Science & Technology Equipment News

For Primary Schools and Teachers of S1/S2 courses

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STS National Support Services in Science, Technology and Safety

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We have had some more constructive criticism of past issues of the "News". It has been suggested that some of our hints on links between science, technology and to other parts of Environmental Studies have at times been too subtle. A second point has concerned an apparent lack of progression in the various activities which are described. We might merely argue that it's there if you care to look. We don't push our ideas too hard however because of the dangers inherent in top-down assumptions about the relative difficulties of ideas and concepts or of acquiring various skills. Classroom practitioners and the children themselves best determine such matters. We will attempt here though to indicate likely stages for the work. We also tie much of it into materials which we can already supply.

Design and drive

In the last issue we described the construction of a buggy. This used the weel-kent Jinks method with 10 mm square softwood framing joined with card diagonals at the corners. That buggy was propeller powered since it was intended to lead onto the design, construction and evaluation of wind powered generators. There was thus no connection between the motor and the wheels to provide the drive. Instead, air displaced by the propeller in one direction - 'backwards' - drives the buggie in another direction (ie 'forwards'). This is an example of action and reaction. Thank you Isaac Newton and goodnight!

What's the best way to couple a motor to the wheels so as to drive them in a more obvious and mechanical way? A popular method is shown in Figure 1(a) below where two pulleys are connected with a belt. This also provides an introduction to simple ideas of gearing to achieve changes in speeds of rotation. In schools an elastic (rubber) band is a common choice to act as the drive belt. This has snags. In not a few designs we have seen, the band can only be replaced if the buggy is partly dismantled. Some crafty souls even fit spare bands over the drive axle during the initial construction.

Figures 1(b) to (d) show other ways of both coupling the motor to an axle and potentially of changing also the speed of the buggy wheels relative to the motor. The method shown as 1(d) is one we tend to favour - why?

Which brings us to the bits we half promised in the introduction above : what kind of progression should we look for in these kinds of activities through the various planning stages and levels. Simple buggy making techniques without frames and using elastic band linked drives would seem apposite to Levels A-C. Design activity might be limited to simple sketches and evaluation restricted to performance tests - eg how far, how fast, how good up a slope? At Level C or D one might expect to begin to see exploration of a fuller range of solutions such as those illustrated in Figure 1. Design activity would call for more significant amounts of sketching and drawing with at least some being done before starting any construction. By Level E say, evaluation would mean including not only simple performance criteria but would encompass other measures of the fitness of a design to its purpose such as reliability, ease of maintenance and repair, costs, ease of construction etc.

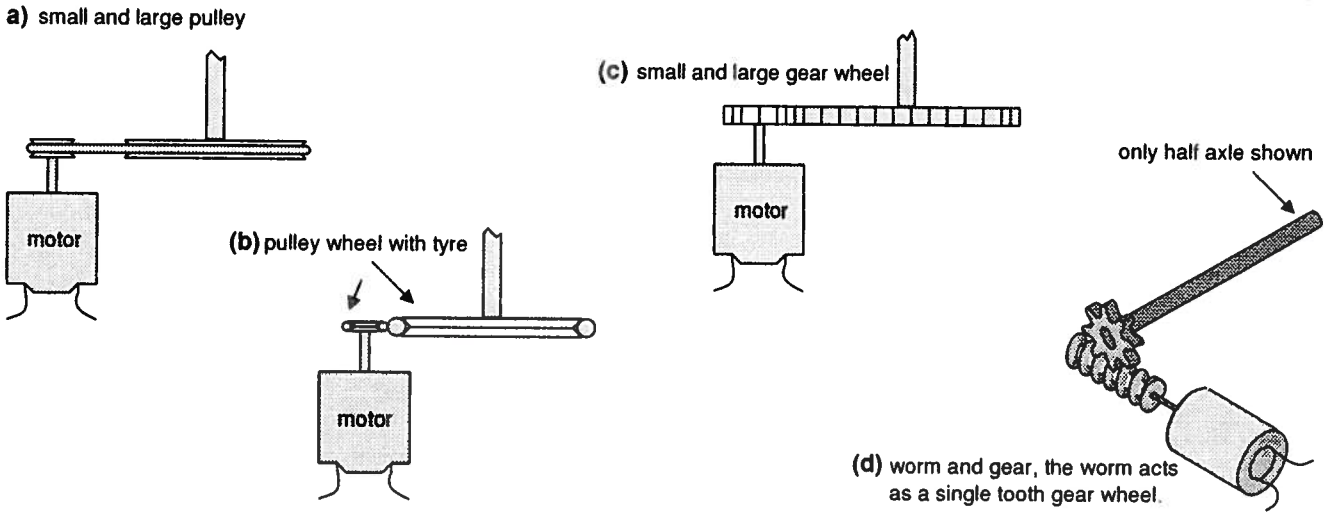


Figure 1 Various ways of coupling a motor to an axle and of achieving changes in rotational speed.

Circuits and switches

A good deal of staff-development and in-service time seems to have gone into courses on electricity. For example there is the training which accompanied the distribution of ScottishPower's electricity kit. This has led to a good deal of work in primary schools on electricity - there's little doubt of that. Again we are told however that there may be insufficient differentiation in this work. It is not impossible to find a primary school where - a mixed group of teachers of different year groups having been on a course - following almost identical activities with, say, P2, P5 and P7. There is little or no progression whereby the same essential concepts may be revisited several times through P1 to P7. This is with the intention that both depth of understanding of an idea and the extent of its application be improved upon.

Series and parallel

The difference between series and parallel circuits is one example of a big idea, the understanding of which may develop slowly. Connecting in series, as the name suggests, means having the parts of a circuit joined one to the other in much the same way as in a daisy chain (see Figure 2). Some Christmas light sets are connected like this as are the parts of a simple circuit using, say, only one lamp and a switch. In series circuits with lamps, if one bulb fails then all the others go out.

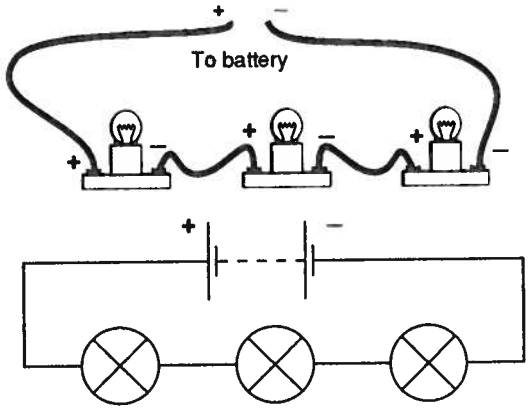


Figure 2 Lamps connected in series

In a parallel circuit, connections from the positive and the negative side of the supply are led to each component in turn (Figure 3). In this circuit should one bulb fail, the others will stay lit. Sockets and lights in schools and houses are wired up in this 'parallel' way.

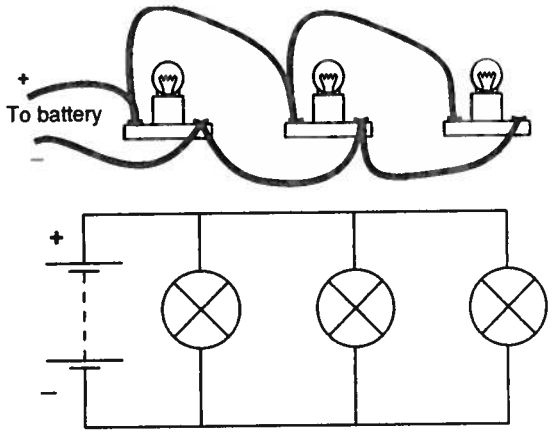


Figure 3 Lamps connected in parallel

What activities might we use to explore and then revisit these ideas?

Just clowning around

In the early years, simple switches with pretty obvious mechanisms are the thing. For a cardboard switch (see Figure 4) you need to cut two pieces of card each about 10 mm by 50 mm. Score one through the middle, then wrap both in kitchen foil. Use two drawing pins as shown to complete the switch. Add two wires and a bulb holder and you have a simple circuit. An extension which we have used with some success is to make a clown's face with a card switch built in as the nose (Fig.5). Press the nose and the eyes light up. The Clown has two eyes and we need two bulbs. How can we wire up the circuit so that both bulbs will be equally brightly lit?

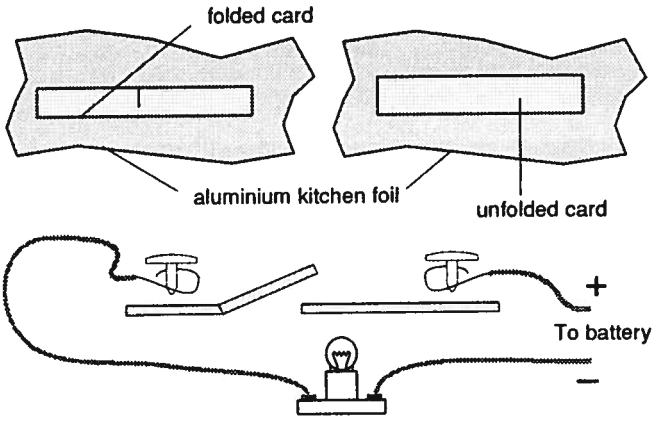


Figure 4 Construction and use of a cardboard switch

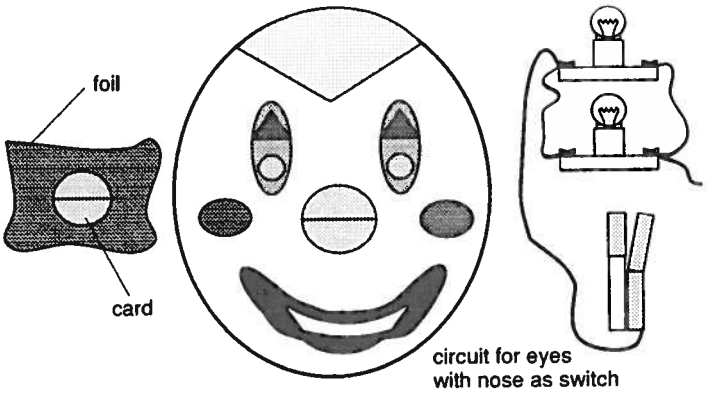


Figure 5 Variation on the cardboard switch shown in Figure 4 used in a parallel two lamp circuit for the clown's eyes.

A further extension to the buggy activity, described in issue number 8 and on page 1 of this issue, provides a similar opportunity and might be appropriate at a somewhat later stage. Suppose we add a body to the basic buggy including a driver's cab with a horn and headlamps? We might wire the horn in series but how would we have to wire the lights? We could also use a different but no less overt switching mechanism such as a paper-clip switch.

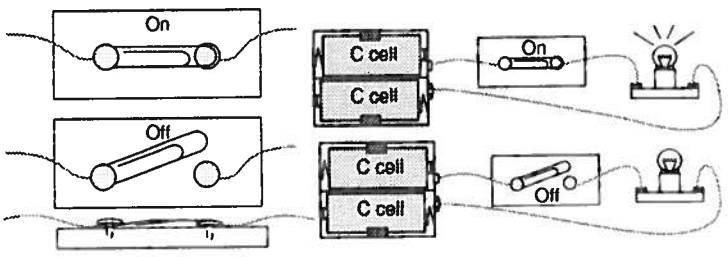


Figure 6 Paper-clip switch and its use in series with a single lamp.

Later we might return to similar problems but seek to improve both depth and breadth of understanding. At P5 -7 or S1/S2 we might use less obvious switching mechanisms such as toggle switches or even microswitches (Figure 7).

As their name suggests these are miniature switches. They are used in such domestic applications as door operated 'fridge lights and to check for door closure on washing machines and dishwashers.

At Level E the design task might be to make a more sophisticated clown's face as a toy for younger children. How could we make it wink? This might need some simple electronics.

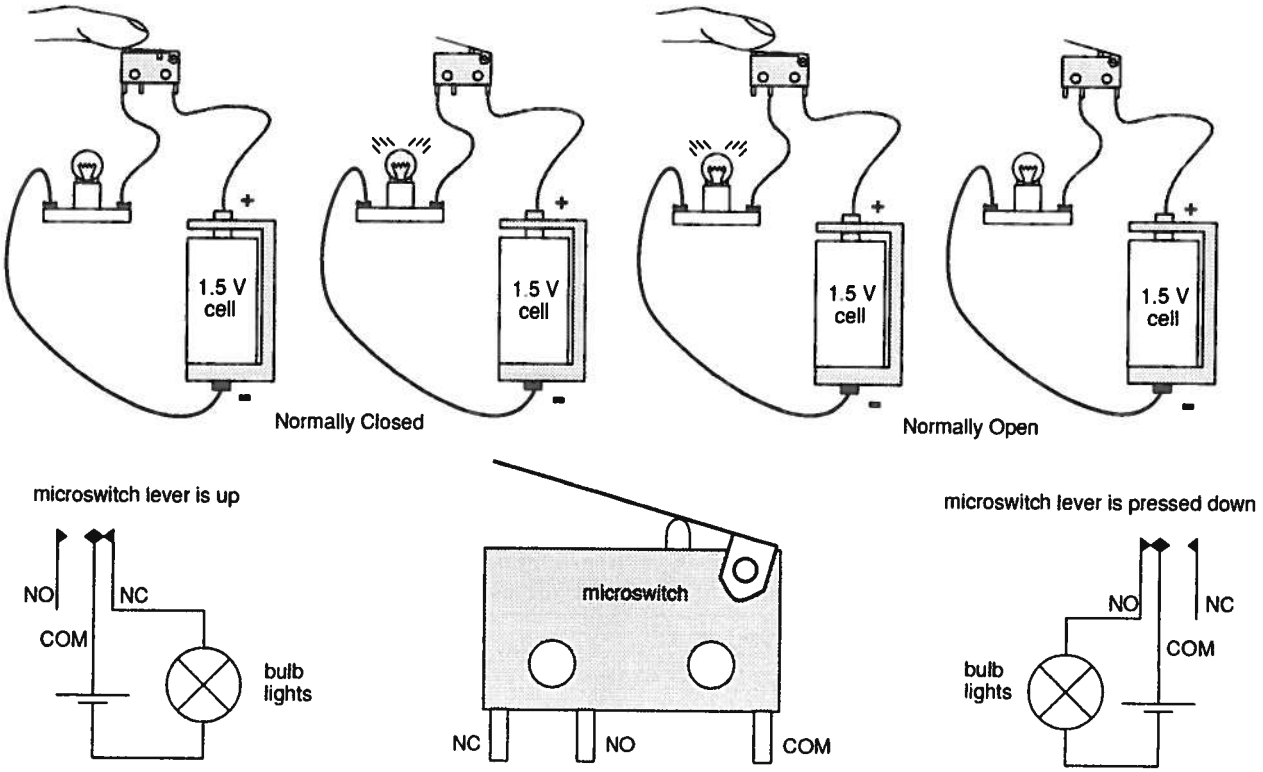


Figure 7 Microswitches are more versatile than simple 'open' and 'closed' contact types such as the card or paper-clip switches. Note the two possible contact positions and thus the choice of wiring them in either the 'normally open' (NO) or 'normally closed' (NC) modes. 'COM' stands for "common" the terminal which is always connected.

Resources

Components :

Many of the simpler materials needed for the activities described may well already be in the school. SSERC can supply many of the others such as gear wheels, pulleys, bulbs and bulb holders etc (see over the page). Where we cannot ourselves supply such items we can advise on suitable third party sources. Which brings us to the 'Good News'.

Third party offers

Microscope

The Royal Microscopical Society (RMS) is offering a subsidised and RMS approved microscope for school use. This is a MOTIC MS-2 , with fixed x20 magnification. The microscope is available from :

Pyser SGI Ltd, Fircroft Way, Edenbridge, Kent, TN8 6HA, Tel. 01732 864111.

The cost of the microscope from Pyser is £43, but if the receipt is sent to RMS (address below) you get back a cheque for £20. Limited to two a school. This offer will only stay open as long as funds remain available.

Royal Microscopical Society, 37/38 St Clements, Oxford, OX4 1AJ Tel. 01865 248768

Free charts and leaflets :

Energy through the ages - two colour wall charts which join together to display a time line of energy use. Age 9 - 13.

Transport - four A4 leaflets looking at aspects of the history of transport. Age 8 - 13.

Ostensibly for somewhat older children [suggested age range 14 -18] : *Scientists of the Royal Institution* - six A4 leaflets covering Humphry Davy; James Dewar (of thermos or Dewar flask fame); Michael Faraday (electricity); John Tyndall (light) and Thomas Young (light).

All available free of charge from *Shell Education Service, PO Box 46, Newbury, Berks. RG13 2YX.*

Activity book :

Travelling Scotland : A Story of Transport

A forty page activity book for 8 -12 year olds which is available at £3.95 a copy from *HMSO Books, 71 Lothian Road, Edinburgh EH3. Tel. 0131 228 4888*

SSERC skeleton offer - see overleaf for an inexpensive template for a card model of the human skeleton.

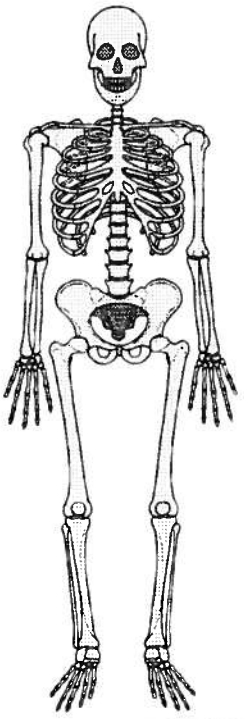
Components & Materials List

593	Miniature motor, 1.5V to 3V, 2mm dia. shaft	30p
614	Miniature motor, 3V to 6V, 2mm dia. shaft.	45p
	Both of the above motors can be used for project work but they run at fairly high speeds, some form of gearing will be required. See worm/gear, item 811	
621	Miniature motor, 1.5V to 3V, 1.5mm shaft. The open body of this motor makes it ideal for showing how such a motor is constructed.	25p
811	Worm and gear, gives a 34 to 1 speed reduction.	35p
629	Dual tone buzzer with flashing light supplied with PP3 battery clip. Ideal for model burglar alarms, warning barriers, police car etc..	55p
710	Sonic switch. Clap your hands, the motor starts, clap again the motor reverses, on the third clap the motor stops. Needs 4 AA cells, not included.	50p
688	Crocodile clips, red, miniature, insulated.	5p
759	as above but black.	5p
789	MES (miniature Edison screw) lamps (bulbs) 3.5V.	9p
691	MES battenholders for above.	20p
508	LED (light emitting diode) 3 mm, red.	50p/10
761	LED 3 mm, yellow.	60p/10
762	LED 3 mm green	60p/10
790	3V buzzer.	55p
788	Crocodile leads, assorted colours, insulated croc. clips at ends, 36cm long.	£1.35
791	Propeller, 3 blade to fit 2mm shaft. Blade 55 mm long.	45p
792	Propeller kit with hub and blades for ten 3 or 2 bladed propellers.	£3.50
793	Cotton reels (for making buggies, rubber powered tanks etc.) pack 10.	45p
794	As above but pack of 100.	£3.50
796	Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters.	£2.50
798	Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia. 15, 22, 32, 40 mm 12 tooth gear fits motor shaft and 40 tooth gear is push fit in cotton reel	£2.00
799	Pack of 24 cams, 6 of each of 4 shapes	£1.00
800	Pack of 100 wheels, 39 mm diameter, assorted colours, 3 mm axle hole	£5.25
814	Ring magnet, 24 mm o.d., 6 mm I.d.	20p
815	Ceramic square magnet, 19 x 19 x 5 mm	15p

Skeleton offer

Paper templates are available to help build a simple model of a human skeleton, about 1/3 normal size. The templates can be photocopied on to thin card, or a cheaper option is to gum the photo copies to a cardboard backing. Individual parts can then be joined by gumming strips behind matching bones.

Templates and card copies ready for cutting out, can be had from SSERC for the small sum of £1.25, including postage. Cash or cheque please unless part of an order exceeding £5 (see below).



Payment with orders less than £5 and please add £1 for carriage then add VAT to the total.

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