The Heart of Glass

Despite the growth of plastics and of automation, in the school chemistry laboratory, glassware is still king. There are literally hundreds of different types of glass but fortunately not all that many are likely to be encountered in the school or college laboratory.

Types of glass

Soda glass

This is the cheapest type used for laboratory glassware, it is not widely used as its heat resistance is poor so it melts at a lower temperature than other glasses and it also tends to shatter when heated or cooled due to its larger coefficient of expansion.

It is commonly used for stirring rods and can be used for test tubes (or other items) but if this is the case they should be labelled clearly as not being suitable for heating.

Borosilicate glass

Almost all modern laboratory glassware is made from borosilicate glass, due to its chemical and thermal resistance and good optical clarity. It is sold under various brand names, the most well known is Pyrex but others include, Duran, Borosil, Simex and many others.

To add to the confusion, there are different types of borosilicate glass depending on composition. However, nowadays they seem to have converged around a standard known as 3.3 Expansion borosilicate glass (made to ISO 3585). This has a very high resistance to attack from water, acids, salt solutions, halogens and organic solvents as well as a low coefficient of thermal expansion and a high resistance to heat: softening at 820 – 830°C with a 'working point' of 1250 – 1260°C.

The term neutral borosilicate that you may come across in older publications refers to a slightly lower specification (though still high quality) but this seems not to be widely available now – if at all.

Telling the difference

You can tell whether an item of glass is soda or borosilicate by putting it into propan-1,2,3-triol (glycerol). This has the same refractive index as borosilicate

glass and so when put into the glycerol it will 'disappear' whereas the outline of soda glass will still be visible.

Class

Figure 1: markings on a measuring cylinder

The standards referred to above only apply to the chemical composition of the glassware, not to its manufacture. Laboratory glassware comes in two grades: Class A and Class B – defined by various International Standards. Class A is manufactured to a greater accuracy in items such as pipettes and measuring cylinders but Class B is quite good enough for all school/college work.

Design

Test tubes in particular appear in catalogues as thin, medium or thick walled (The actual specifications are set out in BS EN ISO 4142) It is not quite as simple as it might appear as a thin walled soda glass tube is thicker than a thin walled borosilicate one. For most purposes, medium walled tubes are a suitable compromise.

Rims

Test tubes can be bought either with or without rims (see Figure 2). Ones with rims are less likely to slip out of test tube holders but the rims are more prone to chips, which can be sharp. This is largely a matter of personal preference.

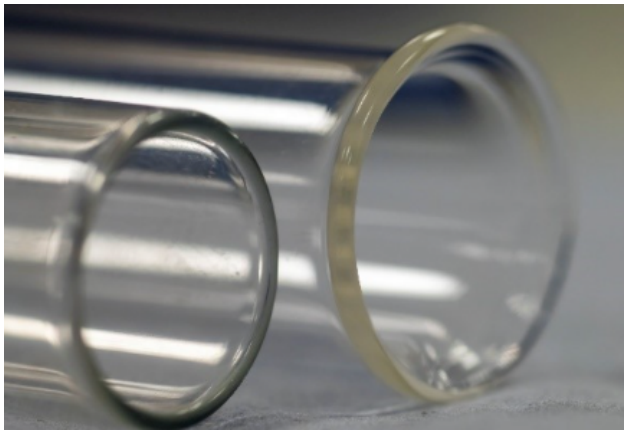

Figure 2: Test tubes with and without rim

Care of your glassware

Chips and breakages

When storing your glassware, you should ensure that they are kept in such a way as to prevent them rolling around or moving in any other way. If they do then they can collide with each other in drawers or trays and become chipped, scratched or even broken (see Figure 3).

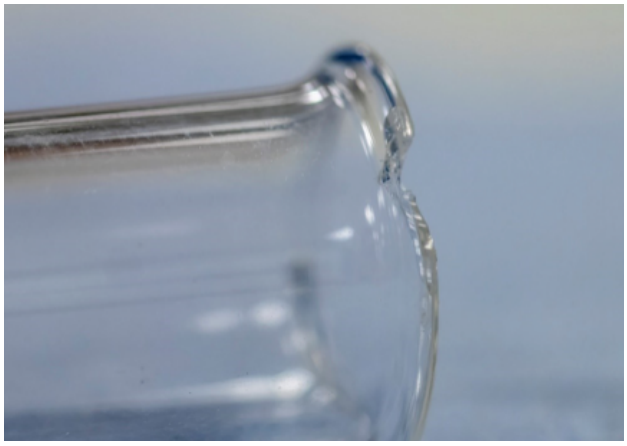

Figure 3: Chip in a test tube

Scratched glass is more prone to break during experiments. Any mark on the surface of an item of glassware is a potential breaking point, especially when the piece is heated.

Chipped or other sharp edges caused by chips on test tubes, measuring cylinders, beakers etc should first be filed gently to remove any of the larger protruding edges and then the area can be flame

fire polished by holding or rotating it in a hot flame.

Cleaning

Figure 4: A stained glass bottle

It makes life a lot easier if you wash glassware as quickly as possible after use. If, as is more likely, a proper clean is not possible immediately, put it to soak in water. If this is not done, it could be impossible to remove the residue.

Glassware can quite safely and effectively be cleaned in a dishwasher. If cleaning is done by hand then it is best to use brushes with wooden or plastic handles a as they will not scratch or abrade the glass surface.

Stains will still sometimes be a problem. Iron compounds, potassium manganate VII, silver and others will often leave stains that can be hard to shift (see Figure 4). Many older books, and indeed some current sources, suggest using chromic acid as a cleaning solution. We do not recommend this as it is corrosive, toxic and carcinogenic and has also in the past even led to explosions when cleaning organic residues. Stains can often be removed using a solution of ethanedioic (oxalic) acid (1 – 2 molar). But there are other options as well which we will look at in a future article.

Glassware should be dried upside down either at room temperature or in a drying cabinet – in this case it must be below 140°C to avoid damaging the glass though they are usually well below this..

Looked after well, there is no reason why your glassware cannot last for many years, decades even.