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Springs and magnets

Teacher's Resources Interactive PDF

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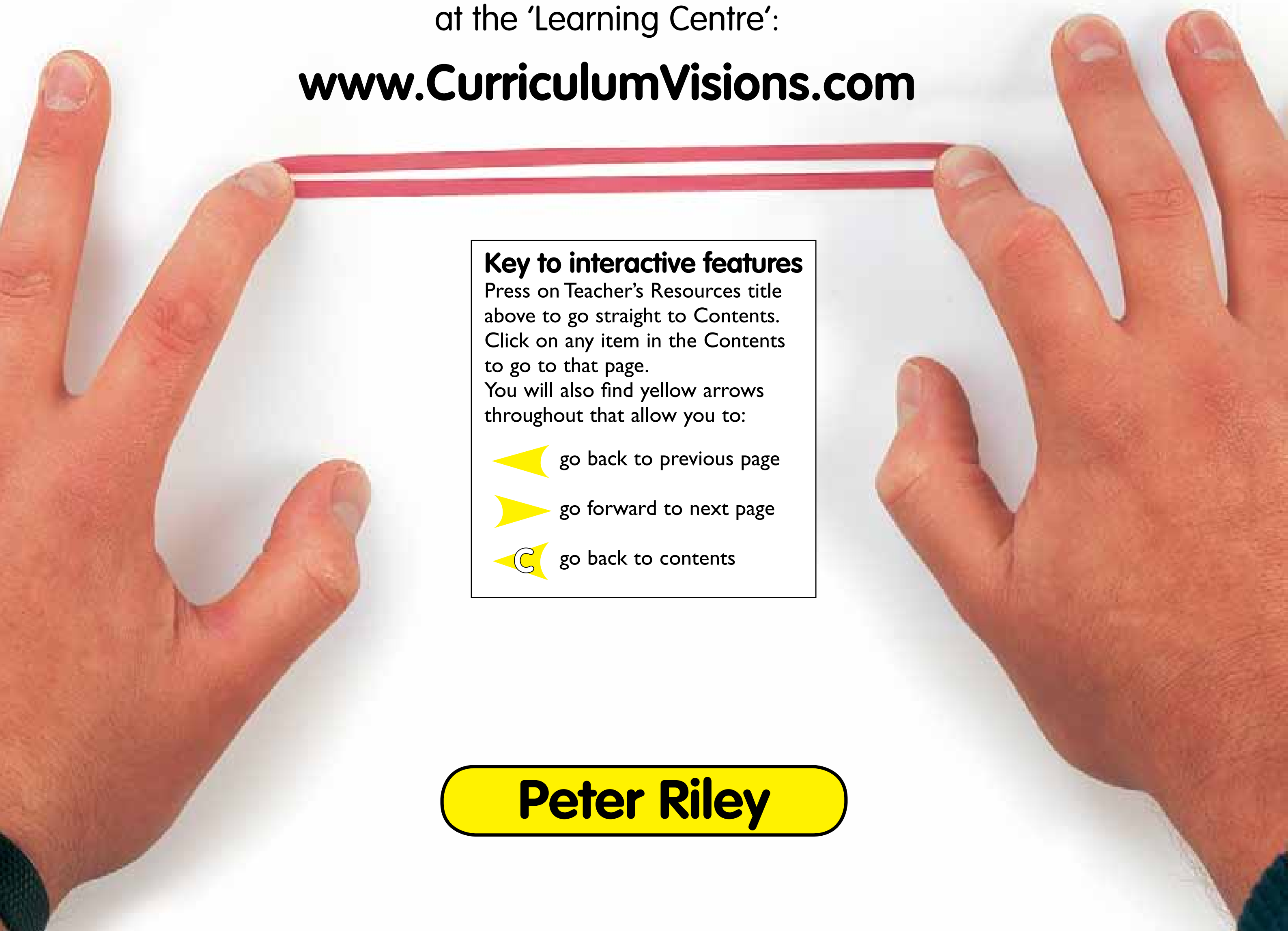

Key to interactive features

Press on Teacher's Resources title above to go straight to Contents.
Click on any item in the Contents to go to that page.
You will also find yellow arrows throughout that allow you to:

- go back to previous page
- go forward to next page
- go back to contents

Peter Riley

Curriculum Visions

A CVP Teacher's Resources
Interactive PDF

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Contents

Section 1: Resources

Welcome to the Teacher's Resources for *Springs and magnets*. The resources we provide are in a number of media:

1 The Springs and magnets pupil book is the full-colour paperback book that provides a comprehensive exploration of the science behind springs and magnets and examines the ways they are used in everyday lives – all in simple, easy-to-follow units which make it accessible to a very wide range of abilities.

3 You can buy various Science @School sets, for example Year 3 set, KS2 class book set, KS2 TG set or the complete Book Box set.

2 Our Learning Centre at

www.curriculumvisions.com

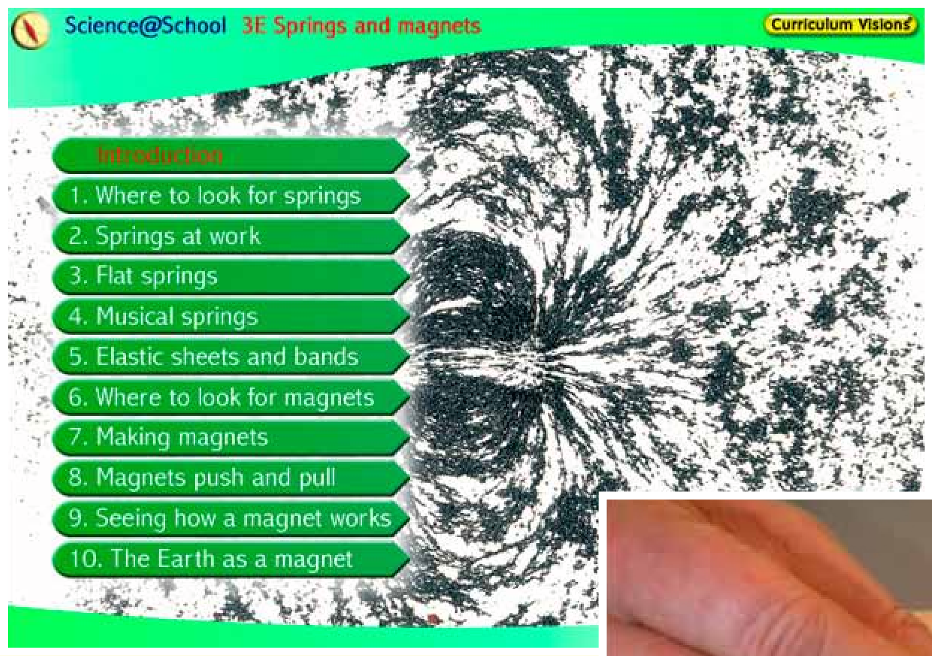
has almost everything you need to teach your primary curriculum in one convenient Virtual Learning Environment.

You can use support videos, e-books, picture and video galleries, plus additional Creative Topic books, graphic books called Storyboards, and workbooks. Together they cover all major curriculum areas.

All topics are easily accessible, and there is a built-in context search across all media.

You can also use our printed student books online as part of your subscription to the Learning Centre. There page-turning versions of every printed Curriculum Visions book for use on your whiteboard.

▼ The Springs and magnets home screen



▲ 'Classroom cinema' video

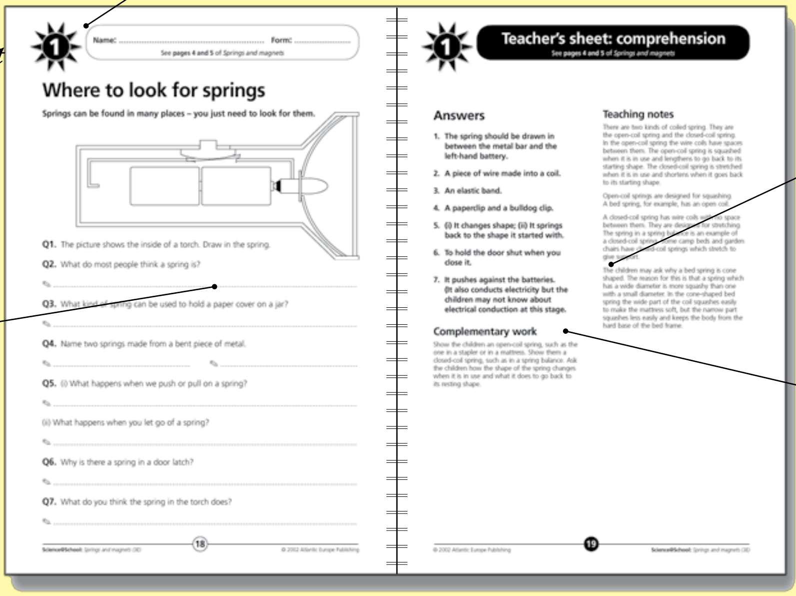
▲ Web site page

▶ Web site caption

▼ ***Each unit has one comprehension worksheet and one activity worksheet, each with a teacher's sheet.***

▶ ***The photocopiable comprehension worksheet and supporting teacher's sheet.***

Unit number.

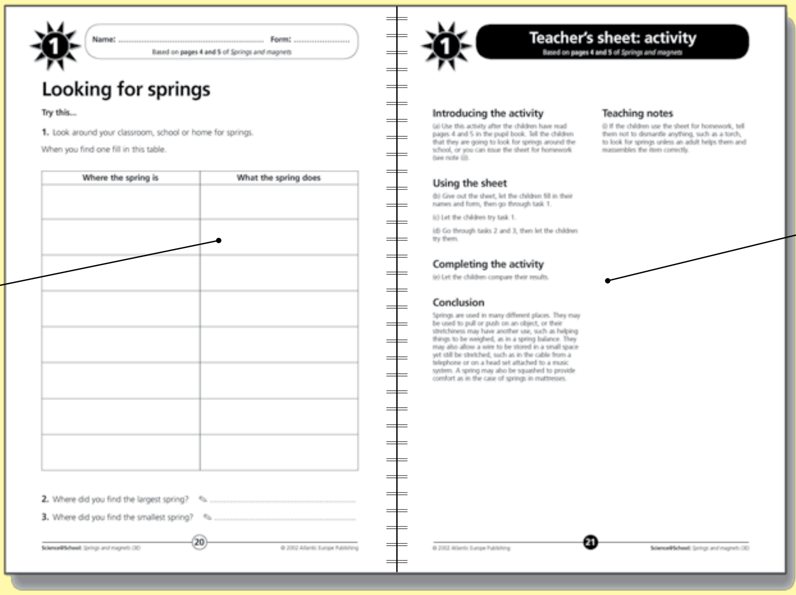


Left hand page is to photocopy and hand out to pupils.

Right hand page is the teacher's sheet and provides answers, suggestions for complementary work and teaching notes.

Resources needed to support the complementary work are shown in List 2 on page 15 of this Teacher's Guide.

▶ ***The photocopiable activity worksheet and supporting teacher's sheet.***



Left hand page is to photocopy and hand out to pupils. For some activities, pupils will also require additional sheets of paper.

Right hand page is the teacher's sheet and provides a detailed activity plan, conclusion and teaching notes. *Resources needed to support the activity worksheet are shown in List 3 on page 15 of this Teacher's Guide.*

Matching the curriculum

This book covers the springs and magnets component of the curriculum in a way that is highly relevant to work in the lower junior classes of a primary school. It builds up a firm foundation for the study of forces throughout the key stage by examining the everyday applications of springs and magnets.

The book includes detailed studies of those properties of springs and magnets which make them useful – and prepares children for further research.

While covering the subject matter of the curriculum, *Springs and magnets* also facilitates the development of investigative skills both in the pupil book and the *Teacher's Guide*.

The pack is fundamentally built around the idea that springs and magnets generate forces which can be useful to us.

Section 2: The pupil book explained unit by unit

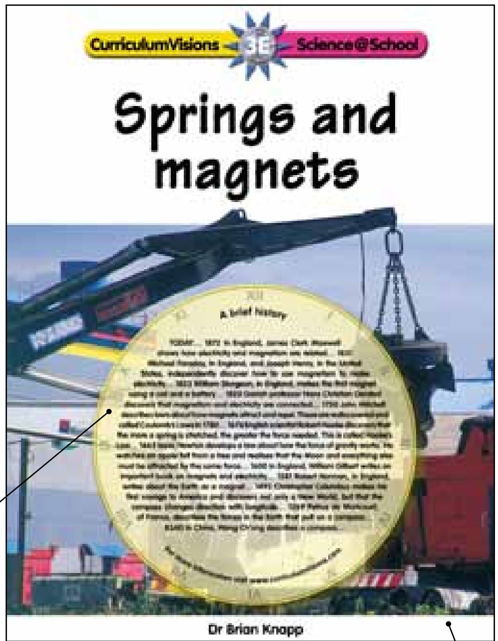
Although the pupil book – *Springs and magnets* – is clear and simple, a great deal of care and thought has been given to the structure and the content of each double page spread or unit. The worksheets and activities in this *Teacher's Guide* also link directly to the pages in *Springs and magnets*.

It is possible to use *Springs and magnets,* and the worksheets and activities, without reading this section, but we would strongly recommend that you take a short time to familiarise yourself with the construction of the pupil book.

The units are arranged in sequence, to help you with your lesson planning. In this section, a brief description of the content of each unit is given, together with hints on how to start or support it. List 1 (Starting a unit with a demonstration) on page 15 sets out the resources that you could use to do the demonstrations where suggested. The activity associated with each unit is also briefly described to help you see how the unit and activity work together.

Title page

The book begins on the title page (page 1). Here you will find information about science and technology in the form of a clock. You may want to use this to set the scene for the study of the book's contents. You may choose to focus on an event which ties in with your work in history, before moving onto the rest of the book. Alternatively, you may wish to skip over this page and return to it later. It is not a core part of the book, but helps the children see how the work they are doing now fits in with the work of scientists and engineers in the past. It may also be used to stimulate more able pupils to research the people and events that are described here.



A time clock giving additional historical information about the topic.

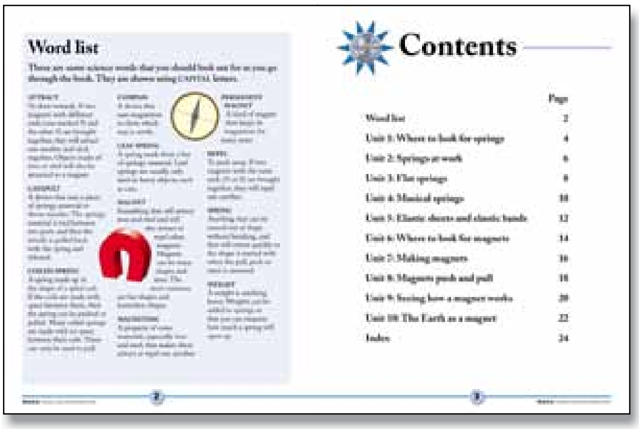
This picture shows an electromagnetic crane using magnetism to move scrap steel around a scrapyard.

Word list and contents

The core content of the book begins with a word list on page 2. This is a glossary, brought to the front for the pupils' attention. Pupils could be encouraged to look at the list and see how many of the words they already recognise.

One of the important things about science is the precision with which words are used. However, many scientific words are also common words, often used in a slightly different way from how they would be used in science. The word list presents the opportunity for pupils to consider the words they already know, and the meanings they are familiar with.

When your teaching unit has been completed, you may want to invite pupils to revisit this list and see if their understanding of the words has been enhanced or changed in any way. A visual dictionary is also given on the CD.



The entire contents are shown on page 3. It shows that the book is organised into double page spreads. Each double page spread covers one unit.

The units

Heading and introduction

Each unit has a heading, below which is an introductory sentence that sets the scene and draws out the most important theme of the unit.

Body

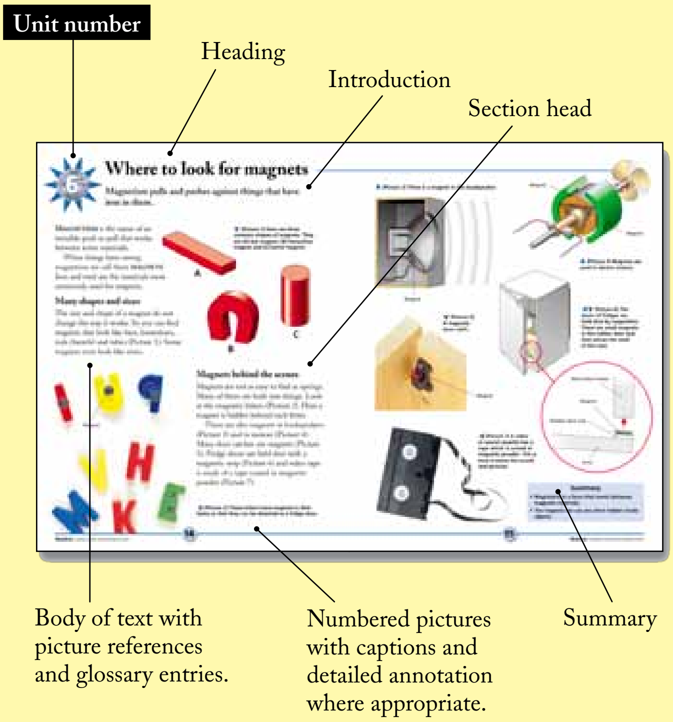
The main text of the page then follows in a straightforward, easy-to-follow, double column format.

Words highlighted in bold capitals in the pupil book are defined in the word list on page 2. A visual dictionary is also given on the CD.

The glossary words are highlighted on the first page on which they occur. They may be highlighted again on subsequent pages if they are regarded as particularly important to that unit.

Summary

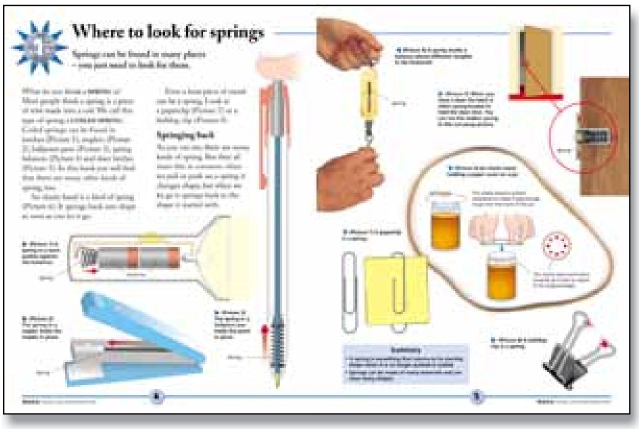
Each unit concludes with a summary, highlighting and reinforcing the main teaching objectives of the unit.



1 Where to look for springs

The unit begins by asking the reader what a spring is and answers the question by saying that most people think of a spring as a coiled piece of wire. You may like to begin by asking the children about springs in toys. You could ask them to bring in some toys with springs and demonstrate them to the class. The toys could include a jack-in-a-box, pogostick and a slinky. You could ask the children about any other material which behaves like a spring and look for an answer about elastic bands or elastic sheets such as trampolines.

The opening statement of the unit is supported by illustrations of coiled springs in use in a torch, stapler, ballpoint pen, spring balance and door latch. The text then moves on to describe a spring as something that springs back into shape. Using this as a definition of a spring widens the scope of objects that can be considered as springs. The unit then supports this description by describing in words and pictures how an elastic band, a paperclip and a bulldog clip may be considered to be springs.



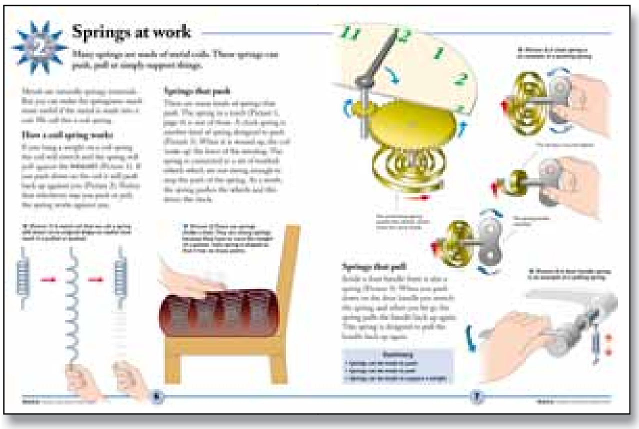
In the complementary work, the children look at how springs return to their starting shape after they have been squashed or stretched. In the activity, the children make a survey about springs around the school or around their homes. In their survey, the children explain the purpose of each spring.

2 Springs at work

This unit builds on the previous one by showing what happens when forces are applied to springs. You could emphasise this by showing the children a toy that uses a clockwork spring to drive it. Show the children the spring and ask them what must be done to make the toy work. Look for an answer about winding up the spring. Wind up the spring a little, then let the toy move across your table. When it stops, ask the children to predict what would happen if you gave the spring three extra 'winds'. Wind up the toy again give it the extra 'winds' and let it go. Let the children compare their predictions with how far the toy went.

Tell the children that when you let go of the toy, the spring pushed on a mechanism inside to make the toy move. Tell the children they are going to find out how springs work by pushing and pulling.

This unit identifies metals as springy materials, but states that this property can be enhanced if the metal is made into a coil. Large, clear diagrams show how a stretched spring pulls against the stretching force, and how a squashed spring pushes against the squashing force. This leads to a division



of springs into those that push and those that pull. A study is made of a clock spring to show how its push helps us to tell the time. The unit ends by featuring the spring in a door handle as an example of a spring that pulls.

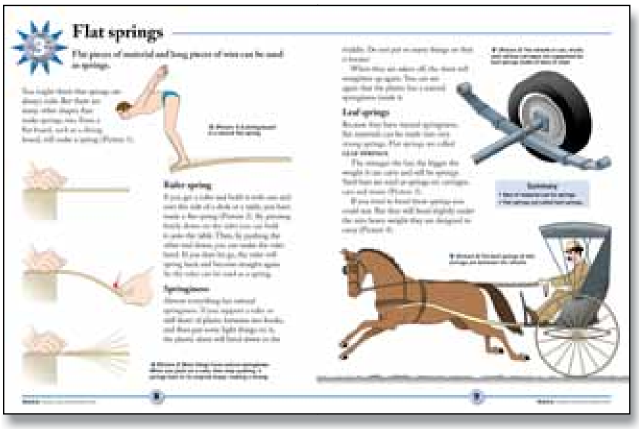
In the complementary work, the children investigate how the length of a spring changes when weights are hung on it. In the activity, the children produce diagrams showing the forces in action when springs are squashed or stretched.

3 Flat springs

This unit builds on the previous unit by showing that all springs are not necessarily coil-shaped. You may like to begin by putting an open-coiled spring (one that squashes) on your table. Stand the coil on end and put a small, soft object, like a paper ball, on top. Press down on the object and the spring and ask the children to predict what will happen. Look for an answer about the object flying into the air, then let the spring go to check the answer.

Now ask the children to make small balls of paper and tell them that they are going to launch them into the air with a spring. Tell the children to take their rulers and hang half of the ruler over the end of their table. When the children have placed the paper balls on the ends of the rulers, tell them to gently bend the ruler and let go. Tell the children they have just used a flat spring.

The unit opens by describing and illustrating the familiar activity of twanging a ruler, to show that a spring may be flat. A simple experiment is then described which shows that even a piece of stiff



plastic can be considered to be a flat spring. The unit ends by showing how metal bars can be used to make leaf springs for a range of vehicles from cars to carriages.

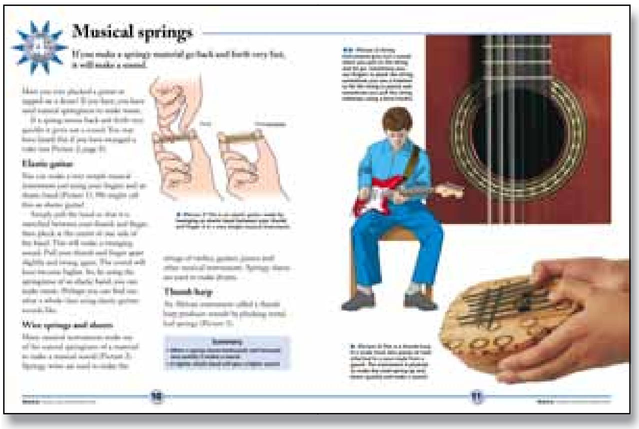
In the complementary work, the children find out about the use of flat springs in transport. In the activity, the children find out how the thickness of a flat spring affects its springiness.

4 Musical springs

This unit begins by stating that playing a guitar or drum is really using springiness to make music. To demonstrate this, you may like to enter the classroom banging a drum. Tell the children that you are using a musical spring and ask the children to identify it. Look for an answer about the drum skin, then ask the children how they could show that things could spring up and down on it. Look for suggestions about placing small objects, such as rice grains, on the drum skin and then striking it. Follow this suggestion and the children should see the rice grains bounce up and down due to the springiness of the drum skin.

This unit supports the concept of a ruler as a flat spring which can be used to make a sound. The concept of an elastic guitar is introduced, and the children are shown by clear illustrations how to play a very simple one using one elastic band and a finger and thumb.

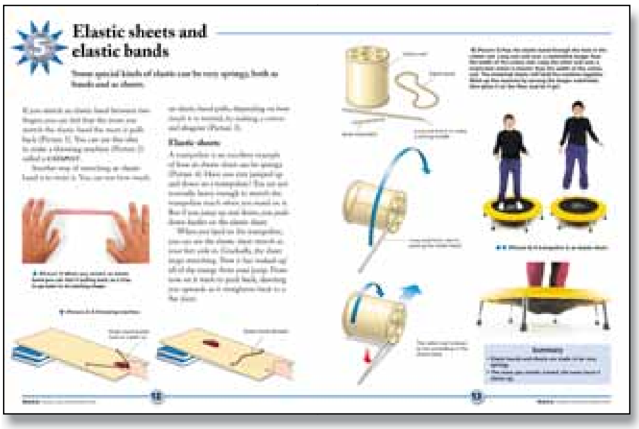
Musical instruments are divided into those with springy wires, such as the piano, and those with



springy sheets, such as the drum. The unit ends with words and pictures about an intriguing instrument from Africa called a thumb harp.

In the complementary work, the children use secondary sources to find out about the number of strings in different stringed instruments. In the activity, the children investigate how the strings on a guitar produce different sounds.

5 Elastic sheets and elastic bands

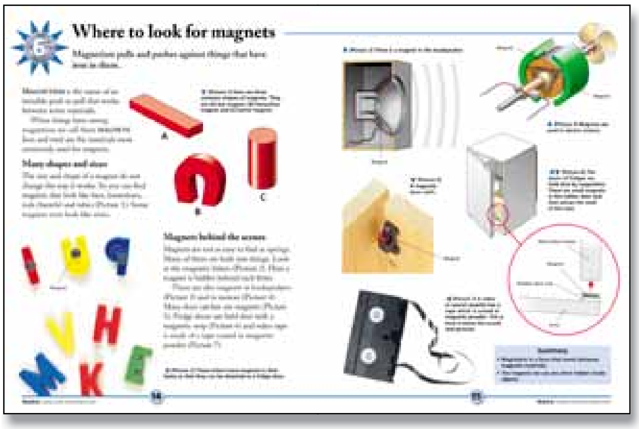


This unit ends the section on springs by showing how elastic bands, introduced as springs in Unit 1 and elastic sheets, introduced as flat springs in Unit 3 can be very springy indeed. Before you introduce this unit, you may like to place an elastic band under a box on a shelf at the back of the classroom. When the children have come in and settled, ask one of them to stand at the back and face the front. Hold up an elastic band and a piece of paper on which you have written a note such as, "Under the box is an elastic band. Use it to send this note back to me". Do not let the children see the contents of the note. Ask the children how you could use the elastic band to send the note to the child at the back of the room. Look for an answer about folding up the note and using your fingers and the elastic band as a catapult. Fire the message to the child and let him or her find the elastic band and fire the note back.

The unit opens by reminding the children what it feels like to pull an elastic band between their fingers. The catapult is given as an example of a throwing machine, and this is illustrated by showing how a car can be propelled up a ramp. Twisting as a means of stretching an elastic band is introduced by showing the children how to make and use a cotton reel dragster. The unit ends by considering how a trampoline can be used to make a person shoot into the air.

In the complementary work, the children can investigate the effect of thickness on elastic band strength and research throwing machines in history. In the activity, the children investigate how elastic bands push toy cars.

6 Where to look for magnets



This unit about magnets follows a similar format to Unit 1. You could begin by asking the children to tell you what they know about magnets. Look for answers that say they may be bar or horseshoe shaped, and that they pick up paperclips but do not pick up materials like paper or wood. Show the children a bar magnet and ask them where the paperclips would stick to it. Look for an answer about sticking to the ends. Tell the children that they cannot really go on a magnet hunt, like they did for springs, because magnets are often hidden from view. However, ask the children where they think there are magnets in the home, and look for an answer about the letters on a fridge door.

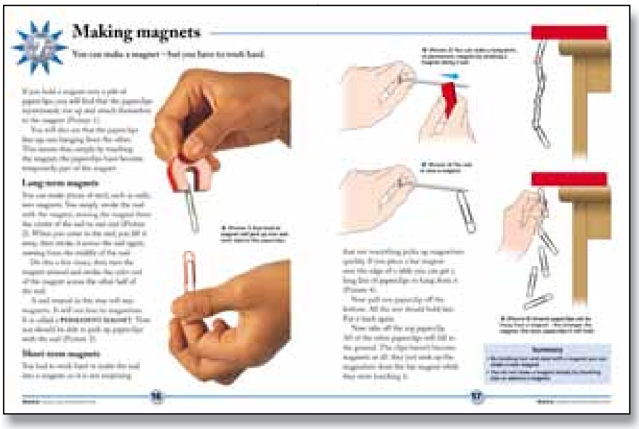
The unit begins by describing magnetism, and identifies iron and steel as the metals commonly used for magnets. The point is made that magnets can be made into different shapes, yet their magnetic properties are not lost. The way letters stay on a fridge door is revealed by showing that each letter contains a button-shaped magnet. This theme of magnets behind the scenes is developed in the rest of the unit where a loudspeaker, electric motor, the magnetic seal on a fridge door and a magnetic door catch are clearly illustrated. The unit ends by revealing that video and sound cassettes contain tapes coated in magnetic powder.

In the complementary work, the children test magnetic and non-magnetic materials. In the activity, the children investigate how paperclips cling to a wide range of magnets.

7 Making magnets

Having established the various shapes and uses of magnets in the previous unit, this one moves on to show how magnets can be made. To help illustrate this, you may like to begin by arranging a group of ten children in two lines of five, but they must stand looking in different directions. Tell the class that magnetic material behaves as if it has tiny magnets in it, but they are arranged in all directions, like the people in the two lines. Tell the class that one way to make a magnet is to rub a magnetic material with a magnet. Say that in this demonstration that you are the magnet and the ten children are a magnetic material. Move one way along the group and turn two people so they face in the same direction. Move away from the group and return to one end, then move down again and turn two more people to face the same direction. Repeat this until all the children are facing in the same direction. Tell the class that the tiny magnets in a magnetic material are lined up like this to turn the material into a magnet.

The unit opens by describing how paperclips can mysteriously rise up and attach themselves to a magnet. It is revealed that when this happens,



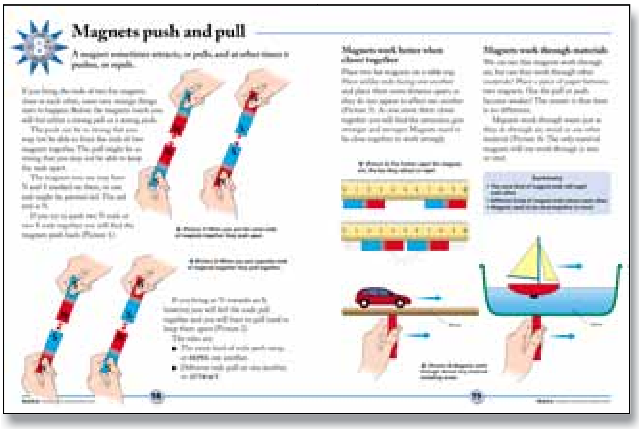
the paperclips themselves become magnets. The unit moves on to show how a magnet can be used to change a nail into a permanent magnet, but considerable effort has to be exerted to bring this about. The unit ends by considering the ease with which paperclips can be turned temporarily into magnets.

In the complementary work, the children can perform a second way of testing magnetic strength, and see how a needle can be turned into a magnet. In the activity, the children test the strength of magnets.

8 Magnets push and pull

This unit takes the study of magnets further by considering what happens when two magnets are brought together. If you used the introduction to the last unit, you may like to remind the children of how a magnet is made up of tiny magnets which are all facing the same way. Ask five children to come out and form a line, each one holding onto the one in front. Tell the class that the children represent a magnet. Now ask another five children to form a 'magnet'. Let the two magnets face each other and ask the class what might happen when they try to join together. Look for an answer about not joining together because they are facing opposite ways. Ask one 'magnet' to turn round. Ask the class what will happen now if the two magnets are brought together, and look for an answer about the magnets joining together because all the tiny magnets are facing the same way.

This unit keeps the concepts simple by referring to ends of magnets rather than poles and identifies the ends with the letters N and S instead of north and south. In doing this, the children quickly come



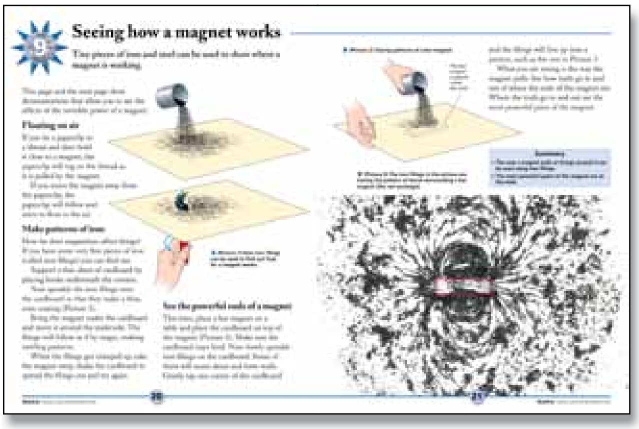
to understand how magnets attract and repel one another. The strength of the magnetic force between magnets is carefully linked to the distance between them. The unit ends by showing that magnets can work through a wide range of materials, even water.

In the complementary work, the children try and move a car with magnets. In the activity, the children investigate how magnets push and pull, and plan an investigation to test magnet strength.

9 Seeing how a magnet works

This unit builds on the last one to consider in greater detail how the magnetic force works. To demonstrate this, you could begin by showing the children two ring magnets. You could let one or two children handle them and see that they have similar properties to bar magnets despite their different shape. Challenge the children to think of a way that they may be able to make one magnet float above the other. Look for answers that lead you to place one magnet over a wooden rod, such as a piece of dowel, and letting it rest on the table, then place another ring magnet over the dowel, with its N end or S end facing the same end of the magnet on the table. When the second magnet is lowered it should float above the first magnet. If it is pushed close and released, it springs back up, showing the power of the invisible magnetic force.

This unit provides instructions on how to use iron filings and also features a large illustration of what can be achieved with iron filings and magnets. This



will be especially useful in cases where the practical work may be inappropriate for the children. The unit ends by relating the trails of iron filings in the pattern to the most powerful parts of the magnet.

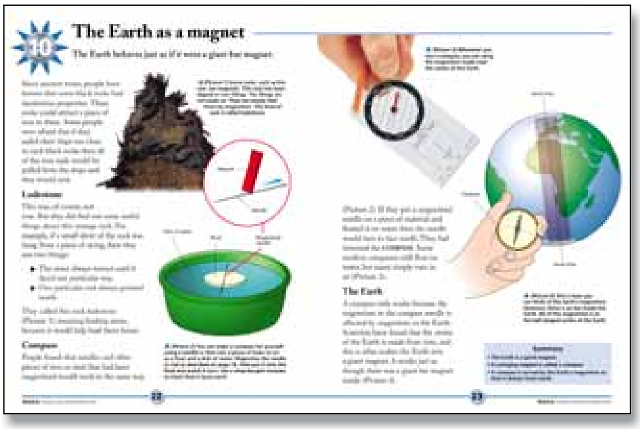
In the complementary work, you can demonstrate how panel pins can form a loop from a magnet. In the activity, the children investigate how magnets affect iron filings.

10 The Earth as a magnet

This unit consolidates work from the previous units while showing how the Earth behaves as if it contained a huge bar magnet. Begin by showing the children a globe. Tell the children that if they were thousands of kilometres out in space this is what the Earth would look like to them. Slowly turn the globe in an anticlockwise direction, as seen from the top, and tell the children that they would also see the Earth turn. Tell the children that, although no one has been deep inside the Earth, scientists think they know what it is made up of because of observations they make when the Earth shakes in an earthquake.

Shake a tin of cotton wool and a tin of nails and ask the children to suggest what makes the sound. Say that they have guessed the contents by making observations, just like the scientists. Tell the children that at the centre of the Earth is iron, and the way this iron moves as the Earth turns makes the Earth behave as a magnet.

The unit opens by introducing a rock called lodestone. A photograph shows how iron filings



behave when they coat the rock's surface. The children are reminded how a magnet can be made, then showed how the magnet can be used to make a simple compass. The unit ends by showing the children how to think about the Earth's magnetism, and reminding them that it is caused by a ball of iron in the planet's centre.

In the complementary work, the children discover a way to identify a lodestone. In the activity, the children use magnets to find north and south.

Index

There is an index on page 24.

Section 3: Using the pupil book and photocopiable worksheets

Introduction

There is a wealth of material to support the topic of springs and magnets in the pupil book and in the *Teacher's Guide*. On this and the following three pages, suggestions are made on how to use the worksheets and their associated teacher's sheets on pages 18 to 57, and how to integrate them for lesson planning. On the page opposite you will find the resource lists for introductory demonstrations, the complementary work and the activity worksheets. The learning objectives are shown on pages 16 and 17.

Starting a unit

Each unit in the pupil book forms the basis for a lesson. You may like to start by reading it with the class, or begin with a demonstration (see pages 7 to 13 and List 1 on page 15). Always begin the unit by reading the introductory sentences in bold type. This helps focus the class on the content of the unit and to prepare them for the work.

The first part of the main text introduces the content, which is then developed in the headed sections. The illustrations are closely keyed to the main text, and the captions of the illustrations develop the main text content (*see* 'The units' at the bottom of page 8).

With less skilled readers, you may prefer to keep to the main text and discuss the illustrations when they are mentioned. With more skilled readers, you may want to let them read the captions for themselves. Each unit ends with a summary. The children can use this for revision work. They can also use it to test their understanding by trying to explain the points made in the summary.

You can find the learning objectives for each unit on pages 16 and 17 of this *Teacher's Guide*.

The style and content of the unit also make it suitable for use in literacy work, where the needs of both English and science are met. You may wish to use the unit as a topic study in literacy work, or you may want to perform an activity in science time and follow it up with a study of the unit during literacy work.

Using the comprehension worksheets

Each unit in the pupil book has one photocopiable comprehension worksheet in this *Teacher's Guide* to provide a test. The learning objectives on page 16 are for these comprehension worksheets and relate directly to the knowledge and understanding component of the science curriculum.

The comprehension worksheets begin with simple questions and have harder questions towards the end.

The worksheets may be used singly, after each unit has been studied, or they may be used along with other worksheets to extend the study.

The teacher's sheet, which is opposite the comprehension worksheet, shows the answers and background information to the unit. This teacher's sheet also carries a section on work complementary to the study topic. This work may feature research using other sources. It may also have value in literacy work.

Using the activity worksheets

The activities are designed to develop skills in scientific enquiry. The learning objectives for practical skills associated with each unit are given on page 17. The activities may be small experiments, may focus on data handling or comprise a whole investigation.

Each activity section is a double page spread in this *Teacher's Guide*. On the left hand page is a photocopiable activity worksheet to help the children in practical work, or it may contain data for the children to use or interpret. The page opposite the worksheet is a teacher's sheet providing a step-by-step activity plan to help you organise your work. Each plan has a set of notes which provide hints on teaching or on the use of resources. The activity plan ends with a conclusion, which you may like to read first, to help you focus on the activity in your lesson planning.

Planning to use a unit

The materials in this pack are very flexible and can be used in a variety of ways. First, look at the unit and activity objectives on pages 16 and 17. Next, read the unit in the pupil book, and the associated worksheet and activity units in this *Teacher's Guide*. Finally, plan how you will integrate the material to make one or more lessons. You may wish to add more objectives, or replace some of the activity objectives with some of your own.

Safety

The practical activities feature equipment made from everyday materials or available from educational suppliers. However, make sure you carry out a risk assessment, following the guidelines of your employer, before you do any of the practical activities in either the pupil's book or the *Teacher's Guide*.

Resources

The three lists below show the resources needed to support the photocopiable worksheets.

- ▶ List 1 shows resources for demonstrations suggested for starting a unit.
- ▶ List 2 gives resources needed for the complementary work featured on the teacher's sheet associated with each comprehension worksheet.
- ▶ List 3 details those resources needed for the 10 activity worksheets.

List 1 (Starting a unit with a demonstration)

▼ UNIT

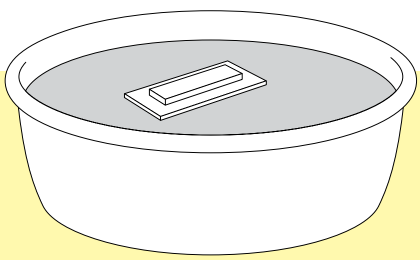
1. Toys with springs inside them.
2. A toy which moves using clockwork.
3. Open-coil spring, paper balls, rulers.
4. A drum and drum stick, some grains of rice.
5. Elastic band, sheet of paper, box.
6. A bar magnet.
7. –
8. –
9. A piece of dowel, two ring magnets.
10. A globe.

List 2 (Complementary work)

Each group will need the following items:

▼ UNIT

1. An open-coil spring, such as in a stapler or mattress, a closed-coil spring, such as in a spring balance.
2. A closed-coil spring, a support for the spring, a scale pan or yoghurt pots, weights or marbles, a ruler.
3. Secondary sources about the use of flat springs in horse drawn carriages, early cars, trains and suspension systems in modern cars.
4. Secondary sources about stringed instruments.
5. (a) A long board with two nails firmly hammered in near one end, an elastic band, a toy car, eye protection, ruler.
   (b) Secondary sources about throwing machines in history.
6. A magnet, freedom to move around the classroom testing different materials.
7. (a) A collection of different magnets, paperclips, a ruler.
   (b) A string, magnet, a needle, a safe place to keep the needle and magnet for a few days.
8. A plastic (lightweight) car, two bar magnets, sticky tape.
9. A bar magnet, panel pins.
10. A piece of lodestone, other rocks of similar size and colour, paperclips or panel pins.



▲ *Investigating magnetic pushes and pulls in the activity for Unit 8.*

List 3 (Activity worksheets)

Each group will need the following items:

▼ UNIT

1. Access to the classroom and other parts of the school. Could also be set as homework.
2. An open-coil and a closed-coil spring.
3. Twelve strips of cardboard about 18cm by 4cm, sticky tape, a piece of string about 50cm long with a loop tied in one end, a small plastic or wooden block.
4. A guitar with six strings (not a toy).
5. A long board with two screw-in hooks near one end, an elastic band, a toy car, eye protection, ruler.
6. A bar magnet, a horseshoe magnet, a ring or disc magnet, paperclips, a loudspeaker removed from its cabinet by an electrician or other similarly competent person (it must not have a wire which could connect it to a music system), an electric motor with its casing removed by an electrician or other competent person (it must not have a wire or plug which can connect it to a power supply).
7. A collection of different magnets, paperclips.
8. A bowl of water, a piece of wood, cork or a plastic float, two bar magnets, pieces of card, paperclip.
9. A container with iron filings inside. Purpose built containers are obtainable from educational suppliers, clear plastic bags may be used or a container made from a piece of card with a piece of clear plastic (from a plastic bag) taped onto the front may be suitable for some children. Eye protection will be needed if containers are not used. Two bar magnets, a horseshoe magnet.
10. A piece of paper, scissors, thread, a support (this could be made from a cereal packet which has its front and back removed), a bowl of water, wood, plastic or cork float, compass.

Learning objectives

Comprehension worksheets

The table below shows the learning objectives for knowledge and understanding associated with each unit in the pupil book, using the comprehension worksheets in this *Teacher's Guide*:

Unit 1

- A spring goes back to its starting shape when it is no longer pushed or pulled.
- Springs can be made of many materials.
- Springs can have many shapes.

Unit 2

- Springs can be made to push.
- Springs can be made to pull.
- Springs can be made to support weight.

Unit 3

- Some materials have a natural springiness.
- Bars of some springy materials can be used as springs.

Unit 4

- When a spring moves backwards and forwards very quickly it makes a sound.
- Springy wires and sheets can be used to make musical instruments.

Unit 5

- Elastic bands and sheets are made to be very springy.
- The more an elastic band or sheet is stretched, the more force it stores up.

Unit 6

- Magnetism is a force which works between magnetic materials.
- Magnets can be made in many shapes.
- Magnets have many uses.

Unit 7

- A new magnet can be made by stroking a piece of iron or steel with a magnet.
- A permanent magnet cannot be made by simply touching iron or steel with a magnet.

Unit 8

- The two ends of a magnet behave in different ways.
- Some ends of magnets are attracted to each other.
- Some ends of magnets are repelled by each other.
- Magnets can work through some materials.

Unit 9

- Iron filings can be used to show the way a magnet pulls on magnetic materials.
- The most powerful parts of a magnet are its ends.

Unit 10

- The Earth is a giant magnet.
- Lodestone is a rock with magnetic properties.
- A compass uses magnetism to show us directions.

Learning objectives

Activity worksheets

The table below shows the learning objectives for practical skills associated with each unit in the pupil book, using the activity worksheets in this *Teacher's Guide*:

Unit 1
- Make careful observations.
- Record observations in written form.

Unit 2
- Use simple equipment safely.
- Record observations diagrammatically.

Unit 3
- Follow instructions.
- Make predictions and test them.
- Identify a pattern.

Unit 4
- Treat equipment with care.
- Make predictions and test them.
- Find a pattern in observations.

Unit 5
- Plan an investigation.
- Construct a table and record results in it.
- Make careful measurements.
- Identify a pattern in results.

Unit 6
- Make careful observations.
- Record observations in diagrammatic form.

Unit 7
- Plan and carry out an investigation.
- Construct a table and record results.
- Draw conclusions from results.

Unit 8
- Make predictions and test them.
- Apply previous knowledge to design an investigation.
- Make a written report of an investigation.

Unit 9
- Use equipment and materials safely.
- Make careful observations.
- Record an observation as a diagram.
- Make predictions and compare them with results.

Unit 10
- Repeat tests to produce more accurate results.
- Draw conclusions from results.

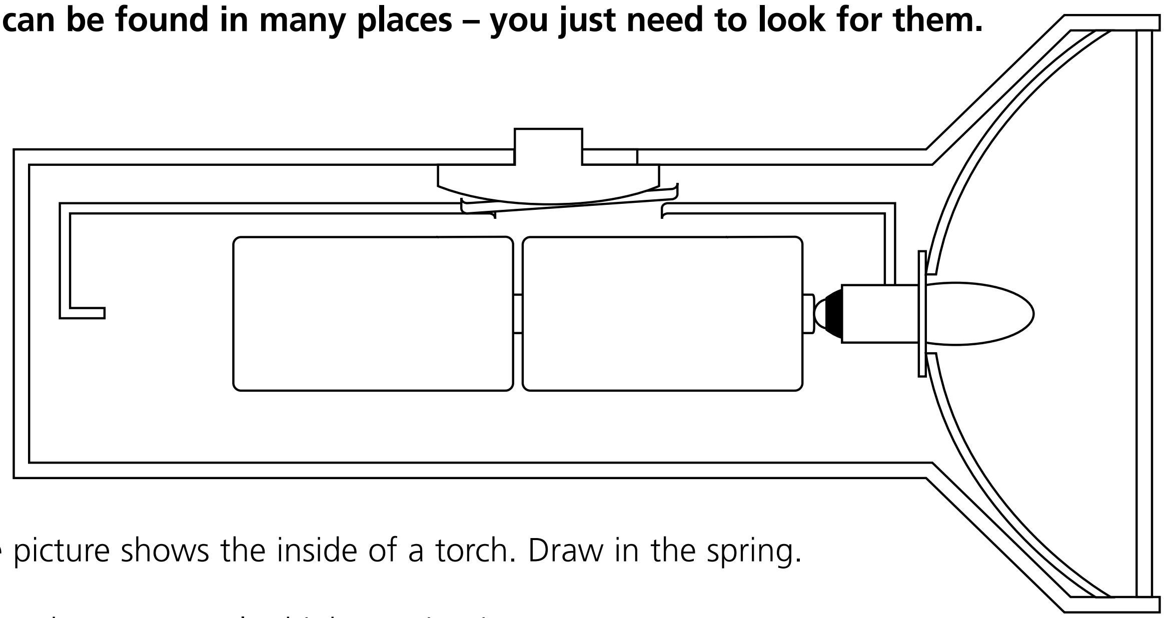
1

Name: .... Form: ....

See **pages 4 and 5** of *Springs and magnets*

Where to look for springs

Springs can be found in many places – you just need to look for them.



Q1. The picture shows the inside of a torch. Draw in the spring.

Q2. What do most people think a spring is?

....

Q3. What kind of spring can be used to hold a paper cover on a jar?

....

Q4. Name two springs made from a bent piece of metal.

....

Q5. (i) What happens when we push or pull on a spring?

....

(ii) What happens when you let go of a spring?

....

Q6. Why is there a spring in a door latch?

....

Q7. What do you think the spring in the torch does?

....

Teacher's sheet: comprehension

See **pages 4 and 5** of *Springs and magnets*

Answers

1. **The spring should be drawn in between the metal bar and the left-hand battery.**
2. **A piece of wire made into a coil.**
3. **An elastic band.**
4. **A paperclip and a bulldog clip.**
5. **(i) It changes shape; (ii) It springs back to the shape it started with.**
6. **To hold the door shut when you close it.**
7. **It pushes against the batteries. (It also conducts electricity but the children may not know about electrical conduction at this stage.)**

Complementary work

Show the children an open-coil spring, such as the one in a stapler or in a mattress. Show them a closed-coil spring, such as in a spring balance. Ask the children how the shape of the spring changes when it is in use and what it does to go back to its resting shape.

Teaching notes

There are two kinds of coiled spring. They are the open-coil spring and the closed-coil spring. In the open-coil spring the wire coils have spaces between them. The open-coil spring is squashed when it is in use and lengthens to go back to its starting shape. The closed-coil spring is stretched when it is in use and shortens when it goes back to its starting shape.

Open-coil springs are designed for squashing. A bed spring, for example, has an open coil.

A closed-coil spring has wire coils with no space between them. They are designed for stretching. The spring in a spring balance is an example of a closed-coil spring. Some camp beds and garden chairs have closed-coil springs which stretch to give support.

The children may ask why a bed spring is cone shaped. The reason for this is that a spring which has a wide diameter is more squashy than one with a small diameter. In the cone-shaped bed spring the wide part of the coil squashes easily to make the mattress soft, but the narrow part squashes less easily and keeps the body from the hard base of the bed frame.

1

Name: .... Form: ....

Based on **pages 4 and 5** of *Springs and magnets*

Looking for springs

Try this...

1. Look around your classroom, school or home for springs.

When you find one fill in this table.

Where the spring is	What the spring does

2. Where did you find the largest spring? ✏ ....

3. Where did you find the smallest spring? ✏ ....

Teacher's sheet: activity

Based on **pages 4 and 5** of *Springs and magnets*

Introducing the activity

(a) Use this activity after the children have read pages 4 and 5 in the pupil book. Tell the children that they are going to look for springs around the school, or you can issue the sheet for homework (see note (i)).

Using the sheet

(b) Give out the sheet, let the children fill in their names and form, then go through task 1.

(c) Let the children try task 1.

(d) Go through tasks 2 and 3, then let the children try them.

Completing the activity

(e) Let the children compare their results.

Conclusion

Springs are used in many different places. They may be used to pull or push on an object, or their stretchiness may have another use, such as helping things to be weighed, as in a spring balance. They may also allow a wire to be stored in a small space yet still be stretched, such as in the cable from a telephone or on a head set attached to a music system. A spring may also be squashed to provide comfort as in the case of springs in mattresses.

Teaching notes

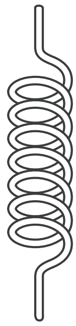
(i) If the children use the sheet for homework, tell them not to dismantle anything, such as a torch, to look for springs unless an adult helps them and reassembles the item correctly.

Name: .... Form: ....

See **pages 6 and 7** of *Springs and magnets*

Springs at work

Many springs are made of metal coils. These springs can push, pull or just support things.



Q1. (i) Draw what would happen to the spring in the diagram if you pulled downwards on it.

(ii) Say what would happen if you let go of the spring.

✏ ....

✏ ....

Q2. Name a piece of furniture which contains springs. ✏ ....

Q3. (i) When you push down on a door handle, what happens to the spring inside it?

✏ ....

(ii) When you let go of the handle, what does the spring do?

✏ ....

Q4. What is a clock spring designed to do?

✏ ....

Q5. What is a clock spring connected to?

✏ ....

Q6. What must you do to a spring in a clock to make the clock work?

✏ ....

2

Teacher's sheet: comprehension

See **pages 6 and 7** of *Springs and magnets*

Answers

1. **(i) The spring is longer, there are wider gaps between the coils; (ii) The spring would go back to its original length and shape.**
2. **A chair.**
3. **(i) It is stretched; (ii) It pulls the door handle back up.**
4. **To push.**
5. **A set of toothed wheels.**
6. **Wind it up.**

Complementary work

The children could hang a closed-coil spring from a support and add a scale pan or yoghurt pot to the lower end. They could then add weights and see how the spring stretched. They should find that the spring stretches in a regular way as more and more weights are added.

More able children may be able to find out that when the weight doubles the extension (not the total length) is also doubled.

Teaching notes

In this unit, the idea that springs push and pull is introduced. In earlier school work the children should have studied pushes and pulls and may even have heard of the word force.

You could now link the ideas together and say that when pushing forces are applied to the ends of a spring, the spring exerts pushing forces in the opposite direction. If the pushing forces on the ends are stronger than the forces exerted by the spring, the coils in the spring are pressed together. If the pushing forces of the spring can match those pushing on its ends, the spring will not be squashed flat. This is what happens in springs in furniture. If the springs were squashed flat, people sitting on a chair or sofa would feel the springs pressed against the furniture frame.

When considering a closed-coil spring that is stretched, you could say that when pulling forces are applied to the ends of the spring, the spring exerts pulling forces in the opposite direction. If the pulling forces on the ends of the spring are stronger than the forces exerted by the spring, the coils can be pulled far apart.

It is important to note that when a spring has been pulled to a certain length it loses its elasticity and will no longer return to its original length when the pulling force is removed from its ends.

Springs return to their normal length when the forces pulling or pushing on them are removed. This happens because the force they exert has nothing to oppose it so the spring springs back into shape.

2

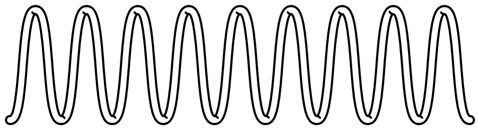
Name: .... Form: ....

Based on **pages 6 and 7** of *Springs and magnets*

Springs and forces

Try this...

Diagram 1



1. Take a spring like the one shown in Diagram 1.

2. Press on the ends of the spring. What do you feel?

✏ ....

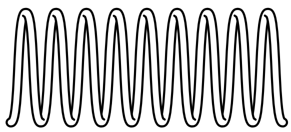
3. In this space, draw the spring as it appears when you are pressing it.

4. On your diagram, use black arrows to show the forces you made when you pressed on it.

5. On your diagram, use blue arrows to show the forces made by the spring.

6. Take a spring like the one shown in Diagram 2.

Diagram 2



7. Pull on the ends of the spring. What do you feel?

✏ ....

8. In this space, draw the spring as it appears when you are pulling it.

9. On your diagram, use black arrows to show the forces you made when you pulled it.

10. On your diagram, use blue arrows to show the forces made by the spring.

Teacher's sheet: activity

Based on **pages 6 and 7** of *Springs and magnets*

Introducing the activity

(a) If you haven't done the complementary work in Unit 1, you may like to show the children the springs in a stapler and a spring balance. Point out that the spring in the stapler has coils which have spaces between them so that when the stapler is full it pushes on the staples to keep them in place. Also point out that the spring balance has no spaces between its coils and it is designed to stretch when the spring balance is in use.

Tell the children that they are going to look more closely at the forces which occur when a spring has changed its shape. Remind the children that forces can be represented as arrows.

Using the sheet

(b) Give out the sheet, let the children fill in their names and form, then go through tasks 1 and 2.

(c) Let the children try tasks 1 and 2.

(d) Go through task 3, then let the children try it (see note (i)).

(e) Go through tasks 4 and 5, then let the children try them.

(f) Go through tasks 6 and 7, then let the children try them.

(g) Go through task 8, then let the children try it.

(h) Go through tasks 9 and 10 with the children, then let them try them.

Completing the activity

(i) Let the children compare their answers.

Conclusion

When the ends of an open-coil spring are pressed, the spring becomes shorter. A pushing force from the spring can be felt in the hands. In the diagram, black arrows at the ends of the spring should point towards the ends of the spring. Blue arrows in the spring, or on top of it, should point outwards from the centre of the spring towards the ends.

When the ends of a closed-coil spring are pulled, the spring becomes longer. A pulling force from the spring can be felt in the hands. In the diagram, black arrows at the ends of the spring should point away from the ends of the spring. Blue arrows in the spring, or on top of it, should point from the ends of the spring towards the centre.

Teaching notes

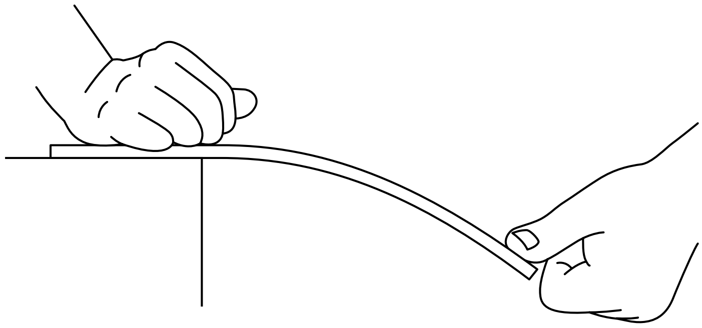
(i) The children cannot physically keep pressing on the spring and draw it at the same time. They must either remember what the spring looked like, or ask a friend to press on the spring while they draw it.

Name: .... Form: ....

See **pages 8 and 9** of *Springs and magnets*

Flat springs

Flat pieces of material and long pieces of wire can be used as springs.



Q1. The picture shows someone holding down the end of a ruler. In the box, draw what happens when the hand is taken away from the end of the ruler.

Q2. (i) Think of a piece of stiff plastic sheet held up with books at its corners. What happens to the plastic if you put some light weights in the middle of it?

✎ ....

(ii) What happens to the sheet of plastic when you take the weights off?

✎ ....

Q3. What are flat springs called? ✎ ....

Q4. Name two types of vehicle which have flat springs.

✎ .... ✎ ....

Q5. What material is used to make flat springs in vehicles? ✎ ....

Q6. Why do you think springs are used in vehicles?

✎ ....

✎ ....

✎ ....

Teacher's sheet: comprehension

See **pages 8 and 9** of *Springs and magnets*

Answers

1. **The end of the ruler goes up and down.**
2. **(i) The sheet bends down in the middle; (ii) The sheet straightens again.**
3. **Leaf springs.**
4. **Cars, trucks, trains, carriages.**
5. **Steel.**
6. **To give a smoother ride. To make it less bumpy for the passengers. To make the ride more comfortable.**

Complementary work

The children can use secondary sources to find out about the use of leaf springs in horse-drawn carriages and early cars, railway carriages and the type of springs used in the suspension of modern cars.

Teaching notes

You may like to use this unit with Unit 4 'Springy materials' in *3C Properties of materials* in this series. Together, they provide the children with a comprehensive view of springiness.

In the two previous units the work has explored the appearance and behaviour of coiled springs. In this unit, the concept of springiness is taken further, to show that some materials have a natural springiness and do not have to be bent into a coil to be of some use. However, shape is still important as the children will find out in the activity. Here the children discover that once a flat shape is built up into a thick bar it loses much of its springiness.

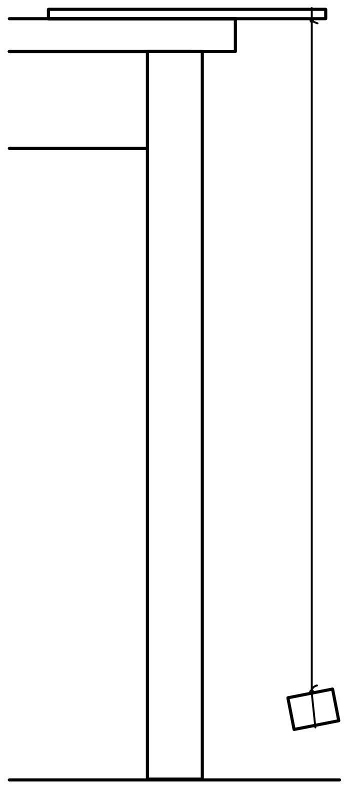
While flat springs play an important part in transport, you may like to point out that a bow and a crossbow are examples of flat springs that were once used as weapons.

Name: .... Form: ....

Based on **pages 8 and 9** of *Springs and magnets*

Investigating flat springs

Try this...



1. Cut out 12 strips of cardboard. Each strip should be about 18cm long and 4cm wide.

2. Take one strip of cardboard and tie a small object to the end of it as the diagram shows.

3. Move the strip so that 6cm of it hangs over the end of the table.

4. Move the string so that it is 1cm from the end of the strip.

5. Bend the end of the strip down a little and let it go. What happens to the object on the string?

✏ ....

✏ ....

✏ ....

6. Predict what would happen if you used three cardboard strips instead of one.

7. Repeat steps 3, 4 and 5 with three cardboard strips. What happens to the object on the string?

✏ ....

✏ ....

8. Predict what would happen if you used 12 cardboard strips instead of one.

9. Repeat steps 3, 4 and 5 with 12 cardboard strips. What happens to the object on the string?

✏ ....

✏ ....

Teacher's sheet: activity

Based on **pages 8 and 9** of *Springs and magnets*

Introducing the activity

(a) You may like to use this activity either before or after the children study pages 8 and 9 in the pupil book. If the children have done the activity in the introduction to this unit on page 10 of this *Teacher's Guide*, you may like to remind them of it.

Tell the children that they are going to see how the thickness of spring affects its springiness, but instead of firing objects into the air, they are going to make an object move up and down under the spring (see note (i)).

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, go through task 1, then let the children it (see note (ii)).

(c) Go through task 2, then let the children try it (see note (iii)).

(d) Go through tasks 3 and 4, then let the children try them (see note (iv)).

(e) Let the children try task 5, then let the children try it.

(f) Go through tasks 6 and 7, then let the children try them (see note (v)).

(g) Go through tasks 8 and 9, then let the children try them.

Completing the activity

(h) Let the children report on their findings.

(i) Let the children draw a conclusion from their work.

Conclusion

When a single piece of card is bent and released it springs up and down a little and raises the object a little way on the string.

When three pieces of card are bent and released they spring more strongly and make the object rise higher. When 12 pieces of card are bent and released they hardly move and the object only rises a little way.

The springiness of a flat spring depends on its thickness. The springiness of a flat spring increases with its thickness up to a point then decreases again as the spring becomes thicker.

Teaching notes

(i) This allows the activity to be more manageable by keeping the moving object generally beneath the table.

(ii) Depending on the ability and attitude of the children you may prefer to prepare the strips before the activity.

(iii) A lasso-type loop should be prepared at the end of the string so it can easily fit over the end of the cardboard and be easily transferred to other groups of cardboard strips in the activity. The small object could be a small plastic or wooden block.

(iv) You may like to demonstrate this.

(v) The strips should be stuck together using two pieces of sticky tape.

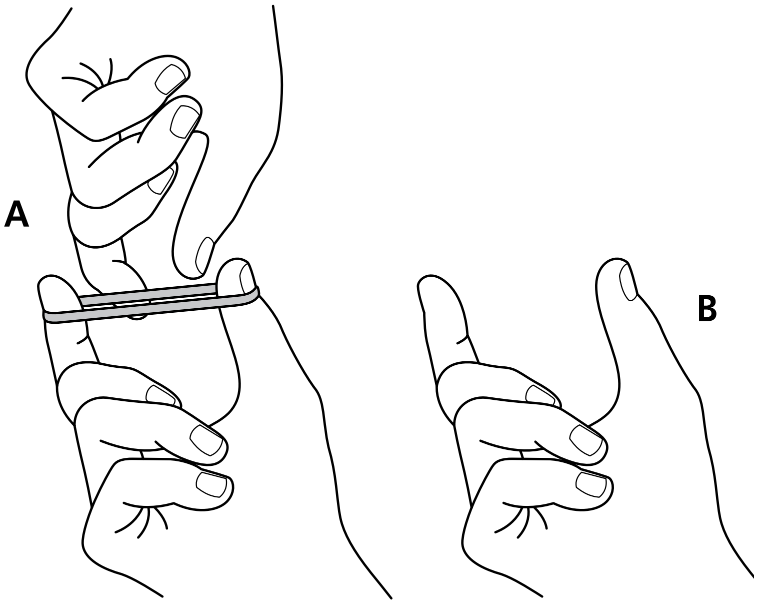
4

Name: .... Form: ....

See **pages 10 and 11** of *Springs and magnets*

Musical springs

If you make a springy material go back and forth very fast, it will make a sound.



Q1. Picture A shows an elastic band being plucked. In picture B, draw what happens to the elastic band next.

Q2. What kind of sound does an elastic band make?

✏ ....

Q3. Name two musical instruments which have springy wires.

✏ .... ✏ ....

Q4. Name an instrument which has a springy sheet. ✏ ....

Q5. (i) Where does a thumb harp come from? ✏ ....

(ii) What part of the harp makes the sound?

✏ ....

✏ ....

Q6. Look at the pictures at the top of this sheet again.

(i) What will happen to the sound if the finger and thumb are moved further apart?

✏ ....

(ii) What will happen to the sound if the finger and thumb are moved closer together?

✏ ....

4 Teacher's sheet: comprehension

See **pages 10 and 11** of *Springs and magnets*

Answers

1. **The elastic band should be shown vibrating.**
2. **A twanging sound.**
3. **A violin, guitar, piano.**
4. **A drum.**
5. **(i) Africa; (ii) Metal leaf springs or thin pieces of steel.**
6. **(i) The sound will go higher; (ii) The sound will go lower.**

Complementary work

The children can use secondary sources to find out how many strings are found on the piano, harp, guitar, banjo, ukelele, violin, viola, double bass and sitar.

Teaching notes

This unit introduces some concepts which the children will find useful later in their science course in different contexts.

The rapid to and fro movement of a string or drum skin is called a vibration. This causes particles in the air to vibrate too. The vibration passes through the air as a sound wave and when it enters the ear it causes the ear drum to vibrate. This is connected, through tiny bones in the ears (which act as levers to strengthen the vibration), to nerves which carry messages about the sound to the brain.

From earlier work, or from general knowledge, the children may be familiar with sounds like 'ping' referred to as a high sound, while sounds like 'pong' are called low sounds. These terms actually refer to low-pitched sounds and high-pitched sounds. A sound is made by a vibrating object. The speed of vibration is called its frequency. An object which vibrates with a low frequency makes a low-pitched sound. An object which vibrates with a high frequency makes a high-pitched sound.

4

Name: .... Form: ....

Based on **pages 10 and 11** of *Springs and magnets*

Investigating guitar strings

Try this...

1. Look at the guitar. How many strings does it have? ✏ ....

2. How do the strings compare?

✏ ....

✏ ....

✏ ....

3. Pluck the top string and the one below it.

4. How do the sounds of the two strings compare?

✏ ....

5. What may cause the difference in the sounds?

✏ ....

6. Look at the next string down. Predict how its sound will compare with the string that is next to the top one.

✏ ....

7. Test your prediction. What did you find?

✏ ....

8. How does the sound of a guitar string change when you press your finger in the middle of it and pluck it?

✏ ....

9. Does the sound of the string depend on where you put your finger?
Explain your answer.

✏ ....

✏ ....

✏ ....

Teacher's sheet: activity

Based on **pages 10 and 11** of *Springs and magnets*

Introducing the activity

(a) Use this activity either straight after the introduction to the unit on page 10 of this *Teacher's Guide*, or after the children have studied pages 10 and 11 in the pupil book (see note (i)).

Take the children into the hall. Remove the front of the piano and let them see the piano wires. Play a few notes and tell them that the sounds are due to the springiness of the wires. Tell the children that they are going to look at an instrument which has fewer wires but still makes a wide range of sounds.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, go through task 1, then let the children try it.

(c) Go through task 2, then let the children try it (see note (ii)).

(d) Go through tasks 3, 4 and 5, then let the children try them (see note (iii)).

(e) Go through tasks 6 and 7, then let the children try them (see note (iv)).

(f) Go through task 8, then let the children try it (see note (v)).

(g) Go through task 9, then let the children try it (see note (vi)).

Completing the activity

(h) Let the children compare their results.

Conclusion

The guitar has six strings. The strings have different thicknesses. The top string is the thickest and the bottom string is the thinnest. The top string has a lower sound than the one next to it. The difference is due to the difference in thickness of the strings.

The string sounds higher when a finger is pressed on it. As the finger moves down the fret board the sound gets higher.

Teaching notes

(i) Some children may need help with the idea of comparing. You may have to help secure this skill by letting them compare a pencil and a pen first.

(ii) Show the children how a guitar is held. The top string is the thickest and the bottom string is the thinnest.

(iii) The children may need reminding that some sounds are high, or high-pitched, sounds and others are low, or low-pitched, sounds.

(iv) Some children may need it made clear that the third string down is being investigated in this task.

(v) Show the children that the string is pressed on the arm of the guitar, which has metal strips across it. This part of the guitar is called the fret board and the metal strips are frets.

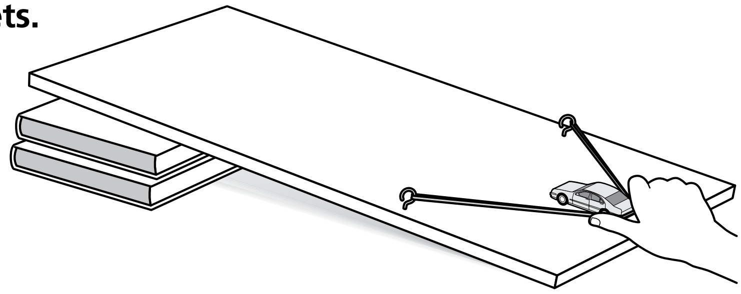
(vi) Tell the children that they should place their finger at several places on the string and pluck each time. Tell them they should see if the sound is related to the position of the finger.

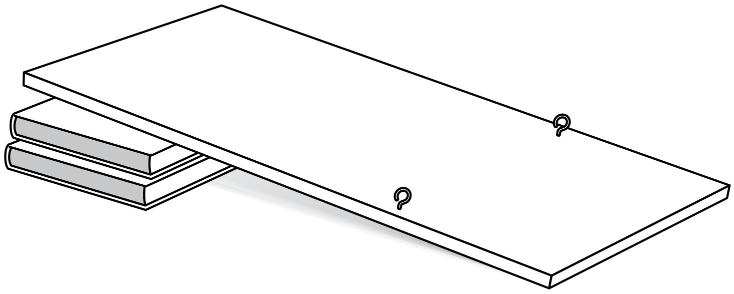
Name: .... **Form:** ....

See **pages 12 and 13** of *Springs and magnets*

Elastic sheets and elastic bands

Some special kinds of elastic can be very springy, both as bands and as sheets.





Q1. In the lower picture, draw what happens to the elastic band and the car when the hand lets them go.

Q2. Name one kind of throwing machine.

....

Q3. In what way is an elastic band stretched in a cotton reel dragster?

....

Q4. How can you stretch a trampoline?

....

Q5. What makes you shoot upwards on a trampoline?

....

....

Q6. (i) What do you feel when you put an elastic band between two fingers and move the fingers apart?

....

....

(ii) Why does the elastic band behave in this way?

....

....

Teacher's sheet: comprehension

See **pages 12 and 13** of *Springs and magnets*

Answers

1. **The car moves up the ramp, the elastic band bends up the ramp.**
2. **A catapult.**
3. **It is twisted.**
4. **Jump up and down on it.**
5. **The sheet pushes back as it tries to straighten.**
6. **(i) The more you stretch the elastic band, the more it pulls back; (ii) It tries to go back to its starting shape.**

Complementary work

(a) The children could use the equipment from activity 5 to investigate how the thickness of an elastic band affects its strength.

(b) The children could use secondary sources to find out about the use of throwing machines in history.

Teaching notes

The illustrations in picture 3 show the basic steps in the making of a cotton reel dragster. The success will depend on the size and strength of the elastic band, the way the short matchstick grips the cotton reel, the ease with which the long matchstick slides over the surface of the cotton reel and the grip between the cotton reel and the surface it is moving along. Over the years there have been many modifications to this basic design that you may wish your children to use in making their cotton reel dragsters. Here are some examples of modifications that could be made:

- ▶ The short matchstick can be stuck in place with sticky paper.
- ▶ A wax washer can be made by cutting a one centimetre slice from the end of a household candle. A groove can be cut in one side to hold the long matchstick The washer can then be placed between the long matchstick and the cotton reel. This helps the long matchstick to turn on the cotton reel by reducing friction. The long matchstick may be held in the groove with sticky tape.

  You will need to make the wax washers for the children but they should be able to add the new components. This activity can be linked with studies in *4E Friction* in this series.

If you wish the children to know about energy, you may say that energy is stored in an elastic sheet or band when it is stretched. This energy is called strain energy (or elastic potential energy). When the elastic material is allowed to release this energy it is converted into movement energy as the elastic material springs back to its original shape. Some of this movement energy is transferred to any object in contact with the contracting elastic material.

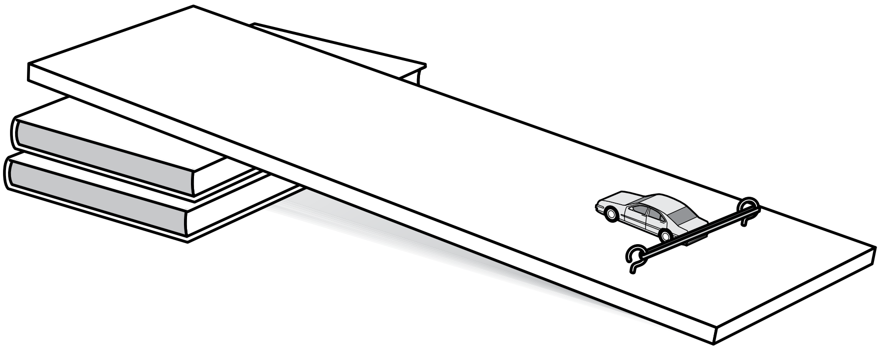
Name: .... Form: ....

Based on **pages 12 and 13** of *Springs and magnets*

The car catapult

Try this...

1. Set up the car catapult as shown in the diagram.



2. What do you think will happen to the car if you pull the elastic band back a short way and then let go?

....

3. Test your prediction. What did you find?

....

4. What do you think will happen to the car if you pull the elastic band back a long way and then let go?

....

5. Test your prediction. What did you find?

....

6. Write up a plan to test for a pattern between the stretch of the elastic band and the distance the car travelled?

....

....

....

....

....

7. On a separate piece of paper, draw a table in which to record your results.

8. Show your teacher your plan and table. If your teacher approves, try your test.

5 Teacher's sheet: activity

Based on **pages 12 and 13** of *Springs and magnets*

Introducing the activity

(a) You can use this activity after the children have studied pages 12 and 13 in the pupil book. If you performed the activity in the introduction to this unit on page 11 of this *Teacher's Guide*, you can remind them of the catapult you made. You can also remind them of the car on the ramp in the pupil book and tell the children that they are going to make an investigation about a car catapult.

Using the sheet

(b) Give out the sheet, let the children fill in their names and form. Go through task 1, then let the children try it (see note (i)).

(c) Go through task 2, then let the children try it.

(d) Go through task 3, then let the children try it.

(e) Go through tasks 4 and 5, then let the children try them.

(f) Go through tasks 6 to 8, then let the children try them (see notes (ii) and (iii)).

Completing the activity

(g) Let the children compare their results.

Conclusion

When the elastic band is pulled back a short way and released, the car only travels a short distance. When the elastic band is pulled back a long way and released, the car travels a long distance. The more the elastic band is stretched, the further the car travels when the elastic band is released.

Teaching notes

(i) Screw the hooks into the board for the children so that they are firmly held in place and will not fly out when an elastic band is stretched between them. Eye protection should be worn. If the board is long and the elastic band is weak, you may prefer to keep the board flat. If the board is short and the elastic band is strong, you may like to raise the end of the board, as shown in the diagram, to prevent the car travelling over the end of the board.

(ii) The elastic band should be stretched to different measured distances and the distance travelled by the car should be measured each time the elastic band is released. The table should have two columns headed: 'Stretch of elastic band (cm)' and 'Distance travelled by car (cm)'. The table may have several columns for the distance travelled by the car if the children have decided to repeat their measurements.

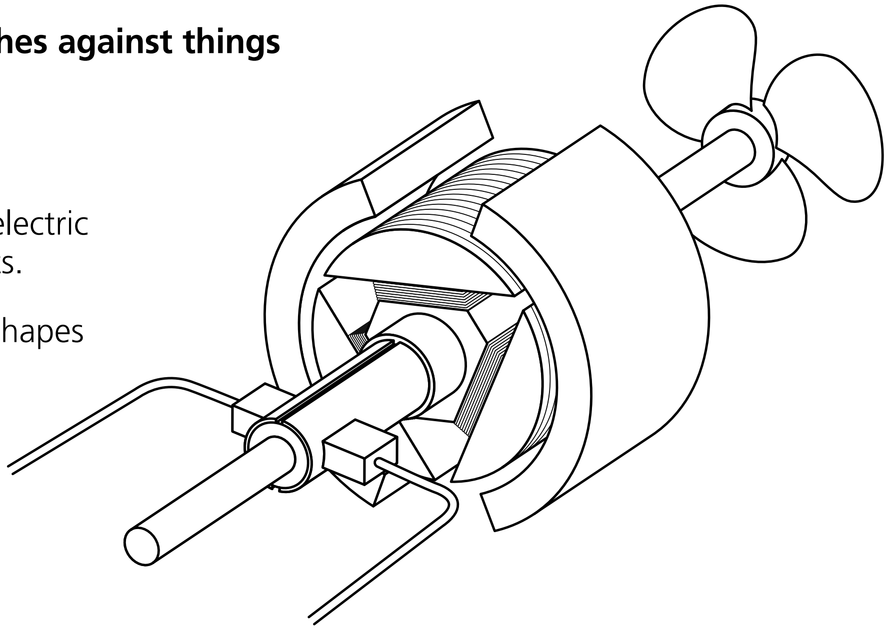
(iii) You may like to use ICT to present the results in a table or to make bar graphs.

Name: .... Form: ....

See **pages 14 and 15** of *Springs and magnets*

Where to look for magnets

Magnetism pulls and pushes against things that have iron in them.



Q1. The picture shows an electric motor. Shade in the magnets.

Q2. Name three common shapes of magnets.

✎ ....

✎ ....

✎ ....

Q3. Why do plastic letters stick to fridge doors?

✎ ....

Q4. Where is a magnet used to make sounds?

✎ ....

Q5. Think of a video recorder in use.

(i) Where is magnetic powder used?

✎ ....

(ii) What does the magnetic powder do?

✎ ....

Q6. When you close a fridge door it stays shut even though there is not a lock. Explain why this happens.

✎ ....

✎ ....

✎ ....

✎ ....

Teacher's sheet: comprehension

See **pages 14 and 15** of *Springs and magnets*

Answers

1. **The two pieces of metal enclosing the central coil should be shaded.**
2. **Bar, horseshoe, barrel.**
3. **Because they have a magnet in them which sticks to the metal.**
4. **In a loudspeaker.**
5. **(i) On the video tape; (ii) It stores sound and pictures.**
6. **There are small magnets in the rubber door seal that attract the steel in the case of the fridge and holds the door to it.**

Complementary work

If the children do not fully understand the difference between magnetic and non-magnetic materials, let them test a wide range of objects in the classroom with a magnet and record their results in a table.

A magnetic material is one to which a magnet sticks. A non-magnetic material is one to which a magnet does not stick. The children should discover that not all metals are magnetic. Do not let the children bring their magnets near a television or any part of a computer.

Teaching notes

Iron and steel are the most widely used magnetic metals. Nickel and cobalt are two other metals which have magnetic properties. You may also see some magnets, particularly those in the form of a ring, advertised as ceramic magnets. Ceramics are used in the making of some magnets but the children do not need to know about them at this stage, as it conflicts with their possible experience of pottery (a kind of ceramic) being a non-magnetic material.

The children may ask why the magnets are associated with electrical devices such as loudspeakers and motors. In fact, magnetism and electricity are very closely related. A loudspeaker contains a coil of wire which receives pulses of electricity. These turn the coil into a magnet which is pushed and pulled by the metal magnet at the base of the cone. The coil is attached to the paper cone. This means that when it is pushed and pulled, it also makes the paper cone vibrate, and this is what produces sound.

In an electric motor, electricity passes through a coil of wire and turns it into a magnet. This is pushed and pulled by the other magnets in the motor. The motor is designed so that these pushes and pulls make the coil spin.

If the children try the complementary work they will find that not all metals are magnetic. This fact is used to separate metals such as steel and aluminium, which are both used to make cans. The separated metals are then taken away for recycling.

Name: .... Form: ....

Based on **pages 14 and 15** of *Springs and magnets*

Looking at magnets

Try this...

1. Take a bar magnet and bring it close to some paperclips. In box A, draw the magnet with the paperclips stuck to it.

2. Take a horseshoe magnet and bring it close to some paperclips. In box B, draw the magnet with the paperclips stuck to it.

3. Take a ring or disc magnet. In box C, draw how you think the paperclips will stick to the magnet when you bring it close to them.

4. Bring the ring or disc magnet close to some paperclips. In box D, draw the magnet with the paperclips stuck to it.

5. Did the paperclips stick to the magnet as you predicted?

....

6. Look at the loudspeaker. Put a paperclip close to some of its parts. The part where it sticks is a magnet. Where is the magnet in a loudspeaker?

....

....

7. Look at the electric motor. Put a paperclip close to some of its parts. The parts where it sticks are the magnets. Where are the magnets in an electric motor?

....

....

A

B

C

D

Teacher's sheet: activity

Based on **pages 14 and 15** of *Springs and magnets*

Introducing the activity

(a) Use this activity either before the children study pages 14 and 15 in the pupil book, and use the pictures of the loudspeaker and the motor to confirm the investigation here. Or you can use the activity after the pages in the pupil book have been studied in order to extend the work on magnet shapes and show magnets used in real equipment.

Using the sheet

(b) Give the children the sheet, let them write their names and form on it, then go through task 1.

(c) Let the children try task 1.

(d) Go through task 2, then let the children try it.

(e) Go through tasks 3, 4 and 5, then let the children try them (see note (i)).

(f) Go through task 6, then let the children try it (see note (ii)).

(g) Go through task 7, then let the children try it (see note (iii)).

Completing the activity

(h) Let the children compare their results.

Conclusion

The paperclips collect at the ends of the bar magnet. They do not collect in the middle. The paperclips collect at the ends of the horseshoe magnet. They do not collect at other parts. The paperclips collect on each side of the ring or disc. They do not collect around its circumference.

The magnet in a loudspeaker is at the bottom of a paper or plastic cone. The magnets in an electric motor are found around a central coil of wire.

Teaching notes

(i) The children may need to be told not to test the magnet with the paperclips until they have drawn how they predict the paperclips will be arranged around the magnet.

(ii) The loudspeaker should have been separated from its cabinet by an electrician or a similarly competent person. There must be no wire which can be used to connect it to a music system.

(iii) The motor should be a battery-powered model. It should not be connected to a battery.

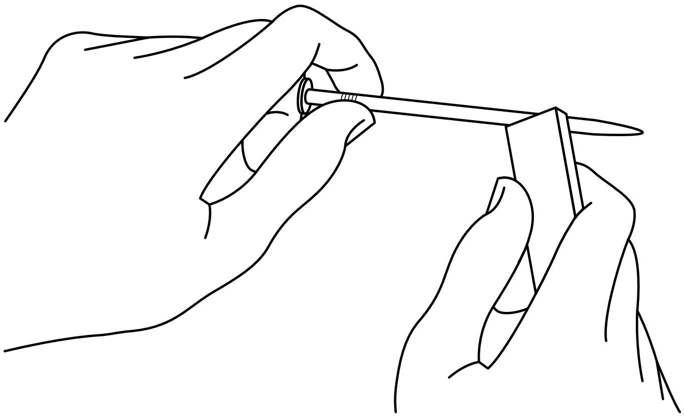
7

Name: .... Form: ....

See **pages 16 and 17** of *Springs and magnets*

Making magnets

You can make a magnet – but you have to work hard.



Q1. (i) The picture shows a nail being made into a magnet. Draw in an arrow to show how the magnet is moved over the nail.

(ii) What must the person do to turn the other end of the nail into a magnet?

✎...

✎...

Q2. What is a magnet called that does not lose its magnetism?

✎...

Q3. What kind of metal objects can be picked up by any kind of magnet?

✎...

Q4. When a paperclip is hung from a magnet, what does the paperclip become?

✎...

Q5. (i) Imagine four paperclips are hanging in a line from a magnet. If the bottom paperclip is taken off, what happens to the other three?

✎...

✎...

(ii) If the top paperclip is taken off, what happens to the others? Explain your answer.

✎...

✎...

✎...

✎...

Teacher's sheet: comprehension

See **pages 16 and 17** of *Springs and magnets*

Answers

1. **(i) The arrow should be drawn from the centre of the nail pointing right towards the tip of the nail; (ii) Turn the magnet round and stroke the other end of the magnet across the other half of the nail.**
2. **A permanent magnet.**
3. **Iron and steel.**
4. **It becomes a magnet.**
5. **(i) Nothing, the other paperclips stay in place; (ii) They fall away from each other. They have lost the magnetism that held them together.**

Complementary work

(a) The children could test the strength of a magnet by measuring the distance from which it can pull a paperclip to itself. This could be done by placing the magnet at one end of a ruler and moving the paperclip towards it until the paperclip jumps to the magnet. If this was demonstrated to the children, they could use the sheet in activity 7 for this activity too.

(b) A needle may be turned into a magnet by placing it next to a strong magnet for a few days. You may demonstrate this for the class.

Teaching notes

The children may ask what the little magnets inside magnetic material are made of. These little magnets are called domains. They are made of groups of tiny particles called atoms. When the children study electricity they may learn that a current of electricity is made by electrons flowing along a wire. Electrons are particles which are even smaller than atoms and are found inside atoms. It is thought that the way some of the electrons spin around inside the atoms of magnetic materials makes the groups of atoms or domains behave like tiny magnets. Although this information may seem too technical at this level, some children have heard of atoms, and in the study of materials later, you may wish to explain changes in terms of particles (that is, the atoms and molecules from which all matter is made).

If the children try to make a magnet as suggested on page 16, they may find the nail will turn into a magnet only after it is stroked about 60 times with a magnet. The nail may then be able to lift a paperclip.

7

Name: .... Form: ....

Based on **pages 16 and 17** of *Springs and magnets*

Testing the strength of magnets

Try this…

1. Make a collection of magnets.

2. Plan a way to test their strength.

✏ ....

✏ ....

✏ ....

✏ ....

✏ ....

3. Make a table in which to record your results.

4. Show your plan and table to your teacher. If your teacher approves, try your test.

Looking at the results.

5. What do the results show?

✏ ....

✏ ....

Teacher's sheet: activity

Based on **pages 16 and 17** of *Springs and magnets*

Introducing the activity

(a) You could begin by asking the children if a magnet can attract more than one thing at a time. Plunge the end of a bar magnet into a dish of paperclips and ask the class to predict what will happen. Raise the bar magnet and show the class how the paperclips cling on to the end in a bunch.

Ask the class how you could compare the strengths of magnets. If you receive a reply that you should count the number of paperclips sticking to an end, remove them all and then put one below another. Tell the children that this may help them with their investigation.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through task 1 and let the children try it.

(c) Go through task 2, then let the children try it (see note (i)).

(d) Go through task 3, then let the children try it (see note (ii)).

(e) Let the children try task 4 (see note (iii)).

(f) Let the children try task 5.

Completing the activity

(g) Let the children compare their results.

Conclusion

The strongest magnet has the longest paperclip chains from both its ends. The weakest magnet has the shortest paperclip chains. The largest magnet is not necessarily the strongest magnet.

Teaching notes

(i) Remind the children that there are two ends, or poles, to a magnet but ask them if both are the same strength. They should think about this in their planning. Suggest that the children may like to predict an order of strength for the magnets, starting with the strongest.

(ii) The table could have two columns headed: 'Magnet' and 'Number of paperclips'. In the magnet column there should be two entries for each magnet. The entries should be headed 'End 1' and 'End 2'.

(iii) The plan should state that a chain of paperclips will be made from each end of the magnet to test the magnet's strength.

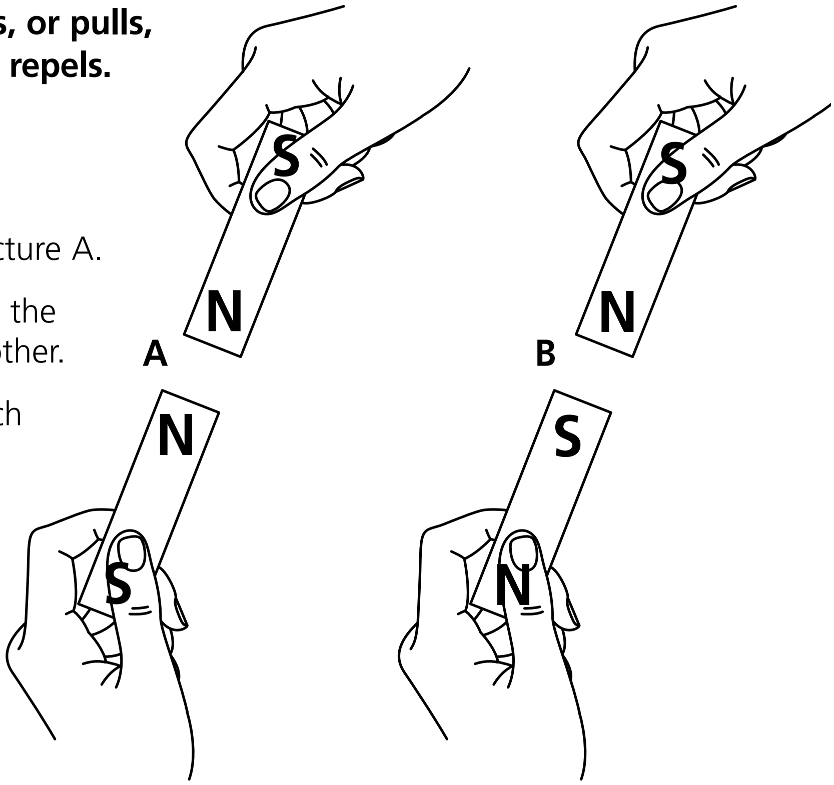
8

Name: .... Form: ....

See **pages 18 and 19** of *Springs and magnets*

Magnets push and pull

A magnet sometimes attracts, or pulls, and other times it pushes, or repels.



Q1. Look at the magnets in picture A.

(i) Draw in arrows to show how the magnets push or pull on each other.

(ii) Do the magnets push on each other or pull on each other?

✏ ....

Q2. Look at the magnets in picture B.

(i) Draw in arrows to show how the magnets push or pull on each other.

(ii) Do the magnets push on each other or pull on each other? ✏ ....

Q3. Some magnets have one end painted red. Is it the N or the S end? ✏ ....

Q4. (i) When two ends pull on one another, what are the ends said to do to each other?

✏ ....

(ii) When two ends push on one another, what are the ends said to do to each other?

✏ ....

Q5. If you put a magnet with its N end against a thin piece of wood and a magnet with its S end on the other side, what would happen to the magnets? Explain your answer.

✏ ....

✏ ....

✏ ....

✏ ....

Teacher's sheet: comprehension

See **pages 18 and 19** of *Springs and magnets*

Answers

1. **(i) The arrows should show the magnets pushing apart; (ii) Push.**
2. **(i) The arrow should show the magnets pulling together; (ii) Pull.**
3. **N.**
4. **(i) Attract; (ii) Repel.**
5. **The magnets would hold each other to the wood, they would be attracted because their magnetism works through wood.**

Complementary work

The children could stick a bar magnet to the top of a lightweight plastic car and see if they could move it by bringing a second magnet near the first magnet.

Teaching notes

The children may wonder why the ends of the magnets are labelled N and S instead of A and B. Although this aspect of magnetism will be addressed in Unit 10, it may be useful here just to say that when a magnet is allowed to hang from a string, one end always points to the north and the other to the south. The ends are named after the directions in which the freely swinging magnet points.

The place where the magnet has its greatest power is not right at its end but a little way in from the ends. These places are called the poles. The pole which is in the end that points north is called the north-seeking pole. The pole which is in the end that points south is called the south-seeking pole.

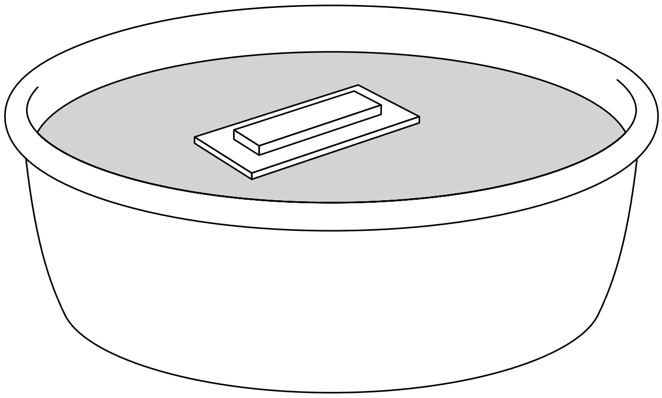
Some magnets are coloured red and blue. The red end contains the north-seeking pole and the blue end contains the south-seeking pole.

Name: .... Form: ....

Based on **pages 18 and 19** of *Springs and magnets*

Investigating magnetic pushes and pulls

Try this...



1. Collect two magnets which have their ends marked with an N and an S.

2. Place one magnet on a piece of wood, cork or plastic and float it in a bowl of water as the diagram shows.

3. Predict what will happen when you bring the N end of the second magnet near the N end of the floating magnet.

✎ ....

4. Bring the N end of the second magnet close to the N end of the floating magnet. Write down what happened.

✎ ....

✎ ....

5. How did your prediction compare with your result?

✎ ....

6. Predict what will happen when you bring the S end of the second magnet near the N end of the floating magnet.

✎ ....

7. Bring the S end of the second magnet close to the N end of the floating magnet. Write down what happened.

✎ ....

✎ ....

8. How did your prediction compare with your result?

✎ ....

Teacher's sheet: activity

Based on **pages 18 and 19** of *Springs and magnets*

Introducing the activity

(a) Use this activity after the children have studied pages 18 and 19 in the pupil book. Tell the children that they are going to use the information they have just studied to make further investigations on how magnets push and pull.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through tasks 1 and 2 with the children (see note (i)).

(c) Let the children try tasks 1 and 2.

(d) Go through tasks 3 and 4, then let the children try them.

(e) Let the children try task 5 (see note (ii)).

(f) Go through tasks 6 and 7, then let the children try them.

(g) Let the children try task 8.

Completing the activity

(h) Let the children compare their results.

Conclusion

The N end of the floating magnet is pushed away or repelled by the N end of the second magnet. The N end of the floating magnet is drawn to or attracted to the S end of the second magnet.

Teaching notes

(i) The children do not need to know that N stands for north and S stands for south although some of them may know this from general knowledge.

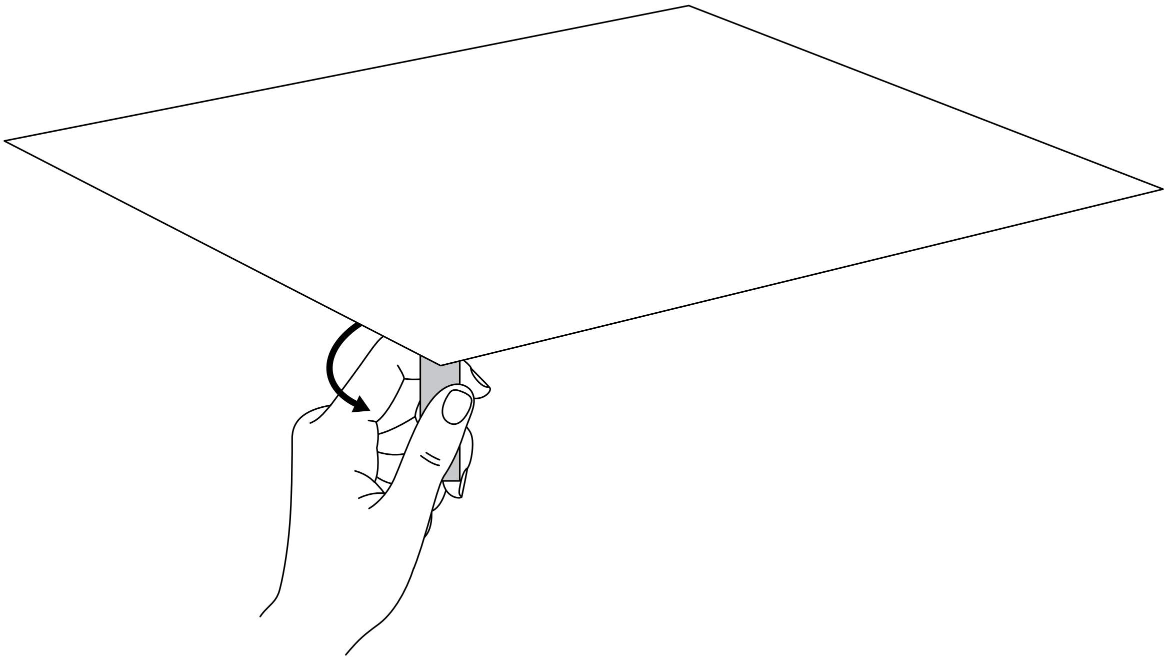
(ii) The children should say that the prediction and result matched, partly matched or did not match. They should not use phrases like 'It was OK'.

Name: .... Form: ....

See **pages 20 and 21** of *Springs and magnets*

Seeing how a magnet works

Tiny pieces of iron and steel can be used to show where a magnet is working.



Q1. The picture shows a magnet being moved about under a sheet of cardboard. Draw how tiny pieces of iron that were scattered on the top of the cardboard are affected by the movement of the magnet.

Q2. What are very fine pieces of iron called? ✎ ....

Q3. When tiny pieces of iron are sprinkled on the cardboard, what happens to some of them?

✎ ....

Q4. What should you do to a corner of the cardboard if you want to make a pattern with the tiny pieces of iron?

✎ ....

Q5. (i) Which are the most powerful parts of the magnet? ✎ ....

(ii) How can you tell the most powerful parts of the magnet?

✎ ....

✎ ....

Teacher's sheet: comprehension

See **pages 20 and 21** of *Springs and magnets*

Answers

1. **On top of the card is a pile of iron filings and a track which matches the movement of the arrow beneath. There could also be an arrow above the card showing how the iron filings move. This matches the arrow under the card.**

2. **Iron filings.**

3. **They move about and form trails.**

4. **Tap it.**

5. **(i) The ends; (ii) They are the parts where the trails go in and out.**

Complementary work

After the children have studied activity 9, you could tell them that each iron filing behaves like a magnet, just as the paperclips on pages 16 and 17 of the pupil book behaved as magnets. Point out that the iron filings made loops between the ends of the magnet. Hang panel pins from the end of a bar magnet and challenge a child to loop them up. The panel pins should form a loop, just like the iron filings.

Teaching notes

There are two kinds of forces – contact forces and non-contact forces. Examples of contact forces are impact forces, such as pushes between cars or people, friction and air resistance. These forces touch the object they affect.

Examples of non-contact forces include magnetism, gravity and the electrostatic force that makes hair stand on end when brought near a rubbed piece of plastic. These forces are generated by an object and act in a region around the object. This region is called a field or force field. You may have heard of the term 'gravitational field'. This refers to the region around the Earth in which any object will feel the pull of the Earth's gravity. In a similar way, there is a magnetic field around each magnet. This is the region in which the magnetic force of the magnet is active.

Iron filings are used to show the size of the magnetic field. When the iron filings are in a magnetic field they behave as tiny magnets and become lined up. They make a pattern of lines (sometimes called lines of force) which is called the magnetic field pattern.

9

Name: .... Form: ....

Based on **pages 20 and 21** of *Springs and magnets*

Magnets and iron filings

Try this...

1. Take a container which has iron filings in it.

2. Bring one end of the magnet close to the container and in box A draw what happens to the iron filings.

3. Move the end of the magnet over the surface of the container.

A

4. Describe what happens to the iron filings as you move the magnet.

✏ ....

✏ ....

5. Lay the magnet under the container and in box B draw how the iron filings arrange themselves.

6. Put two magnets with their N ends or S ends close together.

7. Put the container of iron filings over the ends of the magnets.

8. What happens to the iron filings?

B

✏ ....

✏ ....

9. Place the two magnets so that the N end of one is close to the S end of the other.

10. Put the container of iron filings over the ends of the magnets.

11. What happens to the iron filings?

✏ ....

✏ ....

Teacher's sheet: activity

Based on **pages 20 and 21** of *Springs and magnets*

Introducing the activity

(a) Use this activity after the children have studied pages 20 and 21 in the pupil book. They will benefit by seeing how iron filings behave with a magnet, and will have an idea of what to look for in their investigation.

Using the sheet

(b) Give out the sheet and let the children write their names and form, then let the children try task 1 (see note (i)).

(c) Go through task 2, then let the children try it.

(d) Go through tasks 3 and 4, then let the children try them.

(e) Go through task 5, then let the children try it.

(f) Go through tasks 6 to 8, then let the children try them.

(g) Go through tasks 9 to 11, then let the children try them.

Completing the activity

(h) Let the children compare their results.

Conclusion

When the end of a magnet is brought close to the container, the iron filings rise up and form columns which touch the inside surface of the container. When the end of the magnet is moved over the surface of the container, the columns of iron filings follow it. When a bar magnet is laid under the container of iron filings, the iron filings form lines which spread out from each end and form loops along the sides.

When two magnets are placed so that similar ends face each other, the filings move away from the gap between them. When two magnets are placed so that dissimilar ends face each other, the iron filings fill the gap.

Teaching notes

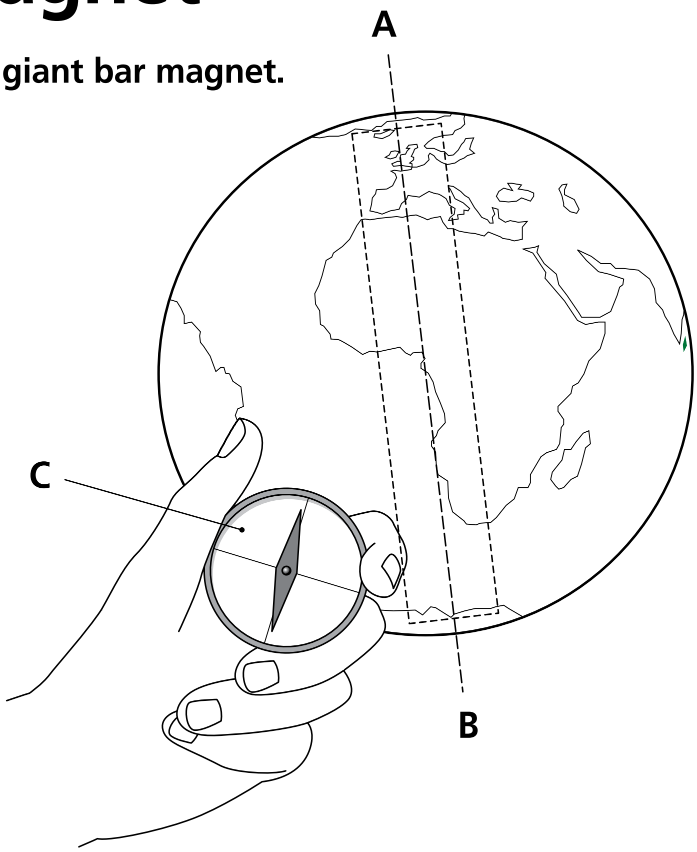
(i) Iron filings can stick to magnets, be a skin irritant and can cause pain if they enter the eyes. For these reasons, iron filings need to be treated with great care. Iron filings in plastic containers can be obtained from educational suppliers. Alternatively, they can be placed in a sealed plastic bag. A container made from a piece of card with a sheet of transparent plastic (from a plastic bag) stuck onto it may make a suitable container for use with some children.

Name: .... Form: ....

See **pages 22 and 23** of *Springs and magnets*

The Earth as a magnet

The Earth behaves just as if it were a giant bar magnet.



Q1. This picture shows the Earth. It behaves as if there is a huge bar magnet inside it.

(i) What are A, B and C?

A ✏ ....

B ✏ ....

C ✏ ....

(ii) Which way does the compass point?

✏ ....

(iii) Why does the compass point in this direction?

✏ ....

Q2. What is magnetic rock called? ✏ ....

Q3. What colour is magnetic rock? ✏ ....

Q4. What happens to the magnetic rock when it is hung from a string?

✏ ....

✏ ....

✏ ....

Q5. What makes the Earth into a giant magnet?

✏ ....

10 Teacher's sheet: comprehension

See **pages 22 and 23** of *Springs and magnets*

Answers

1. **(i) A = North Pole, B = South Pole, C = compass; (ii) North; (iii) Because it is a magnet.**
2. **Lodestone.**
3. **Black.**
4. **It always turns until it faces the same way. The same end always points north.**
5. **Iron at the centre of the Earth.**

Complementary work

You could put a piece of lodestone in a group of other small rocks and ask the children how they could find it. They should use paperclips or panel pins to find it. These items will only stick to the lodestone.

Teaching notes

In Unit 8 the children learned that two north poles repel each other, yet in this activity they may think that the north pole of the magnet is attracted to the north pole at the top of the Earth. At the top of the Earth are two poles. They are the north geographic pole around which the Earth spins and the north magnetic pole to which lodestones and magnets are attracted.

The correct term for the north pole of a magnet is north-seeking pole – it seeks the north magnetic pole. The correct term for the south pole of a magnet is the south-seeking pole – it seeks the south magnetic pole.

If we think of the Earth as containing a bar magnet, it does not have its north pole facing the north magnetic pole. It has its south pole facing that way. It is the south pole of this imaginary magnet which attracts the north-seeking poles of the bar magnets towards the magnetic north. In a similar way, it is the north pole of this imaginary magnet that attracts the south-seeking poles to the south magnetic pole. The children do not need to know this detail but it may help to give an explanation if children query the two 'north poles' being attracted to each other.

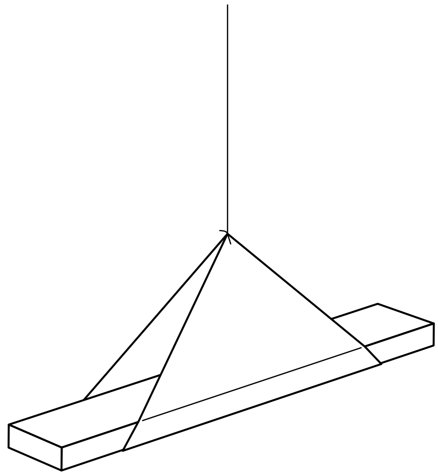
The poles of a magnet are not at its ends. They are a little way in from the ends and are the places where the magnet's power is greatest.

Name: .... Form: ....

Based on **pages 22 and 23** of *Springs and magnets*

Finding directions

Try this...



1. Make a paper holder for a magnet and set it up as the diagram shows.

2. Hang the magnet from the holder and leave it for a few minutes.

3. What are the ends of the magnet pointing at?

✐ ....

4. How can you be sure that the magnet will always point in the same direction? Work out a way to test this.

✐ ....

✐ ....

✐ ....

5. Show the test to your teacher. If your teacher approves, try your test.

6. What did your test show?

✐ ....

✐ ....

7. Does a floating magnet point in the same direction as a hanging magnet? Work out a way to test this.

✐ ....

✐ ....

✐ ....

8. Show the test to your teacher. If your teacher approves, try your test.

9. What did your test show?

✐ ....

✐ ....

10 Teacher's sheet: activity

Based on **pages 22 and 23** of *Springs and magnets*

Introducing the activity

(a) If the children have done the activity in Unit 9, you may like to remind them of how the iron filings arranged themselves around a magnet. Remind the children that the Earth behaves as if it contains a huge bar magnet. Also remind them that if small bar magnets are allowed to move freely, they behave like the iron filings and line up in a certain way.

Tell the children that they are going to see if the power of the Earth's magnetism is working in their classroom and they will test it using bar magnets.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through task 1 (see note (i)).

(c) Go through tasks 2 and 3, then let the children try them (see note (ii)).

(d) Let the children try tasks 4 and 5 (see note (iii)).

(e) Let the children try task 6.

(f) Go through tasks 7 and 8, then let the children try them (see note (iv)).

(g) Let the children try task 9.

Completing the activity

(h) Let the children compare their results.

Conclusion

A bar magnet which is free to move will line itself in a generally north-south direction.

Teaching notes

(i) The children can use the diagram as a simple guide. The dimensions of the paper holder will depend upon the size of the bar magnet. The children may need help attaching the thread. Alternatively, you can make the holders for the children before the lesson.

(ii) It does not matter at this stage that the children look for north or south, they could use things like the board, window or fish tank as markers.

(iii) The plan should suggest that the magnet is moved and left to settle again. Or, the support could be moved and the magnet allowed to settle again. The magnet or support may be moved several times. No other magnets should be close enough to affect the magnet in the holder.

(iv) A bar magnet should be set up on a float in a bowl of water and allowed to settle. The magnet should be moved a few times and allowed to settle again. The magnet should not touch the sides of the bowl. No other magnets should be near.

REVISION QUESTIONS

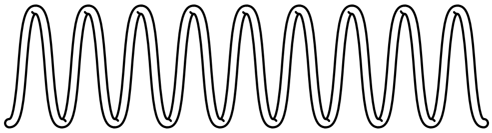
Name: .... **Form:** ....

Q1. Which two items have a spring that pushes when it works?

Tick two boxes:

Stapler ☐ Door handle ☐ Spring balance ☐ Clock ☐

Q2. Here is a spring.



(i) Draw arrows to show how you would push on the spring to close up the coils.

(ii) What happens to the length of the spring when you push on it?

✐...

(iii) The spring makes a force on your hand when you push on it. Is the force …

Tick one box:

☐ … a pushing force?

☐ … a pulling force?

☐ … a twisting force?

Q3. Mina places the end of a ruler over the edge of her desk and twangs it.
Which two things does the ruler do?

Tick two boxes:

Bend up ☐ Go shorter ☐ Go longer ☐ Bend down ☐

Q4. Which musical instrument has hammers which strike against springs?

Tick one box:

Piano ☐ Guitar ☐ Violin ☐ Thumb harp ☐

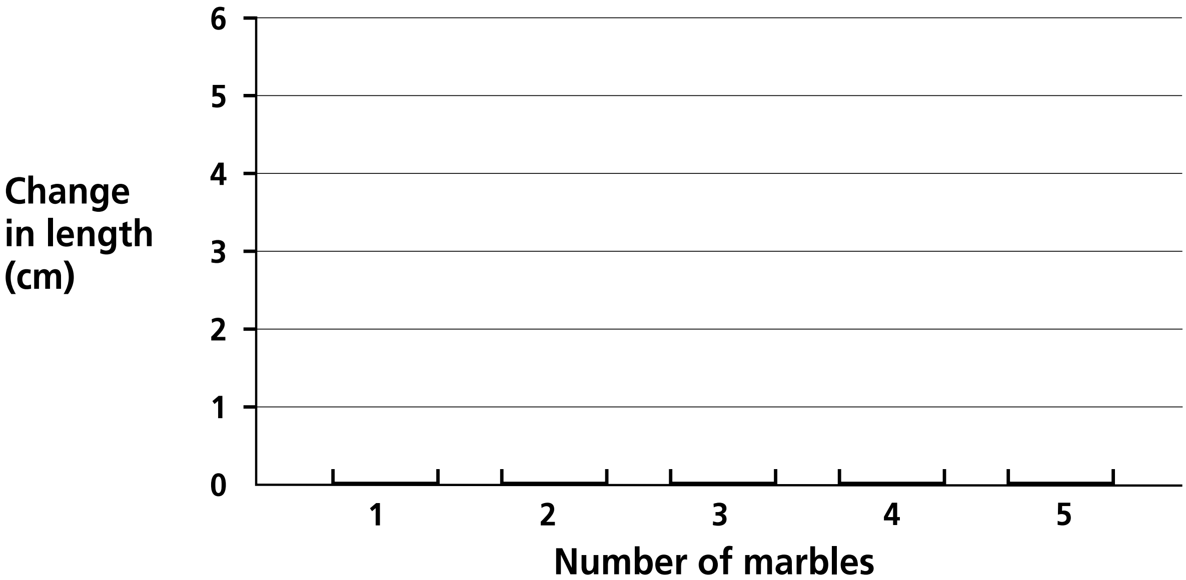
Name: .... Form: ....

Q5. Arif hangs up a spring and ties a yoghurt pot to its lower end.

He puts a marble in the yoghurt pot and measures how the spring changes in length. He adds more marbles and each time he measures how the spring changes in length. The table shows his results.

Number of marbles	Change in length (cm)
1	1
2	2
3	3
4	4

(i) Make a bar chart of the results.



(ii) What happens to the spring as Arif adds more and more marbles?

✏ ....

(ii) Predict how the spring will change in length when there are five marbles in the yoghurt pot.

✏ ....

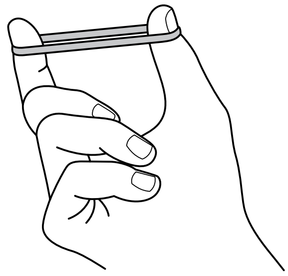
(iii) Add your prediction to the bar chart.

Q6. Which two items contain an elastic sheet?

Tick two boxes:

Guitar ☐ Trampoline ☐ Drum ☐ Spring balance ☐

Q7. Paul puts an elastic band between his thumb and first finger. He stretches the elastic band.



(i) What can Paul feel as he stretches the elastic band?

✐ ....

(ii) Paul plucks the elastic band and makes it move. How does the elastic band move?

✐ ....

(iii) The elastic band makes a sound. Paul stretches the elastic band more and plucks again. Does the sound …

Tick one box:

☐ … become higher?

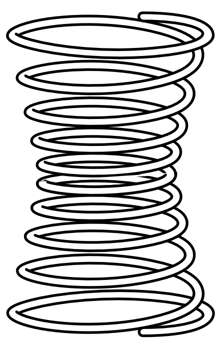
☐ … become lower?

☐ … stay the same?

(iv) What happens to the sound when Paul does not stretch the elastic band as much?

✐ ....

Q8. Here is a spring in a chair.



Jane sits on the chair.

(i) Draw an arrow to show the way Jane's body pushes on the spring. Label the arrow J.

(ii) Draw an arrow to show how the spring pushes on Jane's body. Label the arrow S.

REVISION QUESTIONS

Name: .... **Form:** ....

Q9. Which two metals are commonly used for making magnets.

Tick two boxes:

Copper ☐ Steel ☐ Iron ☐ Aluminium ☐

Q10. When Paul tested some materials with a magnet, this is what he found.

A copper wire did not stick to the magnet.

A steel pin stuck to the magnet.

A plastic ruler did not stick to the magnet.

An iron nail stuck to the magnet.

A piece of wood did not stick to the magnet.

(i) Paul made this table to record his results. Fill it in for him by putting one tick for each material in the table.

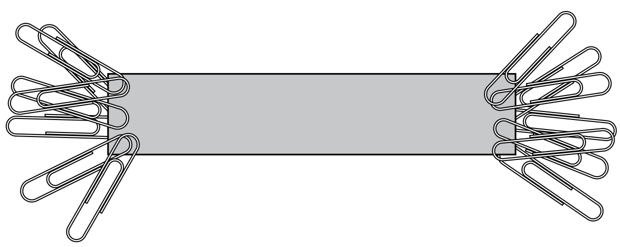
Material	Magnetic	Non-magnetic
Copper		
Steel		
Plastic		
Iron		
Wood		

(ii) Mina thinks that all metals are magnetic. Do Paul's results agree? Explain your answer.

✏ ....

✏ ....

Q11. Arif put a magnet in a box of paperclips. When he took the magnet out he found the paperclips stuck to it as the diagram shows.



What does this tell you about the magnetic power of a magnet?

✏ ....

✏ ....

REVISION QUESTIONS

Name: .... Form: ....

Q12. Jane has a nail and a magnet.

(i) What must she do to turn the nail into a magnet?

Tick one box:

☐ Hit the nail with the magnet.

☐ Stroke the magnet along the nail.

☐ Tap the nail on the magnet.

☐ Rub the nail up and down on the magnet.

(ii) How could Jane use a paperclip to see if the nail had turned into a magnet?

✏ ....

Q13. Use these two words to complete the following sentences: **repel**, **attract**

Mina has two magnets. Each magnet has an N and an S marked on it.

(i) Mina brings the two N ends of the magnets together.

She finds that the magnets ✏........................... each other.

(ii) Mina brings the N end of one magnet close to the S end of the other magnet.

She finds that the magnets ✏........................... each other.

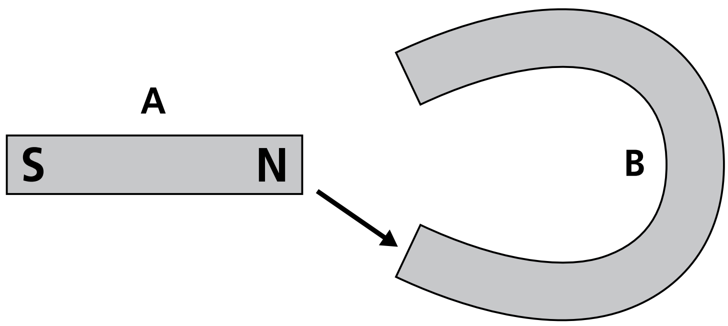
Q14. Paul put two magnets on a table as the diagram shows.

(i) What kind of magnet is A?

✏..

(ii) What kind of magnet is B?

✏..



When Paul pushed magnet A towards magnet B, magnet A would only go towards one end of magnet B as the arrow shows.

(iii) Put labels on the ends of magnet B to show which end is the N end and which end is the S end.

Name: .... Form: ....

Q15. Arif has some thick cards, a magnet and some paperclips.

He put a card over one end of the magnet and hung a chain of paperclips from that end of the magnet. He then added more cards and again tried to hang chains of paperclips from the end of the magnet. This table shows his results.

Number of cards	Number of paperclips in the chain
1	5
2	4
3	3
4	2

(i) How many paperclips hung from the chain when there were two cards on the end of the magnet?

✐...................................

(ii) How many cards were on the end of the magnet when the chain had two paperclips in it?

✐...................................

(iii) How did the number of cards affect the size of the paperclip chains?

✐...

(iv) How many cards do you predict should be used to stop the magnet holding any paperclips?

✐...................................

Q16. Jane wants to move a plastic boat through a bowl of water using a magnet underneath the bowl. What must she add to the boat to make the magnet move it?

✐...

✐...

Q17. Paul makes a needle into a magnet and floats it on a piece of cork in a bowl of water. The needle turns around and then stops moving. In which directions do the ends of the needle point?

✐...

ANSWERS
REVISION QUESTIONS

1. Stapler, clock. *2 marks*

2. (i) Arrows pointing in towards the ends of the spring. *1 mark*
(ii) It gets shorter. *1 mark*
(iii) A pushing force. *1 mark*

3. Bend up, bend down. *2 marks*

4. Piano. *1 mark*

5. (i) Each length correctly shown in the chart. *4 marks*
(ii) It gets longer and longer. *1 mark*
(iii) 5cm. *1 mark*
(iv) Fifth bar correctly drawn. *1 mark*

6. Trampoline, drum. *2 marks*

7. (i) The elastic band pulls back. *1 mark*
(ii) It moves to and fro or backwards and forwards. *1 mark*
(iii) It becomes higher. *1 mark*
(iv) It becomes lower. *1 mark*

8. (i) An arrow labelled J pointing down. *2 marks*
(ii) An arrow labelled S pointing upwards. *2 marks*

9. Iron and steel. *2 marks*

10. (i) Copper – non-magnetic, steel – magnetic, plastic – non-magnetic, iron – magnetic, wood – non-magnetic. *5 marks*
(ii) No. Only iron and steel are magnetic in this test, copper is a metal but is not magnetic. *2 marks*

11. Magnets have magnetic power near their ends. *1 mark*

12. (i) Stroke the magnet along the nail. *1 mark*
(ii) Bring the paperclip close to the magnet and see if the magnet can hold onto it. *1 mark*

13. (i) Repel. *1 mark*
(ii) Attract. *1 mark*

14. (i) Bar magnet. *1 mark*
(ii) Horseshoe magnet. *1 mark*
(iii) The top end of the horseshoe magnet should have N written on it, the bottom end of the horseshoe magnet should have S written on it. *1 mark*

15. (i) 4. *1 mark*
(ii) 4. *1 mark*
(iii) As the number of cards increased, the size of the paperclip chain decreased. *1 mark*
(iv) 6. *1 mark*

16. She must stick a piece of iron or steel to the underside of the boat (not a magnet). *1 mark*

17. North and south. *2 marks*

Total marks: 49