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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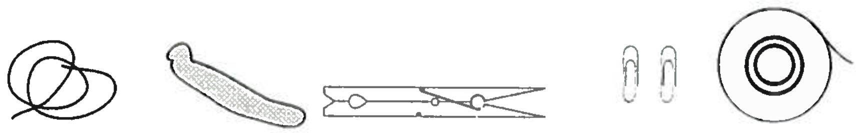
There's not so much waffle in the Editor's box this time - except to remind readers that the bit in our logo come header above - ***Helpline*** - is intended as just that. Despite this one making it a dozen issues over three years or so, Primary schools still seem hesitant to 'phone, fax or write for advice and assistance (other than when placing orders for our bits and pieces). If you get this Newsletter then our service is being supported by your authority and you are entitled to use our direct enquiry and technical service without any further charge. This edition airs a few ideas to support some aspects of learning and teaching in Environmental Studies 5-14 *Science : Understanding Energy and Forces* which also illustrate parts of the Technology guidelines particularly : *Understanding and Using Technology in Society* and *Understanding and Using the Design Process*.



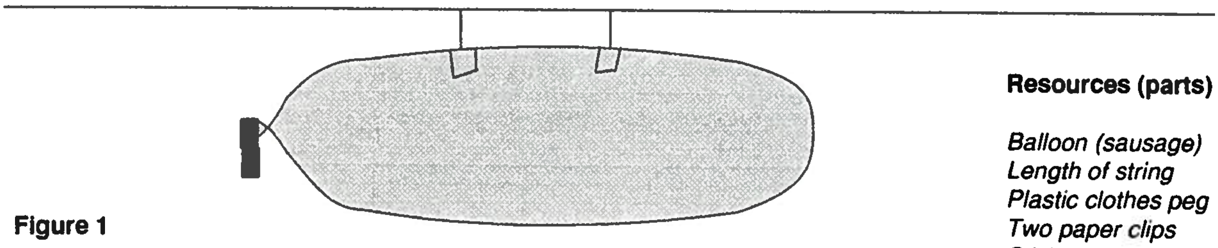


Figure 1

Resources (parts) list

Balloon (sausage)
Length of string
Plastic clothes peg
Two paper clips
Sticky tape

Huff and Puff

These suggested activities may assist in meeting a number of the attainment targets from "Understanding Energy and Forces". First, we need a packet of mixed balloons, round and sausage shaped. Now for a dramatic introduction to the transformation of energy from one form to another (you might wish to give advance warning to colleagues - but not to the pupils unless especially nervous). Blow up one of the round balloons to a good size and prick it with a pin, the bang should wake up the whole class! What caused the noise? Choose any shape of balloon blow it up and release it into the air, hopefully it will *fly* around the classroom. What caused it to move in this way?

These two activities demonstrate a 'release' and transformation of stored energy, one in producing the loud bang, the other - uncontrolled flight. Can we control this release of energy to do more useful work? Figures 1 above and 2 (overleaf) show two tried and tested ideas. All you need for the activity in Figure 1 are a length of string, 2 paper clips, some sticky tape, a plastic clothes peg and a sausage shaped balloon. The clothes peg is used to close the neck of the balloon once it is blown up and before it is attached to the string using the paper clips as hooks taped to the skin of the balloon. Ensure that the neck of the balloon points straight to the rear - otherwise it is going nowhere.

This tethered flight may lead to discussion of other types of balloon flight, from the Montgolfier brothers and their hot air balloon to the motor powered Zeppelin.

Legend has it that the young Joseph Montgolfier observed that a bag, which had once held bread, when thrown on the fire did not ignite but filled with hot air and flew up the chimney (a paper bag equivalent of Newton's mythical apple or James Watt's kettle, perhaps?).

Some publications suggest a simple experiment can be done with a supermarket plastic carrier bag and a hair-dryer. Tie, or tape, the handles of the bag together fill with hot air from the dryer, et voila, it should rise to the classroom ceiling. In our experience this does not work. It's better to obtain a plastic bag from a dry cleaner, hold it over an electric convector heater or similar non-flame containing device. With a little, or slightly more, luck it will then float upwards.

Do not use a naked flame nor a powerful radiant source or paint stripper to heat the air in the bag. See *Be-safe!* (ASE, Scottish Edition) - Flying Things.

Resources for the activity shown in Figure 2 include :

a round balloon (or two):
a length of corrugated plastic (eg Corriflute) about 30cm x 10cm;
double sided tape; clothes peg;
4 wheels and 2 x 120 mm axles.

Some of these you may have bought already from us or elsewhere. Others are widely available from retail outlets. Again this basic balloon powered buggy should be fairly easy to build using just the diagram (Fig. 2). It is even more important with this model that the neck points straight to the rear. Why do you think this is so important? Can we improve this aspect of the design? (A tapered rigid tube fixed at the balloon neck and elsewhere on the buggy helps). Can we control the release of air to keep the airship and buggy moving in a controlled way - eg a straight line? Where does the power that moves the balloon models come from? What energy conversion is taking place?

Kurt Vonnegut, a noted author of science fiction, made an apt statement on the contemporary mania for holding meetings, and the oft times useless conversion of energy consequent thereon :

How do you know a Grandfalloon?
First take the skin from a toy balloon.

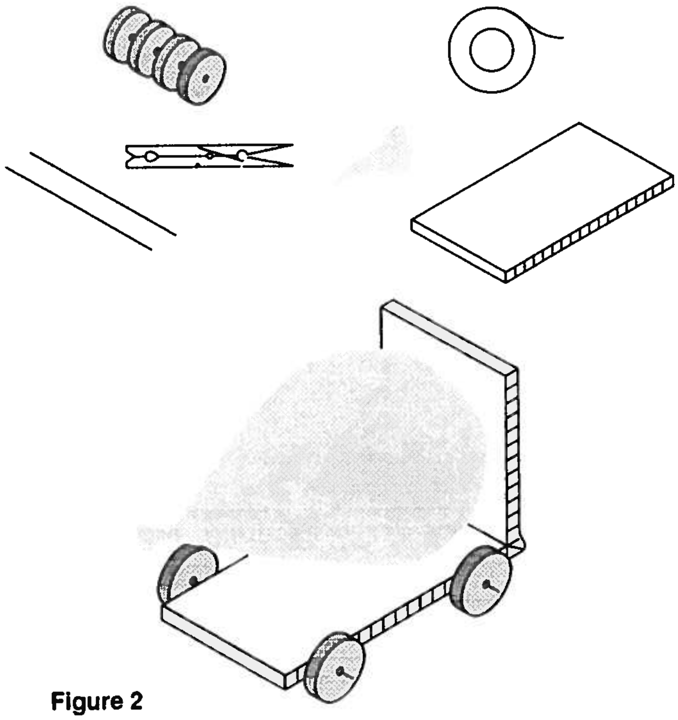


Figure 2

Solar power

Our second group of actitivities stems from a straight-forward investigation into using solar energy to control our own immediate environment. However it does call for a little more practical skill and knowledge than does the work with balloons. The brief would run something like this :

"*On a warm day in summer we would like a method of keeping cool in the classroom. Why is the classroom so warm? What is causing the temperature to rise? Is it warmer inside than outside? (The sun in summer is an obvious answer). Why not use solar energy to help keep us cool?*" (*next column*).

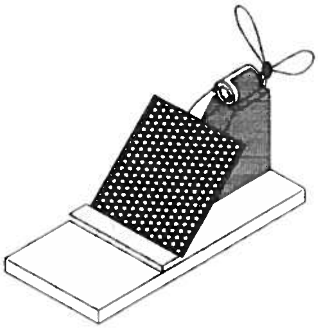


Figure 3 One suggested design for a solar powered fan

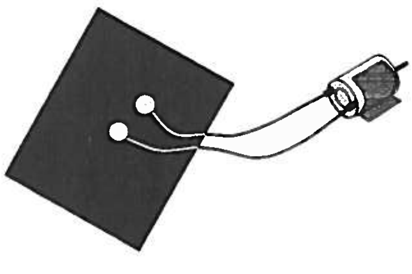


Figure 4

Connect the motor to the two screw and nut connectors at the rear of the solar cell. You may need to experiment with the direction of rotation to see which gives the most effective 'fan'. The direction is changed simply by swapping over the wires at the solar cell connectors.

Resources (see 'exploded' diagram Figure 5) - a minimal list would include :

a solar cell and wires to connect to
a motor which the solar cell will drive;
fan blades (propeller) and scrap wood for
a tower or block to fix the fan upon.

The motor used is a special type, it requires a very small starting and running current, so is ideally suited to work from our solar cell. Figures 4 and 5 give hints on wiring the circuit and on how to mount the motor. The pieces of wood we used came from the scrap box, exact sizes are not crucial. If the motor is to be powered by the sun then angle the solar cell to about 50 degrees. (see Newsletter 7 for an explanation).

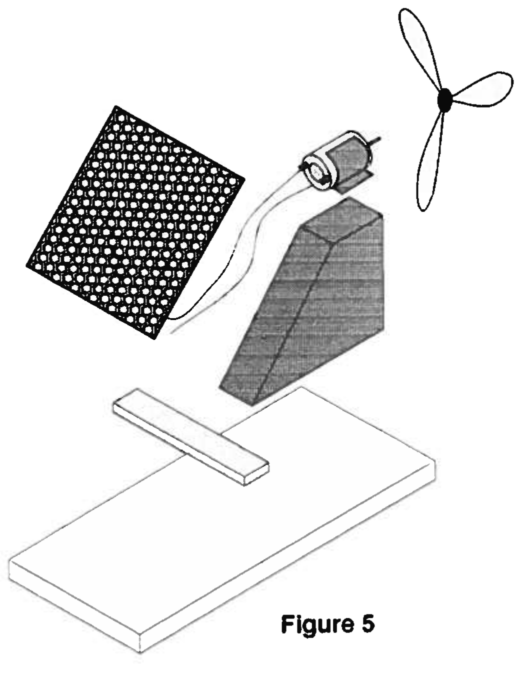


Figure 5

Solar panels

Should we have a spell of sunny weather a 'solar water heater' is another simple but effective way to demonstrate transfer of energy. A sturdy black bin liner half filled with water and left in direct sunlight will, in a short time (about 1 hour) give water hot enough for washing hands.

We do have plans for a more elaborate and efficient solar water heater, a S.A.E. sent to SSERC will have the details speeding to your school.

Tapping sunshine for energy is not a new idea nor is that of using 'solar gain' in buildings. Our ancestors used energy from the sun to evaporate sea water to obtain essential salts. Thousands of years ago the Indians of the dry south-west of America built homes that were warm in winter yet cool in summer. They were called the *Pueblo People*. American architects are now using similar techniques in present day house building.

Native Americans also dried meat by hanging strips of it in the sun. It was known to the cowboys, as 'jerky'. This could be kept for weeks and then eaten raw or cooked in water. Nearer to home many cultures used sun dried fish to top up their winter diet. Nomadic tribes, in different regions of the world, still tan hides by stretching them on a frame and drying them in the sun. Unable to rely on solar power alone, St Kildans and other islanders used to finish off their seabird meat by air-drying it in specially built stone huts with strategically placed holes to let the omnipresent wind howl through. Which brings us to our next set of ideas for investigating and designing - harnessing the wind.

Riding the wind

This final set of activities uses the energy of the wind to do useful work. This is not as in a previous Newsletter for wind generated electricity or in a windmill (see Newsletter 8) but to drive a vehicle - a land yacht.

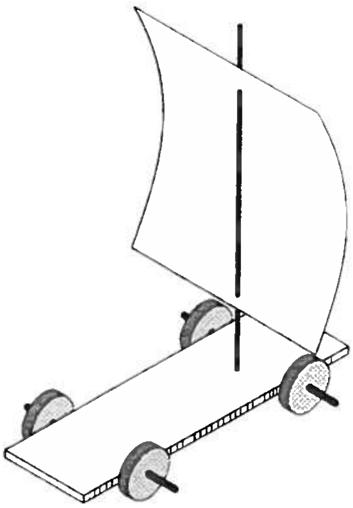


Figure 6 A basic design for a model land yacht

Our land yacht converts the movement of air to motion of a vehicle. In the basic version shown - with a single, square sail (Figure 6) it is very easy to build. Like other early sailing ships ours can only sail *downwind*[1]. To try the model in the classroom a hair-dryer could be used (but preferably not one brought from home - see *Be safe!*). A simpler wind maker uses a propeller fitted to a small electric motor. This can be used to simulate a cool wind from different directions. A number of simple investigations and design tasks may arise in these activities :

Can we adjust the sail to change direction?
What happened to the design of sailing boats through the ages?
Are two sails better than one?
Does the size of wheels affect performance?
Will the size of the sail make a difference?

1. *Footnote See "Primary Technology Using Stories from History", ASE 1997)*

One design task for the children would be the choice of a material for the mast and to find a method of fixing it. The mast needs to be light, flexible and at least 35cm long. Fixing it to the base can be left as a design problem. Modelling clay will do but it may not be strong enough to hold the mast in a 'bit of a blow'. We used a piece of plastic tubing from a construction kit and attached it to the plastic base with a wood screw! If the pupils decide on thin dowel for the mast, it can be glued to the centre hole of a wooden wheel, then fixed to the plastic with glue or double sided sticky tape. One other essential feature missing from the sketch is rigging. Some mechanism will be needed to stop the sail turning on the mast - but let the children first discover that for themselves.

On a good day with a decent breeze it may be possible to hold a regatta outside. This of course assumes the playground or other available area is reasonably smooth.

Resources (parts) list
(See Figure 7 opposite)
plastic sheet eg Corriflute
ca. 200 x 90 mm;
4 wheels, 2 x120 mm axles;
plastic tube or light dowel,
minimum 350 mm;
1 A4 sheet paper or card;
double sided sticky tape or
appropriate adhesive.
(see Be safe!)

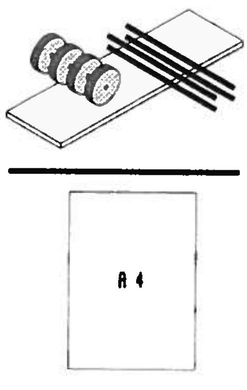


Figure 7 Parts for yacht

Sources of less common components

Corrugated plastic and balloons can be purchased from ;

TTS Tel. 01773 830255 Fax 01773 830325

Heron Tel. 01246 453354 Fax 01246 260876

Commotion Tel. 01732 773399 Fax 01732 773390

We can supply wheels, axles and propellers, for details see the back page. If you have already bought any of our buggy kits you will have bases, wheels and axles already. We can also supply a solar motor at £1.70 and solar cell at £2.10 both plus VAT and postage.

Components & Materials

593 Miniature motor, 1.5V to 3V, 2mm dia. shaft **30p**
614 Miniature motor, 3V to 6V, 2mm dia. shaft. Both motors above 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 **45p**

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**

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**
811 Worm and gear, gives a 34 to 1 speed reduction. **35p**
817 Axles 3 mm dia.,nickel plated, round ends. push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4 **40p**
820 Worms to fit 2mm electric motor shaft, pack of 5 **£1.00**
821 Reducers 3mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5 **25p**

629 Dual tone buzzer NOW SOLD OUT

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. **85p**
723 Microswitch miniature, lever operated **40p**
822 Plastic toggle switch, low voltage **40p**

688 Crocodile clips, red, miniature, insulated. **5p**
759 As above but black. **5p**
789 MES (miniature Edison screw) lamps (bulbs) 3.5 V. **9p**

691 MES battenholders for above. **20p**

508 LED (light emitting diode) 3 mm, red, per 10. **50p**
761 LED 3 mm, yellow, per 10. **60p**
762 LED 3 mm green, per 10. **60p**

790 3V buzzer. **55p**

788 Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long. **£1.35**

801 Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long **35p**

792 Propeller kit with hub and blades for ten 3 or 2 bladed propellers. **£3.50**

794 Cotton reels (for making buggies, rubber powered tanks etc.) pack of 20. **80p**

796 Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters. **£2.50**

837 Ring magnet, 40 mm o.d., 22 mm i.d. **35p**
815 Ceramic square magnet, 19 x 19 x 5 mm **15p**
818 As above but 95mm long, pack of 4 **40p**
819 As above but 12mm long, pack of 4 **40p**
824 Ceramic magnets, poles on face, 25 x 19 x 6mm **35p**
823 Ceramic magnets, poles at ends, 10 x 6 x 22mm **12p**

825 Forehead temperature strips, liquid-crystal type, 36-40°C (96-104°F), [store in cool cupboard] **50p**

The Buggy (£5), Skeleton (£1.25) and Paper Engineering (£1.80) packs are still available (incl. VAT & postage)

Cash with order only when total value is less than £5 and please add £1 for carriage solely to these small orders (except where an inclusive price is indicated eg kits, etc). For orders totalling more than £5 please do not send payment etc but await delivery and then pay on our advice note or invoice.

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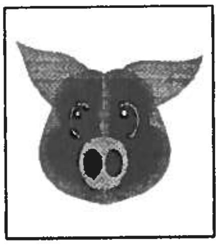

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