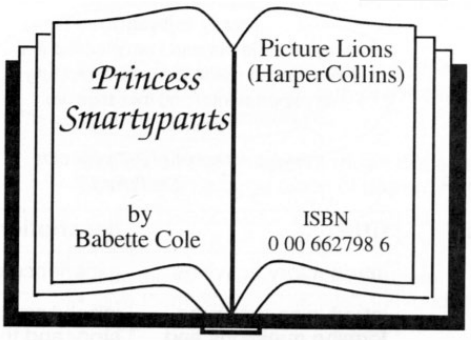
PRINCESSES

A science investigation pack for teachers of 5-7 year olds

CENTRE *for* INDUSTRY
EDUCATION COLLABORATION

Contents

Investigating with Princess Smartypants



BOOK CHOICE

In this well-loved modern fairy story, Princess Smartypants presents her suitors with a series of problems. She is quite confident the young men will not be able to solve them. Some of the problems provide interesting investigations for children to tackle. The problems presented in the story are:

How can you.....

- stop slugs eating the garden?
- feed ferocious pets without getting hurt?
- roller skate longer than someone else?
- go for a cross-country ride without being scared?
- rescue someone from a tower with smooth, slippery walls?
- chop firewood without annoying the trees?
- ride a wild pony?
- carry lots of heavy shopping?
- get a ring out of a crocodile's mouth?

WHAT TO INVESTIGATE

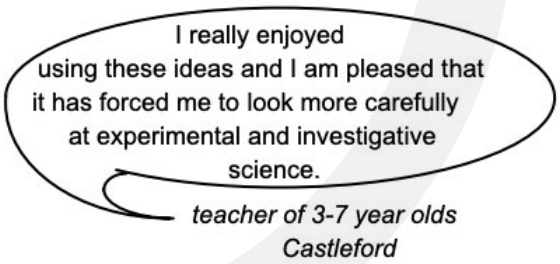
From the problems listed above, a selection can readily be made for children to consider. Problems such as chopping firewood without annoying the trees can provoke discussion (such as 'are the trees alive or dead?'), but are difficult to investigate. Four problems have been chosen and developed as investigations in this chapter. The problems are about slugs, roller skating, tower rescue and heavy shopping bags. All of these problems provide possibilities for classroom activities, with contexts which children can readily understand and which are not difficult to resource. They are also open-ended enough for children to think of more than one feasible investigation.

SEQUENCE OF ACTIVITIES

Title	Description
Introductory activities	Experience of forces
Introducing problems, forming questions and making predictions	Initial discussion of the story and the tasks
Slugs investigation	Preferred conditions
Roller skates investigation	Increasing or reducing the 'stickiness' between two surfaces
Tower rescue investigation	Stickiness or bounciness of surfaces
Shopping investigation	Strength or types of shopping bags

1. Introductory Activities

How to choose and organise the investigations inspired by this story.



INTRODUCTORY ACTIVITIES

Three of the chosen problems link with the science concept area 'forces', so initial work on forces can be carried out before the story is introduced or the investigations started.

Let the children experience a range of 'pushes' and 'pulls':

- In P.E. lessons children can be asked to balance in pairs by pulling or pushing on each other. Individually, children can push or pull on apparatus.
- Small groups of children can be challenged to move a large box across the floor, and compare the ease of pulling the box with that of pushing it.
- Compare pulling a brick tied with string on different surfaces, e.g. sandpaper, carpet, tarmac, a varnished shelf, table top, etc. Children then describe the effort required using words such as 'easy', 'quite hard', 'hard', etc. More able children may be able to use a force metre to measure the force each time.
- The brick can be put on a slope which has a material attached (sandpaper, fabric, etc.) to find out how easily the brick moves down the slope. The distance travelled by the brick can be observed and recorded (see page 12). In this way, the effect of the 'stickiness' of the surface on the ease of the brick's movement is measured.

INTRODUCING THE PROBLEMS

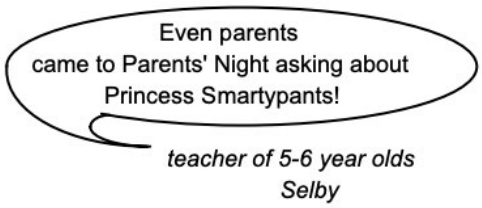
Read the story to the children up to the arrival of Prince Swashbuckle. Discuss the problems faced by the other princes in the story. Ask the children if they can think of any ways in which they could help Prince Swashbuckle solve the problems.

Note: It is best to carry out the discussions and planning the day before carrying out practical activities, to allow for preparation of resources.

Collect all the children's ideas under simple headings on the board or on a large piece of paper. For example:

Slugs • trap them • give them other food • slug pellets	**Pets** • muzzle them • push the food in on a trolley • put them in a cage	**Roller skates** • jet propelled • battery • glue princess's wheels
Motorbike • blindfold • add brakes the prince can use • give him a harness	**Tower** • build a slide • bouncy castle • throw a rope	**Firewood** • pick up twigs • blindfold the trees • play soft music
Pony • find a pony trainer • give it an apple	**Shopping** • use a trolley • use a rucksack • lots of pockets	**Ring** • use a fishing rod • use a magnet

Record all the children's ideas, even though some will not be feasible to test in the classroom. Valuing their ideas in this way encourages more children to offer suggestions in this brainstorming exercise.



teacher of 5-6 year olds
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FORMING QUESTIONS

Acting as the children's role model, show children how to make a statement into a question which can then be investigated. This can be done by discussing each problem in turn. For example, ask the children to describe the problem with the slugs. Children will make statements like *"They're eating all the flowers"*, and so on. Show the children how to turn the statement into a question, like:

- How can you stop slugs eating flowers?

Ask for and list possible solutions to this question. Children may come up with ideas such as trapping the slugs, giving them other food, giving them a better home, etc.

Ask if they can think of a way of turning their ideas into questions (many will still need guidance) e.g.

- Will traps stop slugs eating the flowers?
- Will giving slugs other food stop them eating the flowers?
- What sort of home would slugs like, other than a garden?

These questions can then be refined further by thinking of types of investigations that might be done in the classroom:

- How can slugs be trapped?
- What sort of food do slugs like most?
- Do slugs like the light or dark (or wet /dry) more?

In this way, children are involved in the process required to form questions to investigate.

In each of the following investigations, one question has been chosen to provide a focus. However, the children may think of other avenues to explore. Each question children pose can be discussed as to whether it could be answered in the classroom situation.

MAKING PREDICTIONS

In an investigation, ask children what they think will happen before they carry out their tests. They should also try to give a reason for their prediction, to avoid a simple guessing game and to encourage children to think more carefully about the problem. This kind of prediction can be of the 'best' or 'worst' kind, or can involve children in ranking materials according to specific properties (e.g. slippiest to stickiest). These predictions can aid children at the planning stages whilst in discussion with you or other children. Predictions are described for each investigation outlined on the following pages.

2. How can you stop slugs eating flowers?

Children create a home that gives slugs some choice about their environment.

OBJECTIVES

- To identify and name a variety of plants and animals in thier habitats, including micro-habitats.
- To find out about and describe the basic needs of animals, including humans, for survival (water, food, air).

SLUGS INVESTIGATION

Note: *You can begin this activity by discussing the picture in the storybook - does it look like a 'real' slug? Children can try describing the appearance of slugs before handling them.*

Resource ideas

Tidy tray or shoe box cardboard clear plastic bag black sugar paper paper tissues tongs, rubber gloves or leaves.

The question chosen to illustrate here is:

- Do slugs like the light or dark (or wet /dry) more?

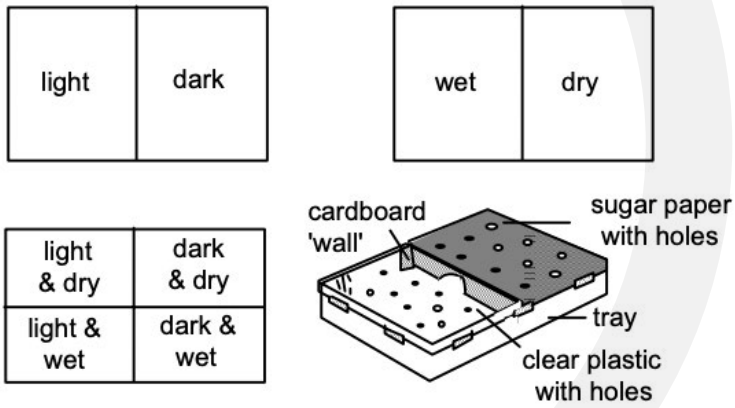
Children create a home that gives some slugs choices over their environment. Depending on the age and ability of the children, they can give the slugs a small or large number of choices. At the simplest level, children give the slugs a choice of two environments. More able children can give the slugs a choice of four environments. Possibilities are shown overleaf.

Predictions can be made about the conditions the slugs will prefer, possibly based on knowledge of their own garden at home or where slugs are found. This may help the children in the creation of the environment. The prediction can be a painting or drawing to show the slug's 'home'.

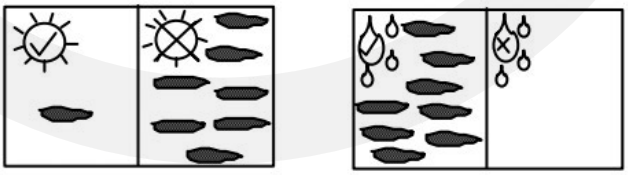
Slug care: The slugs can be carefully picked up with tongs, with a large leaf or wearing rubber gloves. The large leaf is preferable, as this does not convey the message that slugs are dangerous or poisonous in any way.

The slugs must have an option of moisture, and covered containers must have holes pierced in the lid. Slugs can be kept overnight, and for another 24 hour period, if followed immediately with a test to find out which foods slugs eat.

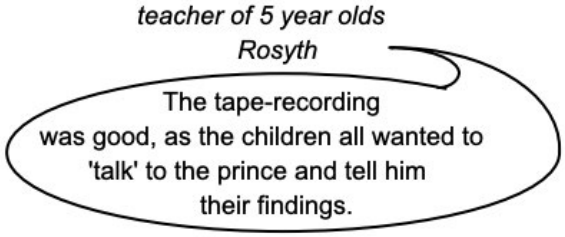
The light/dark environment has been shown in a tidy tray (or shoe box). A wet/dry environment can have a complete cover, and wet paper tissues in one half and dry paper tissues in the other half. An additional wall and doorways are required for the 4-choice tray. The tissues may need repeated dampening if slugs are left overnight. A few small stones can be added to the centre of each section of the box. The same number of slugs is carefully placed in each section of the box, and then left for 8-16 hours. Their position can be checked every hour, or 2- 3 times in 24 hours.



Children can **record** what they find out in pictures, e.g.



Finally, the children decide from their results what the prince should do to outwit the princess (e.g. provide the slugs with the 'ideal' home to entice them away from her garden). These decisions can be written in a letter or tape-recorded as a telephone message, to the prince.



The children tell Prince Swashbuckle the best thing to do, and include the results, or 'proof', that the idea has been tested. Letters can be produced using a word processor.

Once children have chosen the best habitat, they can investigate food choices. Similar arrangements to those shown above can be used to give the slugs a range of foods in different sections of a tray or box. The home can be set up with foodstuffs in each half or quadrant, and the box inspected every 1, 2 or 3 hours. Foods can include lettuce, flowers, apple cores, salt and biscuits.

Gardeners who don't want to kill slugs with pellets use some of the following methods:

- Cultivate the soil to kill the eggs
- Encourage hedgehogs, frogs and thrushes - which eat slugs
- Make pitfall traps in the ground and fill with stale beer
- Trap slugs in upturned hollow grapefruit hemispheres
- Hand-pick slugs at night with tongs and move them to a local woodland!

3. Investigating materials and forces

Children investigate the factors which influence the speed of roller skates, the best method to help someone get to the top of a tall tower and the strength of carrier bags.

OBJECTIVES

- To describe th simple physical properties of ae variety of everyday materials
- To identify and compare the suitability of a variety of everyday materials for particular uses.

ROLLER SKATES INVESTIGATION

To formulate a question, follow the process described on previous pages. Questions illustrated here are:

- How can roller skates be slowed down?
- How can roller skates be speeded up?

The children begin by planning their investigation. Check the children's plans and required resources for feasibility before allowing the children to carry out their investigation. Suggest modifications where necessary. An investigation is suggested here, though children should be allowed to plan their own. This idea should only be given to children who have difficulties devising their own plan.

Fair test aspects which can be incorporated (depending on the children's age and ability) are:

- Constant height of slope
- The skate always starts at the same position on the slope (a starting line can be drawn)
- The skate is 'released', rather than pushed each time, as it is difficult to maintain a constant push.

Resource ideas:

roller skates
slope (shelf)
sandpaper (coarse and fine)
Sellotape
double sided tape
plasticine
vegetable oil
margarine
ruler
roll of paper, e.g: wallpaper
computer paper
newsprint

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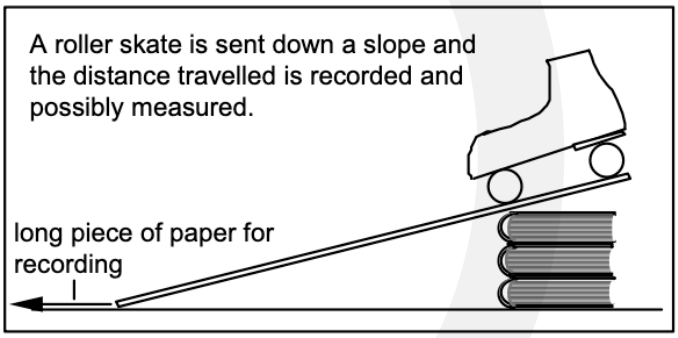
We used roller skates made with Lego, which the children readily accepted.



Predictions can be made about the materials which will cause the skates to move very slowly or very quickly. Some children might want to predict the order of the materials on a 'slowest-to-quickest' scale. A record of the prediction can be kept by sticking pieces of each test material to a sheet, in a specific order. This kind of prediction can help clarify children's plans.

The simplest test would be to compare different types of roller skates, and record which ones travel the furthest, and would, therefore, be best for the prince.

On a more complex level, children can investigate the effect of changing the amount of friction between the wheels and the axle (or base of the skate), or the wheels and the slope. So, each time the skate is sent down the slope, the wheels have different materials attached. Double-sided tape can be stuck round the wheels, plasticine can be wedged between the axle and wheels, sandpaper can be wedged or stuck to axle and wheels, etc. Options may vary with the design of the roller skate and the method of joining the axle to the skate's wheels.

Margarine, cooking oil (or bicycle oil, if an adult adds this) can be added to the skate wheels and axle to reduce the friction, or 'stickiness' of the contact between the two surfaces.

Note for the teacher: *Changing the friction between the wheels and points of contact with the rest of the skate alters the speed of the turning wheels. However, changing the friction between the skate and 'road' surface alters the grip; increased friction - to a point - is a good thing, as too little friction causes the wheels to slip rather than grip.*

To **record** the distance travelled by the skate each time, lines can be drawn on a long piece of paper attached to the end of the slope. A piece of each material used can be glued beside the lines. For smaller, individual record sheets, stick pieces of material to a sheet of paper in order of the distance the skate travelled.

Reliability of data can be introduced with more able or older children, by suggesting that they repeat the 'roller run' 2-3 times, to make sure that a similar distance is reached each time. There will be some spread in the distance travelled, and children should decide whether to report the shortest, longest, or middle distance travelled by the skate (the middle of three results being the best representation of their findings).

Younger children need not take measurements, but older or more able children can measure using feet, hands, other non-standard measures, or use a ruler.

The children decide what the prince should do to outwit the princess. These decisions can be written in a letter or tape-recorded as a telephone message to the prince.

TOWER RESCUE INVESTIGATION

Formulating a question, following the process described on pages 7-8, may result in a question such as:

- How can two slippery surfaces be made more 'sticky'?

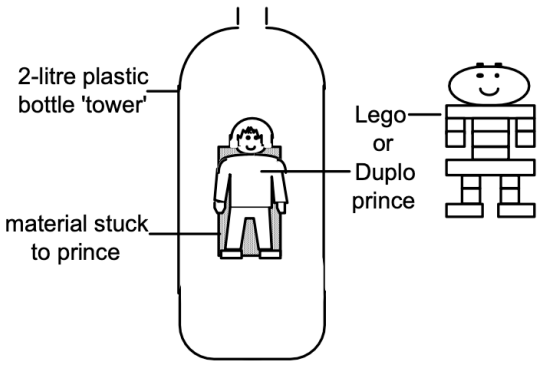
The children plan their investigations. Check their plans and required resources for feasibility before allowing the children to carry out their investigation. Suggest modifications where necessary. An investigation is suggested here, though children should be allowed to plan their own. This idea should only be given to children who have difficulties devising a plan.

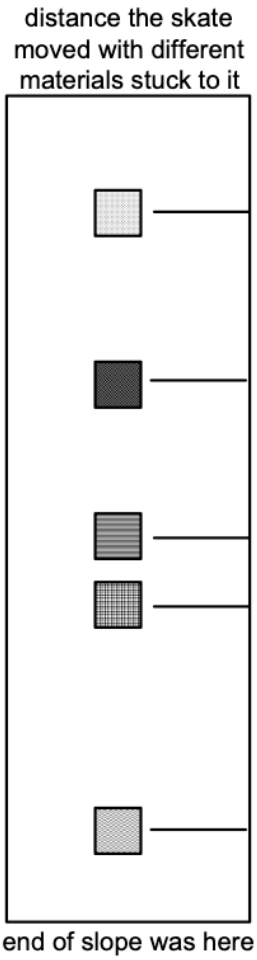
Fair test aspects which can be incorporated are:

- Same 'prince' used for all tests
- Same surface (a plastic bottle) to represent the tower
- Standard area of prince covered with the material

Predictions can be made about the materials which will help the prince stick to the smooth surface. Some children might want to predict the order of the materials on a 'best-to-worst' scale. These predictions can be used to help clarify children's plans.

A different fabric can be wrapped or glued around the prince each time he is placed on the bottle. The prince is then left on the plastic bottle, and the time recorded when he falls off.





Resource ideas:

Lego or Duplo prince
range of surfaces, e.g.
furry fabric
wool fabric
2-litre plastic bottle
viscose fabric
duster
double sided tape
bubble wrap
sandpaper
Velcro
plastic bag glue

The time can be measured using a sand timer or stopclock. If using a sand timer, the children must keep a tally of the number of times the timer is turned before the prince falls.

The test can also be carried out with each chosen material attached to both the bottle and the prince.

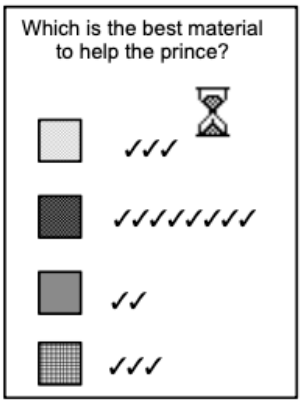
To **record** each sticking time, tallies or ticks are made beside pieces of each material glued to a record sheet.

Reliability of data can be introduced with more able or older children, by suggesting that they repeat each tower test 2-3 times. There will be some spread in the times measured, and children should decide whether to report the shortest, longest, or middle time measured (the middle of three results being the best representation of their findings).

An **alternative question** for investigation can be:

- What is the best surface for the prince to use to bounce up to the princess?

Children then investigate the 'bounciness' of a variety of surfaces. Measurement is difficult in this instance, as watching and recording how high something bounces is not easy. However, children can make a judgement on a variety of surfaces which have clearly different properties, e.g. sponge or foam compared with wood or stone.



SHOPPING INVESTIGATION

An open-ended investigation can be attempted, once children have practised investigational skills in previous activities. This investigation relates to the shopping trip with the Queen Mother. As in previous activities, children work with the teacher to formulate a question, such as those listed overleaf.

- How is heavy shopping most easily moved?
- What is the best type of bag for carrying heavy shopping?
- What is the strongest material for making a shopping bag?
- Are big bags strong enough to carry heavy shopping?

Safety Note

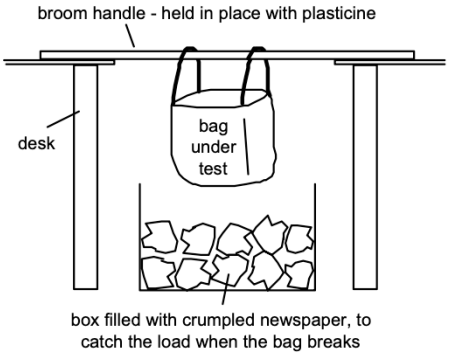
Ensure all bags have ventilation holes. Children must not hold the bag during the test, to prevent a full bag falling on their feet.

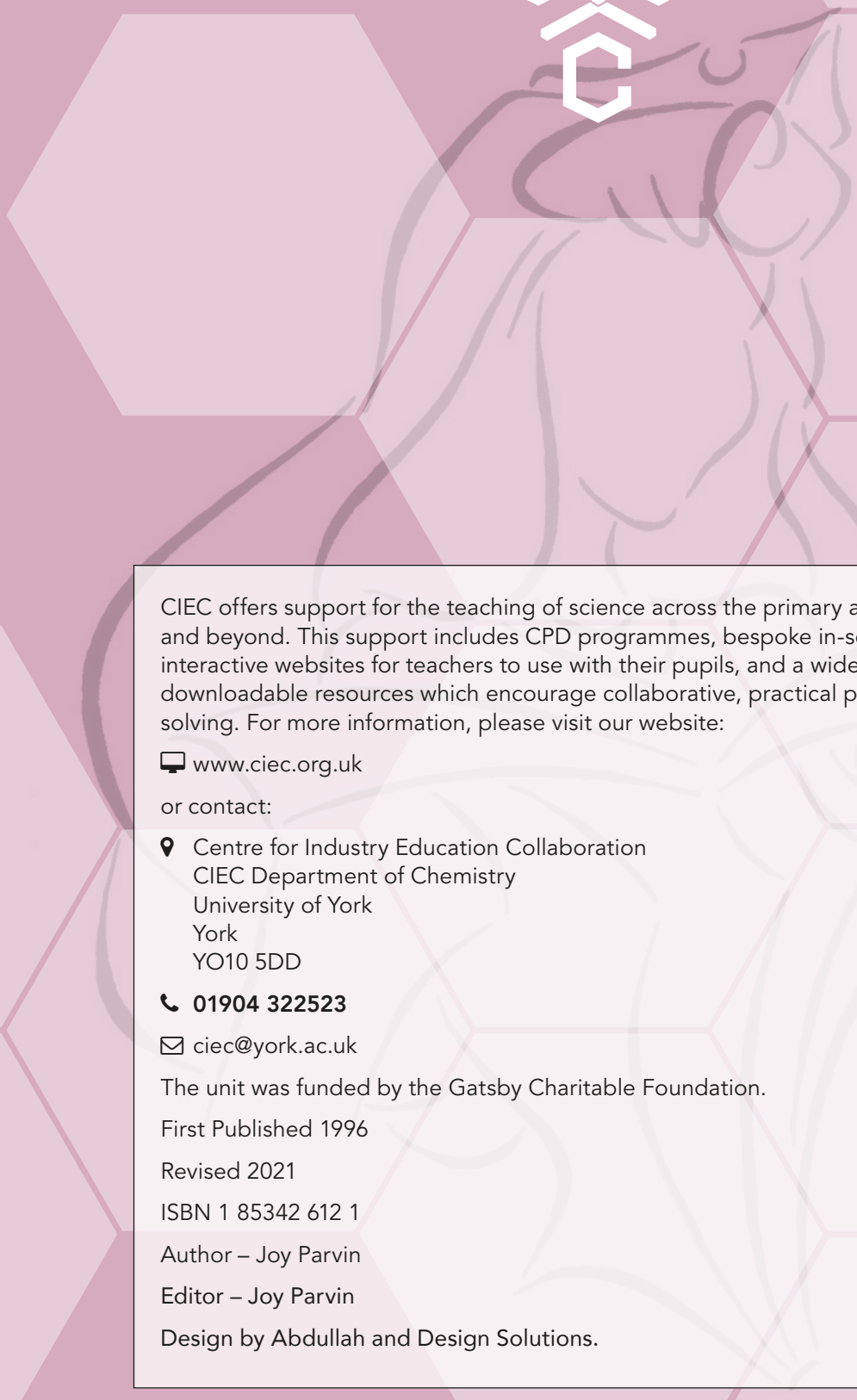
As children can investigate a wide range of questions, a summary of possibilities is provided below, rather than detailed guidance for investigating a particular question.

The first two questions can be investigated by giving children a range of carrying equipment or bags (e.g. rucksacks, wheeled shopping bags, carrier bags, etc.) Predictions can be made before children endeavour to move 'shopping' from one side of the room to another. The 'shopping' can be a pile of books, P.E. equipment or similar. Children can decide which was hard or easy, as well as timing how long it takes to use different methods.

The other questions above can be investigated by giving children a slightly different range of bags. The range could be bags of different materials, such as paper, plastic and cotton fabric, bags of different sizes, or bags from different supermarkets (warn children of the dangers of putting plastic bags over their heads). The children can hang each bag as shown below, and add potatoes, wooden blocks or kilogram weights to the bag, one at a time, until it breaks, or all the weights have been used. The number of potatoes each bag holds will be a simple measure of how suitable or strong the bag is. Using the arrangement shown, children's feet will be clear of the heavily laden bags which may break.

Children can record the results of their investigation in pictures, tapes or letters, as described on pages 9-10.





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