NEWSLETTER

Primary Science and Technology

Support for Science & Technology Coordinators FREE to members

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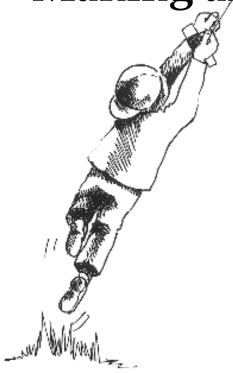

CLEAPSS

School Science Service number 27 autumn 2003

NEWSLETTER

Goodbye and Hello

John Oldham retired in September. He has been with us for 10 years, working part time. Before that he was an Ofsted inspector and science adviser in Hounslow and Waltham Forest, having spent several years teaching in London schools. With us, John has specialised in special needs and primary work, as well as some biology. He was the author of such publications as L204, *Science for primary-aged children with motor difficulties* and L227, *Stick insects*. He has also been responsible for many of the articles in the *PST* newsletter. He has outstanding skills with computer graphics software and many of the illustrations that grace the pages of our publications are the result of his creative work. His calm, thoughtful approach will be greatly missed. John thinks he is going to spend more time messing about on his boat on the Hamble river but we have other ideas and intend to continue to use his skills, albeit at a distance. We wish him well in his 'retirement'!

In *PST* 26, we advertised for a primary teacher to work for CLEAPSS. We recently appointed John Stringer. He will be familiar to many primary school teachers. With 37 years of primary science experience under his belt, he now works as a freelance consultant. He has been involved in writing many primary science curriculum materials, including Ginn *Star Science* and *SATIS 8-14*, published by the ASE, for which he was project director. John's association with the ASE continues with his work as reviews editor for the journal, *Primary Science Review*. He has contributed to, and worked as consultant editor for, *Primary Maths & Science* and advised on around 300 schools' television programmes. You may also have read his feature articles in the TES. We reckon he's quite a catch! We hope he will enjoy working for us and look forward to a rewarding mutual relationship.

John Stringer will be partially stepping into the shoes of John Oldham and writing articles for this newsletter. He will also be producing guidance on teaching *about* health & safety and so help in tackling that part of the Science National Curriculum under 'Breadth of Study' that can easily be overlooked. *John is particularly interested to hear from teachers who have examples of good practice in safety teaching, that they are willing to share.*

Please contact John by post or e-mail.

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NEW GUIDES NES NEW GUIDE UIDES NEW GU

We have revised the existing guide L24b; it is now L24p and renamed as *Magnifiers and Microscopes for Primary Science*. As well as surveying the market for magnifiers and viewers, the guide focuses on the microscopes approved by the Royal Microscopical Society. Schools are reminded of the RMS offer to subsidise the cost of purchasing up to two of these microscopes by £20 each. Digital microscopes are compared and there is also mention of long-arm stereobinocular and standard monocular microscopes which may sometimes be useful.

Using the Intel microscope?

Schools using the QX-3 computer microscope (issued free to establishments in England) sometimes report problems. The web site: www.intel.com/support/intelplay/qx3/index.htm provides help with compatibility and other issues and has some updated software downloads. For those wishing to use the QX-3 on an Apple Mac using system OS X, there is a free software download at http://homepage.mac.com/aireck/qx3/index.html. Go to our web site for these, and other, links (click on the 'Links' button).

Primary/Secondary Liaison

Recent years have seen a welcome increase in the dialogue between primary and secondary schools. Sometimes, a teacher from a secondary school visits a Year 6 class, bringing a box full of science equipment and chemicals. Sometimes, Year 6 pupils visit their local secondary school for an afternoon of taster activities. Mostly, these events work well, with the pupils reassured and perhaps even enthusiastic about their forthcoming transfer to 'the big school' and a better understanding gained by secondary teachers of what primary schools achieve in science.

However, there can be pitfalls. When children start in secondary school, most science departments run an induction course about health & safety, rules for laboratory behaviour and so on. During a liaison event this could be both time-consuming and rather off-putting so is usually omitted or truncated. Normally, on such occasions, children are very well supervised, with their regular teacher present and perhaps classroom assistants as well. These adults will need to be well-briefed by the science teacher. Eg, if pupils are required to wear eye protection, then all adults must wear it as well. Most primary schools will not have sets of safety spectacles or goggles. Items brought in from the secondary school may not fit small heads very well, or may need adjustment for a comfortable fit, so it may be better to avoid activities for which eye protection would be necessary.

Secondary teachers may forget that primary-school pupils will have had little practical experience of using chemicals or glassware. They should realise that Bunsen burners are not available in primary classrooms but may be more surprised to find no sinks (or only one), or a carpet on the floor. Ventilation in primary school classrooms may not be very good and there may be smoke alarms fitted. Some planned activities which create fumes or smoke may not therefore be advisable.

Pupils are likely to be accustomed to sitting down for their practical work. This is not, however, recommended when chemicals are handled or heating activities take place.

It would be helpful to draw the attention of secondary school teachers to *Be Safe! Health & Safety in Primary School Science and Technology* (3rd edition, ASE, 2001) and to such CLEAPSS publications as L5p *The Safe Use of Household and Other Chemicals* so that they become more aware of the guidance on health & safety available to primary schools. Activities routinely carried out by Year 7 pupils in secondary school laboratories may be appropriate for younger pupils in primary school classrooms but there does need to be a risk assessment which takes account of the lack of specialist facilities, the pupils' limited experience but also perhaps the better supervision.

The CLEAPSS web site

Many readers will have visited our web site, for example, to check out details of our publications, to request assistance on our ***Helpline***, to use internet hyperlinks mentioned in newsletters, etc. We have now created a secure area and access to this is only available by password.

The password, and indeed this newsletter, are only for members of CLEAPSS. At present, all LEAs in England, Wales and N Ireland, and their schools, are members. In addition, some, though not all, independent schools subscribe to CLEAPSS services. We would ask you not to divulge the password to schools that are not members.

Letting 25,000 primary schools know individually what the password is each term is a tall order! So we have decided to include the password in each *PST* newsletter. The password will last for a term with a new one given in the next *PST*. Once you have reached our web site **www.cleapss.org.uk**, to access the secure area, click on the 'Primary Schools' button and then on the 'Members only' button. You will then need to type in your user name which, for this term, is **autumn2003** and the password which is **charlesdarwin**.

When you reach the secure area, you will find some of our publications but, particularly, past issues of *PST*, together with the *Index* to their contents. Here there is a wealth of information for you to explore. In due course, we will develop a search engine to the *PST* articles and all of our guides & other goodies will be made available.

Science SATs

Implications for teaching and learning

Whatever our views about SATs, they do provide an insight into the difficulties that children have in understanding particular ideas and processes. Each year in England, the QCA publishes an analysis of pupils' answers to the previous year's science SATs papers. This contains useful suggestions for topics that need more attention or a different approach. The publication for the 2002 SATs is no exception and we have given some thought to the implications for science teaching that it throws up. Just three examples are discussed below.

Patterns in data

"…teaching them how to describe the overall pattern in data collected and how this is different from describing specific parts of the data."

This comment highlights the difficulty that many pupils have in drawing valid conclusions from experimental results obtained. Recognising patterns is an important step in this process, a valuable skill in everyday life as well as science! It does not come easily, however, and needs to be taught using some structured teaching.

To do this, it is necessary to have a *consistent strategy* for analysing the results of every investigation.

- ▲ Once all the results have been gathered, remind children about the dependent variable (the aspect they are studying).
- ▲ Ask them to say whether it has changed during the investigation. (If it has *not*, perhaps an independent variable has been missed!)
- ▲ Now discuss with the children each independent variable in turn to decide whether changing it has altered the dependent variable. Are there any 'rogue' results and how can these be identified and corrected?
- ▲ If changes in an independent variable lead to changes in the outcomes, ask the children whether these fall into one of the categories below.

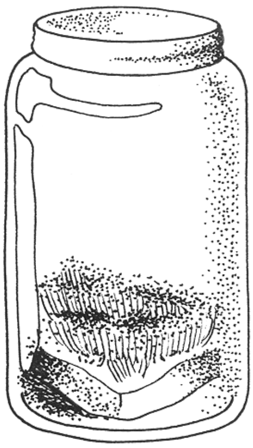
- ➪ **In step** with those observed in the dependent variable. Eg, the warmer the water, the quicker the sugar dissolves (ie, increasing *this* increases *that*…).
- ➪ **In the reverse direction.** Eg, when running toy cars over different surfaces - the rougher the surface, the shorter the distance the car travels (so, the more *this*, the less *that*…).
- ➪ **Only apparent above a threshold level.** Eg, seeds germinate only above a certain temperature (*only* when *more than this* does *that*…).
- ➪ **Subject to a limit**, as when looking at the effect of heat on water (*this* increases *that - up to a limit beyond which…)*.

This critical way of looking at the outcomes of an investigation is an important step in drawing valid conclusions. It will be time well invested!

Microbes

"Fungi & bacteria show the growth and reproduction characteristic of living things."

It is important to refer to CLEAPSS Guide L190, *Studying Microorganisms in Primary Schools*, and to the ASE publication *Be Safe!* in order to ensure that microorganisms are studied safely in the classroom.



Growth of **fungi** can be observed in a mould garden, since each colony develops from a single spore that settled onto the food material. Reproduction, however, is very different from that which children will know about from keeping pets or studying flowering plants. Sexual reproduction in fungi (if it occurs!) is quite unlike the joining of pollen and egg cells in a flower. The most visible type of reproduction is asexual and involves the development of spore-bearing threads (more akin to vegetative propagation in flowering plants). *Air-borne spores may cause allergic responses in sensitive individuals,* particularly if released in large numbers - so it is important not to open containers holding moulds producing spores.

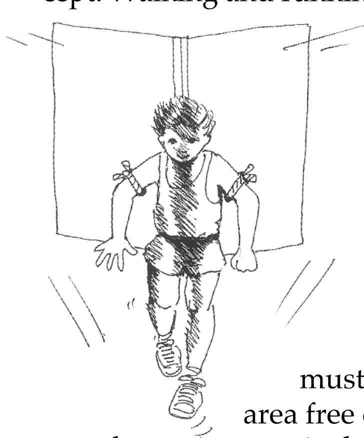
Bacteria are much more difficult to culture safely. Non-dangerous types can easily become contaminated with bacteria that might not be so benign! They are *extremely* small - even most of the microscopes used by sixth formers cannot show their structure clearly. Growth is therefore very difficult to observe. Evidence of asexual reproduction may be observed since some of the coloured 'blobs' seen on bread in mould gardens could be colonies of many thousands of bacteria grouped together. Each 'blob' originated as a single bacterium from the

air. The only bacterium safe enough to culture in primary schools is that which converts milk into yogurt. A small quantity of 'starter' produces large amounts of mature yogurt; indirect evidence of bacterial reproduction!

Air resistance and forces

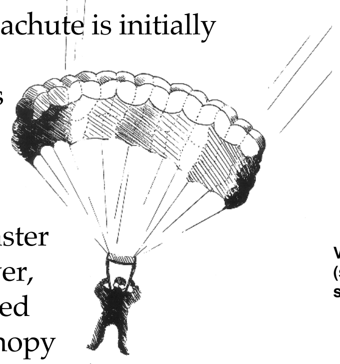
"How air resistance opposes the movement of objects and using arrows to represent the direction of this force."

There are many ways to teach this concept. Walking and running while pulling a large sheet of polystyrene or card gives direct experience of air resistance. (Holding the card, or an open umbrella, in front of you is easier but must be done in an area free of obstacles.)



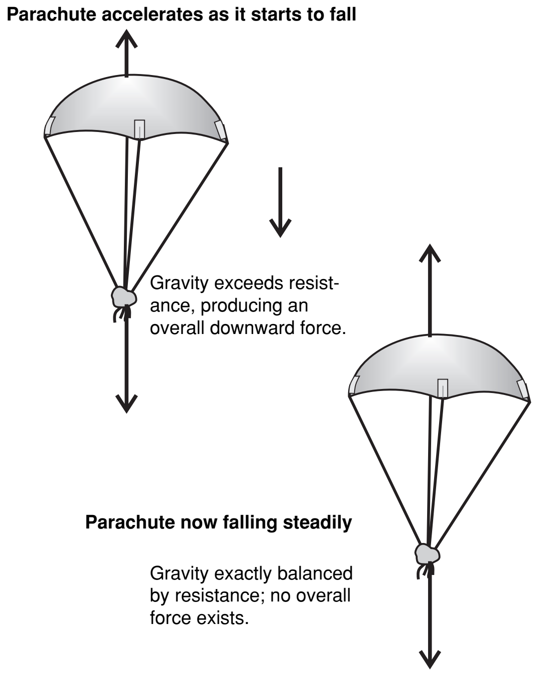
Parachutes, kites and other flying toys offer good opportunities to analyse the forces involved. (The article on pages 6-7 gives instructions for making a basic kite.) The parachute is easiest to *analyse* because only two forces need to be considered - gravity and air resistance.

When an open parachute is initially released, the only force acting on it is the downward force of gravity. This causes the parachute to fall faster and faster. However, air resistance created by the opening canopy creates an upward force that opposes gravity. As the speed of fall increases, so does this air resistance, until eventually the air resistance becomes equal to the force of gravity. At this point, the parachute falls at a steady speed (the final or *terminal velocity*) - see graph opposite.

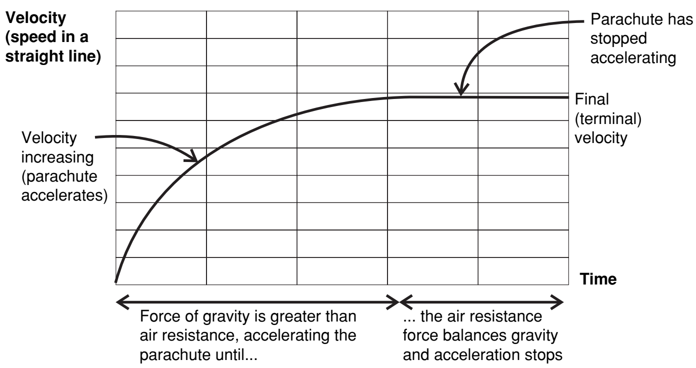


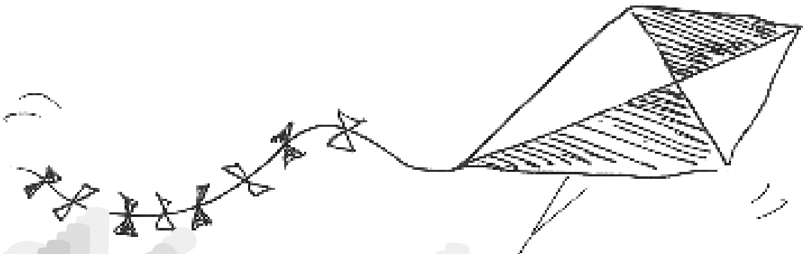
Despite the apparent simplicity of the situation, children need to have a good grasp of a number of concepts before they can understand why parachutes behave as they do. These include the following points.

- ❖ An overall force causes objects to *accelerate* (move faster and faster).
- ❖ Objects that are moving at a *steady speed* can have no *overall* force acting on them.
- ❖ Wherever gravity is acting on objects (ie, everywhere!), objects that are stationary or moving at a steady speed must also be experiencing a force that exactly balances gravity.
- ❖ In the case of parachutes that have reached their terminal velocity, the balancing force is air resistance.
- ❖ Air resistance increases as air speed rises.
- ❖ When the force of air resistance = force of gravity, the parachute stops accelerating.



So, an apparently simple study may need to be revisited more than once before children can appreciate all the ideas involved!





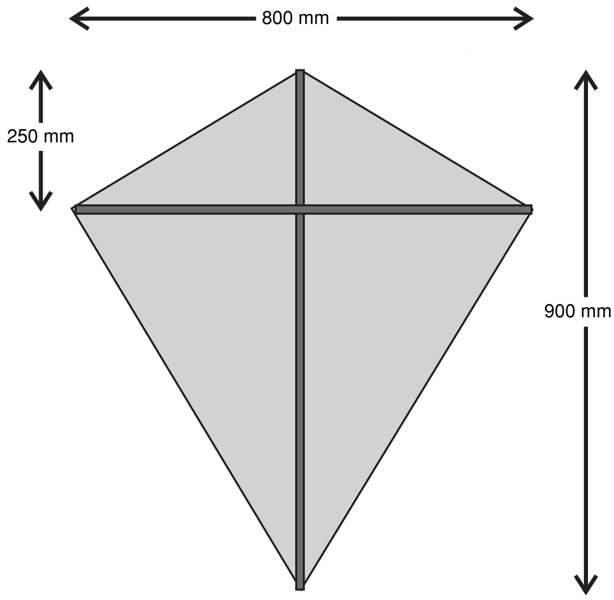
Studying air resistance:

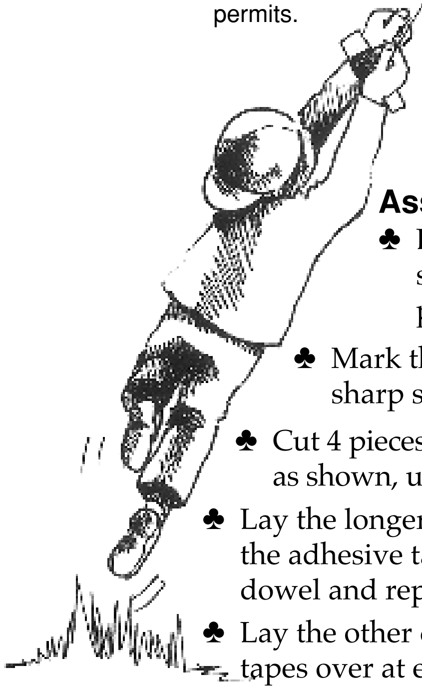
Making kites

Kites of different designs are found in all parts of the world and appear to have originated in China more than 2000 years ago. Before powered flight became possible, large kites were used for military observation or as a source of power for locomotion. Many web sites give instructions for building more complex designs, but here are the dimensions for a basic, easy-to-build model.

What you will need

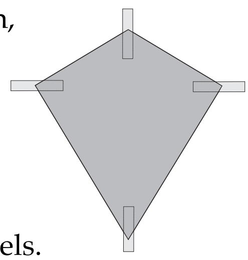
- Two lengths of 6 mm dowel or bamboo spars, one 900 and the other 800 mm.
- A piece of plastic sheet 900 mm x 800 mm (cut from a large bin liner).
- Two strips of plastic, 4 m long and 50 mm wide (or the equivalent size of ribbon) to act as a tail.
- Duck, or similar weatherproof, adhesive tape.
- A piece of string 400 mm long to form a bridle.
- A length of strong, plaited string (**not** fishing line or any other single-filament type, since this can easily cut into the fingers) - at least 30 metres is required, more if the situation permits.



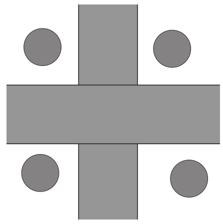


Assembling the parts

- ♣ Lay out the large plastic sheet on a large table. Mark the positions (as shown on the diagram) for the two pieces of dowel (silver felt-tipped pens are good for this).
- ♣ Mark the outline shape based on these positions. Cut out the shape using sharp scissors.
- ♣ Cut 4 pieces of adhesive tape about 100 mm long and put them, as shown, under the guide lines at the four corners of the kite.
- ♣ Lay the longer dowel along the kite from top to bottom. Fold the adhesive tape over at the top corner so that it sticks to the dowel and repeat at the bottom of the kite.
- ♣ Lay the other dowel (the crosspiece) across the kite and fold the tapes over at each end as before, so fixing the plastic to the dowels.

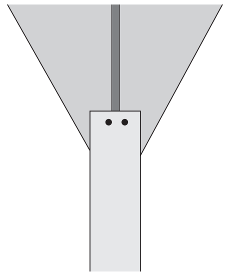


♣ Snip four small holes at the point where the two dowels cross.



♣ Push the end of the 400 mm bridle string through one of these holes and then pass it over one of the dowels and back through the plastic sheet. Repeat this process until the string holds the two dowels firmly together, finally tying off with a secure knot close to the dowels. Leave the other end of the string free for attachment later.

♣ Punch two holes about 50 mm from the end of each tail piece. Place these over the tail end of the longer length of dowel. Snip two holes in the plastic sheet in line with the holes in the tail and line them all up.



♣ Take the other end of the bridle string and pass it two or three times through the two sets of holes in order to tie the tail pieces to the dowel. The bridle string should now connect between the crosspiece dowel and the tail.

♣ Reinforce the plastic sheet along its edges and around the six holes using more Duck tape.

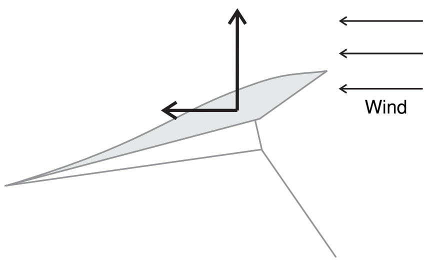
♣ Tie the flying line to the bridle somewhere between 50 and 100 mm from its attachment to the crosspiece dowel (you will need to experiment to find the position in which the kite flies the best).

♣ Now - go fly your kite!

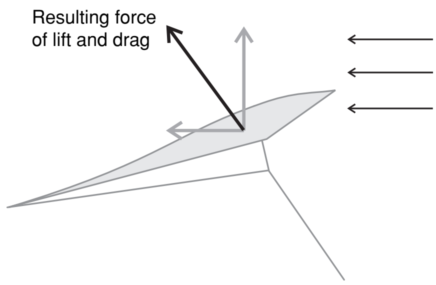
> ⚠ **DO NOT FLY YOUR KITE NEAR TO POWER LINES OR OVERHEAD OBSTRUCTIONS. CHOOSE AN OPEN AREA, AWAY FROM ROADS, STREAMS & OTHER OBSTACLES.**

Kite flying provides a good opportunity to think about the forces involved in flight. In addition to the balanced forces of lift and gravity (see the discussion about parachutes on pages 4-5), wind resistance and lift is balanced by the weight of the kite together with the 'pull' exerted by the flyer on the string.

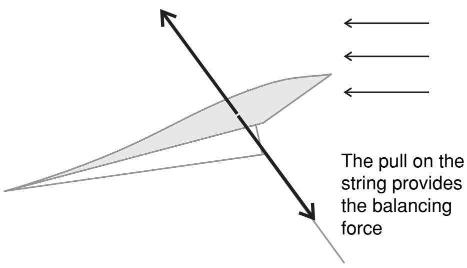
1. The kite surface acts like a wing in the moving air, creating lift and drag (due to wind resistance)



2. These two forces behave like a single force, as shown.



3. If the kite is flying steadily, the resulting force must be balanced by other forces. (For simplicity, we have ignored the relatively small, downwards force exerted by gravity.)



Once the basic construction is mastered, kite making and flying offers a wealth of opportunities for experimentation and creative work.

FREE GUIDES

If you need help with items ***not*** covered by an existing guide, please call our ***Helpline*** (see below for our contact details). We can give you up-to-date information on equipment, animals & plants, dataloggers and all other resources for primary science and technology.

☆ New item

L5p Safe use of household and other chemicals Substances for use by pupils and by teachers only. Safety advice and ideas. 9/99

L18 Glues and Adhesives Guidance on what to use. 5/00

☆**L24p Magnifiers & microscopes for primary science** A survey, including RMS-approved & digital microscopes. Revised; see page 2.

L42 Plants for classrooms Robust and useful plants for the classroom and species to study in the school grounds. 3/89

L46 Storage for primary science Information on shelving, trolleys, stacking boxes etc. 9/93

L52 Small mammals All you need to know to keep small mammals safely and humanely. 4/94

L71 Incubating & Hatching Eggs A complete guide to this exciting work. 3/97

L86p Electrical safety All you need to know about electricity and its use in primary schools. 9/95

L110 Materials & Components for Technology What to buy and the best sources. 3/97

L112 Batteries and L-Vunits Using batteries safely, disposable *vs* rechargeable types or low-voltage units. 07/01

L120p Earth science: Key Stages 1&2 Gives information, resources and ideas for activities. 12/92

L122p Simple electric circuits with bulbs and batteries What you need and how to connect components in various ways. 4/96

L123 Teaching weather at Key Stages 1 & 2 Information on equipment and learning materials for teaching this topic. 4/94

L124 Aquaria in primary schools: electrical safety Guidance to ensure a safe set-up. 1/99

L127 Starting photography An introduction to photograms, blueprints & pinhole cameras. 4/96

L157p Measuring temperature Buying and using all types for practical activities. 07/01

L161 Magnets for primary schools Information, ideas for practical work & details of sources. 4/95

L173 Construction kits Over 180 products; relative sizes of models, what to buy for different pupil age ranges and various tasks. 5/93

L181 Cold water aquaria Safety, setting up, maintenance, feeding and sources, for tadpoles, other amphibians and gold fish. 10/90

L190 Studying microorganisms in primary schools Which microbes to use, safe & exciting investigations, general information. 5/97

L197 Giant African land snails Where to obtain them, how to keep them and what to observe. 3/92

L198 Earth in space Ideas on teaching this topic practically. Also sources of equipment. 7/99

L201 Giant millipedes Where to buy and how to look after these unusual animals. 12/92

L203 Control Technology Advice and equipment. 10/93

L204 Science for primary-aged pupils with motor difficulties Information to help in teaching these pupils in normal classrooms. 5/94

L206 Tadpoles Rearing tadpoles of frogs and toads to adults to ensure a high success rate. 9/94

L213 Science with minibeasts: Snails Information and ideas for practical activities. 9/95

L216p Inspecting Safety in Science: a guide for Ofsted inspectors in primary schools Helps you challenge unwarranted demands by an Ofsted inspector ! 9/96

L221 Developing & using environmental areas Help with creating wildlife areas in school grounds and then using them. 12/98

L224 Model health & safety policy in primary science A model for schools to customise that provides guidance on health & safety, including risk assessment. 12/98

L226 Carnivorous plants How to grow and investigate these bizarre and unusual plants. 11/01

L227 Stick Insects Guidance on keeping and using these fascinating animals. 12/02

PS18 Science policies for primary schools A short guidance note on their production, including a model policy for adapting. 9/96

PS22 Health & Safety in Primary Science & Technology A leaflet discussing essential aspects of health & safety, aimed at new or trainee teachers. 8/01

PS55 Bringing pets & other animals into schools. Guidance on all the issues to consider. 4/02

PS60 Datalogging & control equipment for primary schools. What's available and what to buy. 11/02

E230 Circ-Kit *Download this file from our web site* to help in teaching about electrical circuits. 3/02

☆**INDEX** To *PST* newsletters 1 - 27 (Also available on our web site.)

If you would like publications to be sent electronically, e-mail your request and indicate that you would prefer this format. If you do e-mail us, **please include the name and post code of your school** so that we can check your membership.

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