SCOTTISH SCHOOLS SCIENCE EQUIPMENT RESEARCH CENTRE

Bulletin No. 30. April, 1969.

Contents

Introduction

At the last meeting of the Development Committee it was decided that equipment lists for the revised version of Circular 490 (Physics) which has already been circulated to schools in draft form, and for the Integrated Science Course, would be distributed to all Scottish subscribers to SSSERC. The first of these is now ready and it is likely that by the time this Bulletin is made available, the Physics list will have been posted to schools and other subscribers. To limit our postal charges, the list is being sent only to principal teachers of physics and principal teachers of science in the schools section of our mailing list. If principal teachers of chemistry and biology wish a copy of the list it will be necessary for them to write to the Centre requesting it. The same restriction will not apply to the Integrated Science Course list, which should be posted to subscribers before mid-May.

Equipment lists for the revised version of Circular 512 (Chemistry) and for the Certificate of Sixth Year Studies in Chemistry are in course of preparation; a decision has still to be taken whether these will be published in a future Bulletin or posted as a separate issue.

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The date of 20th June which was provisionally fixed for an exhibition of apparatus for the Sixth Year Studies in Chemistry at St. Andrews has now been confirmed.

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Those writing to the Centre are asked to note our postal code, which is given below, and which should appear as the final line of the address in all communications. This is particularly important as it will be some time before present stocks of our headed notepaper are exhausted.

SSSERC, 103 Broughton Street, Edinburgh, EH1 3RZ.

Opinion

The dichotomy of the two cultures is probably too well known since its assertion by C.P. Snow a few years ago to need restatement here. At staffroom level it shows itself in the classicist or historian who doesn't know how to mend a fuse or cannot appreciate the greatness of Isaac Newton. This need surprise no one, but it is a sadder fact that there are those who boast that this should be so. No doubt there will be as many scientists who cannot appreciate Shakespeare and have not read Kafka, but on the whole, and perhaps because of their training, they are the humbler brethern and tend to be regretful rather than proud of what they recognise are shortcomings. It therefore surprises me, and, as one who feels he has always had a foot in both camps, disturbs me that a group of influential scientists should suddenly/

suddenly decide to become much more militant in their attitude to the literati.

The Systéme Internationale d'Unités (S.I. Units) has its origins, like the metric system in the days of Talleyrand, in France. It is fitting and indeed inevitable that the introduction in Britain of the metric system of measurement into commerce should be accompanied by the establishment of S.I. in the scientific and educational fields. The advantages of a consistent system must far outweigh any nostalgic attachment which a teacher may have for c.g.s., e.m.u. or e.s.u. systems. But this may still leave many teachers disturbed by some of the conventions which S.I., presumably in the interests of international conformity, brings in its train. It is easy to be complacent and assert that no confusion will arise in the printed text, for example between the upright V which is the symbol for the volt, and the italic V which denotes the quantity potential difference. For a start, our typewriter cannot cope with this distinction, and how many school secretaries' typewriters can? The use of 'g' for grammes; is this to be confused with the gravitational acceleration symbol? To object that the gramme is not the S.I. unit of mass is to miss the whole point of this argument, which is that where the activities of the scientist impinge on the everyday world where most of humanity conducts its business, the scientist must conform to the conventions of the majority, if only to preserve that essential sympathy which seems so much in doubt when "two-culture" accusations are being bandied about. No one suggests that Jock Tamson should buy his tobacco and sweets in decimal fractions of a kilogramme.

Arguments about the impossibility of confusion lose their point for a marker reading a barely legible script by a pupil presenting himself for the S.C.E. in a science subject. If the pupil has written mg, will it always be clear from the context whether this is Newton II, milligrammes, or metre-grammes? If the mantle of the inspectorate which used to conduct the examination has descended on the Examination Board, then the guiding principle will still be to give credit for what is correct rather that to punish what is wrong, and this must set some pretty problems for assessors in the future.

The bounds of credulity are surpassed, however, when one hears what is likely to happen to that little letter 's', the S.I. symbol for the second. Unfortunately it is also the way in which the English language forms 80% of its plural nouns. I have never had much sympathy for anyone who wrote 5mAs as the abbreviation for 5 milliamperes, regarding the final s as superflous; even more distasteful is mA's, showing an incorrect use of the apostrophe. Now both of these must be treated as wrong, and the "s" looked upon for what it is, i.e. an abbreviation, amongst other abbreviations, for 'second'. mAs will be wrong, because it should be either mA (milliamperes), or mC (millicoulombs). But when I wanted to write the unit out in full, I would follow normal English usage in adding an 's' to the plural. 5V becomes for me, and for every pupil who uses his mother tongue without thinking about it, five volts. Now I am told I may be in error; amperes, watts, volts, may be confused (in what twisted mind?) for coulomb, joule and weber respectively.

One/

One could afford to laugh at this as the ostrich burying its head in the sand, were it not for the widespread sympathy which this view is attracting amongst influential scientists and educationists. Also since a convention must be universally adopted to have any value, our Examination Board will sooner or later have to decide whether or not to adopt it in the printing of their S.C.E. papers. Then many teachers, in fear of losing examination marks for their pupils will feel obliged to follow suit. We, who were always agreed that it was ridiculous that a pupil should memorise three different statements of Newton II if he studied Engineering, Physics and Dynamics, are in danger of producing an even more ridiculous dichotomy between the usages of standard and scientific English, when they ought to be identical.

So far I have been unable to track down the source of this urge to drop the "s". An article in Vol. 4, No. 1 of Physics Education says "If pupils are to be expected to write 5A, it will probably be advisable to read it as "five ampere", and to confirm the habit it may be desirable to omit the "s" when it is spelled out in full. This, however, is not the usual practice, which is to add the plural 's', whenever the magnitude measured exceeds one." This hardly seems dogmatic enough to justify the authoritative statements I had been receiving, so, and remembering the Continental origins of S.I., I went further afield. From the Union des Physiciens, Paris, I obtained the reply: "On ne doit pas non plus mettre, dans le même nom, un symbole et un nom en toutes lettres. En principe, il n'y a donc pas possibilité de confusion entre le signe du pluriel et le symbole de la seconde. On ecrit: 20 joules où 20 J."

From the British Standards Institution: "If the name of a unit is written out in full and there are two or more of the units being referred to, the unit should be written in the plural. We agree with you that the proposal to drop the 's' from the fully spelt out unit is untenable from a grammatical point of view."

And from the Royal Society: "In the Proceedings and Philosophical Transactions of the Royal Society, the normal grammatical rules are followed when the name of the unit is given in full, e.g. amperes, kilometres etc."

If normal English usage is good enough for the Royal Society, it is good enough for this Bulletin for as long as I shall edit it, and should be good enough for the purveyors to our children of any written material.

Trade News

Pyser-Britex have introduced a new 240 Series of junior student microscopes. The basic model M240 has triple turret nosepiece, sub-stage disc-diaphragm and built-in condenser, plano-concave mirror, x4, x10 and x20 objectives, and x10 wide field eyepiece. The cost is £24.10s. The M244 differs in having a Hugenian x10 eyepiece instead of widefield and costs/

costs £23, while the M245 with a zoom eyepiece from x10 to x20 costs £22. Also available are substage illuminator for mains operation, £4, and x40 retractable objective in place of x20 at an extra £2.12s.

We mentioned in Bulletin 28 that Teledeltos field-plotting paper, required for Higher Engineering and Certificate of Sixth Year Studies in Physics is no longer being handled by Servomex Controls. The paper is now available from Philip Harris in rolls 29 inches wide, 10 feet long for £1.

A new catalogue from Panax Equipment shows that their radioactivity demonstration set SK107B has been replaced by the SK308. In addition to the items in the SK107B, the SK308 contains radiography, autoradiography and spinthariscope plates. The kit also now includes the MX168 Geiger tube and holder, and costs £44.10s. For experiments in radio-chemistry the firm now supply an MX124/01 liquid counter tube and base stand, the counter at £10 and the stand, £6.5s. This counter will operate into the 102ST Panax scaler.

Quickfit and Quartz are no longer to supply their products direct to schools. Instead their apparatus will have to be ordered through their agents, of whom the Scottish based ones are Glass Appliances, Griffin and George, Macfarlane Robson and Townson and Mercer.

Product Bulletin No. 5 from Griffin and George Science Teaching Equipment Division lists amongst their new items a piezo-electric E.H.T. generator at £3.14s; an E.H.T. charge storage unit at £3.10s; ionic potential discharge apparatus at £6.2s; the Franck-Hertz apparatus at £24 and the Ferranti GP1 Helium-Neon laser at £149.

Supplies of Plutonium 239, which is the only pure alpha particle source available to schools, had to be suspended until the source received the approval of D.E.S. for use in schools. It is once again available at 5μCi strength from Griffin and George at £17 and Philip Harris at £13.11s.

Solid state voltage controllers have been known for some time, and several circuits have been published, e.g. Practical Electronics, October 1967; Wireless World, July 1967. The most continuous use of a thyristor control unit likely to arise in the school situation is the regulation of the speed of the electric drill, which should be in every technician's workshop. The portable power drill usually has one, or at most two fixed speeds and for cutting many materials the most suitable speed may be less than those provided. With a thyristor control unit such as that listed below, speed can be continuously varied between 15 and 97% of its full value. At the lower end this makes it possible to improvise a coil-winding machine. The Cressall 'Thyristat' is a completely encapsulated solid state controller suitable for wall mounting beside a mains socket. It has only two connections, the unit being wired in series with the live mains lead. The control knob incorporates an on/off switch, and the unit can be used for loads of 2A or less; cost £6.10s.

100W toroidally wound power rheostats have been a regular feature of the advertisements of Service Trading Co. for many months, and for that reason may have been passed over by many teachers. They are available in 1, 5, 10, 25, 50, 100 and 250 ohm values, all at £1.9s. post and packing inclusive.

50 and 25 watt ratings in the same ohmic values cost £1.2s.6d. and 16s respectively. They can be mounted for school use in a manner similar to that described for the meter mount on page 6.

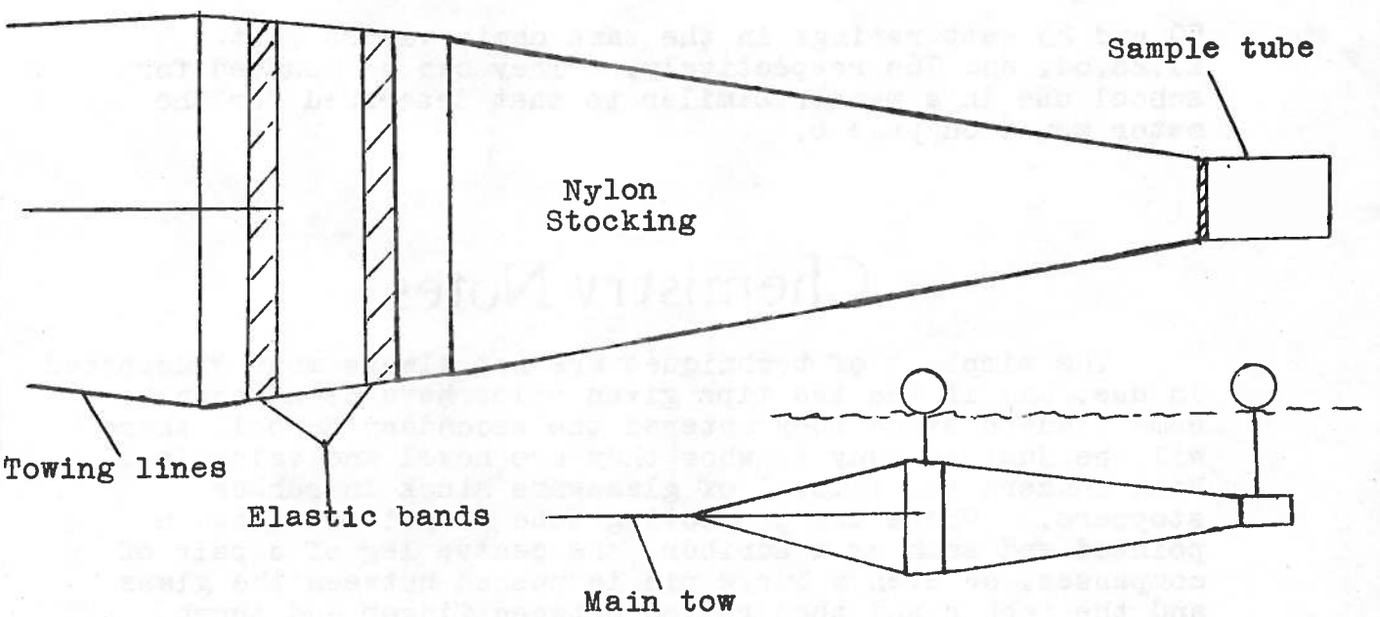
Chemistry Notes

The simplest of techniques are not always most widespread in use, and if the two tips given below have been known to some readers since they entered the secondary school, there will be just as many to whom they are novel and valuable. Both concern the removal of glassware stuck in rubber stoppers. Where the projecting tube is not too long, a pointed end such as a scriber, the centre leg of a pair of compasses, or even a large pin is pushed between the glass and the rubber and then rolled between finger and thumb until it makes a complete circuit of the tube. This often loosens the tube sufficiently to permit its removal. If the tube is longer, or more firmly stuck then a cork-borer which just slips over the glass tube is used instead. This is screwed with a twisting motion into the stopper over the glass tube. The tube should be tested at intervals to see if it will come away freely as it is not usually necessary to work the borer completely through the stopper and indeed the writer has seen a thermometer broken when this was done, as it dropped completely through the cork borer on being freed.

In The Workshop

An effective plankton net can be made from a ladderless nylon stocking, cut off just above the heel. The narrow end is secured firmly round a 25 x 160mm boiling tube or other sample tube while the wide end is pushed through the inside of a plastic collar 10 - 15cm diameter - we used a honey jar with the base removed. The top of the stocking is bent back over the outside of the collar and secured with large elastic bands which can at a pinch be cut from car inner tubes. Four towing strings are attached at cardinal points around the circumference of the collar and these are secured to the main tow.

A method of positioning the net with respect to the surface of the water is to weight the open end if necessary and attach two balloons as floats to the collar and the collecting jar. This keeps the net in position and it can be towed at different speeds without affecting the sample depth.



We described in Bulletin 27 how the smallest size of Japanese meter, the MR38P, could be mounted in a wooden circuit box. For teachers who prefer to use the larger MR65 size, costing £1.12s.6d. from G.W. Smith and Co. the method given below will be suitable, and by suitable alteration of the hole size can be made to fit any other panel mounting meter.

The material is a 20 x 10cm piece of 18 SWG aluminium sheet, and is first drilled as shown in Fig 1. The four meter fixing holes are No. 17 twist drill, and the holes for the 4mm terminals, if Radiospares type are used, are letter drill W. The large hole should be trepanned out, but if a trepanning tool is not available than an Abrafile or even a fretsaw can be used. After drilling the sheet is bent to an angle of 70°, the shorter portion forming the base of the meter. The sheet is then painted and the components mounted in position. It would be possible by rearranging the hole placings to have the 4mm terminals above the meter but we prefer the existing arrangement as connecting leads are then less likely to obscure the meter scale. The meters are stored (but cannot be stacked) face down in a drawer with the scale range written in felt pen on the underside of the mount so that it is immediately visible when the drawer is opened.

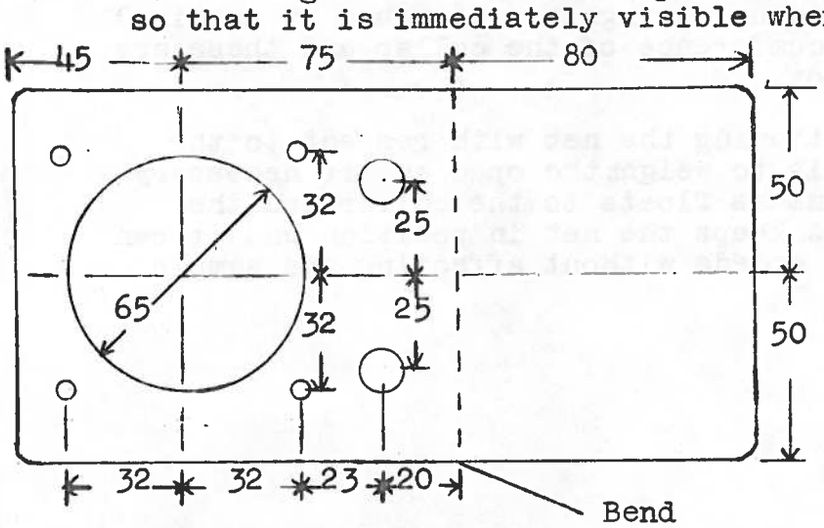


Fig. 1. Drilling details
Dimensions in mm.

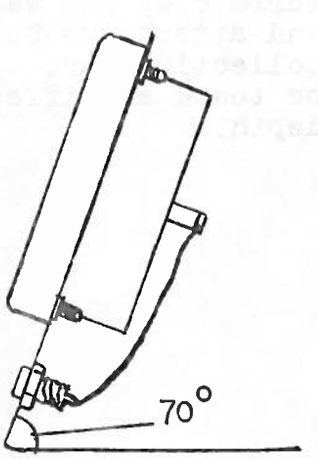


Fig. 2. Final assembly

Bulletin Supplement

Below is a summary of tests carried out on a second selection of low voltage transformers, the first of which appeared in Bulletin 29. Reports on these models can be borrowed by writing to the Director. The classifications used are: A - most suitable for school use; B - satisfactory for school use; C - unsatisfactory.

Model No.	MT51AT	95-27	70/1556
Supplier	Douglas Electronics	Morris Laboratory Instruments	W.B. Nicolson
Price	£3. -s. 9d.	£6. -s. -d.	£7. 2s. 6d.
Output Terminals	12, 15, 20 24 and 30V	2, 6 and 14V	2, 4, 6, 8 and 12V
Maximum Current	5A	6.25A	6A
Output on open circuit	34.0V	14.6V	12.4V
Output on full load	32.0V	13.1V	12.0V
Primary current at full load mA	860	370	335
Primary fuse	No*	Yes	Yes
Transformer screen	No	Yes	No
Secondary winding	Separate	Single	Single
Behaviour on 4V short	Satisfactory	Satisfactory	Unsatisfactory
Assessment	A*	A	B

*This transformer is intended for incorporation into power units under construction, and it is therefore supplied completely unshrouded and without the usual accessories. It requires to be boxed in, and fitted with output terminals and such input circuitry as the teacher considers necessary. The "A" classification given is entirely dependent on these conditions being fulfilled.

S.S.S.E.R.C., 103 Broughton Street, Edinburgh, EH1 3RZ.

Cressall Manufacturing Co. Ltd., Cheston Road, Aston, Birmingham, 7.

Douglas Electronics Ltd., Eastfield Road, Louth, Lincolnshire.

Glass Appliances Ltd., 488 Holburn Street, Aberdeen, AB1 7LY.

Griffin and George Ltd., Braeview Place, Nerston, East Kilbride.

Philip Harris Ltd., St. Colme Drive, Dalgety Bay, Fife.

Macfarlane Robson Ltd., Burnfield Avenue, Thornliebank, Glasgow, S.3.

Morris Laboratory Instruments Ltd., 96-98 High Street, Putney, London, S.W.15.

W.B. Nicolson Ltd., Thornliebank Industrial Estate, Glasgow.

Panax Equipment Ltd., Holmethorpe Industrial Estate, Redhill, Surrey.

Pyser-Britex Ltd., Fircroft Way, Edenbridge, Kent.

Quickfit and Quartz Ltd., Stone, Staffordshire.

Radiospares Ltd., P.O. Box 427, 13-17 Epworth Street, London, E.C.2.

Service Trading Co. Ltd., 57 Bridgman Way, London, W.4.

G.W. Smith and Co. Ltd., 3/34 Lisle Street, London, W.C.2.

Townson and Mercer Ltd., 4-7 Teviot Place, Edinburgh, 1.