as possible.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Seek medical attention if irritation persists.

# Pyridine

Description: Pale liquid with nauseating odour, miscible with water, alcohol or ether.

## Hazards

Highly flammable; mixtures of vapour with air explosive (1.8 – 12.4%). Dangerous fire hazard when exposed to heat, flame or oxidising agents.

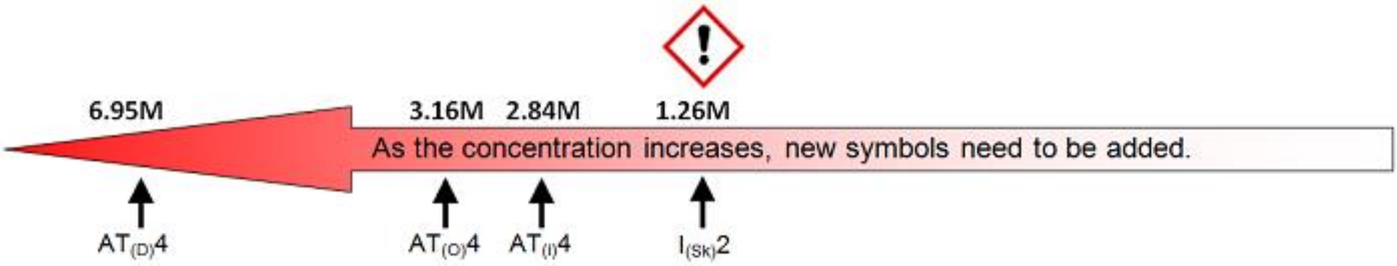
Harmful by skin contact, inhalation and by ingestion, damaging the central nervous system. Vapour is very irritating to the eyes. May cause dermatitis. Very harmful if swallowed. Vapour harmful to eyes and lungs especially if exposure prolonged (threshold of smell is 1 ppm, but can be an unreliable indicator due to olfactory fatigue.) May cause birth defects. Emits toxic fumes when heated to decomposition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| pyridine | Danger | Flammable liquid Cat 2<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation) | H225: Highly flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Mineral acids, chlorosulphonic acid. Oxidising agents; reacts violently with chromium(III) oxide, dinitrogen tetroxide. Even at low concentrations it decomposes cis-butenedioic (maleic) anhydride violently.

## Handling

Wear nitrile gloves and eye protection. Handle open vessels in fume cupboard, away from any source of ignition.

**FF** – WS, F, DP, $CO_2$.

## Storage

Flammables store.

## Disposal

Wear gloves (either low density polyethylene or rubber) and eye protection. Remove sources ofignition.

**Small quantities** – Can be washed to waste with plenty of running water. 2M hydrochloric acid can be added carefully to convert to the less volatile hydrochloride salt.

**Larger quantities** – Disposed by licensed contractor.

## Spillage

Wear gloves (either low density polyethylene or rubber) and eye protection and turn off all sources of ignition. Evacuate laboratory. Soak up on mineral absorbent and transfer to bucket. If spillage small, rinse this with 2M hydrochloric acid and run rinsings to waste. If large, label clearly and store for disposal by contractor. Ventilate spillage area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Remove patient to fresh air from exposure. Rest and keep warm. Obtain medical attention if irritation persists.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Pyrrole

Alternative names: azole, imidole

Description: Colourless liquid which darkens on standing; sparingly soluble in water and very soluble in ethanol, ethoxyethane.

## Hazards

Toxic if ingested. Harmful to eyes and to lungs especially if exposure prolonged. May cause birth defects. Irritating to skin and respiratory system. Flammable – Fire hazard when exposed to heat, flame or oxidising agents. Emits toxic fumes when heated to decomposition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| pyrrole | Danger | Flammable liquid Cat 3<br>Acute toxin Cat 4 (oral) | H226 : Flammable liquid and vapour.<br>H302 : Harmful if swallowed. |  |

## Concentration effects

Solutions of 25% or more (3.73M) Are acute toxins Cat 4 and should be labelled with GH507, the exclamation mark symbol !)

## Incompatibility

Reacts with oxidising agents and strong acids. Polymerises exothermically with acids and glycols. If heated to decomposition produces fumes of nitrogen oxides and carbon monoxide.

## Handling

Wear goggles and gloves (either low density polyethylene or rubber). Use in a fume cupboard and avoid sources of ignition.

**FF** – F, DP, $CO_2$.

## Storage

In a cool, well ventilated store and also, if space is available, in a flammables cabinet. Otherwise, store with organics of low flammability and away from glycols, oxidising agents or strong mineral acids.

## Disposal

Wear polythene or rubber gloves and goggles. Remove sources of ignition.

**Small quantities** – Rinsings from glassware can be washed to waste with plenty of running water.
2M hydrochloric acid can be added carefully to convert to the hydrochloride salt which is more soluble and also less volatile.
**Larger quantities** – Disposed by licensed contractor.

## Spillage

Turn off all sources of ignition, open windows and ventilate the room. Evacuate laboratory. Wear polythene or rubber gloves and goggles. Soak up on mineral absorbent and transfer to bucket. If spillage small, rinse this with 2M hydrochloric acid and run rinsings to waste. If large, label clearly and store for disposal by contractor. Ventilate spillage area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible.

### Mouth

If swallowed, obtain medical attention immediately. Otherwise, wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Remove patient to fresh air from exposure. Rest and keep warm. Obtain medical attention as soon as possible.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Quinoline

Description: Yellow hygroscopic liquid with penetrating odour. Dissolves in hot water. Miscible with ethanol & ethers.

## Hazards

Liquid and vapour are harmful via skin, eyes and lungs. A severe irritant to the same organs. If heated to decomposition it evolves toxic fumes of nitrogen oxides. Prolonged or repeated exposure can cause retinitis and paralysis.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| quinoline | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Skin / Eye irritant Cat 2<br>Mutagen Cat 2<br>Carcinogen Cat 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H302: Harmful if swallowed<br>H312: Harmful in contact with skin.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H341: Suspected of causing genetic defects<br>H350: May cause cancer<br>H411: Toxic to aquatic life with long lasting effects. |  |

## Concentration effects

Quinoline is only very slightly soluble in water at room temperature (0.0006% at 25C) but much more so in hot water so hot solutions are likely to have significant hazards. If details are needed for hot solutions, contact SSERC

## Incompatibility

Vigorous or explosive reactions with oxidising agents – hydrogen peroxide, peroxochromates and dinitrogen tetroxide, sulphur dichloride oxide, maleic anhydride.

## Handling

Wear butyl rubber gloves and goggles (BS EN 166 3). Leave open for the minimum time to minimise absorption of moisture.

**FF** – F, DP, CO2.

## Storage

With flammables, out of light and away from oxidising agents.

## Disposal

Wear goggles (BS EN 166 3) and butyl rubber gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified with detergent and washed to waste. Store larger quantities for disposal by contractor.

## Spillage

Wear eye protection and nitrile gloves. Open windows and doors.

**Smaller spillages** – Soak up on mineral absorbent, transport to fume cupboard. Rinse well with detergent and water. Wash spillage site thoroughly.
**Larger spillages** – Store soaked mineral absorbent or disposal by licensed contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large or if irritation persists.

# Silicon tetrachloride

Volatile colourless liquid, fumes in air, soluble in pet ether, ethoxyethane. Available in bottle or ampoule.

## Hazards

Corrosive irritant liquid and vapour causing burns to eyes, skin and the respiratory system. Toxic if swallowed causing severe internal damage. Emits toxic fumes when heated to decomposition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| silicon tetrachloride | Warning | Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H315: Causes skin irritation.<br>H320: Causes eye irritation.<br>H335: May cause respiratory irritation.<br>EUH014: Reacts violently with water. |  |

## Incompatibility

Fumes in moist air and reacts violently with water to produce hydrogen chloride gas. Reacts violently with sodium, potassium, ethanol, dimethyl sulphoxide.

## Handling

Wear rubber or plastic gloves and eye protection, preferably a faceshield. Handle in a fume cupboard. Remove stopper for shortest practicable time and avoid doing so on humid days to reduce ingress of water vapour. Replace glass stopper with PTFE one or use PTFE sleeves designed for Quickfit ground glass joints. See Uses and Control Measures.

## Storage

In desiccator over anhydrous calcium chloride as products of hydrolysis are silicon dioxide, which over cements the stopper in position, and hydrogen chloride which creates a high internal pressure. Store smallest quantity available.

**SSL** – 2 year maximum unless in sealed glass vials. Store smallest quantity available. Water reactive and over time reacts with moisture from the air. If the lid becomes cemented, the container can explode from the increase in pressure.

## Disposal

Wear rubber or plastic gloves and face shield. In fume cupboard slowly add up to 50 cm3 dropwise to 10 litres of water. When the reaction is complete, neutralise and run to waste with running water.

## Spillage

Evacuate room and open doors and windows. Wear rubber or plastic gloves and face shield. Spread anhydrous sodium carbonate liberally over the spillage, and mop up cautiously with water. Wash to waste using running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff has been inhaled or breathing affected.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Silver and other precious metals

Silver compounds are white/off-white crystals or powders – darken on exposure to light and in the presence of organic matter, e.g. skin. Silver nitrate is the compound that is most likely to be encountered so there is more information on this compound than the others.

## Hazards

Silver nitrate – Corrosive solid, causes burns to skin and damage to eyes. Concentrated solutions also burn. Avoid contact with eyes and skin. Very harmful by ingestion, causing severe internal irritation (exposure by this route unlikely in a laboratory). Very toxic to aquatic organisms and may cause long term effects in the aquatic environment. 0.1M solutions as commonly used are 1.7% and thus classes as Irritant.

Most silver compounds are of fairly low hazard, as are those of gold and other rare metals. Gold and platinum metals are low hazard although platinum is a very effective catalyst for many chemical reactions and can lead to fire/explosion if it is exposed to a mixture of flammable vapour and air. Platinum powder is pyrophoric but in reality, it is only likely to be encountered in schools in the form of wire or gauze.

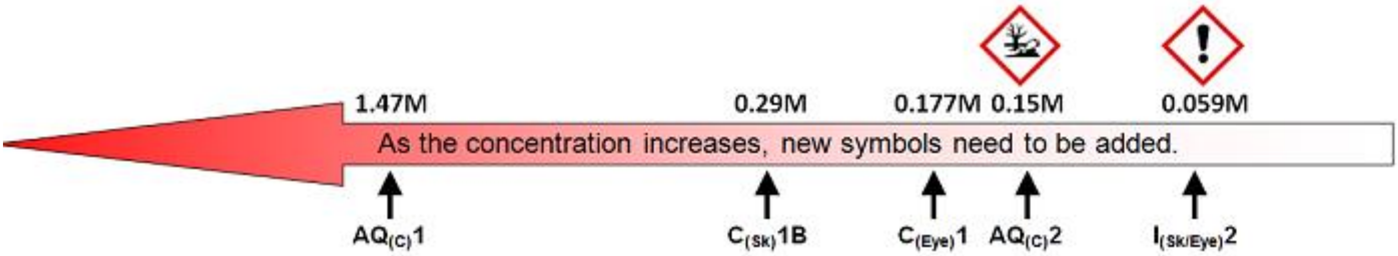
## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| silver, silver halides | | Hazardous to the aquatic environment with long-lasting effects Cat 1 | H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long-lasting effects. |  |
| silver nitrate | Danger | Oxidising solid Cat 2<br>Skin corrosive 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H272: May intensify fire; oxidiser.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long-lasting effects. |    |
| Silver oxide | Danger | Eye damage category 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H318 causes severe eye damage<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long-lasting effects. |   |
| gold III chloride, yttrium oxide | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific Target Organ Toxin on Single exposure Cat 3 | H315 causes skin irritation<br>H319 causes severe eye irritation<br>H335 may cause respiratory irritation |  |
| Gold<br>Platinum | | No significant hazard | | None |

## Concentration effects

### Silver nitrate only

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

**Silver nitrate** is incompatible with ethyne (acetylene) and carbides forms explosive acetylides; even the solution reacts vigorously with magnesium powder and strong reducing agents, especially powdered metals. Violently oxidises carbon, phosphorus and sulphur. Ammoniacal silver nitrate solution can on standing become a touch sensitive explosive. Such solutions should be freshly prepared on the minimum scale when needed and immediately disposed of afterwards by washing to waste with copious amounts of running water. With ethanol forms touch sensitive compounds (mixture of silver fulminate and ethyl nitrate). Silver salts of ethanedioic acid (oxalic acid) and 2,3-dihydroxybutanedioic acid (tartaric acid) decompose vigorously on heating. Reacts vigorously with chlorosulphonic acid.

Other silver compounds are incompatible with strong oxidising agents, strong acids and bases and most with ammonia, amines or ammonium compounds. Gold chloride and yttrium oxide are also incompatible with ammonia, amines and ammonia compounds

## Handling

For handling silver nitrate and oxide, wear goggles (BS EN 166 3) and rubber or plastic gloves. For the others, eye protection is recommended and gloves are a good idea to avoid staining of skin.

## Storage

Securely in store away from ammonia, oxidising & reducing agents.

## Disposal

Wear goggles (BS EN 166 3). Keep silver residues (or gold, yttrium etc residues e.g. silver chloride from titrations) for recycling see Uses, but small quantities of ammoniacal silver nitrate, such as washings, should be washed directly down drains with lots of water.

## Spillage

Wearing rubber or plastic gloves and goggles (BS EN 166 3), sweep up and wash to waste with water or into silver residues bottle. Some recrystallisation may be necessary. Wash the contaminated area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 15 minutes.  For silver nitrate and oxide, obtain medical attention as soon as possible. For the others, obtain medical attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Inhalation is very unlikely. In the event though, move patient from area of exposure. Obtain medical attention.

### Skin

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if irritation persists or large area is involved.

# Soda lime

Description: Calcium oxide with up to 20% sodium hydroxide and 16% water. Cream or green/brown solid as dust, granular or particulate.

## Hazards

Corrosive solid. Dust can burn eyes and skin severely irritate the respiratory system. Avoid breathing the dust.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| soda lime | Danger | Skin corrosive Cat 1A | H314: Causes severe skin burns and eye damage |  |

## Incompatibility

Reacts with water to give a strongly corrosive solution. Incompatible with strong acids. Can ignite if hydrogen sulphide is absorbed on it and is subsequently exposed to air on contact with paper.

## Handling

Wear goggles (BS EN 166 3) and rubber or plastic gloves and avoid raising dust. Granulated or particulate both have the advantage over the powder form of being relatively dust free.

## Storage

General store, cap fitted tightly and out of direct light. The effective life of an absorber of carbon dioxide is reduced with the amount of opening.

## Disposal

Wear goggles (BS EN 166 3) and rubber or plastic gloves. Mix in small portions up to 50 g with a large volume of water, stir and allow time for reaction, neutralise and wash to waste with copious amounts of water. Often the problem of used soda lime is that of the gases absorbed on to it. Soda lime can absorb a large amount of chlorine and this will be rapidly released if it is acidified. If used for absorbing hydrogen sulphide it should be wetted thoroughly immediately afterwards.

## Spillage

Wear rubber or plastic gloves and face shield. Shovel into a dry bucket. Treat as in Disposal.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water continuously. It is important to flush under eyelids also. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Sodium compounds

## Hazards

The tables below do NOT include the substances detailed elsewhere.

In general these sodium compounds are of low hazard, though some of them are moderate to severe eye and skin irritants. And under GHS, most sodium compounds are not classified as Harmful to the Aquatic Environment. Sodium azide, however, is a Category 2 acute toxin. and sodium hexanitrocobaltate is a suspected carcinogen (Cat 2).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium alginate, sodium bromide-2-water, sodium chloride, sodium citrate-2-water, sodium ethanoate, sodium ethanoate-3-water, sodium hydrogen carbonate, sodium methanoate, sodium octadec-9-enoate, sodium octadecanoate, sodium sulphate, sodium tauroglycholate, sodium thiosulphate | | No significant hazard | | None |
| sodium carbonate, sodium carbonate – 10-water | Warning | Eye irritant Cat 2 | H319 Causes serious eye irritation. |  |
| sodium iodide, sodium silicate | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2 | H315 Causes skin irritation.<br>H319 Causes serious eye irritation. |  |
| sodium sesquicarbonate (carbonate/hydrogen carbonate) | Warning | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335 May cause respiratory irritation. |  |
| Sodium nitroprusside | Danger | Acute toxin Cat 3 (oral) | H301: Toxic if swallowed |  |
| sodium bismuthate | Warning | Acute toxin (oral) Cat 4 | H302: Harmful if swallowed. |  |
| sodium azide | Danger | Acute toxin (oral) Cat 2.<br>Very toxic to aquatic life with long lasting effects Cat 1 | H300: Fatal if swallowed.<br>H410 Very toxic to aquatic life with long lasting effects.<br>EUH032 Contact with acids liberates very toxic gas. |   |

| | | | | |
|---|---|---|---|---|
| sodium dodecyl sulphate | Danger | Flammable solid Cat 1<br>Acute toxin (oral) Cat 4.<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Specific target organ toxin on single exposure Cat 3 | H228 Flammable solid.<br>H302 Harmful if swallowed.<br>H315 Causes skin irritation.<br>H318 Causes serious eye damage.<br>H335 May cause respiratory irritation. |  |

## Incompatibility

Nitrate, chromate, dichromate and hexanitrocobaltate should be kept away from combusitble materials. Azide, nitroprusside and thiocyanate react with acids to release flammable and toxic gases.

## Handling

Avoid raising dust from compounds in the solid state. Wear eye protection to handle those classed as irritant or harmful (Acute Tox Cat 4) and goggles (BS EN166 3) when handling the dodecyl sulphate the azide or the hexanitrocobaltate

FF –

## Storage

Securely in store. Keep nitrate, chromate, dichromate and hexanitrocobaltate with oxidising agents.

## Disposal

Wear goggles (BS EN 166 3) where appropriate.  For chromate, dichromate, ethoxide/methoxide fluoride, hydride, hydroxide, nitrate III, nitrate V, phosphate, sulphites and thiocyanates, see approriate page. The low-hazard compounds can be washed to waste with copious quantities of water. For the azide and hexanitrocobaltate, very small quantities such as washings from glassware can be washed to waste. Larger quantities should be stored for disposal by contractor.

## Spillage

For chromate, dichromate, ethoxide/methoxide, fluoride, hydride, hydroxide, nitrate III, nitrate V, phosphate, sulphites and thiocyanates, see appropriate page. For most, wear plastic gloves and eye protection as appropriate. Moisten with water, shovel into bucket and treat as for **Disposal**.

Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Remove contact lenses, if present and easy to do. Obtain medical advice/attention if irritation persists.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.  For **azide**, if swallowed seek medical attention immediately.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if fine powder has been inhaled. (especially for hexanitrocobaltate).

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice/attention if irritation persists.

# Sodium hydride

Crystalline solid dispersed in oil; may contain traces of sodium metal. Some samples are in bags which dissolve in methylbenzene.

## Hazards

Highly flammable especially in powder form. Corrosive / irritant to eyes, skin and respiratory system. Causes severe internal damage if ingested. This solid reacts violently with water, releasing hydrogen gas (EXTREMELY FLAMMABLE) and forming sodium hydroxide solution (CORROSIVE).

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium hydride | Danger | Water reactive Cat 1 | H260 : In contact with water releases flammable gases which may ignite spontaneously. |  |

## Incompatibility

The finely divided powder ignites in dry air. Reacts violently with strong oxidising agents, oxygen or sulphur and incandesces with halogens. Sodium hydride dust can explode on contact with flames, sparks, heat or oxidising agents.

## Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3). Open carefully as pressure may have built up by reaction with atmospheric moisture. Handle away from flames and moisture. Ensure spatula used is dry. Disperse small amount to another smaller container and screw lid of original bottle tight. Using this small bottle only reduces the exposure of the bulk of the sodium hydride to the atmosphere.

**FF** – Extinguish fires using dry powder or sand, **NOT** water or CO2.

## Storage

Best to buy 60% dispersion in mineral oil. Order smallest quantities available.

**SSL** – 2 years maximum. Order smallest quantities available. Water reactive and over time reacts with moisture from the air to form highly flammable hydrogen. If the lid becomes cemented, the container can explode from the increase in pressure.

## Disposal

Wear rubber or plastic gloves and face shield. Remove all sources of ignition. In a well-ventilated area, add small quantities slowly to a large quantity of butanol and when reaction complete neutralise with sodium hydrogensulphate and wash to waste.

## Spillage

Remove all sources of ignition and open windows. Wear gloves and face shield. Cover with dry sand and shovel the solid into a dry bucket. Treat as in *Disposal* above.

## Remedial Measures

**If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.**

### Eyes

Irrigate with water continuously (see note above). It is important to flush under eyelids also. Obtain medical attention as soon as possible.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if irritation persists.

**Skin**

Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## Sodium hydroxide

Alternative names: caustic soda

Appearance: White, deliquescent solid, usually sold as ‘pearls’ . Dissolves readily and exothermically in water.

### Hazards

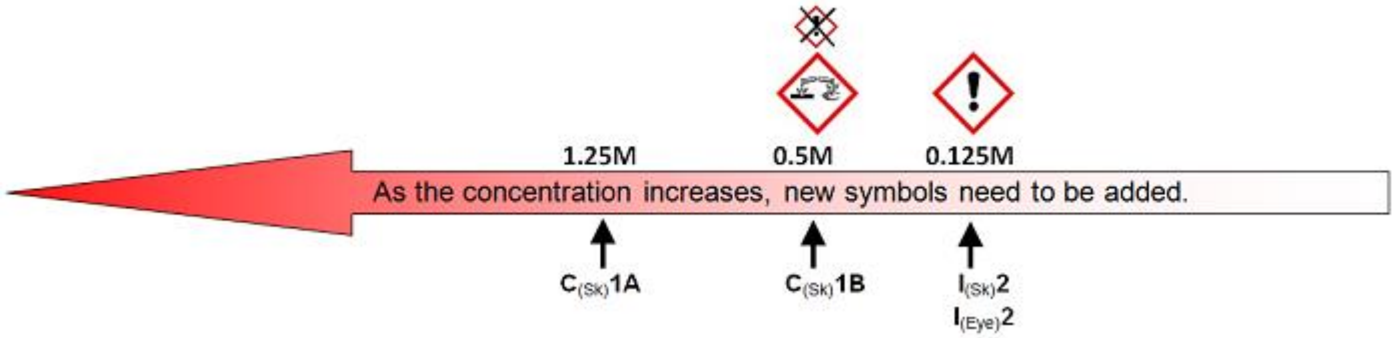
Strongly corrosive solid and solution. Very harmful if swallowed. Extremely dangerous to eyes as damage can occur long after the initial pain has subsided. Skin contact causes severe burning with blisters. Skin damage can be deep as even dilute solutions are absorbed.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium hydroxide | Danger | Skin corrosive Cat 1A | H314: Causes severe skin burns and eye damage. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Acids. Reacts with aluminium, zinc to evolve hydrogen (EXTREMELY FLAMMABLE). Reacts explosively or forms explosive compounds with warm ammoniacal silver nitrate, trichloroethane, trichloroethene, nitrobenzene, 4-chloro-2-methylphenol, sodium tetrahydroborate. Considerable heat is produced with water, and some spattering may occur if the amount of water added is small.

### Handling

Wear pvc gloves and goggles (BS EN 166 3).

### Storage

General store. Never in the laboratory. Do not store solid or solutions in ground glass stoppered bottles since they stick badly.

### Disposal

Wear pvc gloves and face shield. Slowly add up to 40 g to 2 litres of water with stirring. Neutralise with 1M ethanoic or 1M sulphuric acid (IRRITANT) (test with pH paper for approximate neutrality) and wash to waste with lots of running water.

### Spillage

Wear pvc gloves and face shield. Add sand and shovel into dry plastic bucket for transport to safe open area. Treat as in Disposal. The washed sand or absorbent can be placed in the ordinary refuse.

## Remedial Measures

**If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOUR**S. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water continuously (see note above). It is important to flush under eyelids also. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing. Obtain medical attention if area affected is large.

# Sodium metal

Soft, silver/white metal sticks or wire stored under liquid paraffin

## Hazards

A highly flammable and corrosive solid. Reacts violently with water to produce extremely flammable hydrogen gas, and a corrosive solution of sodium hydroxide. Produces chemical and thermal burns in contact with the moisture of the skin. Spontaneously flammable when heated in air. Dangerous fire and explosion hazard when exposed to heat or flame, or by chemical reaction with moisture, air or any oxidising material. See also sodium hydroxide and hydrogen.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sodium metal | Danger | Water reactive Cat 1<br>Skin corrosive Cat 1B | H260: In contact with water releases flammable gases which may ignite spontaneously.<br>H314: Causes severe skin burns and eye damage.<br>EUH014: Reacts violently with water. |  |

## Incompatibility

Reacts violently with acids, carbon dioxide, air, tetrachloromethane and other chlorinated hydrocarbons, halogens (especially liquid bromine) and oxidising agents. Mixtures with many metal halides or with water can react vigorously.

## Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3).

**FF** – Use dry powder or graphite. Alternatively smother with soda ash or dry sand. Allow small quantities to burn out if there are no other flammable or incompatible substances nearby.

Ensure no small pieces of sodium are missed at the end of the experiment or demonstration, e.g. those on tiles or mortars used to cut the sodium or on filter paper used to dry off the liquid paraffin or on bench tops; otherwise the next person may be badly burned. Immerse these items in a sink of water and mop benches down with a very wet cloth.

## Storage

With water reactive metals in secure closed box away from oxidising agents and aqueous solutions. Store under liquid paraffin. Never in lab.

## Disposal

Wear rubber or plastic gloves and face shield. Ensure sources of ignition are absent and preferably use a fume cupboard, but a well ventilated laboratory will be adequate. Add a 2 g piece of sodium to a 50 cm3mixture (3 : 1 by volume) of propan-2-ol (HIGHLY FLAMMABLE and IRRITANT) and ethanol (HIGHLY FLAMMABLE). The reaction with propan-2-ol is quite slow and if necessary, a little ethanol can be added to slightly increase the rate of reaction. When reaction is finished, greatly dilute and wash to waste.

## Spillage

**Small amounts** – treat as in Disposal.
**Larger amounts** – Cover with anhydrous sodium carbonate and shovel into a dry bucket. Transport to a safe, open area and add, a little at a time, to dry propan-2-ol. Leave to stand for 24 hours, neutralise and wash to waste, diluting greatly with running water.

## Remedial Measures

If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance. Continuous irrigation is also recommended for skin and mouth exposure until hospital is reached.

### Eyes

Irrigate with water continuously (see note above) to leach out any hydroxide ions which may have been absorbed into the eye. It is important to flush under eyelids also. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

On exposure to sodium vapour or fumes of sodium oxide Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wearing rubber or plastic gloves, remove any adhering metal and drench the skin with water. Wash well with water for an extended time as damage can continue after irritation has eased. Remove and wash contaminated clothing.

# Strontium compounds

Description: Strontium compounds are white or colourless powders or crystals. The oxide reacts with water to form the hydroxide which in turn will react with carbon dioxide to form the carbonate. Their properties are generally between those of calcium and barium compounds

## Hazards

Strontium compounds exhibit a low order of toxicity. Many of them, like many barium and calcium compounds are corrosive to skin and/or eyes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| strontium carbonate | | No significant hazard | | None |
| strontium chloride | Danger | Skin irritant Cat 2<br>Eye Damage Cat 1<br>Specific Target Organ Toxin on Single Exposure Cat 3 | H315 Causes skin irritation<br>H318 Causes serious eye damage<br>H335 May cause respiratory irritation |  |
| strontium chloride-6-water, strontium nitrate, strontium nitrate-4-water | Danger | Oxidising solid Cat 1 (nitrates only)<br>Eye Damage Cat 1 | H271 May cause fire or explosion; strong oxidiser (nitrates only)*<br>H318 Causes serious eye damage |   |
| strontium oxide | Danger | Skin corrosive Cat 1B | H314 Causes severe skin burns and eye damage |  |
| strontium hydroxide, strontium hydroxide-8-water | Danger | Acute Toxin Cat 4 (oral) (Sr(OH)2 only)<br>Skin corrosive Cat 1B | H302 Harmful if swallowed<br>H314 Causes severe skin burns and eye damage |   |

## Incompatibility

Keep compounds away from strong oxidising agents. Nitrate should be kept away from strong reducing agents. The nitrate and carbonate should be kept away from strong acids and the oxide should be kept away from water.

## Handling

Wear goggles (BS EN166 3) and gloves as required. Avoid raising dust.

## Storage

The nitrate should be kept with other oxidising reagents. Others can be kept in the general store.

## Disposal

Small amounts can be diluted with water to less than 0.1M and washed to waste with copious quantities of water. Large amounts should be kept for disposal by licensed contractors.

## Spillage

Wear eye protection and gloves. Sweep up solids carefully and treat as for disposal above.

## Remedial Measures

### Eyes

Remove contact lenses if worn and if possible to do so. Irrigate with water for at least 15 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Seek medical advice if feeling unwell. If unconscious obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Sulphamic acid

Alternative name: amidosulphonic acid

Description: Colourless, non-hygroscopic orthorhombic crystals. Soluble in water.

## Hazards

Irritant to the eyes, skin and respiratory system (if inhaled as dust). When dissolved in water gives strongly acidic solutions with pH of approx. 1 (Ka = $10^{-1}$). Moderately toxic if ingested in quantity. Harmful to aquatic organisms.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sulphamic acid | Warning | Skin / Eye irritant cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 3 | H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H412: Harmful to aquatic life with long lasting effects. |  |

## Incompatibility

Oxidising agents. Violent or explosive reactions with fuming nitric acid, metal nitrates or nitrites + heat, or reacts with chlorine to give explosive nitrogen chloride. Gives off toxic fumes when heated to decomposition.

## Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3), nitrile gloves and use a fume cupboard.

## Storage

In general store away from oxidising agents.

## Disposal

Wear rubber or plastic gloves and goggles (BS EN 166 3). Dissolve up to 10 g at a time in a large volume of water, carefully add 2M sodium hydroxide (CORROSIVE) to neutralise and run to waste with more water.

## Spillage

**Solid** -Wear goggles (BS EN 166 3). Carefully lift into a bucket and treat as in Disposal.
**Solution** – Soak up on mineral absorbent or sand and transfer to a bucket. Treat as in Disposal. The washed absorbent may be placed with the ordinary refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if large area is involved.

# Sulphanilic acid

Alternative name: 4-aminobenzenesulphonic acid

## Hazards

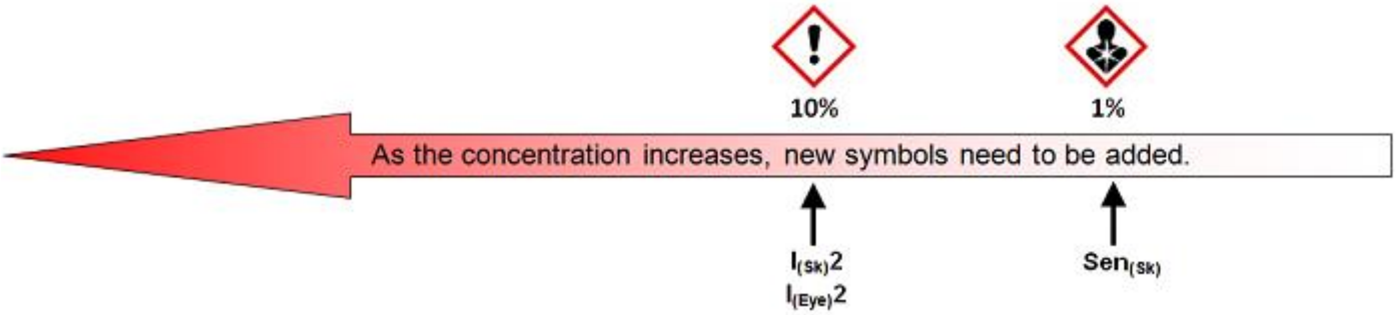
Irritating to eyes and skin. Possible skin sensitiser. Harmful if swallowed. When heated to decomposition it emits very toxic fumes.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| Sulphanilamide | | No significant hazard | | None |
| p-sulphanilic acid | Warning | Skin / Eye irritant Cat 2<br>Skin sensitiser Cat 1 | H315: Causes skin irritation.<br>H317: May cause an allergic skin reaction<br>H319: Causes serious eye irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents.

## Handling

Wear rubber or plastic gloves and eye protection.

## Storage

General store away from oxidising agents.

## Disposal

Wear eye protection and rubber gloves. The small amounts of the solution used in colorimetric determination may be washed to waste. For any larger amounts that this or test-tube washings, store for disposal by a licensed waste disposal contractor.

## Spillage

Wear rubber or plastic gloves and eye protection, scoop into containers and dissolve small portions in a large volume of warm water and wash to waste. If the amount is large, store for disposal by a licensed waste disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. Obtain medical advice.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice if irritation persists.

## Sulphates and sulphites (sodium & potassium)

Alternative names: There are various names which are not always used consistently. $SO_4$ is always sulphate, $SO_3$ is always sulphite and $S_2O_3$ is always thiosulphate. Hydrogen sulphates are also known as bisulphites.

Hydrogen sulphates are both very soluble in water and can be used as a solid acid: $Ka = 10^{-2}$

### Hazards

Sulphates are of low hazards but the various sulphites are generally corrosive/irritant to some degree.

Solid and strong solutions of hydrogen sulphates are corrosive and cause severe burns to eyes and can irritate skin. Very destructive of mucous membranes and dust is very irritating to the respiratory system. Very harmful if ingested. The sodium salt is listed as being ‘irritant’ rather that corrosive. Given that the corrosive agent seems to be the hydrogen sulphate moiety, it would be prudent to treat it as corrosive, whatever the official classification. Many sulphites will emit toxic sulphur dioxide in contact with acids.

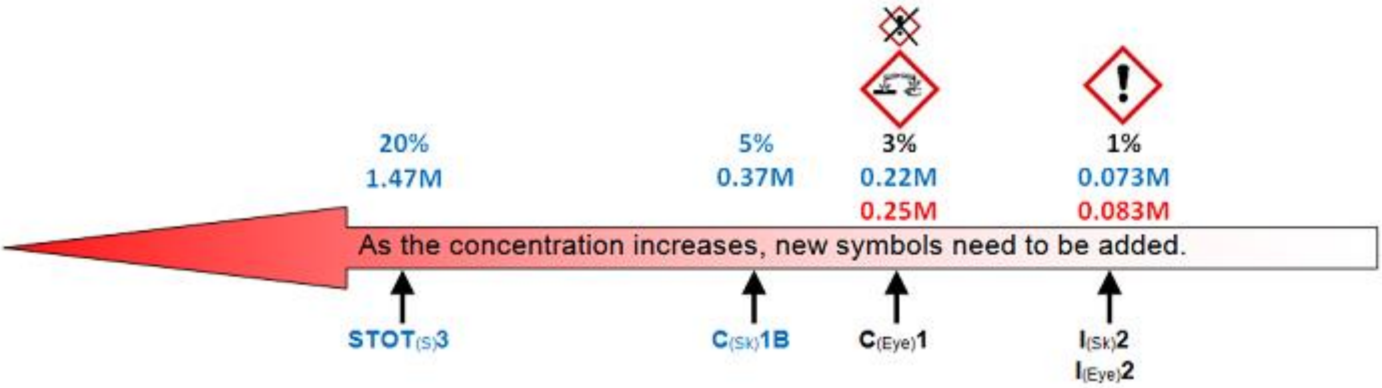
### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| potassium sulphate, sodium sulphate sodium sulphate-10-water, potassium sulphite, disodium disulphate, sodium thiosulphate | | No significant hazard | | None |
| Potassium hydrogen sulphate, potassium disulphate, Sodium sulphite | Danger | Skin corrosive Cat 1B<br>(Specific target organ toxin on single exposure Cat 3 – $KHSO_3$ only) | H314 Causes severe skin burns and eye damage.<br>(H335 May cause respiratory irritation – $KHSO_3$only) |  |
| Sodium hydrogen sulphite, sodium hydrogen sulphite-1-water, sodium disulphate | Danger | Eye damage Cat 1<br>(Acute toxin Cat 4 (oral) – disulphate only) | H318: Causes serious eye damage<br>(H302: Harmful if swallowed – disulphate only |  |
| Sodium dithionite | | Self Heating Solid Cat 1<br>Acute toxin Cat 4 (oral)<br>Contact with acids liberates toxic gas | H251: Self-heating, may catch fire<br>H302: Harmful if swallowed<br>EUH031; Contact with acids liberates toxic gas |  |
| dipotassium disulphite, potassium disulphate, sodium sulphite | | Skin irritant Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H315 Causes skin irritation<br>H319 Causes severe eye irritation<br>H335 May cause respiratory irritation |  |

### Concentration Effects

Figures are given here for hydrogen sulphates only. If you need information on any of the others, please contact SSERC.

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. **Blue** = *potassium hydrogen sulphate*, **Red** = *sodium hydrogen sulphate*



## Incompatibility

Sulphates VI are stable. There is a risk of release of toxic sulphur dioxide on exposure to acids. Also, mixture with sodium nitrate III (nitrite) will lead to a vigorous exothermic reaction.

**Hydrogen sulphates** react with chlorates(I) to liberate chlorine (TOXIC); mixture of the two solids may explode. Can act as a possible acidic catalyst. If heated strongly with propane-1,2,3-triol, the latter is dehydrated to yield the very toxic propenal (acrolein).

**Dithionite** addition of small amounts of water to the solid can cause spontaneous ignition. Explosive mixtures may form with oxidising agents.

## Handling

Sulphates and thiosulphates are of low hazard. Wear goggles (BS EN 166 3) and nitrile gloves when handling solids or solutions more concentrated than 10% or approx. 1M; label CORROSIVE. For solutions between 0.5 and 1M label IRRITANT.

## Storage

With general chemicals. Sulphates and thiosulphates are stable. All sulphites will absorb water vapour from the atmosphere to release toxic sulphur dioxide (and possibly increase pressure in the container). They will also react (slowly) with atmospheric oxygen. **Dithionite** must be kept dry. If it gets damp enough, the substance can spontaneously ignite in air. Moisture can cause release of toxic sulphur dioxide (and possible increase of pressure in container).

## Disposal

**Sulphates** and **thiosulphates** can be washed to waste with copious quantities of water. For **dithionite**: Add 20 g of the solid to 1 litre of water in 5 g amounts in a fume cupboard. Wait until the reaction is finished before more is added. Pour the liquid down a foul-water drain. For **sulphites** and **hydrogen sulphites**, wear goggles (BS EN 166 3) and gloves. Small quantities such as washings of glassware can be washed down the drain. Larger quantities – dissolve in water (up to 20 g per litre), neutralise with sodium carbonate and run to waste. Otherwise store for collection by licensed contractor.

## Spillage

Carefully sweep up and treat as in Disposal. Soak up solutions on absorbents. Wash through with plenty of water and place washed absorbent in refuse.

For dithionite: If the solid or concentrated solution is producing appreciable amounts of sulphur dioxide, the fire brigade should be called. Scoop up as much solid as possible. Rinse the area with a large excess of water, add mineral absorbent and clear up.

## Remedial Measures

**If the eyes are exposed they MUST BE IRRIGATED CONTINUOUSLY until the hospital is reached and thereafter for possibly HOURS. The irrigation in transit may be difficult in a vehicle other than an ambulance.**

### Eyes

Irrigate with water continuously (see above). Obtain medical attention as soon as possible.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

**Lungs**

Exposure by this route unlikely. Move patient from area of exposure. Rest and keep warm.If wheezing or coughing persists, obtain medical attention.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing. If area or irritation persists or is large, obtain medical attention.

## Sulphur

Description: Yellow powder, hard roll, crystals, powder or sticks with a slight, characteristic smell.

### Hazards

Low toxicity but the solid is easily ignited to produce TOXIC sulphur dioxide. Dust can be irritating to eyes and if inhaled.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sulphur | Warning | Skin irritant Cat 2 | H315: Causes skin irritation |  |

### Incompatibility

Dangerous explosive mixtures with many metallic powders (especially zinc, magnesium & aluminium), phosphorus, halogen oxides – chlorine dioxide and iodine(V) oxide, carbides. It can react at room temperature with fine copper powder under slightly damp conditions. It ignites spontaneously with lampblack or freshly calcined charcoal. Mixtures with many oxidising agents are unstable, e.g. ammonium nitrate, nitrates and nitrites of sodium and potassium, chromic(VI) acid, mercury(II) oxide, chlorates(V) and (VII) and halogenates, metal oxides (e.g., silver, chromium(VI), mercury(II) and lead(IV)) and metal peroxides.

### Handling

Wear eye protection and avoid possible ignition.

**FF** – WS.

### Storage

General store away from oxidising agents and metals.

### Disposal

Wear eye protection. Small amounts such as washings of test tubes can be run to waste. Test tubes used for examining the effect of heat on sulphur can be kept and used again. Alternatively small amounts can be burnt off in the fume cupboard and the fumes of sulphur dioxide trapped in alkali solution.

### Spillage

Wear eye protection. Moisten slightly and sweep up. If quantity large, purify by dissolving off soluble materials. If there is doubt about its purity, keep for licensed disposal contractor.

### Remedial Measures

#### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

#### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice.

#### Lungs

If dust is inhaled move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

#### Skin

Wash well with soap and water. Remove and brush powder off clothing. Avoid breathing dust. Wash contaminated clothing.

# Sulphur dichloride dioxide

Alternative name: sulphuryl chloride

## Hazards

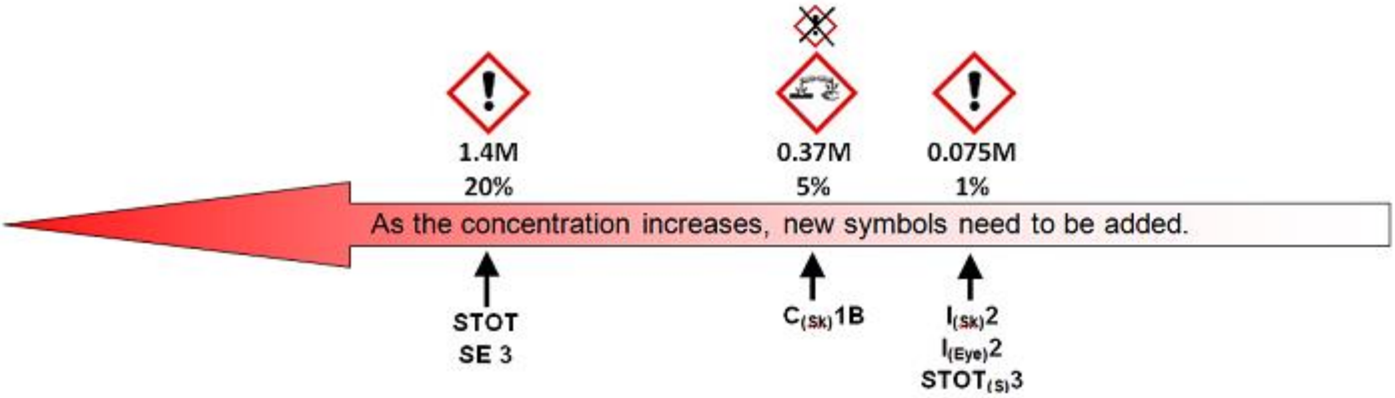
Corrosive liquid and vapour burns and is severely irritating to skin, eyes and respiratory system. Dangerous if swallowed or inhaled causing serious irritation and damage. An experimental carcinogen.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sulphur dichloride dioxide | Danger | Skin corrosive Cat 1B<br>Specific target organ toxin on single exposure Cat 3 | H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation.<br>EUH014: Reacts violently with water |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Reacts violently with water or steam to give heat and toxic/corrosive fumes of sulphuric and hydrochloric acids. Reacts violently/explosively with alkalis, lead(IV) oxide (lead dioxide), phosphorus, dimethyl sulphoxide and higher oxides of nitrogen. Emits toxic/corrosive fumes when heated to decomposition. Solution in ether or ether peroxides can decompose vigorously.

## Handling

Wear nitrile gloves and goggles (BS EN 166 3). Handle only in fume cupboard. Open carefully as pressure may have built up.

## Storage

With acids securely in store.

**SL** – Maximum of 2 years if stored in good conditions.

## Disposal

Wear face shield and nitrile gloves. Using a fume cupboard add slowly in small portions to a large volume of cold water with ice added in a plastic bucket. Allow time for reaction between the addition of portions. Leave to stand for a day. When reaction is complete neutralise with sodium carbonate and wash to waste with lots of running water.

## Spillage

Ventilate and evacuate room and allow fumes to subside. Wearing protective clothing, nitrile gloves and face shield, cover small spillages with excess soda ash or sodium hydrogencarbonate. Mop up carefully and wash to waste with lots of running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists or if large area is involved.

## Sulphur dichloride oxide

Alternative name: thionyl chloride

Description: Colourless/pale yellow/yellow to red fuming liquid with a sulphur dioxide like smell.

### Hazards

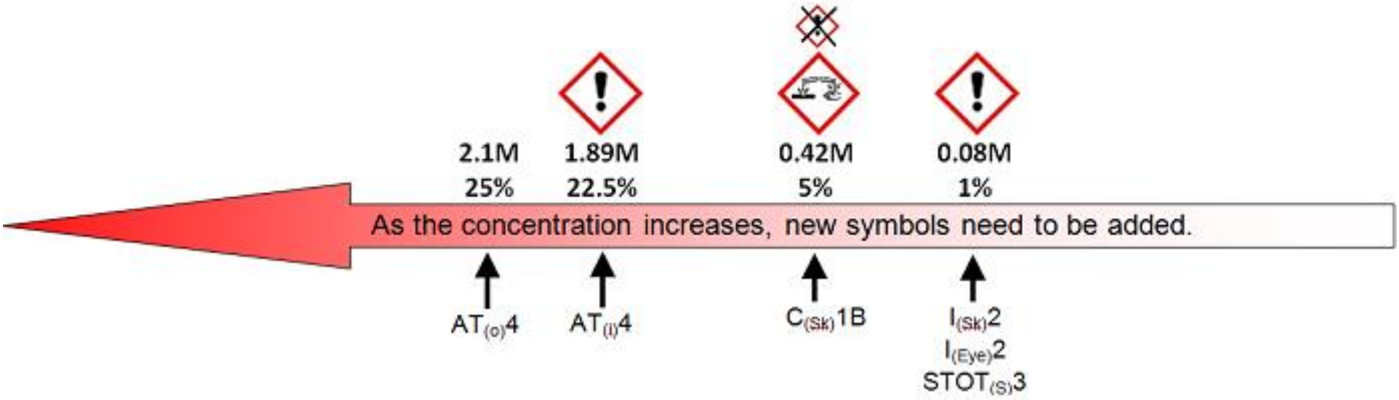
The vapour and liquid are corrosive. Irritating to the eyes, skin and respiratory system causing serious burns. Harmful by inhalation giving off a pungent odour akin to sulphur dioxide. Liquid is considered to be more toxic than sulphur dioxide. If swallowed causes serious internal damage.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sulphur dichloride oxide | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Skin corrosive Cat 1A | H302: Harmful if swallowed.<br>H332: Harmful if inhaled.<br>H314: Causes severe skin burns and eye damage.<br>EUH014: Reacts violently with water.<br>EUH029: Contact with water liberates toxic gas. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Incompatible with oxidising agents, acids, alkalis, combustibles. Reacts violently with water to produce hydrogen chloride and sulphur dioxide (both toxic gases). Explosive reaction with ammonia, dimethyl sulphoxide or dimethyl methanamide (dimethyl formamide).

Handling

Wear high grade pvc gloves and goggles (BS EN 166 3). Handle only in fume cupboard. Open carefully as pressure may have built up.

### Storage

With water reactive corrosives. Keep cool and dry.

**SSL** – Maximum of 2 years if stored under good conditions. Water reactive and over time reacts with moisture from the air to produce violent reactions.

## Disposal

Wear high grade pvc gloves and face shield. In a fume cupboard, carefully mix with anhydrous sodium hydrogencarbonate. Add this mixture carefully to a large volume of water, neutralise with 4M ammonium hydroxide (CORROSIVE) or 4M hydrochloric acid (CORROSIVE) and wash to waste with a large excess of running water.

## Spillage

Wear high grade pvc gloves, protective clothing and goggles (BS EN 166 3). Ventilate room and after fumes have died down spread anhydrous sodium hydrogencarbonate or dry soda ash / calcium hydroxide (50/50) (IRRITATING) over the liquid, scoop into bucket, neutralise as in Disposal then wash to waste with a large excess of running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention.

## Sulphur dioxide

Colourless, choking gas: soluble in water, ethanol & ether. Also available as liquid.

### Hazards

Vapour is corrosive and very toxic by inhalation above 400-500 ppm. The respiratory system is irritated by concentrations of 6-12 ppm and even a small amount may severely affect persons suffering from bronchitis and asthma. Irritant to eyes at 20 ppm. Do not attempt to inhale the gas. Light aluminium syphons are easily punctured and tend to corrode. These have now been withdrawn and replaced with thick-walled stainless steel. Any remaining aluminium syphons should be disposed of.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sulphur dioxide | Danger | Pressurised gas<br>Acute toxin Cat 3 (inhalation)<br>Skin corrosive Cat 1B | H280: Contains gas under pressure; may explode if heated<br>H331: Toxic if inhaled.<br>H314: Causes severe skin burns and eye damage. |  |

### Incompatibility

Reaction with water generates a lot of heat. Iron(II) oxide, tin(II) oxide and lead(IV) oxide all incandesce on heating in the gas and barium peroxide does so without heat. Sodium hydride reacts explosively. With potassium chlorate(V) explosive chlorine dioxide is evolved. Finely divided chromium and manganese metals and alkali metal acetylides incandesce in it.

### Handling

Wear pvc gloves and goggles (BS EN 166 3). Preparation of sulphur dioxide or use of syphon or cylinder should be carried out in fume cupboard. Avoid the possibility of suck back of water into syphon by using a trap (gas wash bottle with connections reversed).

### Storage

Older aluminium cylinders containing sulphur dioxide are susceptible to corrosion, particularly the valve itself and at the junction where the brass valve is in contact with the aluminium cylinder. Remove any tubing and store out of contact with corrosive fumes from acids. The most suitable place is an open shelf in a ventilated store. Never in laboratory or in a fume cupboard unless leaking.

**SSL** – There is no shelf life or safe shelf life associated with the sulphur dioxide itself. However, there can be issues with the cylinders as, in humid conditions, the gas reacts with water to form corrosive acids. This causes rapid corrosion of some metals including the cylinder and valve. Store the cylinder in polythene bag containing silica gel. Consult the supplier of your cylinder for details of safe shelf life. If no other information or guidance is forthcoming then assume a value of 6 or 7 years.

### Disposal

Wear pvc gloves and face shield. Leaking cylinders should be placed in a fume cupboard. If a valve on a cylinder cannot be opened, the cylinder should be placed in the freezing compartment of a laboratory fridge or deep freeze for at least 4 hours. The pressure in the cylinder is reduced to about atmospheric and it is then quite safe to file the cylinder at the neck until a very small hole is produced. The gas can then be allowed to escape **slowly** in fume cupboard or in an open area. Alternatively bubble the gas through a solution of alkali or absorb it in the solution using the inverted filter funnel anti-suck back device. Wash the solution to waste.

## Spillage

In the case of an escape of the gas into the laboratory evacuate and ventilate the room by opening external windows. Proceed as in Disposal.

## Remedial Measures

### Eyes

For vapour – irrigate with water for at least 10 minutes. If liquid is splashed irrigate with water as above and obtain medical attention as soon as possible.

### Mouth

Exposure is unlikely by this route. Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention immediately.

### Lungs

Move patient from area of exposure. If asthmatic attack is brought on, the casualty can use their own inhaler/nebuliser e.g. Ventolin. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## Sulphuric acid

Sulphuric acid – colourless solution to colourless, dense, oily liquid

Oleum – colourless-brown fuming liquid/solid

### Hazards

Sulphuric acid is very corrosive to all body tissue causing severe burns. **Never add water to the concentrated acid** as the large heat of solution can vaporise the water and produce spattering. Dilute acid is also harmful to eyes and skin and repeated contact can cause dermatitis.

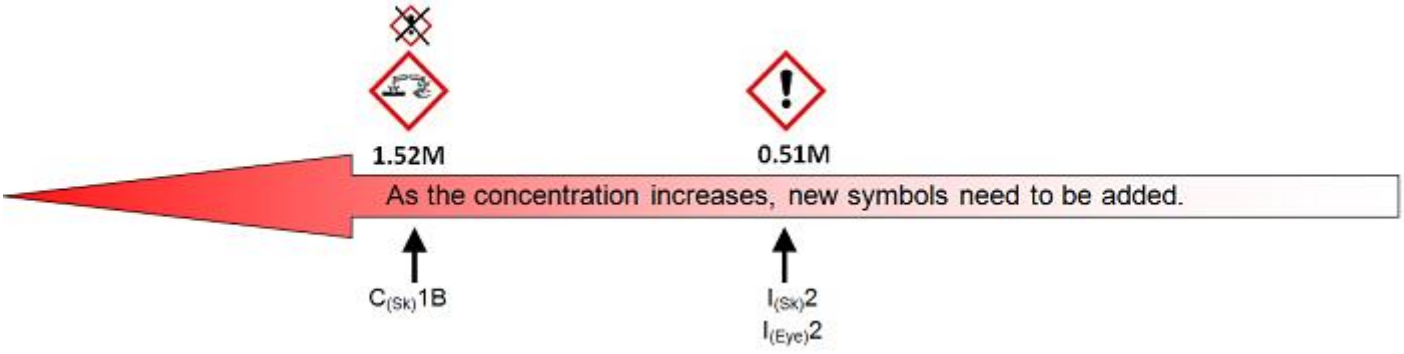
**Oleum should not be used in a school chemistry lab.** It is an extremely dangerous liquid with very harmful fumes (see sulphur dioxide /trioxide). Causes burns to eyes and skin, and fumes are very harmful to all parts of the respiratory system. Never add water to oleum. Extremely harmful if swallowed. Much more dangerous than concentrated sulphuric acid.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| sulphuric acid | Danger | Skin corrosive Cat 1A | H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation. |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Concentrated sulphuric acid and oleum both react very violently with water or substances containing water, and with reducing agents. They can ignite or explode on contact with a wide range of materials. Incompatible with hydrochloric acid, concentrated hydrogen peroxide, halides, chlorates, manganates(VII), white phosphorus, sodium, potassium, copper, phenylmethanol, several salts with water of crystallisation etc.

### Handling

Wear face shield, nitrile gloves and pvc apron. Use fume cupboard for oleum.

### Storage

With acids in general store.

### Disposal

Wear face shield, nitrile gloves and pvc apron. Disposal is best done in a plastic bucket placed in a sink. Add in small portions, with stirring, up to a total of 100 $cm^3$ to 5 litres of water chilled with ice. Neutralise with sodium carbonate and wash to waste with running water.

### Spillage

Wear face shield, nitrile gloves and pvc apron. Spread anhydrous sodium carbonate over the spillage, lift on to shovel and treat as in **Disposal**. Mop up contaminated area well.

## Remedial Measures

If the eyes are affected it is essential to obtain medical attention as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Possible exposure by aerosol of acid. Move patient from area of exposure. Rest and keep warm. Obtain medical attention if irritation is produced.

### Skin

Wash well with soap and copious amounts of water. Remove and wash contaminated clothing. Obtain medical attention if area affected is large.

## Tetrachloromethane & 1,1,1-trichloroethane

**These compounds have both been banned for many years as ozone depleters.**

**In the unlikely event you find any old stock, arrange for disposal by licensed contractor.**

# Tetrachloroethene and Trichloroethene

Description: Colourless liquids with smells like chloroform (tri) or ether (tetra).

## Hazards

Category 2 and 1B carcinogens respectively. Risk of irreversible effects causing liver and kidney damage. CNS damage. The tetra- is less toxic than the trichloro- compound and both are readily absorbed via skin and lungs. Vapours are harmful to lungs, eyes and skin. Inhalation of lower concentrations of the vapours or ingestion of the liquids may cause headache, nausea and disorientation; High concentrations of the trichloro- compound cause unconsciousness and cardiac arrhythmias, possibly causing death. Repeated exposure defats the skin and may lead to dermatitis. Flammable only at high temperatures giving off toxic and corrosive gases.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| tetrachloroethene | Danger | Carcinogen Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H351: Suspected of causing cancer.<br>H411: Toxic to aquatic life with long lasting effects. |  |
| trichloroethene | Danger | Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Mutagen Cat 2<br>Carcinogen Cat 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 3 | H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H341: Suspected of causing genetic defects by inhalation<br>H350: May cause cancer by inhalation<br>H336: May cause drowsiness or dizziness.<br>H412: Harmful to aquatic life with long lasting effects. |  |

## Incompatibility

Powerful oxidising agents; can explode with alkali metals, alkaline earth metals, and with aluminium, producing acidic gases. Incompatible with strong alkalis. Reacts with solid or concentrated sodium hydroxide or potassium hydroxide to form dichloroethyne which explodes on contact with air.

## Handling

Wear nitrile gloves and eye protection. Try to substitute and reduce exposure to a minimum. Dispensing and other “open” activities must be in a fume cupboard.

**FF** – DP, CO2, VL.

## Storage

General store. They hydrolyse slowly to give hydrochloric acid. Keep away from light.

## Disposal

Wear nitrile gloves and eye protection. Unavoidable discharges, e.g. small quantities such as washings from glassware should be emulsified and washed to waste. Store larger quantities for disposal by contractor.

## Spillage

Wear nitrile gloves and face shield. Emulsify with water and detergent and wash to waste. If spillage large, open windows and soak up on mineral absorbent and store for uplift by disposal contractor.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention as soon as possible.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## Tetrahydrofuran

Alternative name: THF

Description: Colourless, volatile liquid with ether-like smell. Usually sold stabilised with 0.1% quinol or BHT (butylated hydroxybenzene).

### Hazards

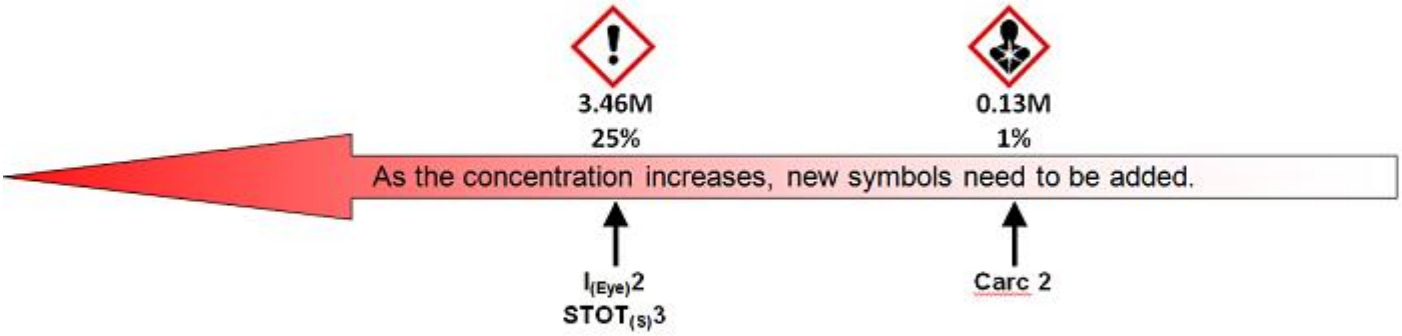
Highly flammable volatile liquid and vapour. Presents a dangerous fire or explosion risk (explosive range 1.8 – 11.8%) when exposed to heat, flame or oxidising agents. If unstabilised will form thermally explosive peroxides when exposed to the air. Irritates and is harmful to the eyes and respiratory system. Moderately toxic if swallowed possibly causing liver and kidney damage. Narcotic in high concentrations causing anaesthesia. Dermatitis can be caused by skin exposure.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| tetrahydrofuran | Danger | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Carcinogen Cat 2 | H225: Highly flammable liquid and vapour.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation.<br>H351: Suspected of causing cancer |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Oxidising agents. Explosive peroxides can form by autoxidation. Explosive reactions with potassium hydroxide, sodium hydroxide, sodium aluminium hydride, lithium aluminium hydride, sodium borohydride, bromine, calcium hydride + heat etc. Gives off acrid smoke and irritating fumes when heated to decomposition.

### Handling

Wear nitrile gloves and eye protection. Do not use potassium hydroxide or sodium hydroxide to dry tetrahydrofuran suspected of containing peroxides. Don’t distil to an extent where less than 15% remains in the reaction flask. Test for traces of peroxides before distillation. They can be removed by an acidified (with sodium hydrogensulphite) strong iron(II) sulphate solution, or passing down alumina column.

**FF** – F, DP, CO2, WS

## Storage

Dark bottles should be used for storage in a dark part of the flammables store.

**SSL** – 2 years maximum if stored under good conditions. Can form explosive peroxides in storage (rate of formation increased by exposure to light and air).

## Disposal

Ensure there are no sources of ignition. Wear face shield and nitrile gloves. Spread out 100 cm3 portions in a secure place and allow to evaporate. Small portions can be evaporated in a fume cupboard. Very old bottles may contain sodium wire as drying agent. See Ethoxyethane for methods of dealing with sodium wire.

## Spillage

Turn off all sources of ignition. Evacuate and ventilate the area. Absorb on to paper towel and allow to evaporate in fume cupboard. Once the paper has dried soak with water and place with refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Turn off all sources of ignition. Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical advice if large area is involved.

# Thermit mixture

A stoichiometric mixture of powdered aluminium and iron(III) (ferric) oxide

## Hazards

Highly flammable. Fire hazard is considerable when exposed to heat and flames. The reaction between iron(III) oxide and aluminium when started is difficult to stop. Temperature attained is about 2500°C. Hydrogen gas (EXTREMELY FLAMMABLE) is evolved with acids, alkalis and even from water. Damp powder will self-heat and may ignite. Toxicity as for aluminium powder and iron compounds. OES for aluminium powder (8 hr, total inhalable) – 10 mg.m$^{-3}$ and iron oxide (15 min, fume) – 10 mg.m$^{-3}$.

Incompatibility

The ingredients are incompatible themselves and only require sufficient heat to initiate a violent reaction. This has happened when the mixture was being pre-dried for a demonstration.

## Handling

**Do not purchase commercial mixture, but make up small quantities as required.**

**Do not store.** This enables the two ingredients to be heated separately to dry them. Wear eye protection and use two safety screens.

**FF** – DS or DP. Don’t use halon or $CO_2$.

## Storage

Do not store.

## Disposal

No need for disposal if only small amount is prepared and used. If spilled wear eye protection. Wet with water and mix with sand, put in normal refuse bin.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Treat as for non-toxic foreign body in the eye. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical advice.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

## Thiocyanates

Description: White hygroscopic crystals or crystalline powders which are very soluble in water.

### Hazards

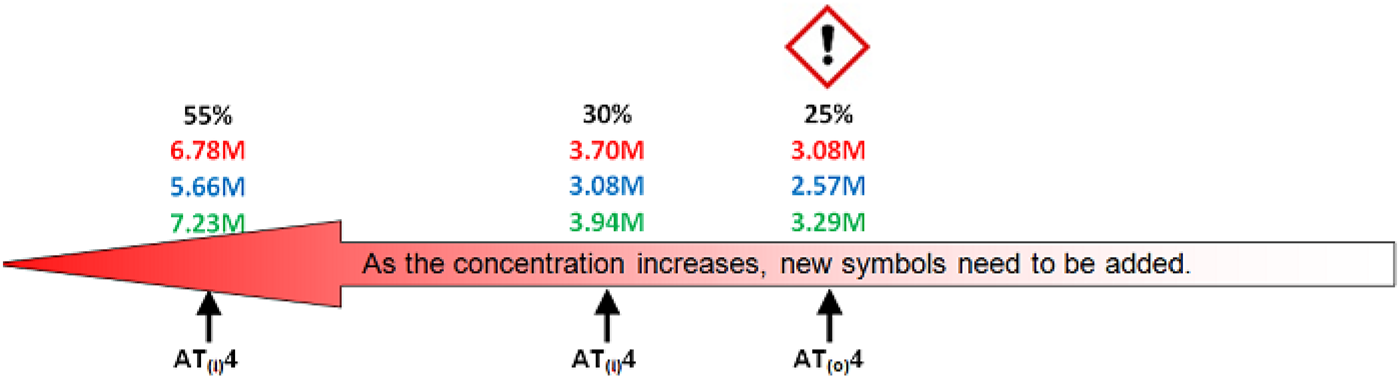
Irritating to eyes and skin, and harmful by swallowing, inhalation or prolonged exposure. If heated strongly they emit fumes of hydrogen cyanide (VERY TOXIC) and hydrogen sulphide (VERY TOXIC). Some evidence of reproductive effects. Solutions > 25% (3M) should be labelled HARMFUL. Harmful to aquatic organisms.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| ammonium thiocyanate,<br>potassium thiocyanate,<br>sodium thiocyanate | Warning | Flammable liquid Cat 2<br>Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Carcinogen Cat 2 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H412: Harmful to aquatic life with long lasting effects.<br>EU032: Contact with acids releases a very toxic gas |  |

### Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



### Incompatibility

Explosive if mixed with chlorates(V), nitrates(III), peroxides. Reacts violently with concentrated sulphuric acid to evolve toxic carbonyl sulphide. With hot dilute strong acids and with zinc and dilute hydrochloric acid. Toxic $NH_3$ (ammonia), SOx, NOx and HCN are evolved when heated to decomposition.

### Handling

Wear rubber or plastic gloves and eye protection. May be used on small scale in well ventilated laboratory.

### Storage

General store, away from acids and oxidising agents.

### Disposal

Wear rubber or plastic gloves and eye protection. Flush out sink traps and then wash up to 10 g to waste with copious amounts of water. Store larger amounts to await uplift by disposal contractor.

### Spillage

Wear rubber or plastic gloves and eye protection. Shovel into bucket and treat as for Disposal. For spillages of solution, absorb on sand (50 parts to one of thiocyanate), transfer to bucket and rinse well. Place sand with ordinary refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If more than about 1 g swallowed obtain medical attention as soon as possible.

### Lungs

Exposure unlikely by this route. Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if large area is involved.

# Thiourea

Alternative name: thiocarbamide

Description: White crystals, soluble in water.

## Hazards

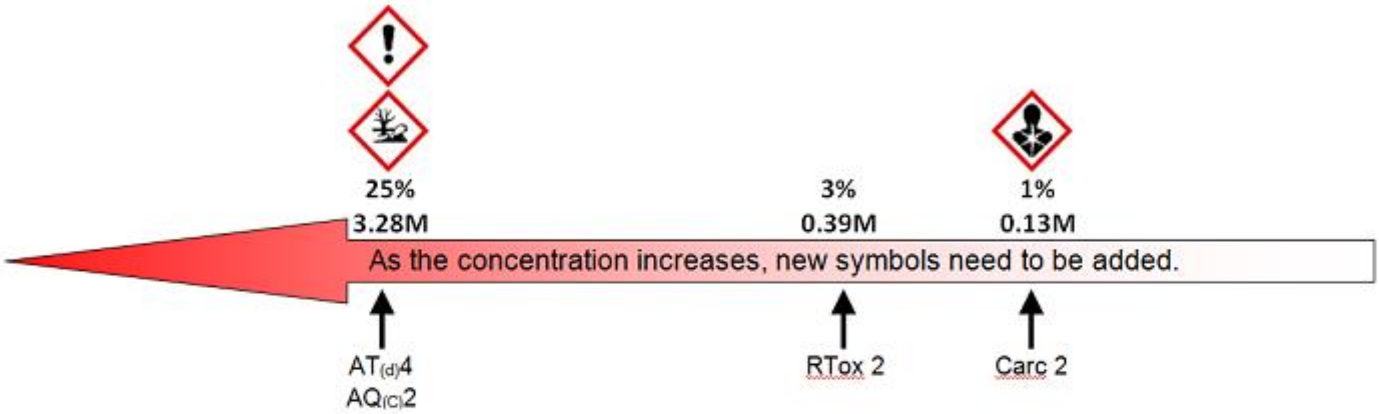
Very harmful if swallowed. Category 2 carcinogen and reproductive toxin. Mildly irritating to skin, eyes and respiratory tract. May cause allergic skin reactions. Prolonged exposure to low concentrations dangerous. Possible mutagen and teratogen. Emits dangerous fumes if heated to decomposition. Avoid raising dust. Dangerous for the environment – May cause long term adverse effects in the aquatic environment.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| thiourea | Danger | Acute toxin Cat 4 (oral)<br>Carcinogen Cat 2<br>Reproductive toxin Cat 2<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H302 : Harmful if swallowed.<br>H351 : Suspected of causing cancer .<br>H361 : Suspected of damaging fertility or the unborn child .<br>H411 : Toxic to aquatic life with long lasting effects. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

Oxidising agents. Can form explosive peroxides with nitric acid and hydrogen peroxide.

## Handling

Wear rubber or plastic gloves and eye protection. Avoid raising dust.

## Storage

Securely in store. Usually only small amounts needed.

## Disposal

Wear rubber or plastic gloves and eye protection. If amounts are small e.g. washings from test tubes, run to waste. Otherwise use disposal contractor.

## Spillage

Wear rubber or plastic gloves and eye protection. Dampen slightly to reduce the likelihood of dust. Sweep up carefully and treat as in Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

# Tin II compounds

tin(II) chloride – powerful reducing agent. Soluble in water, propanone, ethers & esters.

tin(II) sulphate – used in preparation of tin(II) salts. Soluble in water and dilute sulphuric acid.

## Hazards

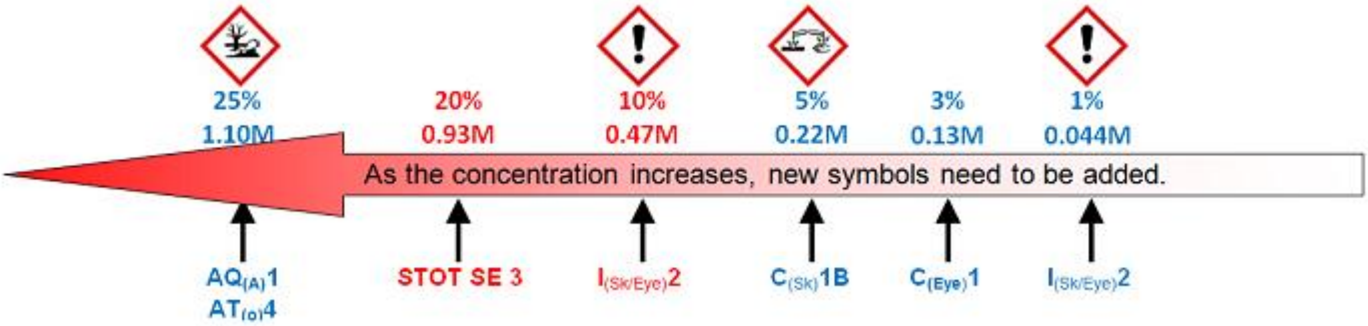
Harmful by inhalation and ingestion and if inhaled as dust. The anhydrous chlorides are strong irritants of the gastric system, but are poorly absorbed; the anhydrous chloride is also corrosive and burns skin and eyes, whilst the hydrate irritates.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| tin(II) chloride, anhydrous | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Skin corrosive Cat 1B<br>Hazardous to the aquatic environment Cat 1 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life. |  |
| tin(II) chloride-2-water | Danger | Acute toxin Cat 4 (oral)<br>Skin corrosive Cat 1B<br>Hazardous to the aquatic environment Cat 1 | H302: Harmful if swallowed.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life. |  |
| tin(II) sulphate | Warning | Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation. |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. **Blue** = *tin II chloride*, **Red** = *tin II sulphate*



## Incompatibility

Tin(II) compounds are reasonably powerful reducing agents. Avoid mixing with oxidising agents. Tin(II) nitrate is very unstable – do not attempt to prepare. Do not mix tin(II) chloride with nitrates. A mixture of tin(II) chloride and calcium dicarbide burns vigorously.

## Handling

Wear goggles (BS EN 166 3) and pvc gloves. Do not leave the lid off the anhydrous tin(II) compounds any longer than necessary.

## Storage

Anhydrous chloride with fuming water reactives. Oxide and hydrated chloride with general chemicals. Keep lids of tin(II) salts tightly closed.

## Disposal

Wear goggles (BS EN 166 3) and pvc gloves. Washings of glassware and small quantities can be dissolved in a large volume of water and washed to waste. Larger quantities should be disposed of by licensed contractor.

## Spillage

Wear goggles (BS EN 166 3) and pvc gloves. Carefully sweep up solids into a large plastic bucket and treat as in **Disposal**. Soak up solutions on mineral absorbent. If small wash the absorbent and run washings to waste with the absorbent being placed with refuse. Otherwise store to await uplift by disposal contractor. Wash the contaminated area well.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention and for the anhydrous salt as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed obtain medical attention as soon as possible.

### Lungs

Exposure by this route unlikely but oxide is powdery and the anhydrous chloride gives off fumes of hydrogen chloride. Move patient from area of exposure. Rest and keep warm.

### Skin

Carefully brush off any surplus solid. Wash well with soap and water. Remove and wash contaminated clothing.

# Tin IV compounds

tin(IV) chloride (anhydrous) – fuming clear liquid. Soluble in alcohol & chlorinated hydrocarbons. The pentahydrate has white/yellow crystals. Reacts violently with water.

tin(IV) iodide – yellow/orange/reddish crystals. Decompose in water to form the oxyiodide.

## Hazards

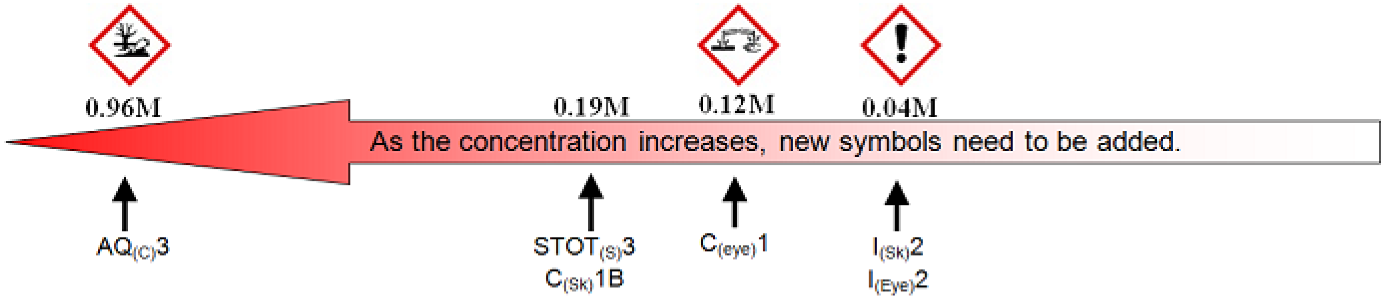
Both tin(IV) halides are corrosive causing burns to the eyes and skin. The fumes and liquid of the anhydrous chloride irritate the respiratory system. It also produces corrosive fumes of hydrogen chloride and heat in contact with moisture in the air. The iodide also irritates the respiratory system. Both are poisonous and will cause severe internal irritation if swallowed. They evolve toxic fumes when heated to decomposition.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| tin(IV) chloride, anhydrous | Danger | Skin corrosive Cat 1B<br>Specific target organ toxin on single exposure Cat 3<br>Hazardous to the aquatic environment with long-lasting effects Cat 3 | H314: Causes severe skin burns and eye damage.<br>H335: May cause respiratory irritation<br>H412: Harmful to aquatic life with long lasting effects. |  |
| tin(IV) iodide | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Skin corrosive Cat 1B<br>Skin sensitiser Cat 1<br>Respiratory sensitiser Cat 1 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin<br>H314: Causes severe skin burns and eye damage.<br>H317: May cause an allergic skin reaction.<br>H332: Harmful if inhaled.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled. |  |

## Concentration effects (chloride)

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.



## Incompatibility

In contact with water or when heated tin(IV) chloride reacts vigorously with production of heat and toxic fumes. Interacts violently with alkyl nitrates often after several hours delay. Turps can be ignited by tin(IV) chloride. The iodide is incompatible with oxidising agents and has a strong reaction with nitryl chloride and nitrobenzene. The iodide absorbs oxygen from the air or decomposes in water to form the oxyiodide.

## Handling

Wear rubber or nitrile gloves and goggles (BS EN 166 3). Handle in fume cupboard in dry conditions. Keep stopper off for minimum time.

## Storage

With fuming water reactive corrosives in well ventilated dry area. Keep containers tightly closed. Keep small quantity in desiccator or plastic bag with silica gel.

**SSL** – 2 years maximum for the chloride unless in sealed glass vials. Is readily hydrolysed by water and moisture from the air, becoming highly corrosive to metals.

## Disposal

Wear rubber gloves and face shield. Small quantities such as washings of glassware, etc. can, in fume cupboard, be sprinkled in small portions into large volume of water with stirring, then neutralised and washed to waste with water. For larger quantities store to await uplift by disposal contractor.

## Spillage

Ventilate area and wear rubber gloves & face shield. Spread on anhydrous sodium carbonate. Cautiously shovel into a bucket. Add slowly to a large volume of water, neutralise if necessary and wash to waste with plenty of running water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

## Trihalogenomethanes

Alternative names: chloroform and iodoform.

Description:

Trichloromethane: Colourless, volatile liquid with characteristic smell

Tri-iodomethane – Yellow crystalline solid, with characteristic smell. Practically insoluble in water but volatile in steam. Soluble in ethanol and propanone.

### Hazards

Trichloromethane is a Category 2 carcinogen. Risk of irreversible effects. The vapour is an anaesthetic and causes headache, nausea, sickness and unconsciousness and is mildly irritant to eyes, skin and lungs. Acute exposure to high concentrations may lead to cardiac failure and death; chronic exposure to lower concentrations damages liver and kidneys. Liquid if swallowed is poisonous. Liquid defats skin, but is not appreciably absorbed through intact skin. Non-flammable but may form carbonyl chloride (phosgene) at high temperature in air due to oxidation.

Tri-iodomethane is much less hazardous – harmful by inhaling, ingesting and by skin contact. Irritating to eyes, respiratory system and skin. Heating to decomposition emits fumes of iodine compounds.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| trichloromethane | Danger | Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Carcinogen Cat 2<br>Specific target organ toxin on repeated exposure Cat 2 | H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H351: Suspected of causing cancer<br>H373: May cause damage to organs orally and by inhalation |  |
| triiodomethane | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Skin / Eye irritant cat 2<br>Specific target organ toxin on single exposure Cat 3 | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H332: Harmful if inhaled.<br>H335: May cause respiratory irritation. |  |

### Incompatibility

Both react vigorously with oxidising agents, alkaline propanone (acetone) or alkaline methanol. They react violently with alkali and alkaline earth (Group I & II) metals – trichloromethane forming impact sensitive mixtures. Trichloromethane reacts explosively with aluminium if traces of aluminium chloride present. Even if initially absent this catalyst is slowly formed. Tri-iodomethane forms an explosive compound with hexamethylenetetramine.

### Handling

Always first seek alternative chemicals. Use in fume cupboard, or handle in well ventilated laboratory on small scale and if well contained, i.e. in closed vessels or using reflux condensers. Wear eye protection and nitrile gloves.

### Storage

Securely in store. Keep trichloromethane out of sunlight, in dark bottles as sunlight promotes the formation of toxic carbonyl chloride (phosgene) gas.

## Disposal

Wear eye protection and nitrile gloves. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste (A trace of methylated spirits can help). Keep larger quantities for disposal by licensed contractor.

## Spillage

**Trichloromethane** is volatile and will evaporate quickly.
**Small spillages** of a few $cm^3$ – Quickly cover with mineral absorbent, open windows and retreat from room. When vapour has subsided re-enter and carry absorbent outside or to fume cupboard. Allow trichloromethane to evaporate or rinse it with water and detergent and wash to waste with running water.
**Larger spillages** – Evacuate room and open windows and simply allow the trichloromethane to evaporate.

**Tri-iodomethane** is not volatile. Wear eye protection and gloves.
**Solid –** Shovel into bucket after wetting with water.
**Solutions –** Soak up on absorbent; if quantity small rinse with water and detergent. If the quantity is large, place in a suitably sized container, label HARMFUL and store for disposal by contractor. Wash spillage area with detergent and water.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if a large area is affected or if irritation persists.

# Trinitrophenol 2,4,6-

Alternative names: picric acid

Description: Yellow crystals wetted with 50% water. Dyes wools and silk yellow.

Dangerously explosive when dry. Keep wetted with up to 50% water and keep the contact area between container and lid clean to avoid solid getting trapped there and drying out. Avoid heating or shocking this chemical

## Hazards

Toxic by ingestion ($LD_{50}$ 200 mg/kg (rat) and 120 mg/kg (rabbit)), by absorption through the skin and inhalation of dust. It is extremely irritating to eyes. Skin contact may lead to local (dermatitis) and systemic allergic reactions. Evidence of mutagenic effects. The dry solid is a powerful explosive.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| 2,4,6-trinitrophenol | Danger | Explosive Cat 1.1<br>Acute toxin Cat 3 (oral)<br>Acute toxin Cat 3 (dermal)<br>Acute toxin Cat 3 (inhalation) | H201: Explosive; mass explosion hazard.<br>H301: Toxic if swallowed.<br>H311: Toxic in contact with skin.<br>H331: Toxic if inhaled. |  |

## Incompatibility

Forms picrates of copper, lead, zinc, silver, mercury, ammonia and other bases which are even more sensitive to impact than the parent phenol. Do not mix with metal oxides. Mixtures with aluminium and water will ignite after a delay.

## Handling

Wear rubber or plastic gloves and eye protection. Do not allow to dry out and do not heat. Do not grind or stir with a metal spatula.

**FF** – WS.

## Storage

Securely in store with toxic chemicals. Keep moist with not less than half its own weight of water. Containers should not have either screw-top or glass lids, since on replacing the lid, some of the trinitrophenol may be ground and explode. Cork stoppers in wide mouth bottles are best. Label solutions TOXIC.

## Disposal

Wear rubber or plastic gloves and eye protection. Small quantities of washings from glassware can be dissolved in water and washed to waste with plenty of water. Otherwise use disposal contractor. If dried out do not open, but seek specialist help.

## Spillage

Wearing rubber or plastic gloves and face shield, moisten well with water and use a plastic dust pan to put it into a plastic bucket. For small quantities, add hot water to dissolve and wash to waste with running water. Otherwise store to await uplift by disposal contractor. Wash area of spillage well.

## Remedial Measures

**In all cases of exposure take casualty to hospital as soon as possible.**

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting.

**Lungs**

Move patient from area of exposure. Rest and keep warm.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

# Trioxygen

Alternative names: ozone

Description: This gas is not usually prepared but may be formed during the use of ultra-violet lamps, photocopiers, induction coils, etc

## Hazards

Very toxic by inhalation. The odour can be detected at 0.015 ppm; concentrations as low as 1 ppm have a disagreeable smell and may cause headaches and irritation of eyes and the upper respiratory system and dermatitis. These effects are reversible on removal from exposure. High concentrations have caused pulmonary oedema and death.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| trioxygen | Danger | Oxidising gas Cat 1<br>Skin / Eye irritant Cat 2<br>Acute toxin Cat 3 (inhalation)<br>Specific target organ toxin on single exposure Cat 3<br>Mutagen Cat 2<br>Specific target organ toxin on repeated exposure Cat 2<br>Hazardous to the aquatic environment Cat 1 | H270: May cause or intensify fire; oxidiser.<br>H315; Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H330: Fatal if inhaled.<br>H335: May cause respiratory irritation.<br>H341: Suspected of causing genetic defects.<br>H373: May cause damage to organs<br>H400: Very toxic to aquatic life. |  |

## Incompatibility

Dangerous reactions have been reported with alkenes, alkynes, arenes, combustible gases such as ammonia, carbon monoxide, ethene, organic matter, nitrogen and nitrogen oxides. At probable concentrations, many of these reactions will be slow. Ozonides are unstable and should not be isolated.

## Handling

Any apparatus producing ozone should only be used in a well-ventilated area. Check any equipment fitted with carbon filters e.g. photocopiers and replace filters if needed.

## Remedial Measures

### Eyes

Remove patient from area. Irrigate with water for at least 10 minutes.

### Lungs

Move patient from area of exposure. Rest and keep warm. If breathing is seriously affected take casualty to hospital as soon as possible.

# Turpentine

Alternative names: fir oil. Not to be confused with turpentine substitute (white spirit).

Description: Colourless liquid composed of a variable mixture of terpenes depending on the geographical source of the oil and on the amount of refining.

## Hazards

Quite harmful by inhalation, skin absorption and by swallowing. Irritates the eyes and respiratory system. Flammable – keep away from flames and sources of ignition (lel 1.8%). Can cause serious injury to kidneys, bladder and the central nervous system. Some evidence of being carcinogenic to animals. High acute doses by mouth can be fatal, whilst low, chronic doses may cause anaemia. Certain batches of the oil contain significant quantities of α-pinene, δ-3-carene, dipentene and terpineols which are sensitisers and may lead to skin reactions and to asthma. Some brands are low in these components and therefore more acceptable.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| turpentine | Danger | Flammable liquid Cat 3<br>Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation)<br>Aspiration toxin Cat 1<br>Skin / Eye irritant Cat 2<br>Skin sensitiser Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H225: Highly flammable liquid and vapour.<br>H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation<br>H317: May cause an allergic skin reaction.<br>H304: May be fatal if swallowed and enters airways.<br>H411: Toxic to aquatic life with long lasting effects. |  |

## Incompatibility

Emits acrid fumes when heated. Reacts vigorously and ignites with chlorine, chlorates(I), chromium(III) oxide, tin(IV) chloride and with powerful oxidising agents. It will even spontaneously ignite in air if soaked on cloth dusters or on Fuller's earth. Dusters, etc. soaked in it should be dampened and placed in outdoor metal bin.

## Handling

Wear nitrile gloves and eye protection. Use in well-ventilated area away from sources of ignition and heaters.

**FF** – F, DP, CO$_2$.

## Storage

Flammables store.

## Disposal

Wear nitrile gloves and eye protection and remove all sources of ignition. Unavoidable discharges, e.g. small quantities such as washings from glassware, etc. should be emulsified and washed to waste.
**Larger quantities –** seek an alternative user or label clearly and store for disposal by contractor, but an experienced person could dispose of it by soaking onto mineral absorbent and incinerating in a safe place.

## Spillage

Turn off all sources of ignition and open windows. Wear nitrile gloves and eye protection. Soak up on mineral absorbent and treat as in Disposal.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if more than a whiff inhaled.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Vanadium and compounds

The metavanadates are the only compounds likely to be commonly encountered.

vanadium(V) oxide – yellow to rust-brown crystals used as catalyst and UV light inhibitor in glassmaking.

ammonium metavanadate(V) – white or slightly yellow crystalline powder used in dyeing.

sodium metavanadate(V) – yellowish-white, crystalline powder used in photography and inks.

## Hazards

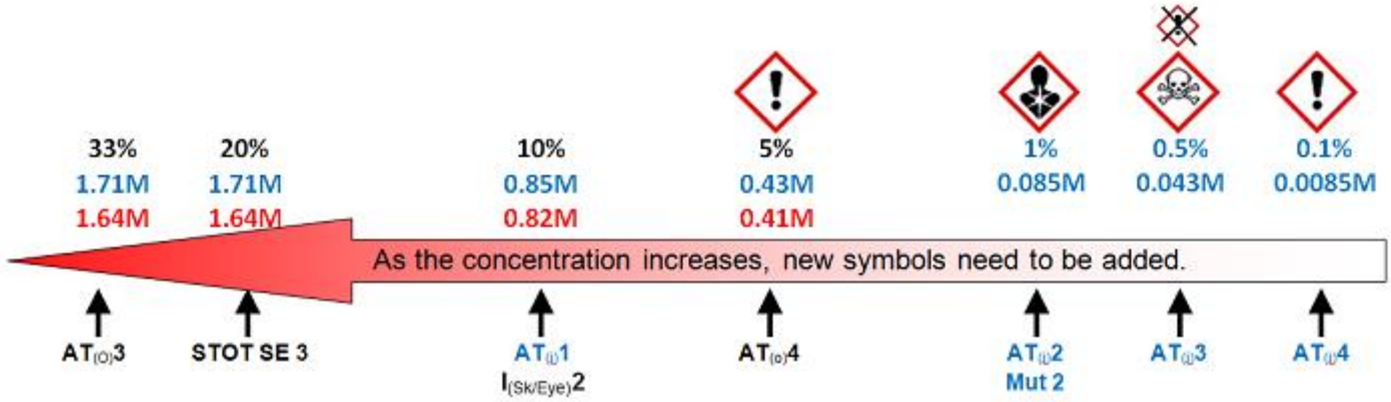
Vanadium metal has no particular hazards (though large or long term exposure can cause irritation). Vanadium(V) oxide is toxic by inhalation of dust, a Category 2 mutagen and reproductive toxin and a teratogen. May cause a skin rash. Ammonium and sodium metavanadates are toxic by inhalation of dust, ingestion and by skin contact; experimental teratogens and mutagens. The dust of these salts is also damaging to the eyes and very irritating to the skin and respiratory system.

## Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| vanadium(V) oxide | Danger | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (inhalation)<br>Mutagen Cat 2<br>Reproductive toxin Cat 2<br>Specific target organ toxin on single exposure Cat 3<br>Specific target organ toxin on repeated exposure Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 2 | H302: Harmful if swallowed.<br>H332: Harmful if inhaled<br>H361: Suspected of damaging fertility or the unborn child<br>H341: Suspected of causing genetic defects<br>H335: May cause respiratory irritation.<br>H372: Causes damage to organs<br>H411: Toxic to aquatic life with long lasting effects. |  |
| ammonium metavanadate(V) | | Acute toxin Cat 3 (oral)<br>Acute toxin Cat 1 (inhalation)<br>Skin / Eye irritant Cat 2<br>Mutagen Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H301 Toxic if swallowed.<br>H330 Fatal if inhaled.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H341: Suspected of causing genetic defects<br>H335 May cause respiratory irritation |  |
| sodium metavanadate(V) | | Acute toxin Cat 3 (oral)<br>Skin / Eye irritant Cat 2<br>Specific target organ toxin on single exposure Cat 3 | H301 Toxic if swallowed.<br>H315 Causes skin irritation.<br>H319 Causes serious eye irritation.<br>H335 May cause respiratory irritation |  |
| sodium orthovanadate | Warning | Acute toxin Cat 4 (oral)<br>Acute toxin Cat 4 (dermal)<br>Acute toxin Cat 4 (inhalation) | H302: Harmful if swallowed.<br>H312: Harmful in contact with skin.<br>H332: Harmful if inhaled |  |

## Concentration effects

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply. **Blue** = *ammonium vanadate*, **Red** = *sodium vanadate*



## Incompatibility

Vanadium(V) oxide may ignite spontaneously with a mixture of calcium, sulphur and water. Incompatible with chlorine trifluoride, lithium or methaneperoxoic acid (peroxyformic acid). When ammonium or sodium metavanadate are heated to decomposition they emit toxic fumes.

## Handling

Wear rubber or plastic gloves and eye protection. **Avoid producing dust**. Avoid contact with skin and eyes.

## Storage

Securely in store.

## Disposal

Wear rubber or plastic gloves and eye protection. Small quantities such as washings from glassware can be run to waste. Otherwise store securely and arrange for collection by disposal contractor. Soluble vanadates(V) and metavanadates(V) in solution can be precipitated as barium or lead vanadates and stored as such.

## Spillage

Wear eye protection and rubber or plastic gloves. Dampen and carefully sweep up solid. Soak up solution on absorbent. If quantity small, rinse and flush washings to waste; place rinsed absorbent in ordinary refuse. If quantity spilled is more than a few g, do not rinse absorbent, but store for disposal by contractor.

## Remedial Measures

If swallowed or skin or eye contact has been other than slight, or more than a trace of dust has been inhaled, then seek medical attention as soon as possible.

### Eyes

Irrigate with water for at least 10 minutes.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. If swallowed, seek medical attention.

### Lungs

Move patient from area of exposure. Rest and keep warm.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing.

## Zinc metal

Description: Grey metal  or grey powders which become coated with carbonate when exposed to moist air.

### Hazards

Low toxicity, but fumes of zinc oxide from heated/burning zinc are harmful. Dust is flammable and may ignite if exposed to sparks or flames. Therefore keep containers tightly closed and dry. The pyrophoric dust/air mixture can be spontaneously flammable or explosive especially if the air is moist or if dampened with limited amounts of water. Will react with water to liberate hydrogen (EXTREMELY FLAMMABLE). Coarse powder or turnings are safer.

### Hazard Statements

| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| zinc powder | Warning | Hazardous to the aquatic environment with long-lasting effects Cat 1 | H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| zinc powder (pyrophoric) | Danger | Pyrophoric solid cat 1<br>Water reactive Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H250: Catches fire spontaneously if exposed to air.<br>H260: In contact with water releases flammable gases which may ignite spontaneously.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |   |

### Incompatibility

Reacts with acids, alkalis or water/steam to form the extremely flammable gas hydrogen. Can react violently with sulphur and other strong oxidising agents (halogens, oxides, peroxides and several oxyanions, e.g. nitrates, halogenates, manganates, chromates, higher metal oxides and hydrocarbons). Coarser powder, turnings or granulated zinc will undergo these reactions more slowly.

### Handling

Wear eye protection. Where possible use coarse powder or turnings. The former has the consistency of sand. Some manufacturers give the range of mesh numbers – the smaller the mesh number the larger the diameter e.g. particles of mesh 8 and 50 correspond to diameters of ~2 and 0.3 mm respectively. **Avoid raising dust and only remove lid from dust well away from sources of ignition**. **FF** – DP, S.

### Storage

With metals and reducing agents. Containers of fine powder may develop pressure from reaction with moisture.

**SSL** – 3 years maximum. Water reactive and over time reacts with moisture from the air. If the lid becomes cemented, the container can explode from the increase in pressure.

### Disposal

Wear eye protection.

**Metal powder –** Store for disposal by licensed contractor.
**Dust –** Mix with dry sand to make it less flammable and store for licensed contractor.
**Granulated –** Rinse that used for hydrogen preparation and store for re-use.

### Spillage

Ensure ignition sources are absent. Mix with dry sand, brush up carefully and treat as in **Disposal**.

### Remedial Measures

**Eyes**

Irrigate with water for at least 10 minutes. Obtain medical attention.

**Mouth**

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention if a large quantity has been swallowed.

**Lungs**

Move patient from area of exposure. Rest and keep warm. Obtain medical attention if breathing is affected.

**Skin**

Wash well with soap and water. Remove and wash contaminated clothing.

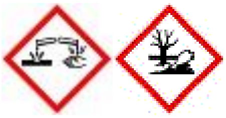
# Zinc compounds

## Hazards

Zinc chloride (anhydrous) is corrosive. It can be hydrolysed by water and burns eyes, skin and mucous membranes. Fumes are particularly toxic. Dermatitis, boils and conjunctivitis may result. It is an animal carcinogen and causes teratogenic and reproductive effects. The digestive and respiratory systems may be affected severely by repeated or prolonged exposure. Sulphate and nitrate are harmful if swallowed and are irritating to the eyes, respiratory tract and skin. Contact of nitrate with combustible material may cause a fire – oxidising agent. The iodide burns the skin and eyes and is irritating to the respiratory system. It severely irritates the alimentary canal if ingested.

Other zinc compounds:- these will largely have the toxicity and hazards of the anion, e.g. fluoride, sulphide, etc. The fluoride is toxic by skin absorption, if swallowed and by inhalation. The sulphide is harmful if swallowed and emits the toxic gas hydrogen sulphide when in contact with acids. Zinc chromate is insoluble and is a carcinogen. The oxide in fume form irritates the eyes, skin & respiratory system (metal fume fever). The carbonate and sulphate irritate the eyes, skin and respiratory system. All zinc(II) salts are likely to be equally unacceptable in the environment.

## Hazard Statements

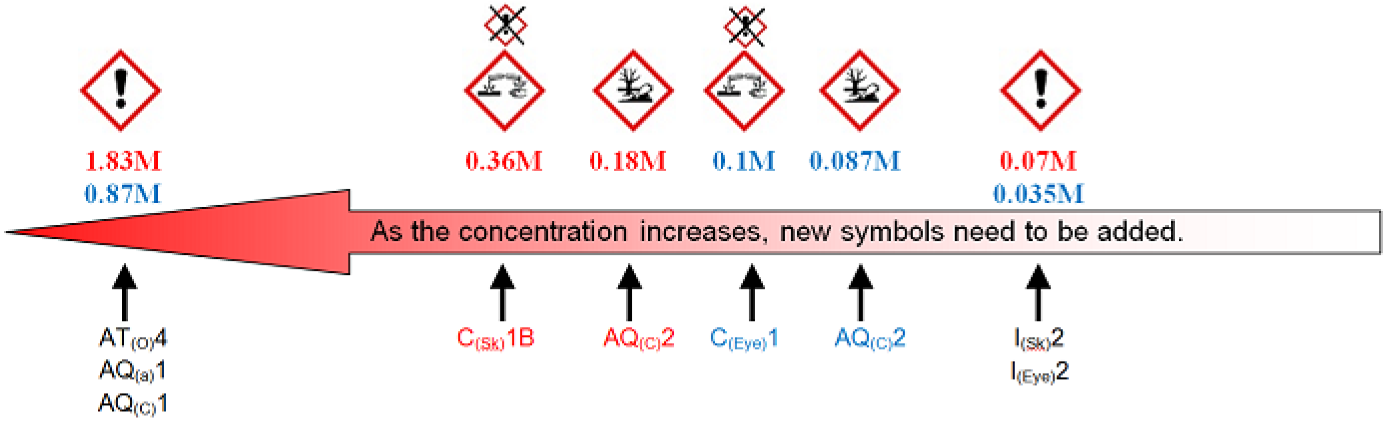
| Name | Signal word | Hazards | Hazard Statements | Pictograms |
|---|---|---|---|---|
| zinc chloride | Danger | Acute toxin Cat 4 (oral)<br>Skin corrosive 1B<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H314: Causes severe skin burns and eye damage.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| zinc chromate | Danger | Acute toxin Cat 4 (oral)<br>Skin sensitiser Cat 1<br>Carcinogen Cat 1A<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H317: May cause an allergic skin reaction.<br>H350: May cause cancer by inhalation<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long-lasting effects. |  |
| zinc iodide | | Skin corrosive Cat 1B | H314: Causes severe skin burns and eye damage. |  |
| zinc nitrate-6-wate | | Oxidising solid Cat 2<br>Acute toxin Cat 4 (oral)<br>Skin irritant Cat 2<br>Eye damage Cat 1<br>Specific target organ toxin on single exposure Cat 3<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H272: May intensify fire; oxidiser.<br>H302: Harmful if swallowed.<br>H315: Causes skin irritation.<br>H319: Causes serious eye irritation.<br>H335: May cause respiratory irritation.<br>H410: Very toxic to aquatic life with long lasting effects. |  |
| zinc oxide | Warning | Hazardous to the aquatic environment with long-lasting effects Cat 1 | H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |

|  |  |  |  |  |
|---|---|---|---|---|
| zinc sulphate-7-water |  | Acute toxin Cat 4 (oral)<br>Eye damage Cat 1<br>Hazardous to the aquatic environment with long-lasting effects Cat 1 | H302: Harmful if swallowed.<br>H318: Causes serious eye damage.<br>H400: Very toxic to aquatic life.<br>H410: Very toxic to aquatic life with long lasting effects. |  |

## Concentration effects (zinc chloride only)

Find the concentration of your solution – the symbols (and classifications) to the RIGHT of it are the ones that apply.

(**RED** applies to zinc chloride, **BLUE** applies to zinc sulphate.7-water and **BLACK** to both.)



## Incompatibility

Zinc chloride is incompatible with potassium or powdered zinc. Emits toxic fumes if heated to decomposition. Zinc iodide reacts violently with concentrated sulphuric acid.

Zinc nitrate is a powerful oxidising agent and can react violently with sulphur, phosphorus, carbon, alkali metals, finely divided metals, reducing agents and organic compounds in general.

## Handling

Wear rubber or plastic gloves and goggles (BS EN 166 3). Replace lids of containers and seal tightly. Open carefully as pressure may have been generated inside by reaction with atmospheric moisture.

## Storage

Store zinc chloride in general store.

**SL** – 2 to 3 years if stored under good conditions. Make sure the container is tightly closed as zinc chloride is hygroscopic and even deliquescent. Therefore protect from sources of moisture, including moisture in the air. No increased hazard.

Store zinc nitrate with oxidising agents in general store. Keep cool and well closed.

## Disposal

Wear goggles (BS EN 166 3) and rubber or plastic gloves. Test tube washings can be washed to waste. Otherwise store for disposal by licensed contractor. Solutions may, if required, be precipitated as carbonate or hydroxide and these kept for disposal.

**Zinc chromate(VI) –** if amount is other than a trace of precipitate formed in microscale work, store to await uplift by disposal contractor.

## Spillage

Wear goggles (BS EN 166 3) and rubber or plastic gloves.
**Solid** – carefully sweep up and treat as in **Disposal**.

**Solutions** – soak up on absorbent. If quantities large – store to await collection by licensed disposal contractor. If small, place used absorbent with ordinary refuse.

## Remedial Measures

### Eyes

Irrigate with water for at least 10 minutes. Obtain medical attention as soon as possible if the anhydrous zinc halide is involved.

### Mouth

Wash out mouth thoroughly with water. Don’t induce vomiting. Obtain medical attention as soon as possible if the anhydrous zinc halide is involved.

### Lungs

Move patient from area of exposure. Rest and keep warm. Obtain medical attention.

### Skin

Wash well with soap and water. Remove and wash contaminated clothing. Obtain medical attention if irritation persists.

# Appendix A – Biochemicals and Biochemical Tests

Biochemical tests for: carbohydrates, lipids, proteins miscellaneous

Biochemicals: Enzymes, nucleic acids. Amino acids, proteins, hormones (animal and plant), miscellaneous, clearing agents, fixatives & preservatives, macerating and narcotising reagents.

# Biochemicals – Tests for Carbohydrates

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| Phenylammonium chloride/sulphate (aniline hydrochloride / sulphate) | Specific for lignin. Used small scale (drops) usually on microscope slide mounted samples. | S5, T. Wear eye protection and gloves. Use reliable, drip free, dropper bottles. Small scale provides major control measure. | TOXIC (Cat 3) all routes,<br>EYE DAMAGE,<br>SKIN SENSITISER,<br>MUTAGEN (Cat 2),<br>CARCINOGEN (Cat 2)<br>STOT SE1 and if dissolved in ethanol HIGHLY FLAMMABLE |  |
| Barfoed's reagent | Glucose | S6. Contains copper(II) ethanoate and glacial ethanoic acid (CORROSIVE). | No classification. Best treated as a SKIN/EYE IRRITANT though. |  |
| Benedict's solution | Reducing sugars | S2-6. Contains copper(II) sulphate. Preferable to Fehling's solution. See also main data sheet entry on Fehling's. | EYE IRRITANT Cat 2 |  |
| Benzene-1,3,5-triol (Phloroglucinol) | Pentoses & lignin | S5.Wear goggles (BS EN 166 3) and avoid sources of ignition. See main hazard sheets for benzene diols and triols. | This recipe has no hazard from ethanol or HCl. 2% benzene-1,3,5-triol is a Cat2 MUTAGEN. |  |
| Bial's reagent | Pentoses | S5. Testing – Place 2 cm3 of a sample solution in a test tube. Add two cm3 of Bial's reagent. Heat the solution gently in a Bunsen Burner or hot water bath. A blue colour indicates a positive test. If the color is not obvious, more water can be added to the tube. | CORROSIVE |  |
| **Biphenyl-4,4'-diamine (benzidine)** | **Lignin** | **Not to be used in schools.** | | |
| Chlor-zinc-iodine (Schultze's solution) | Cellulose & lipids | S5 Contains zinc chloride & iodine – see data sheets. When preparing solutions wear goggles (BS EN 166 3) and gloves (T). Don't confuse wth Schultze's (macerating) fluid. | CORROSIVE |  |
| Clinistix strips | Glucose | S2-6. Don't touch tips. Store and dispose of safely. Use as directed. | TOXIC & CARCINOGEN (very small amount in tip). |  |
| Clinitest tablets | Glucose | S2-6. Contain sodium hydroxide. See main hazard | CORROSIVE |  |

| | | | | |
|---|---|---|---|---|
| | | sheet. Wear goggles (BS EN 166 3). | | |
| Diabur-Test 5000 strips | Glucose | S1/2t. Don't touch tips. Store and dispose of safely. Use as directed. | Possibly as for Clinistix. No significant risk if used as directed by instructions. | None |
| Fehling's reagent | Reducing sugars | S5. Use Benedict's solution or better still Sandell's reagent in preference. Solution A contains copper(II) sulphate & B contains sodium hydroxide. See main hazard sheets for Fehling's & separate chemicals. Wear goggles (BS EN 166 3) and use a water bath for heating. See also main data sheet entry on Fehling's. | CORROSIVE |  |
| Iodine Solution (aq. in KI) | Starch & cellulose | S1-4. (use of solution) Making up by T.<br>S6. Cellulose test may use sulphuric acid (CORROSIVE) at high concentration. Wear goggles (BS EN 166 3) and exercise care when diluting acid. Phosphoric acid (CORROSIVE) is a safer alternative | NO SIGNIFICANT HAZARD.<br>Iodine- vapour is HARMFUL to respiratory system. Vapour & solid irritate the eyes and the latter also burns the skin. Wear goggles (BS EN 166 3) and gloves. See main hazard sheet. | None |
| Molisch's reagent | Carbohydrates | S5. Contains naphthalen-1-ol (1-naphthol) and ethanol. See main hazard sheets for these. Wear eye protection and keep away from sources of ignition. | HIGHLY FLAMMABLE and DAMAGING TO EYES |  |
| Periodic acid Schiff – (PAS) reaction | Polysaccharides | S5. Contains basic fuschin (experimental carcinogen). Wear goggles (BS EN 166 3) and gloves when diluting the periodic acid. | Periodic acid – NO SIGNIFICANT HAZARD.<br>Schiff stain – Basic Fuchsin is a category 2 CARCINOGEN (=/> 1%) |  |
| Phenylhydrazine | Sugars | S5. Wear eye protection and gloves. Avoid contact with the eyes. Can cause skin sensitisation & dermatitis. See main sheet. | TOXIC (Cat 3) (by all routes)<br>SKIN/EYE IRRITANT,<br>SKIN SENSITISER,<br>MUTAGEN (Cat 2),<br>CARCINOGEN (Cat 1B) |  |
| Sandell's Reagent | Reducing sugars and alkanals | S2. Contains 0.4M sodium hydroxide (IRRITANT), EDTA and copper(II) sulphate. Wear goggles (BS EN 166 3) for preparation of solution. Sodium hydroxide (CORROSIVE), copper(II) sulphate (HARMFUL), but prepared solution is only | NO SIGNIFICANT HAZARD (Best treated as an IRRITANT) | None |

| | | | | |
|---|---|---|---|---|
| | | IRRITANT. Wear goggles (BS EN 166 3) for its use. See also main data sheet entry on Fehling's. | | |

# Biochemicals – Test for Lipids

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| Chlor-zinc-iodine (Schultze's reagent) | Test for lipids and for cellulose | S5. Contains zinc chloride & iodine. Goggles (BS EN 166 3) and gloves needed when preparing. NOT the same as Schultze's macerating solution. | CORROSIVE and HARMFUL |  |
| Chromium(VI) oxide (Chromic acid) | Test for cutin and suberin | Not recommended. Use chlor-zinc-iodine, Sudan Black or Sudan III. | TOXIC, CORROSIVE and OXIDISING AGENT |  |
| Leibermann Burchard Reagent | Test for Cholesterol | | corrorrosive, harmful by skin contact or inhalation |  |
| Osmium(VII) oxide (osmium tetroxide, osmic acid) | Not recommended. | Do not use. | TOXIC |  |
| Propan-2-ol (isopropyl alcohol) | In emulsification test. | S2t. Keep away from sources of ignition. | FLAMMABLE Cat 2, IRRITANT |  |
| Sudan Black | For cutin, suberin and fatty tissues. | S3t. | MUTAGEN (Cat 2), Ethanol – FLAMMABLE Cat 2, Propane-1,2-diol – NO SIGNIFICANT HAZARD |  |
| Sudan III | As above. | S5. Made up in ethanol and propanone mixed in equal volumes. Sudan Black and Sudan IV are often more effective. | Sudan III – NO SIGNIFICANT HAZARD, Ethanol – FLAMMABLE Cat 2 |  |
| Sudan IV | Fats and cutin. | S5. | Sudan IV – (Not Harmonised) SKIN/EYE IRRITANT, CARCINOGEN Cat 2, Ethanol – FLAMMABLE Cat 2 |  |

# Biochemicals – Test for Proteins

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| Albustix test strips (Protein equiv. of Clinistix) | Dip tests detect albumin. | S2-6. Merely as a precautionary measure, don't handle active tips. | NO SIGNIFICANT HAZARD | None |
| Biuret test | General test for detecting most/all proteins. | S3-6t. Some older preparations use quite concentrated sodium hydroxide (see main safety sheet on this) and are CORROSIVE. Wear goggles (BS EN 166 3). | NO SIGNIFICANT HAZARD (Unless old recipe is used in which case it is CORROSIVE) | None |
| Millon's reagent | Detects tyrosine & proteins containing this amino acid. | Contains mercury compounds in concentrated nitric acid and has to be heated for the test. Use Cole's modification or Sakaguchi Test. | CORROSIVE, TOXIC | <br> |
| Millon's Reagent – Cole's modification | | S5t. Two solution variation using sulphuric acid of lower concentration than the nitric used in the original recipe. See main safety data sheet on Millon's reagent. | CORROSIVE, TOXIC, Solution A – FATAL (Cat 1 derm, Cat 2 (or/inh), STOT RE 2 Solution B – NO SIGNIFICANT HAZARD | <br> |
| Sakaguchi test | Test for amino acid arginine and thus most proteins. | S5t. Three solution test and thus more complex than Millon's but probably safer. Detects proteins in situ. See main data sheet on Millon's reagent. | Solution A – CORROSIVE Solution B – EYE IRRITANT Solution C – CORROSIVE | <br><br> |
| Xanthoproteic test | General test for proteins. | S6t or T. Uses concentrated nitric acid and sodium hydroxide or ammonia solution. Goggles (BS EN 166 3) required. | Both solutions are CORROSIVE |  |

# Biochemicals – Miscellaneous tests

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| DCPIP (dichlorophenol indophenol, sodium salt) | Estimating Vitamin C (ascorbic acid) | S2. Solution often used is 0.1%. | NO SIGNIFICANT HAZARD | None |
| L-Dopa (L-3,4-dihydroxyphenylalanine) | As a substrate in enzyme studies. | Solution prepared by technician / teacher. Solution used by S5 and above | Harmful if swallowed, skin, eye & respiratory irritant, reproductive toxin (Cat 2) NO SIGNIFICANT HAZARD | none |

## Biochemicals - enzymes

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| Amylase (Diastase, Termamyl is an amylase preparation from NCBE) | Experiments involving the digestion of starch. Testing specificity of enzymes.<br>See Bulletin 221 | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. |  |
| Amyloglucosidase (AMG) | removes glucose units from liquefied starch in a stepwise manner, producing glucose | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. |  |
| Bromelain | Unlikely to be encountered in its pure form. Bromelain is a protease found in pineapple fruit and is commercially used as a meat tenderiser | S3-6. Use preparations from biological sources where possible. From pineapples Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |   |
| Carbohydrase (Viscozyme is a trademarked preparation from Sigma) | catalyses the breakdown of starches into simple sugars | S3-6. | No significant hazard | None |
| Catalase | catalyses the breakdown of hydrogen peroxide into water and oxygen | S3-6. Use preparations from biological sources where possible. Most commonly used as a preparation from liver or yeast. | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. |  |
| Chymosin (Rennin – A rennet extract is also sometimes known as rennilase or Maxiren) | The main protease found in rennet. Rennet is a complex of many enzymes produced in the mammalian stomach, and is often used in the production of cheese. | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled . Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |   |
| Fromase (emparase, mucor acid protease.) | A fungal alternative to rennet (chymosin) used for clotting proteins in milk. | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |   |

|  |  |  |  |  |
|---|---|---|---|---|
| Glucose isomerase (xylose isomerase) | used to interconvert aldoses and ketoses; most commonly glucose and fructose |  | No harmonised classification but probably a RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. |  |
| Glucose oxidase | Glucose oxidase is widely used for the determination of free glucose in body fluids and other tissues | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled |  |
| β-Glucosidase | Glucose oxidase is widely used for the determination of free glucose in body fluids and other tissues | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder.(Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled |  |
| Invertase | catalyses the hydrolysis glucosidic linkages of disaccarides. Can be used in the classroom experiment with p-nitrophenol for investigating enzyme systems | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. |  |
| Lactase (beta-galactosidase, Lactozym) | catalyses the hydrolysis of lactose to glucose and galactose | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. |  |
| Lipase | Experiments involving digestion of fats. | S3-6. As above | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Pancrelipase is also a skin sensitiser and a skin/eye and respiratory irritant. Solutions < 1% are of low hazard. |   |
| Neutrase | Neutrase is a general protease. NCBE use it to degrade proteins when preparing crude extracts of DNA from plant and animal cells. | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |   |
| Pancreatin | A mixture of amylase, lipase and protease produced in the pancreas | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY and SKIN SENSITISER, possible allergic reaction if powder inhaled. Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |   |

| | | | | |
|---|---|---|---|---|
| Papain | Unlikely to be encountered in its pure form. papain is a protease found in papaya (pawpaw) fruit and is commercially used as a meat tenderiser | S3-6. Use preparations from biological sources where possible. From papaya fruit. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY and SKIN SENSITISER, possible allergic reaction if powder inhaled. Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |  |
| Pectinase (Pectolase or pectic enzyme) | Breaks down pectin into sugars. Used in brewing and winemaking. Also used to increase yield when extracting juice from fruit such as apples. | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY and SKIN SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. (Interestingly, Sigma say it is of no significant hazard). |  |
| Pectinesterase | Catalyses the de-esterification of pectin into pectate and methanol. Involved in breakdown of plant tissue by fungi. | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY and SKIN SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. (Again, Sigma say it is of no significant hazard) |  |
| Pepsin | Digestion of proteins. | S3-6. As above | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |  |
| Phosphatase | A group of enzymes that catalyse the removal of a phosphate group from a phosphorylated substrate | S3-6. | No significant hazard | None |
| Phosphorylase | A group of enzymes that catalyse the addition of a phosphate group from an inorganic phosphate to an acceptor – such as glucose | S3-6. | No significant hazard | None |
| Protease | A general term for enzymes that digest protein. See also pepsin | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |  |

| | | | | |
|---|---|---|---|---|
| Subtilisin | A commn bacterial protease derived from B. subtilis that goes by many names including: alcalase, bioprase, esperase, generase, maxatase, savinase, superase and thermoase | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | Causes eye damage, and is a skin & respiratory irritant. It is also a skin sensitiser. Solutions < 1% are of low hazard. |  |
| Trypsin | A commn protease | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |  |
| Urease | Breakdown of urea. Testing specificity of enzymes.<br>See Bulletin 221. Determination of urea in 'blood' and 'urine'. | S3-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Also a skin, eye and respiratory irritant. Solutions < 1% are of low hazard. |  |

# Nucleic acids, amino acids and other proteins

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| DNA and RNA | We are not aware of any uses for RNA in school but DNA can have certain hazards associated with its use. See the SSERC publication Materials of Living origin – Educational Uses: A code of practice for Scottish Schools and Colleges for details. | | These compounds are of no significant chemical hazard. | None |
| Adenine | | | Toxic Cat 3 if swallowed | ☠ |
| Cytosine, Guanine, Thymine, Uracil | | | Irritant to skin, eyes and respiratory system. | ❗ |
| Adenosine, Cytidine, ATP | | | No significant hazard | None |
| Guanidine | | | Toxic Cat 3 if swallowed | ☠ |
| Uridine | | | Irritant to skin, eyes and respiratory system. | ❗ |
| Alanine, Asparagine, Glutamic acid, Glutamine, Glycine, Isoleucine, Leucine, Lysine, Methionine, Ornithine, Phenylalanine, Proline, Serine, Threonine, Tryptophan & Valine | | | No Significant hazard | None |
| Arginine & Aspartic acid | | | Eye irritant cat 2 | ❗ |
| Cysteine | | | Harmful cat 4 if swallowed | ❗ |

| | | | | |
|---|---|---|---|---|
| Histidine | | | Harmful cat 4 if swallowed or inhaled.<br>Skin / eye / respiratory irritant. |  |
| Tyrosine | | | Skin / eye / respiratory irritant. |  |
| Albumen | Experiments involving proteins, particularly as a standard for food tests – it is much less messy than egg-white.. | S1-6. Use liquid preparations where possible. Mask and gloves to be worn when making up solutions from powder (Technicians only) | RESPIRATORY SENSITISER, possible allergic reaction if powder inhaled. Solutions < 1% are of low hazard. |  |
| Casein | Experiments involving proteins, | S1-6. Use liquid preparations where possible. Avoid raising dust when making up solutions from powder (Technicians only) | No significant hazard. But avoid inhaling powder. | None |
| Gelatin | Experiments involving proteins and also as a gel-forming substance for other purposes | S1-6. Use liquid preparations where possible. Avoid raising dust when making up solutions from powder (Technicians only) | No significant hazard. But avoid inhaling powder. | None |
| Haemoglobin | Not often used but may be encountered as a blood substitute. | S5-6. Use liquid preparations where possible. Avoid raising dust when making up solutions from powder (Technicians only) Blood contains about 35% haemoglobin. | No significant hazard. But avoid inhaling powder. | None |
| Peptone | Peptone is a mixture of amino acids and peptides resulting from the digestion of protein. Usually used as a component of culture media. | S4-6. Use liquid preparations where possible. Avoid raising dust when making up solutions from powder (Technicians only) | No significant hazard. But avoid inhaling powder. | None |

# Plant and animal hormones

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| 2,4-dichlorophenoxy-ethanoic acid (2,4-D) | Weedkillers and artificial plant growth promoter. | S5t. HARMFUL if swallowed. Irritates eyes and skin. Respiratory sensitiser. Experimental teratogen. Best not handled by females of child bearing age. Wear gloves and eye protection when handling solid, making up solutions etc. (T) | HARMFUL, EYE DAMAGE, SKIN SENSITISER |  |
| 3-Indolylethanoic acid Indole acetic acid (IAA) | Plant growth experiments. Rooting cuttings. | S3t (dilute solutions etc.). Poisonous if swallowed. An experimental teratogen. Handling as above for concentrate/solid – wear eye protection and gloves (T). | SKIN/EYE IRRITANT |  |
| Indole butyric acid (IBA)) | Plant growth experiments. Rooting cuttings. | S3t (dilute solutions etc.). Poisonous if swallowed. An experimental teratogen. Handling as above for concentrate/solid – wear eye protection and gloves (T). | TOXIC Cat 3 (oral), SKIN/EYE IRRITANT |  |
| Kinetin (furfuryl aminopurine) | used in plant tissue culture for inducing formation of callus and to regenerate shoot tissues from callus | S5t. Mutagenic. Wear gloves and eye protection when handling solid, making up solutions etc. (T) | Mutagen Cat 2 |  |
| Sacchs solutions for plant growth | | | No significant hazard from the solutions | None |
| | | | No significant hazard from solutions | None |
| Acetylcholine | Physiology investigations. | S5t Avoid skin contact and do not inhale dust. Some samples are derived from bovine nervous tissue. | SKIN/EYE/RESPIRATORY IRRITANT |  |
| Adrenaline | As above | S6t TOXIC by inhalation, in contact with the skin and if swallowed. May cause dermatitis. Wear eye protection and gloves. | TOXIC Cat 3 (derm) Cat 2 (or/inh) |  |

|  |  |  |  |  |
|---|---|---|---|---|
| Caffeine | Not used often but could be used for physiology experiments | S5. Not used very often but is commonly extracted from tea or stimulant drinks. | Harmful Cat 4 (oral) |  |
| Colchicine | Arresting cell division to see chromosomes | Not suitable for use in schools Use 1,4-dichlorobenzene or acenaphthene instead | Fatal if swallowed (cat 2) Mutagen (cat 2) |  |
| Chorionic gonadotrophin | Induction of egg laying and mating in Xenopusthe African Clawed Toad. | Wear eye protection and gloves. Human reproductive effects. Best not handled by females of child bearing age. | Reproductive toxin (cat 2) Harmful Cat 4 (oral) Skin Sensitiser (Not Hazardous according to Sigma) |  |
| Ethidium bromide | Staining nucleic acids in gel electrophoresis | Not suitable for school use. | Harmful cat 4 (oral, Fatal (cat 2) if inhaled, Mutagen |  |
| Nicotine | Physiological investigations | Should not be purified. S6 Dilute solutions may perhaps be used. Smoking machines are banned in Scotland | Fatal if swallowed (cat 1) or in contact with skin (cat 1) Harmful for the aqautic environment Cat 2 |  |
| Thyroxine | Amphibian growth and development investigations. | T. Toxicity as per last entry. Experimental teratogen and mutagen. Best not handled by females of child bearing age. | REPRODUCTIVE TOXIN Cat 2, ACUTE TOXIN Cat 4 |  |
| Thiocarbamide (Thiourea) | As above. | S6t,T. HARMFUL if swallowed and mild irritant to eyes, skin, and respiratory tract. Sensitiser, may lead to allergenic skin reactions. Prolonged exposure to low concentrations inadvisable. Possible mutagen and teratogen. | CARCINOGEN Cat 2, REPRODUCTIVE TOXIN Cat 2, TOXIN Cat 4 |  |

## Biochemicals - miscellaneous

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| Beeswax | Chemically, beeswax consists mainly of esters of fatty acids and various long-chain alcohols. | S1-6. No problems | No significant hazard | |
| Castor oil | Castor oil can be used as an example of a vegetable oil and is commonly used for reacting with sulphuric acid to make an example of a detergent. | S1-6. No problems | No significant hazard | |
| Clove oil | Clove oil is >90% Eugenol, a terpene, and so may be used for eugenol extraction at higher or advanced higher | S5-6. Work in a well-ventilated area. Wear gloves. | Flammable (Cat 3) Aspiration Toxin, Skin sensitiser, and Irritant to eyes, skin and respiratory system. < 1% are of low hazard. | |
| Eugenol | Technically a terpene rather than an oil. Eugenol may be encountered in eugenol extraction and analysis at higher or advanced higher. | S5-6. Work in a well-ventilated area. Wear gloves. | Skin sensitiser, and Irritant to eyes, skin and respiratory system. < 1% are of low hazard. | |
| Lanolin | A wax extracted from wool. Not a true fay, rather a mixture of sterol esters | S1-6 No issues with use | No significant hazard. Allergies to lanolin have been greatly overstated – due to a misreporting of 1% of people with dermatological disorders as 1% of the normal population. | |
| Olive oil | As an example of an oil. Or to show fluorescence from the chlorophyll in it. | S1-6 No issues with use. | No significant hazard | |
| Paraffin (liquid) | Used as an inert, viscous liquid. Sometimes as an oil bath for heating. | S1-6. No issues with use | No significant hazard | |
| Paraffin Wax | Used in tealights. Also for the 'ground' in copper etching and various other things. | S1-6. No issues with use | No significant hazard. | |

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|---|---|---|---|---|
| Peptones | This is a name for an enzymatic hydrolysate of various tissues (commonly beef). The result is a mixture of amino acids, peptides and sugars which is used as a nitrient in microbiology. | | All of them are of no significant hazard. | |
| Plant oils (other) | Various – making biodiesel, examining properties of hydrocarbons etc. | S1-6. No issues with use. (Other than nut allergies) | No significant hazard. But be careful of peanut (groundnut) oil and people with nut allergies | |
| Artificial Urine – 1) Simple Recipe | | | No significant hazard. | |
| Artificial Urine – 2) Diabetic urine | | | No significant hazard. | |
| Artificial Urine – 3) More exact recipe | | An artificial urine solution was prepared according to the recipe reported by Brooks and Keevil[1] . | significant hazard. | |

# Biochemicals – Clearing agents

| Name | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|
| Alcohol / 1,2-dimethylbenzene | T. Clearing agent (may cause 'milkiness' if even a trace of water is left). | HIGHLY FLAMMABLE, IRRITANT & HARMFUL |  |
| Algal mountant | S6t, T. Mountant. Wear goggles (BS EN 166 3) | MUTAGEN Cat 2, CORROSIVE & TOXIC Cat 3 (all) |  |
| Amann's medium (see also lactophenol) | S6t, T. Clearing agent for delicate algae, fungi and nematodes. Wear goggles (BS EN 166 3). | MUTAGEN Cat 2, CORROSIVE & TOXIC Cat 3 (all) |  |
| Berlese's fluid (see Gum chloral) | Not recommended. | TOXIC |  |
| Canada balsam (CB) | S6, T. Mountant but not recommended. Replace with modern synthetic substitute. | HARMFUL & IRRITANT |  |
| Carnoy's fluid | For clearing and mounting small arthropod specimens. | HIGHLY FLAMMABLE, CORROSIVE & HARMFUL, CARCINOGEN |  |
| Cedarwood oil | S6, T. Clearing fluid | ASPIRATION TOXIN, SKIN IRRITANT |  |
| Celloidin (collodion or nuloidin) | S6, T. For embedding sections. | EXTREMELY FLAMMABLE, HARMFUL |  |
| Clove oil / glacial ethanoic acid | S6, T. Clearing fluid – good for plant sections stained with safranine & light green. Wear goggles (BS EN 166 3). | CORROSIVE |  |
| Dammar | Not recommended. Avoid use – reported as unreliable. | HARMFUL & IRRITANT |  |

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|---|---|---|---|
| Diethylene dioxide (1,4-Dioxane) | Use not recommended. If used ensure adequate ventilation and avoid breathing vapour (T). | HARMFUL VAPOUR HIGHLY FLAMMABLE. Peroxide formation like diethyl ether. Cat.2 CARCINOGEN in animals. |  |
| De Faure's mountant/fixative (See Gum Chloral) | Not recommended. | TOXIC |  |
| Dimethylbenzene (xylene or xylol) | T. Clearing agent after final dehydration. Substitute with modern alternatives (e.g. citrus oil types). | HARMFUL & IRRITANT HIGHLY FLAMMABLE |  |
| DPX mountant | S6, T. Mountant. | HARMFUL, IRRITANT, FLAMMABLE and REPRODUCTIVE TOXIN (Cat 1B), HARMFUL VAPOUR |  |
| Ethane-1,2-diol (ethylene glycol) | S6, T. Clearing fluid and dehydrating agent. More rapid than alcohol series. | FLAMMABLE, HARMFUL, REPRODUCTIVE TOXIN (CaT 1b). |  |
| Euparal | S6, T. Mountant. | FLAMMABLE, IRRITANT, HARMFUL |  |
| Gum Chloral (See also Berlese's fluid and De Faure's mountant/fixative.) | Not recommended. ountant for insects and ungi. | TOXIC |  |
| Immersion oil | S5,T. Clearing agent etc. Use newer POCB free ypes. | SKIN/EYE/RESPIRATORY IRRITANT. Old samples may contain POCBs (polychlorobiphenyls). |  |
| Lactophenol (See also Amann's medium) | S6t,T. Clearing agent and temp. mountant especially for fungi. | MUTAGEN Cat 2, CORROSIVE & TOXIC Cat 3 (all) |  |
| Pampel's fluid (see Fixatives) | | | |

| | | | |
|---|---|---|---|
| Phenol / 1,2-dimethylbenzene | Not recommended | TOXIC & CORROSIVE |  |
| Propanone – 1,2-dimethylbenzene (acetone-xylene) | Not recommended | HARMFUL, IRRITANT & HIGHLY FLAMMABLE |  |
| Polyvinyl lactophenol | Not recommended | TOXIC & CORROSIVE |  |
| Propane-1,2,3-triol (glycerol) | S3, T. Temporary mountant and for dehydration of delicate material. Place tissue material in solution & allow water to evaporate for a week hen transfer to 95% ethanol. | NO SIGNIFICANT HAZARDS | None |

# Biochemicals – Fixatives

| Name | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|
| Acetic alcohol (Clarke's fluid) | S5. Fixative for cytology esp. chromosomes. | CORROSIVE and HIGHLY FLAMMABLE |  |
| Acetic carmine (carmine acetic) | S5/6t, T. Stain/fixative for protozoa and nuclei. | CORROSIVE |  |
| Acetic orcein (orceine acetic) | S5. Stain/fixative for chromosomes and connective tissue. | CORROSIVE |  |
| Algal preservative | BANNED | TOXIC (Methanal is a Category 2 CARCINOGEN) |  |
| Ammonium dichromate | T. Fixing & hardening nervous tissue. | EXPLOSIVE, TOXIC, Corrosive, CARCINOGEN |  |
| Anisaldehyde | Can be used to preserve animal tissue for up to a month – longer if the specimen is fixed first. | Low Hazard (possibly irritant – classification of Teepol L is not harmonised) | None |
| Bensley's fixative | Not recommended(Mitochondria). | TOXIC | |
| Berlese's fluid (Gum chloral) | For clearing and mounting small insects / arthropod specimens. Not recommended. | TOXIC |  |
| Bouin's solution | Not recommended(Marine invertebrates, embryos). | EXPLOSIVE if dry, TOXIC |  |
| Cajal's fixative | S6t, T. Golgi bodies. | TOXIC (Category 1B CARCINOGEN). |  |

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|---|---|---|---|
| Carnoy‘s fluid | S5t, T. For meristems, root tips & anthers. | HIGHLY FLAMMABLE, HARMFUL & CORROSIVE |  |
| Champy‘s fixative | Not recommended. (Mitochondria and animal tissues). | TOXIC & CORROSIVE (Category 1B CARCINOGEN) |  |
| Chromo ethanoic fixative 1 (Chrom-acetic) fixative | Marine algae. Not recommended. | CORROSIVE & OXIDISING AGENT (Category 1B CARCINOGEN) |  |
| Chromo ethanoic fixative 2 | Algae. Not recommended. | | As above |
| Chromo ethanoic fixative 3 | Filamentous algae. Not recommended. | | As above |
| Chromo ethanoic fixative 4 | Plant tissues. Not recommended. | | As above |
| Chromo ethanoic fixative 5 | Prothalli and fungi. Not recommended. | | As above |
| Chromo ethanoic fixative 6 | Meristems, root tips & ovaries. Not recommended. | | As above |
| Chromo ethanoic fixative 7 | T. Leaves and woody material. Not recommended. | | As above |
| Chromic acid (chromium (VI) oxide) | Not recommended. Fixative in cytology (animal tissue). | CORROSIVE, OXIDISING, TOXIC, Category 1A CARCINOGEN by inhalation. |  |
| Colchicine | Not recommended. (Pre-fixative treatment for root tips – stops clumping of chromosomes). | VERY TOXIC |  |
| Clarke‘s fluid (ethanoic acid / ethanol) | S5. See “Acetic alcohol”. | HIGHLY FLAMMABLE & CORROSIVE |  |

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|---|---|---|---|
| Dubosq-brasil (alcoholic Bouin) | Not recommended. Fixative for arthropods, particularly with parasites). | EXPLOSIVE if dry, TOXIC & CORROSIVE |  |
| Ethanoic acid | S4t. Nuclei and chromosomes and differential fixative for white and yellow fibres in connective tissue. | CORROSIVE & FLAMMABLE |  |
| Farmer's fluid | S5t. Fixative for nuclear material. | TOXIC & CORROSIVE |  |
| Flemming's fluid (strong) | Not recommended. (Fixative for cytology). | TOXIC Category 1A CARCINOGEN) |  |
| Flemming's fluid (weak) | Not recommended. (Fixative for fungi and rotifera). | TOXIC, Category 1A CARCINOGEN) |  |
| Gatenby's fluid | Not recommended. (Removes albumen from amphibian eggs). Smith's fixative is an alternative. | CORROSIVE & OXIDISING , Category 1A CARCINOGEN . |  |
| Gilson's fixative | Not recommended. | TOXIC, CORROSIVE & FLAMMABLE |  |
| Green algae preservative | Not recommended. Suggest use Kaiserling's fixative (see below). | TOXIC (and methanal is Category 2 CARCINOGEN) | |
| Kaiserling's fixative | S6t, T. Soak in a) for a day then store in b) | TOXIC & CORROSIVE |  |
| La Cour's fixatives (2BX, 2BE & 2BD) | Not recommended.(Plant tissue fixatives). | TOXIC & CARCINOGEN |  |
| Malachite green | Used as vital stain for plant tissue. | HARMFUL |  |

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|---|---|---|---|
| Merkel‘s fluid | S5/S6t, T. Alternative to chromo-ethanoic fixative – good for mitosis in flowering plants. | TOXIC |  |
| Methanal (formalin – 3%) | T. Preservative | TOXIC & CARCINOGEN |  |
| Methanal (formalin – 4%) | T. Fixative | TOXIC & CARCINOGEN |  |
| Methanal – aceto-alcohol (FAA fixative) | T. Algal fixative | HIGHLY FLAMMABLE TOXIC and CARCINOGEN |  |
| Methanal / alcohol | T. Fixative | HIGHLY FLAMMABLE TOXIC and CARCINOGEN |  |
| Methanal / calcium (Baker‘s fixative) | T. Fixative | TOXIC, CARCINOGEN |  |
| Methanal / dichromate | Not recommended. (Fixative for hardening brain tissue). | TOXIC, IRRITANT and CARCINOGEN CORROSIVE |  |
| Methanal / saline | T. Good general fixative | TOXIC, CARCINOGEN |  |
| Methanal – Hg(II) sublimate | Not recommended for routine use. | TOXIC, CARCINOGEN |  |
| Navashin‘s fluid | T. if for fixing parasitic fungi in plant tissue. | CORROSIVE, OXIDISING AGENT & TOXIC |  |

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|---|---|---|---|
| Odourless preservative (opresol or phenoxetol) | Can be used to preserve animal tissue for up to a month – longer if the specimen is fixed first. | Low hazard | None |
| Osmium(VIII) oxide (osmium tetroxide) | Not recommended. (Fixing protozoa). See – Stains. | TOXIC |  |
| Pampel's fluid | S6t, T. Preservative good for insect material. | TOXIC & CORROSIVE (Methanal – Category 2 CARCINOGEN |  |
| Paradichlorbenzene | S6t, T. Alternative to colchicine. A pre-fixation bath to prevent clumping of chromosomes. | HARMFUL & IRRITANT |  |
| Propanoic orcein | S5. Stains and fixes. | CORROSIVE |  |
| Rossman's fluid | Not recommended. | TOXIC, EXPLOSIVE if dry |  |
| Schaudinn's fixative | Not generally recommended. T. (If as fixative for protozoa). | HIGHLY FLAMMABLE, TOXIC. |  |
| Smith's fixative | T. Possibly safer alternative to Gatenby's Fluid. Mix sol'ns A and B in equal parts just before use. | CORROSIVE, TOXIC & OXIDISING AGENT |  |
| Sodium fluoride | S6t, T. Fixative of intestinal mucosa. | TOXIC |  |
| Sodium thiosulphate (hypo) | S5t, T. For removing iodine from tissue treated with iodine and fixed with mercury(II) chloride. | No significant hazard | None |
| Susa fixative (Heidenhain's Susa) | T. General fixative for animal tissue. Doesn't harden tissue too much. | IRRITANT & TOXIC (Methanal – Category 2 CARCINOGEN). |  |

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|---|---|---|---|
| Zenker's fixative | T. Fixative for fine detail in animal tissue and also for mitosis. | TOXIC |  |
| Zenker's methanal | T. Animal histology fixative. Not for plant tissues. Fix for 12 hours. | TOXIC & CARCINOGEN by inhalation. |  |
| Zirkle's fluid | T. Fixative for plant mitochondria. | HARMFUL & CARCINOGEN by inhalation. |  |

## Biochemicals – Macerating and Narcotising Reagents

| Name | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|
| Cellulose ethanoate | S6t,T. Softens wood for sectioning. | HIGHLY FLAMMABLE |  |
| Chromic acid (Priestly – plant tissue) (Ranvier – animal tissue) | Not recommended. | CORROSIVE & OXIDISING, TOXIC, Cat 1A CARCINOGEN |  |
| Eau de Javelle | S5, T. Removes soft tissue around hard skeletal material. Can be substituted by enzyme based washing powder (but beware possible allergenic reactions). | HARMFUL & CORROSIVE |  |
| Harlow's solutions | S5t, T. Place wood shavings in A for 2 to 3 hours. Transfer to B at 90°C for 15 minutes. Repeat cycle until tissues fall apart. | HARMFUL |  |
| Jeffery's macerating fluid | Not recommended. | CORROSIVE & OXIDISING, TOXIC, Cat 1B CARCINOGEN |  |
| Schulze's macerating fluid | Not recommended. For woody tissue. Substitute with Harlow's solutions. | CORROSIVE & OXIDISING, TOXIC, Cat 2 CARCINOGEN |  |

Narcotising agents

| Name | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|
| Carbon dioxide | T. For killing mammals & birds and as soda water for aquatic organisms. Also echinoderms, coelenterates & annelids. | ASPHYXIANT | None |
| Chloral hydrate (2,2,2-trichloroethanediol) | For narcotising small aquatic animals. Not recommended. | TOXIC |  |
| Clove oil | S6t,T. For anaesthetising invertebrates. | IRRITANT |  |
| Ethanol | T. For fresh-water invertebrates. | HIGHLY FLAMMABLE |  |
| Ethoxyethane (diethyl ether) | T. Use to anaesthetise insects e.g. Drosophila; or arachnids. Do not use to kill vertebrates. | EXTREMELY FLAMMABLE |  |
| Ethyl 3-aminobenzoate (MS-222) | T. For killing fish and amphibians. Do not use for sedation of vertebrates. | HARMFUL |  |
| Ethyl 4-aminobenzoate (benzocaine) | T. For killing aquatic animals or anaesthetising invertebrates. | HARMFUL |  |
| Ethyl ethanoate (ethyl acetate) | S6t, T. For killing insects. | HIGHLY FLAMMABLE |  |
| Ethyl urethane (ethyl carbamate) | Not recommended. | TOXIC. Suspected CARCINOGEN. |  |
| Magnesium chloride / magnesium sulphate | S6t, T. Use for marine animals |  | None |
| Menthol | S6t, T. For sessile aquatic animals. | HARMFUL in quantity and IRRITANT |  |
| Potassium cyanide | Not recommended. Substitute chopped foliage of Cherry Laurel. | TOXIC |  |

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|---|---|---|---|
| Tetrachloromethane (carbon tetrachloride) | Banned | TOXIC & Cat.3 CARCINOGEN. DANGEROUS FOR THE ENVIRONMENT |  |
| Trichloromethane (chloroform) | Not recommended. | HARMFUL & IRRITANT Cat.2 CARCINOGEN |  |
| 1,1,1-trichloro-2-methyl- propan-2-ol (chlorbutol or chloretone) | T. For invertebrates, vertebrate larvae and fish. | HARMFUL |  |

# Appendix B - Dyes and stains

## Hazards

There are many dyes of varying types, structures and degrees of hazard. Not all dyes of the same class necessarily have the same type of chemical structure and hence generalisations on their toxicities cannot be made on the basis of class. For example some *Disperse* dyes are phenylazo compounds, but others are anthraquinones. Other general points are:

- **Some dyes are CARCINOGENS** – many of low potency, but others have high potency and their use or synthesis should be avoided.
- **Dyes purchased from reputable craft shops should be of low hazard** – Safety Data Sheets (SDS's) will be supplied upon purchase. Few dyes are 100% pure and it is often the impurities which may pose the main hazard. Direct benzidine type dyes are components of many dyestuffs; if they cannot be avoided, use with great care.
- **Avoid Direct Blue 14 (Tryptan Blue), Direct Brown 95, Direct Blue 6, Direct Black 36. Sudan I,II,III and IV are suspect carcinogens, with the evidence against Sudan IV more reliable.**
- **Choose azo dyes with one or more sulphonate groups which confer water solubility on the molecule** – the azo link is cleaved reductively by the gut flora to two separate amines, usually aromatic. If these amines are are soluble they tend to be excreted faster and generally have a negligible carcinogenic potency.

See Topic 12 in Topics in Safety (ASE) for more discussion.

- **Many dyes are IRRITANTS and HARMFUL** – Many of the *Reactive dyes*, e.g. some Procion dyes, are skin sensitisers and a small number of them are respiratory sensitisers**.** *Reactive dyes* which are designed to chemically bond to protein fibres and will also readily bond to proteins in skin or in lungs, thereby initiating sensitisation.

**Some of the mordants used in mordant dyeing are VERY TOXIC** – e.g. chromium(VI) compounds which are best avoided.

## Handling

Do not inhale dust during preparation of solution or suspension. Prepare solutions in a fume cupboard. Wear gloves, eye protection and a pvc apron for making up solutions. Use only "de-dusted" preparations. The glove type needed is dependent on the solvent used to dissolve the dyestuff. In general solutions of dyes, including indicators are best prepared by a teacher or technician.

## Storage

Keep away from oxidising agents.

## Disposal

Wear eye protection, gloves and apron. Up to 2 litres of dilute solutions can be washed to waste. It may be possible with larger volumes or more concentrated solutions to absorb the dye onto activated charcoal or mineral absorbent and place in solid refuse. The supernatant can be washed to waste. Alternatively, store for uplift by a licensed disposal contractor.

## Spillage

Wear eye protection, gloves and apron. Cover both solid and solutions with sand or mineral absorbent, moisten and carefully lift into bucket. Treat as in *Disposal*.

**Remedial Measures**

***Given the wide range of products in this category, the advice here can only be general. If in doubt, consult the suppliers Safety Data Sheet for a particular dye.***

***Eyes***

Irrigate with water for at least 10 minutes.

***Mouth***

Wash out mouth thoroughly with water. Don’t induce vomiting.

***Lungs***

As many are fine powders and exposure is possible by this route. Move patient from area of exposure. Rest and keep warm.

***Skin***

Wash well with soap and water. Remove and wash contaminated clothing.

# Dyes and Stains

| Name | Other names | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| Acetic carmine (carmine acetic) | | S5/6t, T. Stain fixative for protozoa and nuclei. | CORROSIVE |  |
| Acetic lacmoid | | S5/6t, T. Stain fixative for chromosomes. | CORROSIVE |  |
| Acetic orcein (orceine acetic) | | S5t, T. Stain fixative for chromosomes and connective tissue. | IRRITANT/HARMFUL |  |
| Acid alcohol | | S5t, T. Differentiating reagent. | HIGHLY FLAMMABLE |  |
| acid blue 40 | acid blue 2g CAS 6424-85-7 | Bonds to amide linkages of wool, silk and nylon. – a component of 'magic dye'. | No significant hazard | None |
| Acid fuschin (Mallory) (Acid magenta) | | S5t, T. Excellent general stain. Use as counterstain to aniline blue, methyl green, iodine green and malachite green. | HARMFUL HIGHLY FLAMMABLE |   |
| acridine orange | Solvent orange 15, Basic orange 14, Rhoduline orange CAS 65-61-2 | Nucleic acid-selective fluorescent cationic dye useful for cell cycle determination | Mutagen Cat 1A |  |
| alizarin | Mordant red 11, turkey red, 1,2-dihydroxyanthraquinone. CAS 72-48-0 | A crimson pigment, historically derived from the root of the madder plant. Can be used to stain calcium in tissue samples. | Acute toxin Cat 4 (oral), Irritant to skin and eyes Cat 2. |  |
| Alizarin red S | | S6, T. To stain developing bone n whole mounts. | IRRITANT |  |
| aluminon | Ammonium aurin tricarboxylate CAS 569-58-4 | Commonly used to detect the presence of the aluminium ion in an aqueous solution.. | Irritant to skin and eyes Cat 2. |  |
| aniline blue WS | aniline blue, china blue, soluble blue | This can be either methyl blue or water blue (cf) or a mixture of both of them | Probably IRRITANT |  |

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| Aniline blue (phenylamine blue) | | S5, T. Cellulose stain. S5, T. Algae and fungi stain. | HIGHLY FLAMMABLE, HARMFUL and Cat.2 CARCINOGEN. |  |
| Aniline blue-actophenol (Cotton blue lactophenol) | | S5t, T. Good fungi stain/fixative. 'Specific' for fungal cellulose. | TOXIC and Cat.2 CARCINOGEN. |  |
| Aniline sulphate | | S5t, T. Stain specific to lignin. Wear goggles (BS EN 166 3) and gloves. Toxic by skin absorption and breathing vapour. | TOXIC and Cat.2 CARCINOGEN |  |
| Azure A | | S5, Lambda DNA Protocol. | IRRITANT |  |
| Basic fuschin | | S5t, T. Stain for bacteria and nuclei. | HARMFUL |  |
| blue dextran | CAS 87915-38-6 | This is a dextran with the dye reactive blue 2 attached randomly to hydroxyl groups along the chain. | No significant hazards | None |
| brilliant yellow | Direct yellow 4, Brilliant yellow C, Paper yellow CB, Fenamin Yellow 3G CAS 3051-11-4 | | No significant hazards | None |
| Carbol fuschin (Cf) | | S5/6t, T. Nuclear stain for fung and bacteria and for spores esp. bacterial & yeast spores. | CORROSIVE & TOXIC. HIGHLY FLAMMABLE |  |
| Carbol gentian violet (Gram's iodine as counterstain) | | S5t, T. Gram stain for bacteria & fungal stain to show nuclei and cell division. Also used for epithelia & spermatozoa. | CORROSIVE & TOXIC |  |
| Carbol thionin | | S6t, T. Stain for fungi & bacteria. Shows fungi in host plant. | CORROSIVE & TOXIC |  |
| carmine | Cochineal, Natural red 4, crimson lake, | Carminic acid is the staining agent in carmine. Usually used | Skin corrosive Cat 1A |  |

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|  | casminic acid<br>CAS 1260-17-7 | as a solution in ethanoic acids – carmine acetic. |  |  |
| Congo red |  | S3/4t, T. For protozoa & live yeast. | Suspect CARCINOGEN and possible TERATOGEN – BDH |  |
| Coomassie blue | Brilliant Blue, Coomassie brilliant blue, Acif blue 83, Brilliand indocyanine 6B CAS 6104-50-2 | Coomassie stain is used particularly for visualising proteins in electrophoresis. There are two version of this dye, the G form and the R form, the G form having two extra methyl groups. Both will work equally well but the G form is faster, while the R form is more sensitive – though it can take many hours to develop. | Probably very low hazard but may be slightly Irritant to skin and eyes Cat 2 and to the respiratory system. The solution is of no significant hazard | None |
| cresyl violet acetate | cresyl fast violet, cresole violet CAS 10510-54-0 | A histological stain. Used, amongst other things to show the nissl substance in neurons and cell nuclei | Skin irritant Cat 2, Eye irritant Cat 2, May cause respiratory irritation |  |
| Crystal violet (use Gram's or Lugol's odine as Gram counterstain) |  | S5t, T. Gram stain for bacteria. Useful also for mitotic figures. | Solid is CARCINOGEN (1B), EYE DAMAGE, HARMFUL IF INGESTED. Solution as made up is of low hazard | None |
| Crystal Violet (Lillies recipe) |  |  | Solid cv is CARCINOGEN (1B), EYE DAMAGE, HARMFUL IF INGESTED. | None |
| direct black 36 | direct blue black<br>CAS 6360-26-5 |  | Carcinogen Cat 1B. Label needed for solutions of 0.1% and over. |  |
| direct blue 14 | trypan blue CAS 72-57-1 | tetrasodium salt. Label needed for solutions of 0.1% and over. | Carcinogen Cat 1B |  |
| direct blue 6 | direct blue 2B<br>CAS 2602-46-2 | tetrasodium salt. Label needed for solutions of 0.1% and over. | Carcinogen Cat 1B, Reproductive toxin Cat 2 |  |
| direct brown 95 | CAS 16071-86-6 | disodium salt. Label needed for solutions of 0.1% and over. | Carcinogen Cat 1B |  |
| direct red 23 | Direct red B, Red B, Direct scarlet, Solophenyl scarlet<br>CAS 3441-14-3 | bonds by hydrogen bonding and takes well to cellulose-based fibres such as cotton, viscose and rayon which have many –OH groups polyester – a component of 'magic dye'. | no significant hazard | None |

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| disperse yellow 7 | CAS 36300-37-4 | Used for dyeing hydrophobic polymers like polyester – a component of ‘magic dye’. | Skin irritant Cat 2, Eye irritant Cat 2, May cause respiratory irritation |  |
| Eosin | | S5, T. General stain for e.g. transpiration stream experiments. | HARMFUL, IRRITANT and suspect CARCINOGEN if trichloromethane added. |  |
| Eosin alcoholic | | S5, T. Good cytoplasmic stain used as counterstain for Ehrlich‘s Haematoxylin. | HIGHLY FLAMMABLE |  |
| Erythrosin (dye also used in dental disclosing tablets) | | 5, T. Cytoplasmic stain. Counter stain for Delafield‘s haematoxalin. | HIGHLY FLAMMABLE |  |
| Fast green F.C.F. | | S6, T. Counterstain to safranin n plant sections. | HIGHLY FLAMMABLE |  |
| Fast red 7B (Sudan red) | | S3/4t. Fat stain. | HARMFUL |  |
| Feulgen stain (Schiff‘s reagent) | | S5t, T. Feulgen reaction for DNA. Also used in organic chemistry/biochemistry. | HARMFUL |  |
| fuchsine, acid | CAS 3244-88-0 | Used for staining marine algae and small crustaceans | Skin irritant Cat 2, Eye irritant Cat 2, May cause respiratory irritation |  |
| fuchsine, basic | Magenta, rosaniline hydrochloride CAS 632-99-5 | As well as dying textiles, fuchsine is used to stain bacteria, as a pH indicator and sometimes as a disinfectant. Health hazard label needed for solutions of 1% and over. | Carcinogen Cat 2, Harmful if swallowed Cat 4, Skin irritant Cat 2, Eye irritant Cat 2, Harmful to the aquatic environment with long-lasting effects Cat 2 |  |
| fuchsine, new | Basic violet 2, Magenta III CAS 3248-91-7 | One of the components of basic fuchsine. Similar uses to basic fuchsine. Health hazard label needed for solutions of 1% and over. | Carcinogen Cat 2, Eye damage Cat 1, Skin irritant Cat 2, May cause respiratory irritation, Specific Target Organ Toxin (on repeated exposure) Cat 2 (liver & kidneys) |  |
| Gram stain (dilute Cf) | | S5t, T. Gram stain for micro-organisms. This recipe is but one of several variants. | CORROSIVE & TOXIC |  |
| Gram‘s iodine | (a counterstain to some of the many variants of | S5t. A counterstain in Gram‘s procedure to test for Gram +ve | HARMFUL |  |

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|  | Gram's stain procedures) | & Gram -ve bacteria. See also Lugol's iodine). |  |  |
| Haematoxylin (Delafield's) |  | S5. Most commonly used and best general stain for animal material. If stain has been stored for too long it won't 'blue' with tap water, add a few drops of sodium hydroxide. | TOXIC & HIGHLY FLAMMABLE (on account of the methanol) | 🔥 ☠ |
| Haematoxylin (Ehrlich's) |  | S5, T. Excellent, commonly used stain for animal histology. | HIGHLY FLAMMABLE | 🔥 |
| Haematoxylin (Harris's) |  | S6t, T. Good for general use. This and many other formulations of haematoxylin which contain mercury(II) oxide are TOXIC. | TOXIC | ☠ |
| Iodine (in potassium iodide) |  | S1-5t. Temporary stain for plant material. Stains cellulose yellow and starch blue-black. | No significant hazards | None |
| Janus green B |  | S5t. Vital stain (H grade) for mitochondria & golgi bodies. | No significant hazard | None |
| Lacto – fuschin |  | S6t. Stain-mountant for fungal hyphae. | IRRITANT. Lactic acid causes EYE DAMAGE | ⚠ |
| Lactopropionic orcein |  | S5t, T. Stain fixative for chromosomes and connective tissue. | CORROSIVE | ⚠ |
| Leishman's stain |  | Not recommended for use | HIGHLY FLAMMABLE and TOXIC | 🔥 ☠ |
| ight green | Light Green SF yellowish, Acid Green, Lissamine green SF, Acid Green 5, Food Green 2, FD&C Green no. 2, Green No. 205, Acid Brilliant Green 5, Pencil Green SF CAS – 5141-20-8 | Used in histology for staining collagen. In Masson's trichrome it is used as a counterstain to acid fuchsin.Usually comes as disodium salt | Eye irritant Cat 2 | ❗ |
| Lugol's iodine |  | S5t. Modification of Gram's iodine – counterstain for various Gram's stain variants. | HARMFUL | ❗ |

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| Mallory's triple stain. Made up from 3 solutions A, B and C | | S6, T. General histology stain. Material is best fixed in Zenker's fixative. | A & B are IRRITANT |  |
| methyl blue | Cotton blue, Helvetia blue,acid blue 93<br>CAS 28983-56-4 | Used as a stain in histology, and stains collagen blue in tissue sections. Fungal cell walls are also stained by methyl blue | No significant hazard | None |
| Methyl violet 6B | | S5t. Jensen's modification of Gram's stain. | No significant hazard | None |
| Methylene blue | | S1t. A vital stain. | Solution is of no significant hazard | None |
| Neutral red | | S6t. Important stain for protozoa. In acidic conditions it turns yellow e.g. in food vacuoles. | Solution is of no significant hazard | None |
| Neutral red (Jensen's) | | S5t. Jensen's modification of Gram's stain (counterstain). | Solution is of no significant hazard | None |
| Nigrosine | | S3t. Good stain for spores & capsules of bacteria e.g. yoghurt. | No significant hazard | None |
| orange G | Orange Gelb, Acid orange 10 CAS 1400-62-0 | Used as a stain in histology, and stains collagen blue in tissue sections. Fungal cell walls are also stained by methyl blue | No significant hazards | None |
| orcein | Acid orange 10<br>CAS 1936-15-8 | Used as a histological stain, especially for keratin. Also as a color marker to monitor the process of agarose gel electrophoresis | Harmful if swallowed Cat 4 |  |
| pararosaniline | Basic Red 9, para magenta CAS 1569-61-9 | A component of basic fuchsin. Health hazard label needed for solutions of 1% and over. | Carcinogen Cat 1B |  |
| Phloroglucinol | | S4t, S5. An excellent temporary stain for lignin. On a slide add stain to the section and then add 1 drop of concentrated HCl. | Phloroglucinol is IRRITANT and a SKIN SENSITISER.<br>Solution is sensitiser and flammable |   |
| Picric acid (trinitrophenol) | | Not recommended for school use. | EXPLOSIVE if dry and TOXIC |   |
| Resazurin | | Solid S5&6, solution S1. Used as a redox indicator for monitoring aerobic respiration. Can be used to measure the freshness of milk by a proxy | Powder = irritant to skin, eyes and respiratory system. Solution = no significant hazard | None |

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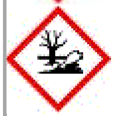
| | | measurement of the numner of bacteria present. | | |
| rhodamine 101 nner salt | CAS  116450-56-7 | One of the brightest of the flourescent dyes. | Skin irritant Cat 2, Eye irritant Cat 2, May cause respiratory rritation. Solution = no significant hazard | None |
| rhodamine 110 | CAS 13558-31-1 | One of the highly fluorescent family of dyes | Harmful if swallowed Cat 4. Solution = no significant hazard | None |
| rhodamine 123 | CAS 62669-70-9 | Fluorescent dye. Also used in biochemistry to inhibit mitochondrion function. | Harmful if swallowed Cat 4. Solution = no significant hazard | None |
| rhodamine 3B | C.I. basic violet 11<br>CAS 2390-63-8 | | Harmful if swallowed or inhaled Cat 4, Eye damage Cat 1, Harmful to the aquatic environment with long-asting effects Cat 3. Solution = no significant hazard | None |
| rhodamine 6G | C Rhodamine 590, C.I. Pigment Red 81, C.I. Pigment Red 169, Basic Rhodamine Yellow, Basic red 1 CAS 989-38-8 | Fluorescent dye. most commonly comes as the chloride but the perchlorate and tetrafluoroborate are also available. | Toxic if swallowed Cat 3, Eye damage Cat 1, Harmful to the aquatic environment with long-asting effects Cat 1 |    |
| rhodamine B | Rhodamine 610, C.I. Pigment Violet 1, Basic Violet 10 CAS 81-88-9 | Used as a staining fluorescent dye. | Eye damage Cat 1, |  |
| rhodozinic acid | Dihydroxydiquinoyl, dioxydiquinone<br>CAS 118-76-3 | Mainly encountered as sodium rhodizonate in test for lead (GSR) | no significant hazard | None |
| rose Bengal | Dihydroxydiquinoyl, dioxydiquinone<br>CAS 11121-48-5 | A stain, commonly used in eye drops for diagnosing damage but it has several other uses too. | no significant hazard | None |
| Safranine alcoholic | | S4t, S5. Good stain for animal and plant tissues, especially if counterstained with fast green. | HIGHLY FLAMMABLE |  |
| Safranine aqueous | | S4t, S5. For bacterial spores. | Solution of 1% is IRRITANT |  |
| Schultze's solution | | S5t. For cellulose and lipids. Note – not the same thing as Schultze's fluid which is a macerating fluid. | EYE DAMAGE |  |

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| Sudan black |  | S3t. For cutin, suberin and fatty tissues. | FLAMMABLE & MUTAGEN |  |
| Sudan I | CI solvent yellow,<br>Solvent orange R<br>CAS 842-07-9 | Added to to colourise waxes, oils, petrol, solvents and polishes also for colouring various foodstuffs, especially curry powder and chilli powder) Health hazard label needed for solutions of 1% and over. | Skin sensitiser Cat 1, Mutagen Cat 2, Carcinogen Cat 2, Harmful to the aquatic environment with long-asting effects Cat 4 |  |
| Sudan II | Solvent orange 7, CI Solvent orange 7, Sudan red & LOTS more CAS 3118-97-6 | Used for staining of triglycerides n frozen sections, and some protein bound lipids and ipoproteins on paraffin sections | Skin irritant Cat 2, Eye irritant Cat 2, May cause respiratory irritation |  |
| Sudan III | Sudan Red BK, Fat Ponceau G, Cerasin Red, Solvent Red 23, Sudan Red, Sudan Red III, Sudan V, Sudan Red B, Sudan G, Scarlet B, Tony Red CAS 85-86-9 | S3t. For root endodermis. Sudan black & IV are better for fats (but see below). It is used for staining of triglycerides in frozen sections, and some protein bound lipids and ipoproteins on paraffin sections. | Skin irritant Cat 2, Eye irritant Cat 2, May cause respiratory irritation, Harmful to the aquatic environment with long-lasting effects Cat 4. HIGHLY FLAMMABLE & suspect CARCINOGEN |  |
| Sudan IV | Sudan R, C.I. Solvent Red 24, Lipid Crimson, Oil Red, Oil Red BB, Fat Red B, Oil Red IV, Scarlet Red, Scarlet Red N.F, Scarlet Red Scharlach, Scarlet R<br>CAS 85-83-6 | S6t. For fat and cutin. Use other fat stains if possible. It is used for staining of triglycerides in frozen sections, and some protein bound lipids and ipoproteins on paraffin sections. Health hazard label needed for solutions of 1% and over. | Skin irritant Cat 2, Eye irritant Cat 2, Carcinogen Cat 2. HIGHLY FLAMMABLE |  |
| toluidine blue | toluidine blue O,<br>tolonium chloride<br>CAS 92-31-9 |  | no significant hazard | None |
| Van Gieson's stain | (contains trinitrophenol – picric acid) | Permanent stain for protozoa. | EXPLOSIVE if dry and TOXIC |  |
| water blue | Aniline blue, acid blue 22, soluble blue 3M, marine blue V<br>CAS 28631-66-5 | Water blue stains collagen blue n tissue sections. | Skin irritant Cat 2, Eye irritant Cat 2, May cause respiratory irritation |  |
| xylenol orange | Aniline blue, acid blue 22, soluble blue 3M, marine blue V<br>CAS 1611-35-4 | used as a tetrasodium salt as an ndicator for metal titrations. | Skin irritant Cat 2, Eye irritant Cat 2, May cause respiratory irritation. |  |

# Appendix C – Colorimetric reagents and Indicators

## Colorimetric reagents

| Name | Use (Test for) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| Eriochrome cyanine R | $Al^{3+}$ (aluminium) | Requires adjustment to pH6 with either 0.2M acid or alkali | IRRITANT as solid. NO SIGNIFICANT HAZARD at use concentration. | None |
| Nessler's reagent | $NH_3$ (ammonia) | | TOXIC by all three routes. CORROSIVE. MUTAGEN (Cat 2) |  |
| Diphenylcarbazide | $CrO_4^{2-}$ (chromate) | | SKIN / EYE IRRITANT |  |
| Neo-cuproin (2,9-dimethyl-1,10-phenanthroline) | Cu(II) & (after reduction) Cu(I) (copper I&II) | Other reagents include hydroxylamine (IRRITANT). Use this reagent or dithiodiethyldithio-carbamate in preference to Cupferron which is TOXIC & a suspect CARCINOGEN. | Neo-Cuproin is IRRITANT. At use concentration NO SIGNIFICANT HAZARD. Solvent HIGHLY FLAMMABLE. | None |
| Nitroso-R-salt (3-hydroxy-4-nitroso-naphthalene-disulphonic acid, Na salt) | $Co^{2+}$ (cobalt) | | Salt HARMFUL by all three routes. At working concentration NO SIGNIFICANT HAZARD. contains two sulphonate groups and the 2,7-substituted isomer is preferable to 2-nitroso-1-naphthol. Concentrated hydrochloric acid (CORROSIVE) is used. | None |
| Potassium thiocyanate | $Fe^{3+}$ (iron(III)) | | Solid HARMFUL by all three routes. At working concentration NO SIGNIFICANT HAZARD. Conc. hydrochloric acid (CORROSIVE) is used. | None |
| 1,10-phenanthroline | $Fe^{2+}$ & $Fe^{3+}$ | | Solid TOXIC (Cat 3) by ingestion. At working concentration NO SIGNIFICANT HAZARD. Either hydroxylamine (HARMFUL) or hydroquinone (HARMFUL, SENSITISER) is used as a reducing agent. Substitute ascorbic acid. | None |
| Mercaptoethanoic acid (thioglycollic acid) | $Fe^{3+}$ (iron(III)) | | Reagent is HARMFUL, SKIN/EYE IRRITANT. Working concentration SKIN/EYE IRRITANT. |  |

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| | | | .880 ammonia CORROSIVE is also used in the procedure. | |
| Dithizone | Pb2+ (lead) | Other reagents which may be used – sodium diethyldithiocarbamate (HARMFUL) & 1M hydrochloric acid | Solid is SKIN/EYE IRRITANT. Working solution is FLAMMABLE Replace tetrachloromethane with pentyl ethanoate or butyl ethanoate (FLAMMABLE) – may cause drowsiness |  |
| Solochrome Black (Eriochrome Black T) | Mg2+(magnesium) | | Solid EYE IRRITANT. working solution in Methanol (HIGHLY FLAMMABLE & (TOXIC). |   |
| Thiazole Yellow G (Titan Yellow) | Mg2+(magnesium) | | NO SIGNIFICANT HAZARD Procedure also uses :- 1M sodium hydroxide (CORROSIVE) & hydroxylamine hydrochloride (HARMFUL) |   |
| Oxidation by odate(VII) (periodat e) | Mn2+(manganese) | | Potassium iodate(VII)(SKIN/EYE IRRITANT, OXIDISING SOLID Wash any spillages well. 2m nitric acid is CORROSIVE. Phosphoric acid (85%) – CORROSIVE |  |
| Potassium thiocyanate | Mo (molybdenum(V)) | | Solid HARMFUL by three routes. Working solution NO SIGNIFICANT HAZARD. Also uses conc. hydrochloric acid(CORROSIVE), tin(II) chloride-2-water (IRRITANT), 3-methylbutanol (HIGHLY FLAMMABLE & HARMFUL by inhalation.) | None |
| Dimethylglyoxime | Ni (nickel) | | Solid is FLAMMABLE and TOXIC Substitute trichloromethane as extractant by petroleum ether (100-120°C) if swallowed. Working solution is FLAMMABLE. bromine water (TOXIC & CORROSIVE) 0.5M hydrochloric acid. |  |
| Oxidation by hydrogen peroxide | Sn(IV) (tin(IV)) | | 20 vol (6%) is IRRITANT & 100 vol s CORROSIVE. Working solution has NO SIGNIFICANT HAZARD. Other reagents include :- conc. sulphuric acid (CORROSIVE) & 1M phosphoric(V) acid (IRRITANT) | None |
| Oxidation by hydrogen peroxide | V (vanadium) | | 20 vol (6%) is IRRITANT & 100 vol s CORROSIVE. Working solution has NO SIGNIFICANT HAZARD. Other reagents include :- conc. sulphuric acid (CORROSIVE) & 1M phosphoric(V) acid (IRRITANT) | None |

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| Phosphoric acid<br>& sodium tungstate | V (vanadium) |  | Sodium tungstate solid. Working solution is CORROSIVE. is HARMFUL. Phosphoric acid is CORROSIVE. |  |
| Toluene-3,4-dithiol | W(VI) (tungsten(VI)) |  | Solid is HARMFUL by ingestion EYE DAMAGE & SKIN IRRITANT. Pentyl ethanoate is FLAMMABLE. Working solution is FLAMMABLE |  |
| Sulphanilamide & NED hydrochloride (naphthylethylene-diamine hydrochloride) | NO2- (nitrite) |  | Sulphanilamide – NO SIGNIFICANT HAZARD. NED – SKIN/EYE IRRITANT. Working solution SKIN/EYE/RESPIRATORY IRRITANT |  |
| 2 | NO2- (nitrite) |  | NO SIGNIFICANT HAZARD | None |
| Sulphanilamide & NED hydrochloride | NO3- (nitrate) as for nitrite after reduction |  | See NITRITE above. For a reducing agent zinc is safer than cadmium |  |
| Sodium molybdate reagent with ascorbic added. | PO43- phosphate |  | Solid is a SKIN/EYE IRRITANT and is HAZARDOUS by ingestion. Some sources recommend acid reducing the phosphomolybdate complex with hydrazine. Substitute by ascorbic acid or amino acids. (20 mg is sufficient excess per 0.1 mg of phosphorus.) |  |
| Phosphovanado-molybdate method | $PO_4^{3-}$ phosphate |  | Vanadate is VERY TOXIC by all routes. Nitric acid is CORROSIVE & OXIDISING AGENT.<br>Molybdate is IRRITANT.<br>Solution is low hazard | None |

# Indicators - pH

| Name | Colour change and (pH Range) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| Bicarbonate Indicator | Gradual change from yellow to purple Between pH 7.6 and 9.2 | | Solid – N/A<br>Solution – No significant Hazard | None |
| brilliant orange | Red to Yellow pH1.2 – 2.8 | | Solid- Not classified as hazardous.<br>Solution – No Hazard | None |
| bromocresol green | Yellow to Blue pH 3.5 – 5.2 | | Solid – No harmonised classification – may be a skin/eye/respiratory rritant Solution -No Hazard except Flammable due to ethanol |  f in ethanol or propanol |
| bromocresol purple | Yellow to violet pH 5.2 – 6.8 | | Solid- No harmonised classification – is probably a skin/eye/respiratory rritant Solution- No Hazard. | None |
| bromophenol blue | Yellow to violet pH 2.8 – 4.6 | | Solid – HARMFUL (Acute toxin Cat 4) by skin contact or inhalation.<br>Skin/eye irritant (Cat 2).<br>Solution – No Hazard. | None |
| bromothymol blue | Yellow to Blue pH 6.0 – 7.6 | | Solid – Not classified as hazardous but may be harmful if ingested nhaled Solution- No Hazard. | None |
| m-cresol purple | Yellow to purple pH 7.2 – 8.8 | | Solid – Not classified as hazardous but may be harmful if ingested / nhaled Solution- No Hazard. | None |
| cresol red | Yellow to purple pH 7.2 – 8.8 | | Solid – No harmonised classification – is probably a skin/eye/respiratory rritant Solution – No Hazard. | None |
| crystal violet | Yellow to violet pH 2.8 – 4.6 | | Solid -suspected carcinogen (Cat 2) and reproductive toxin (Cat 2), causes eye damage (Cat 1) and is harmful if swallowed. Also harmful to the aquatic environment with long-asting effects. Solution – No Hazard. | None |
| 2,4-dinitrophenol | Colourless to Yellow pH 2.8 – 4.4 | | Solid – TOXIC (Cat 3 by all routes).<br>Harmful to organs (STOT SE2)<br>Harmful to the aquatic environment (long lasting). Wear rubber or plastic gloves and goggles (BS EN 166 3)<br>Solution – No Hazard. | None |
| 2,6-dinitrophenol | Red to Yellow pH 2.8 – 4.4 | | Solid – TOXIC (Cat 3 by all routes).<br>Harmful to organs (STOT SE2)<br>Harmful to the aquatic environment | None |

| | | | | |
|---|---|---|---|---|
| | | | (long lasting). Wear rubber or plastic gloves and goggles (BS EN 166 3) Solution – No Hazard. | |
| ndigo carmine | Blue to yellow pH 11.4 – 13.0 | | Solid -No harmonised classification – may be harmful if ingested. Solution – No Hazard. | None |
| itmus | Red to blue pH 4.5 – 8.3 | | Solid – No Hazard. Solution – No Hazard. | None |
| methyl orange | Orange/Red to Yellow pH 2.8 – 4.6 | | Solid – TOXIC (Cat 3) if ingested. Solution – No Hazard. | None |
| methyl orange (screened) Methyl orange + Xylene Cyanol FF | Violet to green (with ntermediate grey at pH 3.8 pH 2.9 – 4.6 | | Solid – No harmonised classification – is probably a skin/eye/respiratory rritant Solution – No Hazard except Flammable due to ethanol | <br>f in ethanol / propanol |
| methyl red | Red to Yellow pH 4.4 – 6.3 | | Solid -No harmonised classification – may be harmful if ingested. Solution – No Hazard. | None |
| methyl yellow | Red to Yellow pH 2.8 – 4.4 | | Solid -suspected carcinogen (Cat 2) and toxic (Cat 3) if ingested. May also be a skin sensitiser Solution – No Hazard except Flammable due to ethanol | <br>f in ethanol or propanol |
| 1-naphthophthalein | Yellow to blue pH 7.3 – 8.7 | | Solid – No harmonised classification – is probably a skin/eye/respiratory rritant. Solution – No Hazard except Flammable due to ethanol | <br>f in ethanol or propanol |
| neutral red | Red to Yellow pH 2.8 – 4.4 | | Solid – No harmonised classification – is probably a skin/eye/respiratory rritant Solution – No Hazard. | None |
| nile blue | Blue to red pH 10.1 – 11.1 | | Solid – Not classified as hazardous. Solution – No Hazard | None |
| 3-nitrophenol | Colourless to yellow pH 6.8 – 8.4 | | Solid – Can cause eye damage (Cat 1) and skin irritation (Cat 2). HARMFUL (Acute Toxin Cat 4) if ngested. Solution – No Hazard | None |
| 4-nitrophenol | Colourless to Yellow pH 5.0 – 7.0 | | Solid – HARMFUL (Acute toxin Cat 4) by ingestion,. skin contact or nhalation. May cause damage to organs on long term exposure (STOT RE2) Solution – No Hazard | None |
| phenolphthalein | Colourless to pink pH 6.8 – 8.4 | | Solid – Carcinogen (Cat 1A) Mutagen (Cat 2) and Reproductive toxin (Cat 2). Solution – No Hazards – except Flammable due to ethanol/propan-2-ol | <br>f in ethanol or propanol |

|  |  |  |  |  |
|---|---|---|---|---|
| phenol red | Yellow to red pH 6.6 – 8.0 |  | Solid – No harmonised classification – is probably a skin/eye/respiratory irritant Solution – No Hazard. | None |
| thymol blue | Acid – Red to Yellow pH1.2 – 2.8 Base – Yellow to blue pH 8.0 – 9.6 |  | Solid – Not classified as hazardous but may be harmful if swallowed. Solution – No Hazard. | None |
| thymolphthalein | Colourless to blue pH 9.3 – 10.5 |  | Solid – Not classified as hazardous but may be harmful if ingested in large quantities. Solution – No Hazard except Flammable due to ethanol. | <br>If in ethanol or propanol |
| thymol violet | yellow to violet pH 9.0 – 13 |  | Solid – Irritant, skin, eye and respiratory Solution – No Hazard. | None |
| titan yellow (TY) | Yellow to red pH 12.0 – 13.0 |  | Solid – Not classified as hazardous. Solution – No Hazard. | None |

# Other Indicators

| Name | Colour change and (pH Range) | User levels and applications | Hazards (at point of use concentration) | Pictograms |
|---|---|---|---|---|
| barium diphenylamine-4-sulfonate or sodium salt | Red/violet to colourless | | Solid – Harmful (Cat 4) if swallowed or inhaled.<br>Solution – No Hazard | None |
| cucurmin | yellow to red with boron | | Solid – Pure substance is a skin, eye and respiratory irritant (Cat 2)<br>Solution -No Hazard. | None |
| DCPIP | Blue to colourless | | Solid- No hazard. Solution- No Hazard | None |
| Eriochrome black T | red to blue | | Solid – Eye irritant (Cat 2) and hazardous for the aquatic environment with long lasting effects (Cat 2) Solution – No Hazard. | None |
| ferroin | blue to red | | Solid – 1,10-Phenanthroline is toxic if swallowed (Cat 3)<br>and hazardous for the aquatic environment with long lasting effects (Cat 1) Iron II sulphate (7-water) is harmful (Cat 4) if swallowed and a skin/eye irritant (Cat 2) Solution- No Hazard. | None |
| ferroxyl | colourless to blue in the presence of Fe 2+. Goes pink in presence of OH- | | Solid – Solution – no hazard | None |
| fluorescein | white precipitate goes pink (Cl titration) | | Solid – No harmonised classification as hazardous but may be irritating to skin/eyes. Solution- No Hazard | None |
| Hydrogencarbonate indicator | purple to red to yellow with increasing CO2concentration | | olid – thymol blue us harmful (cat 4) if vallowed. cresol red is a in/eye/respiratory irritant (Cat 2)<br>olution – No No Hazard. | None |
| magneson I | red/violet goes to blue (precipitate unless low concentration) in the presence of magnesium | | Solid – Irritant to skin and eyes azo violet, 4-(4-nitrophenylazo) resorcinol, 4-(4-nitropenylazo) benzene-1,3-diol.<br>Solution – None if in water, corrosive if in NaOH | None |
| Magneson II | red goes to blue (precipitate unless low | | Solid – Irritant to skin, eyes and respiratory system.4-(4- | None |

| | | | | |
|---|---|---|---|---|
| | concentration) in the presence of magnesium (or orange n the presence of Beryllium II) | | nitrophenylazo)-1-naphthol Solution – None if in water, corrosive if in NaOH | |
| methylene blue | Blue to colourless | | Solid – No harmonised classification but is Harmful (Cat 4) if swallowed and may cause serious eye damage (Cat 1). Solution – No Hazard. | None |
| murexide (ammonium purpurate) | Red to blue with calcium / magnesium | | Solid – No harmonised classification. May be a mutagen (Cat 2) and/or a skin/eye/respiratory irritant (Cat 2) Solution – No Hazard. | None |
| neutral red | Violet/red to colourless | | Solid -No harmonised classification – may be harmful if ingested. Solution – No Hazard. | None |
| Patton & Reeders ndicator ((2-hydroxy-1-(2-hydroxy-4-sulpho-1-naphthylazo)-3-naphthoic acid (111) – HHSNNA)) | Red to blue with calcium | | Solid – skin/eye/respiratory irritant (Cat 2) Solution – No Hazard. | None |
| phenosafranine | Orange/Red to Yellow pH 2.8 – 4.6 | | Solid – skin/eye/respiratory irritant (Cat 2) Solution – No Hazard. | None |
| n-phenylanthranilic acid | Red to colourless | | Solid – skin/eye/respiratory irritant Solution – No Hazard except Flammable due to ethanol |  if in ethanol or propanol |
| potassium chromate | yellow to red/brown precipitate (with Ag in cl titration) | | Solid – Mutagen (Cat 1B) and carcinogen (Cat 1B), skin sensitiser (Cat 1) Skin/eye/respiratory irritant (Cat 2). Harmful to the aquatic environment with long-lasting effects (Cat 1)Solution – Mutagen (Cat 1B) and carcinogen (Cat 1B), skin sensitiser (Cat 1) |  |
| safranin T | Red/violet to colourless | | Solid – eye damage (Cat 1) Solution – No Hazard. | None |
| solochrome dark blue | pink to blue with calcium / magnesium | | Solid – skin/eye/respiratory irritant Solution – No Hazard except Flammable due to ethanol |  if in ethanol or propanol |

|  |  |  |  |  |
|---|---|---|---|---|
| starch | colourless to blue/black with iodine |  | Solid – No hazard Solution – No Hazard | None |
| thionine | Violet to colourless |  | Solid – Not classified as hazardous. Solution – No Hazard | on None |