TEACHER'S GUIDE

Simply Science 1

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INTRODUCTION

Aims and content of the course

Simply Science is based on the Pakistan National Curriculum for Primary Science and the exemplar scheme of work prepared jointly by the Qualifications and Curriculum Authority (QCA) and the Standards and Effectiveness Unit of the Department for Education and Employment in Britain. The course aims to meet the needs of teachers and pupils by building on the core scientific themes in carefully graded stages, thereby providing a comprehensive introduction to science for pupils aged 3 to 11 years.

The course is designed to do three main things:

1) To give students a solid body of knowledge in the natural, physical and earth sciences.
2) To introduce them to the nature of scientific enquiry.
3) To enable them to explore values and attitudes through science.

These three elements are developed side by side through the books which make up the complete course. At the same time, the course aims to provide all the help and guidance necessary to allow the busy non-specialist teacher to cope with the demands of primary school science. To this end, it is hoped that the course will save the teacher time, resources and preparation.

The course

The course consists of units to be taught in years Prep to 5. These units are planned to cover the programme of study in three two-year cycles, thus ensuring that key areas are revisited, consolidated and extended. However, care has been taken to ensure that, though the course builds on students' earlier experiences, it does not repeat activities and investigations. This approach will also support those teachers planning for mixed ability and mixed age classes. The units in any one year are interchangeable and do not have to be delivered in the order given within any one student's book. This will help to meet the demands imposed by the availability of materials and the local seasonal and climatic conditions that may affect when certain environmental aspects of science can be taught. Each unit starts from real-life situations, and much of the information is presented in both picture and text. The context for activities within the units can be either cross-curricular or specifically scientific, depending upon the preferred teaching style. *Simply Science* is aimed at the average student but is flexible enough to allow use by students of all abilities. It also promotes the development of independent learning by students.

Using this Teacher's Guide

The demands which the *Simply Science* course make upon the teacher depend entirely on how far he or she wishes to progress with a particular class or group of children. The student's books are intended to provide core material on the three broad themes of:

- Life and living processes
- Materials and their properties
- Physical processes

The themes chosen are based firmly on the students' own experience and cover areas affecting their everyday lives. The units in the student's books contain a high proportion of direct teaching, so that they can be used as they stand or as part of a more extensive science programme, with the help of the appropriate Teacher's Guides.

The themes within any one student's book can be taught in almost any order. If there are two or more teachers with classes of students of the same age, they could each choose different themes. The teachers could acquire the materials for their particular theme and then, after the work is completed, they could exchange materials and ideas, and discuss any problems that arise.

For practical activities, it may be necessary to divide the class into groups of a size you consider appropriate for each particular activity. The groups should be as small as possible but should have enough students to adequately handle the materials and to keep a record of the results. For most activities, two or three students is probably the optimum number for a group. Many of the activities can be done individually. Certainly the groups should never be so large that some students are merely spectators. In the case of activities which require a great deal of the teacher's attention, it is suggested that the class is divided into two, and while part of the class is engaged in the practical activity, the other part is kept busy with the 'desk-bound' written or other activities in the student's books or in the ***Going Further*** sections of this Teacher's Guide.

Most of the sections in this Teacher's Guide are self-explanatory. There is an introductory section, directed specially at the non-specialist teacher, which aims to explain what science is and how it works.

Background information is aimed at giving the non-scientist teacher confidence. It contains all of the scientific knowledge necessary to teach a particular unit.

Answers provides, where possible, the expected results of any activity and answers to any questions posed under the headings of *Rapid fire* and *Try it out*.

Going further contains activities, experiments, demonstrations and suggestions for discussion which can be used to add depth to each lesson, or to reinforce it.

Worksheets The worksheets are designed to be photocopied and used within the purchasing institution. They are designed to allow the students to record their findings on the actual worksheets, but you should also encourage the students to use IT and other methods of recording, as appropriate.

Although it is in the *doing* of science that students learn best, this involves more than just practical work. As well as needing to observe, record, predict, measure, look for patterns, classify, ask questions and so on, students need time to discuss their work. In this connection, the worksheets should be discussed both before and after the completion of the activity. This is particularly important with those students who are not fluent readers. Such discussion also helps to clarify the main ideas and will help you to monitor progress and discover what interests the students, with a view to developing their interests in future sessions. Discussion will also reveal any misunderstandings which can then be corrected as soon as possible.

Notes on individual worksheets explains the key idea behind each worksheet. It also describes briefly expected results or answers and makes suggestions for further activities and investigations. This section also warns of any safety considerations involved in the topic. The question of safety is dealt with more fully in the section below.

Glossary The glossary at the end of the book is intended for use by the teacher and it gives brief definitions of some of the most important scientific words in this Teacher's Guide.

Equipment and materials

Essential materials and equipment are listed under 'What you need' on each worksheet. Nearly all the items are readily available. It may be necessary from time to time to call upon the school kitchen for access to a refrigerator or deep freeze. The students themselves may be able to collect some of the materials if they are given sufficient notice.

Safety!

The activities described in this Teacher's Guide and in the student's books mainly use everyday items of equipment, and materials which are perfectly safe if used sensibly. All the activities have been checked for safety as part of the reviewing process. In particular, every attempt has been made to ensure that all recognized hazards have been identified, suitable safety precautions are suggested, and, wherever possible, the procedures are in accordance with commonly used risk assessments.

However, it is important to be aware that mistakes can be made. Therefore, before beginning any practical activity, you should carry out your own risk assessment in relation to local circumstances. In particular, any local guidelines issued by your employer **must** be observed, whatever is recommended here. As a general principle if, on safety grounds, you are not completely sure about the ability of your class to carry an experiment, then demonstrate it to them rather than risk an accident.

General safety precautions

There are a number of general safety rules which you should observe:

- If the students taste or handle food, ensure they wash their hands before doing so and that tables and utensils are clean and foods are fresh and uncontaminated. Do not use nuts, as some children are allergic to them, particularly peanuts. Be sensitive to different dietary requirements.
- Young children have little say or control over what they are given to eat at home. When discussing the components of a balanced diet, take care to ensure that children do not feel that you disapprove of their dietary habits. Similarly, when comparisons are made between students, it is important to emphasize that we are all different. Children are built differently, grow at different rates, and have different backgrounds and likes and dislikes.
- Visits beyond the school grounds must be carried out in accordance with the guidelines of your school or employing authority.
- Warn students never to look directly at the Sun. It could damage their eyesight or cause blindness.
- Some children are allergic to certain plants, e.g. some flower bulbs, and pollen (from flowers), and remember that some plants are poisonous. Many children are allergic to certain animals.
- Many seeds bought from garden centres will have been treated with pesticides and are not safe for students to handle. Seeds bought from health food shops are usually safe, although it is best to avoid red kidney beans.
- Whenever possible, use transparent plastic containers, rather than glass containers, particularly for holding water or collecting living things outside.
- Night lights and short, stubby candles are difficult to knock over. When using a naked flame always work in a metal tray, such as a baking tray, filled with sand.
- Use soils free from glass, nails and other sharp objects, and collect soil samples from places that are unlikely to be contaminated with dog or cat faeces. Wash hands after handling soils.
- Wash hands after handling animals.
- Be alert to the potential risks of suffocation associated with polythene bags.
- Students should not touch ice immediately after it has been taken out of a freezer.
- Take great care with hot water or steam.
- Mercury thermometers (recognizable by the silver colour of the liquid inside them) are not suitable for use in primary schools because of the dangers from the toxic metal mercury if they are broken.
- Warn students of the dangers of mains electricity. However, assure them that the batteries they use in class are safe.
- Use plastic mirrors wherever possible. If you have to use glass mirrors, ensure that they do not have sharp edges; bind edges with masking tape or insulating tape.

What is science?

Before taking a class for science, it may be helpful for the non-specialist teacher to consider what this ‘mysterious’ subject is all about. The word ‘science’ comes from the Latin word *scire*, to know. Science is concerned with our knowledge of the universe and all that is in it. Science is an organized body of subject matter, and in this it is no different from geography, history or any of the other subjects in the school curriculum. Where science differs from these other subjects is that it involves a method of discovery based on experimentation. Experiments entail finding an answer to a question by observing the effects of making systematic changes.

The first stage in the development of any science is based largely on observation. Science begins when we notice something interesting and ask questions about it. ‘I can crush this drink can by standing on it.’ ‘Will all metal cans crush as easily as this?’ ‘This block of wood floats. Will all types of wood float?’ ‘How many seeds are there in a dandelion ‘clock’? Will they all grow?’ It is important to remember that careful observation is a practical skill which can be encouraged and enhanced by regular practice.

It comes naturally for young children to try things out to see how they work, to manipulate, to feel, to be curious, to ask questions, and to seek answers. That is science. They should ask Who? Where? When? Why? How many? How much? How far? and so on. They should be encouraged to find their own answers, as far as possible by devising simple experiments.

The testing out of an idea, properly called a hypothesis, is the usual way in which scientists carry out an experiment, but children often carry out an experiment with no particular hypothesis in mind, simply to see what happens.

A useful test in science is the controlled experiment, in which two situations are compared that are identical except for the one factor (called a variable) being tested. Having observed mung bean seeds growing on moist cotton wool, and dying when the cotton wool was allowed to dry out, we might decide that water is an important factor in initiating the germination of mung bean seeds (our hypothesis). We might then take two saucers filled with cotton wool, on which equal numbers of mung bean seeds are sprinkled. The saucers are placed next to each other on a sunny window sill. They are identical except that the cotton wool in one is kept moist while the other is left dry. The saucer with the dry cotton wool in it is the ‘control’ experiment.

The notion of a ‘fair test’ or control experiment is an important one, but devising suitable controls for experiments is difficult for many primary school students, and indeed many secondary school students and some university students. However, young children do have a well-developed sense of fairness, and this is a necessary stage in the development of an understanding of the need for controlled experiments. If, for example, we try to see which of two snails can move fastest over a sheet of paper, we may soon be rebuked by the student who points out quite rightly. ‘That’s not fair, this snail is bigger than that one!’ We should, whenever possible, encourage students to see that their experiments are ‘fair’ and that they can identify the variables involved.

All experiments ‘work’, although not always in the way we expect them to. When experiments fail to produce expected results, it is sometimes because the hypothesis being tested needs to be thought out again, or because the experiment itself may be badly designed. Deciding which is the case is a matter of experience, but also provides a golden opportunity for more scientific thought and experimentation.

Another possible cause of difficulty is that sooner or later a student will ask a question to which the teacher does not know the answer. Teachers who are unsure about areas of science are then placed in a situation where their areas of greatest insecurity may well be called upon by the students without warning.

What the teacher and students together can do is to set about finding the answer, by experiment if possible, with the aid of reference books or the Internet or, if all else fails, by asking someone more knowledgeable. If the teacher can approach the finding out by experiment without any preconceived ideas, then the experience will be very valuable for both teacher and taught. This is definitely one situation where the clear-thinking, ‘non-scientist’ teacher has a distinct advantage.

Sometimes it will be necessary for a primary school student to be told, tactfully, that the answer to a question is quite simply too difficult for him or her to understand at present.

Active learning

Students learn most effectively through ‘doing’ and being actively involved. This is what this Teacher’s Guide, and the student’s books that make up *Simply Science*, hope to encourage.

It should be emphasized that, all the way through, it is important that the students have understood the activity or problem that has been set before they begin any practical work. It is also important to remember that students learn not only by doing but also by thinking and talking about what they have done. Students learn by fitting their latest activity or discovery into their existing pattern of experience, and thus continue to develop and refine the ideas they are already forming about the world in which they live. Quality learning, with time to think out theories, develop ideas and talk them through, is very difficult to achieve in a busy classroom, with all the pressures on the teacher’s time and attention.

Lesson objectives

- To introduce some of the features that show we are alive
- To name some living things and illustrate and identify signs of life
- To identify some non-living things

Background information

Living things

Since this theme examines life processes, it is appropriate to ask what is meant by a 'living thing'. Altogether there are seven features shared by all living things whether plant or animal:

1 *Movement*

All living things are capable of movement. Most animals move about using legs, wings, or fins. Plants mainly move by growing. Their roots grow down into the soil, while their shoots and other aerial parts grow up towards the light. Some very simple single-celled plants do, however, actively swim around in the sea or fresh water.

2 *Feeding*

All living things need food to provide energy and for growth. Animals obtain their food by eating plants, other animals, or the dead remains of plants and animals. Almost all plants make their own food using the energy of sunlight to combine water and carbon dioxide gas to make sugars. This is called photosynthesis.

3 *Respiration*

All living things need energy for movement, for growth and to work the various organs and organ systems of the body. This energy is obtained by a process called respiration. During respiration, a number of chemical changes release energy from food, usually by combining the food with oxygen. Some living things, like humans, can breathe air to obtain their oxygen, while others can obtain dissolved oxygen only from water. This and other needs exert a great influence on where an animal can live. Fish, for example, must live in water while most air-breathing animals live on land (whales and dolphins, for example, are exceptions).

4 *Excretion*

All living things produce waste substances as a result of the chemical reactions that must take place in their cells. Carbon dioxide (a waste product of respiration), urine, water, and other chemicals may be excreted.

5 *Reproduction*

All living things reproduce to replace organisms that die or are eaten. If a species does not reproduce fast enough to replace those that die, the species becomes extinct. Some very simple plants and animals can reproduce by splitting in two, or by the growth of parts which break off from the parent organism. This is an example of asexual reproduction. However, most animals are either male or female and reproduce sexually. The flowers of plants contain sexual organs which produce seeds, and the seeds grow into new plants.

6 *Growth*

All living things grow by a process of cell division. Animals grow until they reach a certain adult size, but most plants can grow continuously throughout their lives.

7 *Sensitivity*

All living things respond to changes in their environment. This means that, to varying extents, they are aware of what is happening around them. Many animals use sense organs, such as eyes and ears, which are part of the nervous system, to find out about their surroundings. Humans, like all animals, respond to stimuli. They react positively to features of their environment they like or need, and move away from stimuli they dislike or which are harmful.

Although plants do not have specific sense organs, they are able to detect and respond to changes in such things as light, water, and gravity.

Differences between animals and plants

Animals can communicate with each other in various ways, including vocal, chemical and sign languages. No such communication is known to exist in plants. Most familiar plants are stationary and only a few microscopically small ones are able to move about. The chief difference between plants and animals, however, is that plants can manufacture their own food, using the process called photosynthesis, whereas animals, including humans, must get their food either by eating plants or by feeding on animals that have eaten plants. During photosynthesis, green plants use sunlight energy to make their food from water and carbon dioxide gas from the air. Oxygen, which all plants and animals need to breathe, is produced as a waste product of photosynthesis. Since the only living things that are able to make their own food are green plants, all living things are interdependent, relying ultimately on green plants for food and oxygen.

Safety

Some children are allergic to certain plants, e.g. some flower bulbs, and pollen (from flowers), and remember that some plants are poisonous. Many children are allergic to certain animals. The students should always wash their hands after handling plants and animals, and particularly before touching food.

Answers

We are alive: **Rapid fire, pg 3.**

1) Living—mouse, tree, man, cat, girl, snail, dog, pot-plant.
   Non-living—watch, book, pencil, cup, table, stone, bicycle, car.
2) Sparrow—fly and walk or hop; crab—walk; snake—slide or slither (although some species of snake can also swim); horse—walk, run, jump; tiger—walk, run; earthworm—slither, slide or burrow.
3) True: a), b), d), and e). False: c).

Animal babies: **Rapid fire, pg 5.**

1) Birds change gradually as they grow into adults. They moult their first feathers to attain the adult plumage. Frogs and butterflies go through distinct stages of growth, called metamorphosis. A frog's egg develops into a tadpole, which gradually changes into a small frog. A butterfly egg hatches into a feeding stage, called a larva or caterpillar. This changes into a resting stage, called a pupa or chrysalis, from which the adult butterfly eventually emerges.
2) Most cold-blooded vertebrate animals (reptiles, amphibians and fishes) do not look after their eggs or babies. In general, if an animal lays a large number of eggs or produces large numbers of babies, there is no parental care of them. A few insects and other invertebrate animals do look after their eggs and young (e.g. the social ants, bees, wasps and termites), but the vast majority do not.
3) True: a), b) and d). False: c) and e).

Human babies: **Rapid fire, pg 7.**

1) Open answers.
2) A toddler can walk, talk to some extent, and feed itself.
3) Open answers.
4) Fingernails, toenails and hair grow fastest. We know because we have to cut them frequently. Teeth grow quite fast at certain times during our childhood. We know because we can see and often feel them growing. The other parts of our bodies grow slowly.

Plants are alive: **Rapid fire, pg 9.**

1) A plant would make its own food and would move only as it grew. An animal would move about and would have to search for food. It would respond to light and dark, touch and other environmental changes much more quickly than a plant, i.e. an animal is more sensitive to external stimuli.
2) True: b), c), and e). False: a) and d).
3) There is no correlation between the size of a seed and the size of the plant it grows into. To take a simple, everyday example, a runner bean seed is smaller than a broad bean seed, yet the runner bean plant is much larger than a broad bean plant. While some tree seeds are very large (such as the coconut), others are very small (e.g. apple pips or birch tree seeds). To prove this lack of correlation, one would need to sow a range of seeds, large and small, under identical conditions and measure the size of the resulting mature plants.

Non-living things: **Rapid fire, pg 11**.

1) Plants and animals move, grow, breathe, produce waste materials, feed, respond to stimuli, and reproduce. Rocks and metals cannot do any of these things.
2) Living—fish, tree, boy, cat, earthworm, pot-plant.
   Non-living—clock, book, pencil, cup, paperclip, chair, stone.
   Never-alive—clock, cup, paperclip, stone. The chair also comes into this category, but only if it is made of metal or plastic. A wooden chair would have once been alive.
3) A car cannot grow or reproduce itself.

Going further

Identify and draw the living things the children have seen during a walk to school or a visit to a farm or park. Collect pictures of as many plants and animals (including humans) as possible. Mount the pictures on card. Let the children group them into sets on the basis of things like plants/animals, shape, size, colour, kind of food it eats, etc. Reference books or the Internet will help with this activity.

Set up a bird table in the school grounds. Keep a daily record of the number of birds of each species which visit the bird table. Discuss how they move. What other signs are there that the birds are alive? How could you discover whether the different bird species prefer different kinds of food?

Make a collection of pictures of people moving in different ways. Look in particular at pictures of athletes and sportspeople. How many different ways of moving can you find?

Look at your hand. Compare it with an old person’s hand. In what ways are they similar? How are they different?

1. Living and non-living

What you need:

- pencil

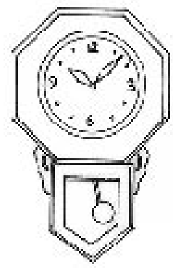
What you do:

Which of these are living things? Which are non-living things? Draw or write them in the boxes below:

earthworm

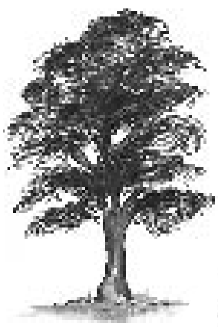
football

cat

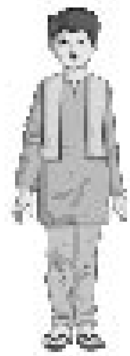


clock

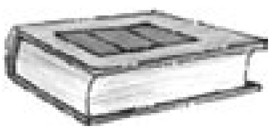
pen



tree



child



book

cup and saucer

dandelion

Living

Non-living

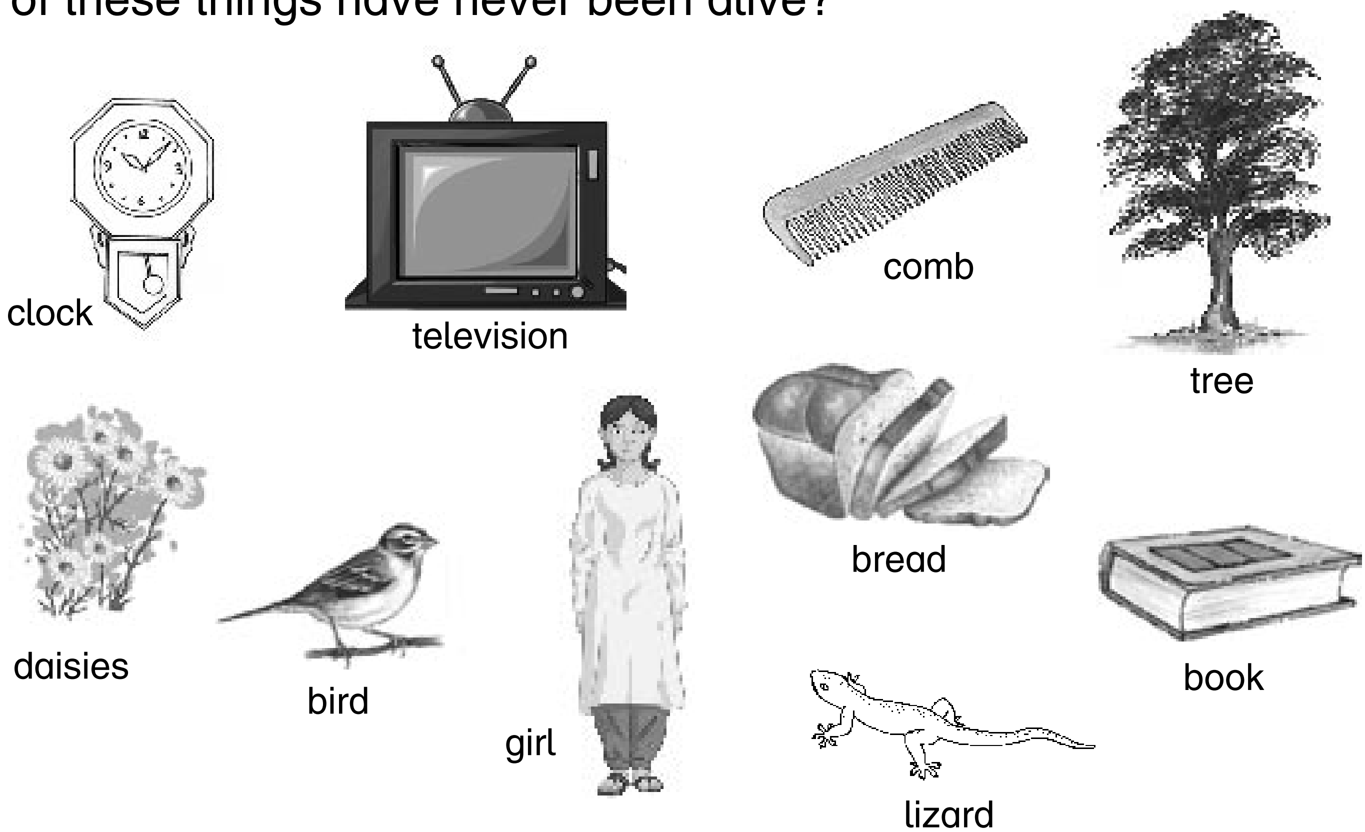
2. Living, non-living and never alive

What you need:

- pencil

What you do:

Which of these things are living? Which are non-living? Which of these things have never been alive?



Fill in the chart below.

Living	Non-living	Never alive

Look around your school. Add some more things to the table.

3. Moving about

What you need:

- pencil

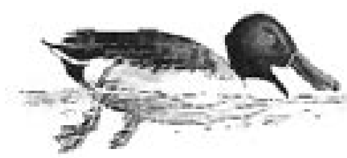
What you do:

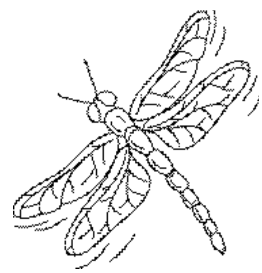
Look at these animals.

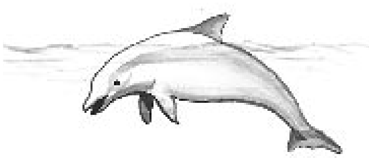
Underneath each one say how it is moving.

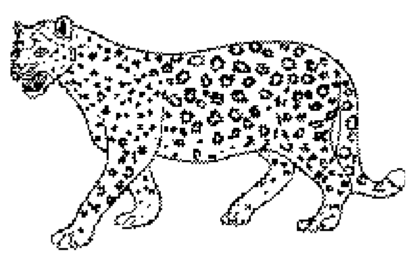
Choose your answers from the words in the box below:

crawl	**swim**	**walk**	**run**	**fly**	**climb**









4. Animal babies

What you need:

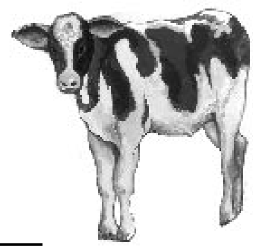
- pencil

What you do:

Draw lines to match the adult animal to its baby.

Fill in the name of the baby animal.

woman



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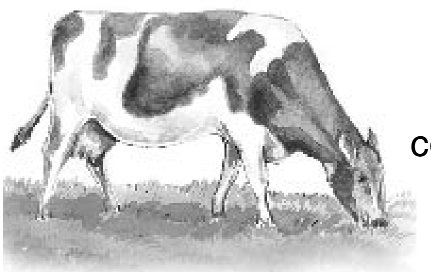
hen

____



cow

____

sheep

____

cat

____

5. Humans and other animals

What you need:

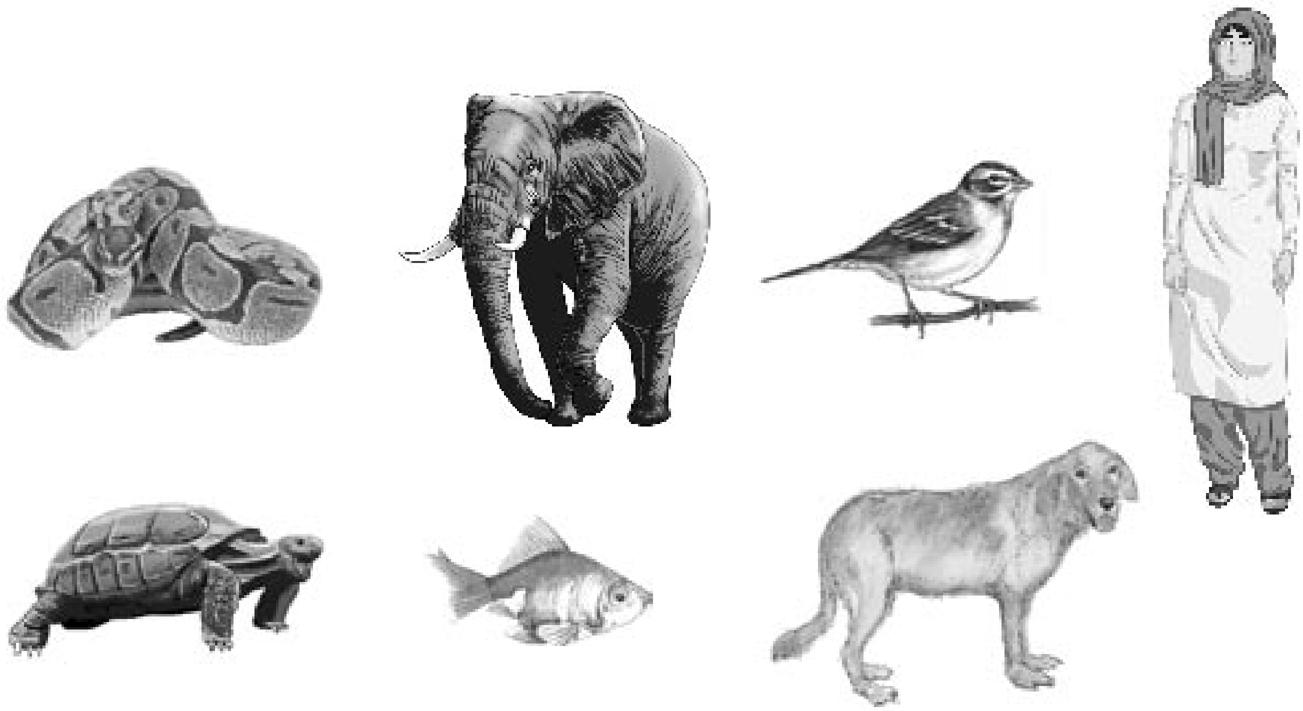
- pencil

What you do:

Look at the pictures.

What can all of these animals do?

Tick the five correct answers below.



feed	☐	talk	☐
grow	☐	produce babies or young	☐
lay eggs	☐	run	☐
breathe	☐	move	☐
swim	☐		

Notes on individual worksheets

1. Living and non-living

Key ideas The children are required to classify a group of objects into 'living' and 'non-living'.

Outcome Living: dandelion plant, earthworm, tree, child, and cat.
Non-living: clock, book, pen, cup and saucer, and football.

Extension Divide these and other living organisms into plants and animals.

2. Living, non-living and never alive

Key ideas To show that not only can objects be classified into living and non-living, but that the latter can be further subdivided into objects that were once alive and those that have never been alive.

Outcome Living: daisy plant, tree, bird, girl, lizard.
Non-living: television set, comb, loaf of bread, clock, book.
Never alive: television set, comb, clock.

Extension More able children could make a decision tree using simple questions that require 'Yes' or 'No' answers to classify objects. Such questions might include:

- Can it move?
- Does it feed?
- Does it grow?
- Does it breed/have babies/or reproduce?

3. Moving about

Key idea To identify some of the ways in which animals can move about.

Outcome human baby—crawl; duck—swim; spider—crawl, walk or run; eagle—fly; girl—run; dragonfly—fly; dolphin—swim; squirrel—climb; leopard—walk.

Extension Collect pictures of animals moving in different ways and group the pictures using the categories above.

4. Animal babies

Key ideas To connect baby animals with their parents and to show the variety of names used for baby animals.

Outcome Sheep and lamb, cat and kitten, cow and calf, human mother and baby, hen and chick.

Extension Discuss how and in what ways the baby animals in the pictures will change to become like their parents.

5. Humans and other animals

Key ideas To show the main features possessed by all animals.

Outcome Feed, grow, move, produce babies or young, breathe.

Extension Keep a pet animal, such as a mouse, gerbil or hamster, in the classroom for a few days. With appropriate hygienic precautions, let the students take turns to look after it. Keep a diary of the animal's needs and actions.

Safety Ensure the students always wash their hands thoroughly after touching animals or their cages or bedding. Remember that a few children suffer an allergic reaction in the presence of animals, and particularly birds and mammals.

Lesson objectives

- To provide introductory ideas about feeding and growth and to show some of the ways in which we need to look after ourselves to stay healthy.

Background information

Food supplies energy to humans and other members of the animal kingdom. It is important to remember that all of our food energy comes either directly from plants or from animals that feed on plants. Plants, in turn, obtain their energy from sunlight.

We need food not only to provide us with energy but also to keep us healthy and provide the materials for growth and the repair of damaged parts of the body. These functions are best fulfilled by eating a varied and balanced diet containing proteins, carbohydrates, fats, mineral salts, and vitamins, together with adequate fibre or roughage. The latter aids the movement of the food through the digestive system and so prevents constipation and possibly other diseases including heart trouble and bowel cancer.

Scientifically it should be remembered that there are no good or bad foods, only bad diets. All the foods we eat fall into the few basic categories listed above, and it is important for our health and well-being that we have a diet that contains a balance of these food categories.

How much energy an individual needs depends upon his or her physical size, level of activity, and rate of growth. If a person regularly eats food containing more energy than is needed, then the extra food is stored in the body as fat. It is a sobering thought that one in three adults is overweight.

Weight for weight, fatty foods contain most energy, but many of us eat excessive amounts of sugary or starchy carbohydrate foods, such as cakes, biscuits, and sweets, all of which have a high energy content. These latter foods are also important agents in the formation in the mouth of acids that lead to tooth decay.

In general, to achieve a balanced diet, we should eat more fruit, vegetables and cereals, and more low-fat sources of protein such as chicken, fish and beans. We should eat less fried foods, crisps, butter, sweets, jams and cakes, and less factory processed food, since the latter often contains preservatives and excessive amounts of sugar and salt. Finally, it should also be remembered that the body needs water to replace that lost during breathing, sweating and excretion.

Exercise and physical fitness

Unlike a machine, the human body wears out faster when it is idle than when it is used. If we laze around for a week, our muscles, heart, lungs and blood circulation adapt to that lethargic situation. Their efficiency decreases drastically because they do not need to be particularly efficient to supply our lower energy requirements. Even the bone marrow produces fewer red blood cells because fewer are being destroyed by activity. When we do start moving around, our body cannot easily adjust to the new situation and so we feel tired and listless.

Without adequate exercise, tendons and muscles shorten as we get older. This causes stiffening of the joints, making it more difficult to bend, twist and turn. The stance of many elderly people—back hunched, elbows and knees bent, feet apart to maintain balance—shows the effect of decreasing mobility. It is the typical posture of a body that has been allowed to seize up at the joints. It is often avoidable, except in the various forms of rheumatism where, through some body malfunction, the joints become inflamed, stiff and ultimately non-functional.

Unfortunately postural laziness is not confined to the old. Round shoulders are a posture defect found in all ages, including young children. Over the years, the horizontal muscles across the upper back lengthen and the chest muscles contract, making it more difficult to straighten the shoulders. In the spine, the vertebrae may begin to move against each other on the rims rather than flat on top; the edges of the bones wear away and discs may be displaced or ‘slipped’.

Most of these problems could be avoided by simple exercises or activities that stretch the muscles, tendons and ligaments of the body in order to achieve a full range of unrestricted movement at all major joints.

Fitness

There are, therefore, good physiological as well as psychological reasons for taking regular exercise. In the case of children and young people, exercise is essential if they are to achieve full and proper growth. In everyone, young and old, the increased blood flow helps all areas of the body, including the heart, lungs, nervous system, brain and other organs, to become more efficient. At the same time, we recover from injuries and illness quicker if we are physically fit.

Regular exercise reduces the dangerous build-up of fatty substances in the blood vessels and fit people decline more slowly with age. And once physical fitness has been lost, it is difficult to regain. In addition, exercise may provide an essential relaxation from sedentary and stressful occupations, and certain forms of exercise provide social benefits. Finally, and perhaps most important, there is a feeling of well-being that comes from being fit.

Becoming physically fit simply means improving the condition of your body so that you can easily meet the demands of everyday life and still have something in reserve to cope with sudden or unexpected stress. The object, in essence, is to maintain or recapture (according to age) some of the health, strength and vitality of youth. Most people find as they get older that their physical condition deteriorates. However, as we have seen, much of this deterioration is caused not by the ageing process itself but by neglect of the body.

Exercise and diet

There is a close relationship between exercise and diet. The more physical exercise that is carried out, the more energy-giving foods are required. If the body receives insufficient food energy, then we quickly become fatigued. If the body receives more food energy than is required over a long period of time, then the excess food is stored as fat and obesity may eventually result. If we are trying to build up strength and fitness, and to increase suppleness, then we need to increase the intake of body-building protein foods. During increased activity we also need to increase water intake, to compensate for that lost by sweating.

Rest and sleep

Regular rest and sleep are just as important as regular exercise. However, although a great deal is now known about the physiology of rest and sleep, the necessity for them has not yet been fully explained scientifically. What we do know for certain is that during periods of rest the cells of the body are replenished with fuel and building materials, while carbon dioxide and other waste products are removed from them. During sleep, the pulse rate slows, blood pressure falls, the body temperature drops by 3 to 4 degrees Centigrade, the muscles relax and an essential sequence of sleeping and dreaming takes place. Although the brain becomes much less sensitive to external stimuli during sleep, its activities do not cease.

The traditional views about how much sleep is needed are given less and less credibility today. Research shows that there are very widely differing requirements for sleep in each individual, and social pressures and habits often determine when and for how long people sleep rather than their bodily needs. In the case of children, only common sense observation will tell whether a child is starting the day refreshed or fatigued.

Drugs and medicines

A drug is any substance, natural or synthetic, which has an effect on the functioning of the human body. By this definition, substances such as alcohol, the nicotine from tobacco, the caffeine in tea and coffee, and the solvents of glues and other substances are drugs. A medicine has a much more restricted definition. It is any substance taken into the body which has a curative or beneficial effect, such as relieving pain or treating illness. Thus all medicines are drugs, but not all drugs are medicines.

The caffeine in coffee, and to a lesser extent in tea and some cola drinks, and the alcohol in some other drinks are stimulant drugs. In small doses they may not be harmful but large doses over a long period can be dangerous. Like alcohol, the nicotine in tobacco is an addictive drug which causes difficulty in breathing, a smoker's cough or even bronchitis. Sometimes during violent coughing the air sacs in the lungs burst. There is less surface area for oxygen and carbon dioxide to be exchanged, and the illness that results is called emphysema.

The problems do not end there. The poisonous carbon monoxide gas in the tobacco smoke gets into the blood and makes it harder for the red blood cells to pick up oxygen. At the same time, the tar in the tobacco smoke sticks to the air sacs of the lungs, irritating them, and eventually causing lung cancer in some people. There is definite evidence that people who smoke, or who regularly breathe in someone else's smoke, die on average, younger than non-smokers.

It should be remembered that all drugs are chemicals that can change the way the body works. Most drugs are prescribed by doctors and are put into the body by swallowing or injection, or are applied to the skin. The drugs which combat asthma are inhaled. However, all drugs involve a risk, and dosage instructions must be followed carefully. The body can become tolerant to some drugs so that larger doses are needed to produce the same effect. And, as can be seen in the case of alcohol and nicotine, some people quickly become addicted to drugs.

Safety

Be aware that young children have little or no say or control over what they are given to eat at home. Therefore, when discussing food and diets, take care that they do not get the impression that you disapprove of their dietary habits.

When discussing medicines, always stress the important safety messages, including:

- Never take medicines unless they are given to you by a trusted adult.
- Things that look like sweets may not be sweets and could make you very ill.
- Never touch a syringe you might find. It might hurt you or have germs on it.

Answers

We need food: **Rapid fire, pg 13.**

1) and 2): Open answers

3) a) milk
   b) wheat (or corn)
   c) butter
   d) refrigerator
   e) water

Foods for different purposes: **Rapid fire, pg 15.**

1) a) We need food for energy, warmth, growth, and to keep us healthy.
   b) If we do not eat or drink we will become weak, ill and eventually die.
   c) Plants make their own food from simple raw materials (carbon dioxide from the air and water from the soil) using the energy of sunlight.

d) Foods rich in fibre are fruits, vegetables and cereals (also foods made from whole cereal grains).
e) Fibre is good for you because it absorbs water and helps to move the waste food along the digestive system and out of the body. Lack of fibre in the diet leads to constipation and other disorders of the large intestine, and possibly also to bowel cancer and heart problems.

2) a) Foods that help the body to grow include lean meat, fish, milk, cheese, eggs and nuts.
b) Foods that give us quick energy include sweets, biscuits and cakes and any other foods that contain a lot of sugar or starch.
c) Foods that give us energy to store include fat meat, oily fish, fried foods, butter and margarine. If we eat more of any food than we need, the surplus is stored as fat.
d) Fruits and vegetables help to keep us healthy.

3) Human babies are fed on milk at first because they lack teeth and also because their digestive systems have not developed enough to deal with solid foods. A baby cries to tell its mother it is hungry. All of the mammals (animals with hair or fur) feed their young on milk. The only other vertebrate animals which feed their young are birds. The social ants, bee, wasps and termites feed their young as well. In general, these feed their young on small pieces of the adult food.

Exercise, rest and sleep: **Rapid fire. pg 17.**

1) Open answers.
2) Children need more sleep than adults because their bodies are still growing. Accept open answers for remaining part of question.
3) Objects which grow: b) a boy; c) a tree; e) your teeth; g) a leaf; j) a girl; k) your fingernails.

Medicines: **Rapid fire, pg 19.**

1) In general, we care for people who are ill by keeping them warm and allowing them to have plenty of rest and sleep. We provide them with foods and drinks that will help their bodies to recover quickly. Medicines may be given to relieve the symptoms or to cure the illness, depending on what condition the patient is suffering from.
2) a) We take medicines to kill pain, to help us get better when we are ill or to stop us becoming ill.
b) We take medicines by swallowing them, applying them to the skin, putting them under the skin, or by breathing them in.
c) A responsible adult should always be with us when we take some medicine to ensure we take the right medicine in the correct dose in the right way at the right time.
d) It is very dangerous to take medicines from someone we do not know because they might want to hurt us.
e) Medicines should be kept out of reach of babies and toddlers because they might mistake them for sweets. Many medicines are dangerous if taken in the wrong quantity by someone who does not need them.
3) Open answers.

Going further

Collect pictures of different types of foods from magazines. Make sets of the different foods, such as meat, vegetables, fruits and cereals, foods you eat raw and foods you eat cooked.

Display a class chart of favourite foods and some of the food sets the students have devised with their pictures in the previous activity. Use these to emphasize the fact that there is no one ‘ideal’ meal, and that as long as a meal contains a variety of foods, it is good for them. Stress that the occasional meal that is not well balanced does no harm. Remember that it is also important that the students drink lots of water and not just sweet or fizzy drinks.

Collect some empty food packets, food labels and wrappers. Look to see where the foods came from. Sort them into as many different sets as possible.

Write down the times at which you have your meals. What is the shortest gap between meals? What is the longest gap between meals? Do you know why we call the first meal of the day ‘breakfast’? Why is it bad for people not to eat anything at breakfast time?

To fast is to go without food, so that ‘breakfast’ means the breaking or ending of a period without food. Breakfast is the most important meal of the day because, unless they eat breakfast, it is possible that some children will have fasted for 18 or 20 hours. As a result they will be lacking in energy and inattentive. There is also the risk that, if a heavy meal is eaten to make up for the period of ‘fasting,’ the surplus food will be deposited as fat.

Discuss why we cook much of our food and how the food we eat is changed by cooking. What other things are done to our food when it is prepared? Refer to washing, cutting, slicing, peeling, grating, freezing, melting, thawing, etc. We cook food to make it tender, to kill any germs, and to release flavours and nutrients that would otherwise be ‘locked up’ in the food.

Cut out coloured photographs from magazines that show plates of food. Stick them on to pieces of card. Use them for a ‘good food quiz’. Which of the plates of food are healthiest? Which are less healthy?

The healthiest plates of food contain a high proportion of fruit, vegetables, seeds or grains, together with lean meat, fish or eggs. The plates should contain foods that are low in fat, sugar and salt. Processed foods and fizzy drinks should be avoided as far as possible.

1. Which foods do you eat?

What you need:

- pencil and paper

What you do:

Keep a food diary like this.

Record the foods you eat each day.

Day	Meal	Food and drink	How much
Monday	breakfast	cornflakes and milk toast orange juice	1 bowl 1 slice 1 glass
	lunch		

Keep your food diary for a week.
Compare it with one of your friends' diaries.
How are the two diaries the same? How are they different?

2. Food and drink

If we are to keep fit and healthy, we must eat a selection of different foods.

Draw or write a balanced meal.

Main meal

Dessert

3. Healthy school lunches

Invent your own school meals for a week. To be healthy, each lunch must have at least two kinds of fruit and vegetables every day. Bread and water or some other drink should be served every day, but chocolate and crisps are banned. Chips can be served only once a week.

Day	Meat/ nuts/ fish	Potatoes or rice	Vegetable	Vegetable	Dessert/ fruit	Drink
Monday						
Tuesday						
Wednesday						
Thursday						
Friday						

4. Exercise, rest and sleep

What you need:

- pencil

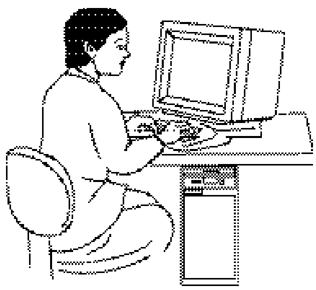
What you do:

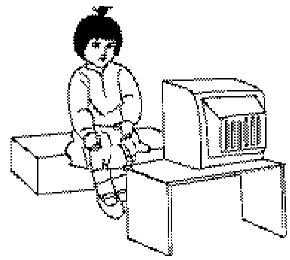
Look at these pictures.

Circle all the people who are exercising.









Which exercises do you do?..
How long for each week?..
What time do you go to bed?..
What time do you get up?...
How many hours do you sleep each night?...

5. Taking your medicine

What you need:

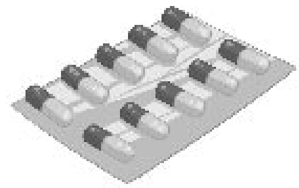
- pencil

What you do:

Look at the pictures. They show some of the ways we can take medicines. Draw a line to join the medicine to how it is taken.

on the skin

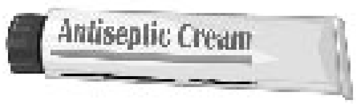
tablets



capsules

breathed in

under the skin



cream

inhaler

swallowed

swallowed

cough syrup

syringe

swallowed

Name two people who are allowed to give us medicines.

a)..

b)..

When could medicines be harmful to us?

a)..

b)..

Notes on individual worksheets

1. Which foods do you eat?

Key ideas We consume a wide variety of foods and drinks. People differ in their individual preferences.
Extension Construct a bar chart of favourite foods.

2. Food and drink

Key idea To be able to recognize the constituents of a balanced meal.
Outcome It is impossible to predict the outcome of this activity, but the meal should contain body-building foods, such as meat, fish, chicken, beans, lentils or egg, energy-producing foods such as bread or rice, and fruit and vegetables.
Extension Make a collection of clean food containers—jars, packets and cans. Compile a chart showing where they come from (country as well as plant or animal), and how they are kept fresh.

3. Healthy school lunches

Key idea To design a menu of healthy lunches for a week.
Outcome It is impossible to predict the outcome of this activity but it is important that the students should follow the instructions at the beginning of the activity.
Extension Ask the children to draw a large picture of a lunch box. Let them stick pictures of foods cut from magazines and newspapers in the lunch box to create a healthy picnic. Discuss with the students why they have chosen those particular foods.

4. Exercise, rest and sleep

Key idea To identify physical activities and activities which are not exercise; the children then have to complete a chart on their own exercise and sleep habits.
Outcome Physical exercise: running, cycling, football and swimming.
Not physical exercise: watching television, reading, and using a computer.
Extension Calculate the length of time spent doing exercise each week. Discuss why we often sweat after vigorous exercise and why we should cover ourselves after sweating, particularly on a cold day, and why we need to wash thoroughly after sweating.

5. Taking your medicine

Key idea To be able to link six types of medicine with the ways in which they are applied or taken; to identify the people from whom students may accept medicines.
Outcome Antiseptic cream—on the skin. Antibiotic capsules, headache (pain relief) tablets and cough mixture are swallowed. Injection of vaccine—under the skin. Asthma inhaler—breathed in.
People who are allowed to give us medicines could include: a parent or guardian, a close adult relative, a doctor, nurse, or dentist. Medicines could be harmful to us when intended for someone else, in the absence of illness, and in the wrong dose.
Extension Make a large collage picture of a chemist's shop to illustrate the source of many drugs and medicines and to emphasize the wide range of containers in which drugs and medicines are supplied.
Safety Stress that the children should never take medicines unless they are given by a trusted adult. Never touch a syringe. Things that look like sweets may not be sweets and could make them ill.

Lesson objectives

- To show that some materials occur naturally while others are manufactured.
- To demonstrate that heat can change materials and that these changes may be reversible or permanent.
- To show that some of the changes brought about by heat produce new materials that are useful.

Background information

The *Concise Oxford Dictionary* defines material as 'matter from which a thing is made'. By this broad definition, every thing in the universe is made up of materials, including all living organisms.

If we consider only the common raw materials used by people, then a distinction can be made between natural materials, which come from animals and plants or from the Earth's crust, and synthetic or manufactured materials such as steel, glass, paper, and plastics, which are made from other natural materials.

Physical changes

Physical changes do not produce any new substances. The material keeps its original chemical composition and any change is reversible. The material may be folded, cut, bent, frozen, or compressed, but the matter you end up with is the same as the one you started with.

An excellent example of a physical change is the freezing of water and the melting of the resulting ice. Similarly, moulding clay or Plasticine (but not baking it) is an example of a physical change.

Chemical changes

A chemical change is more complicated. In a chemical change, you start with one material and end up with one or more new one(s). What is more, the change is permanent and the new material has a different chemical composition from the one you started with.

Some examples of chemical changes are burning, rusting, and the digesting of food. When a fuel such as coal or wood is burned it combines with oxygen from the air, and produces a great deal of heat and light energy, plus waste products such as ash, smoke, and other gases. There is no way in which these substances can be recombined to form the original fuel. Oil and natural gas, when burned, also produce heat and light energy, with waste products, including gases such as water vapour and carbon dioxide.

Cooking an egg, or any other food, is also an example of a chemical change. The taste, texture, and appearance of the food are changed by the heat. An iron nail or a piece of steel left outside soon starts to turn brown and crumbly on the surface. The iron or steel has reacted with water and oxygen in the air to produce a new chemical compound, 'rust', which is a form of iron oxide. We can slow down the process of rusting by reducing the contact of the iron or steel with oxygen. This can be achieved by coating the metal with oil, grease or Vaseline, painting it, or coating it with zinc (a process known as galvanizing) or tin. Zinc and tin do not rust and so protect the iron or steel underneath. We can similarly slow down burning by reducing the supply of oxygen to the fire by smothering it with a special fireproof blanket, by spraying it with water (which also cools down the burning materials), or by using a fire extinguisher which 'blankets' the fire with heavy carbon dioxide gas or a special foam, both of which exclude oxygen.

There are many other simple examples of chemical changes that can be demonstrated to children. Adding a few drops of vinegar to baking powder or bicarbonate of soda produces a vigorous chemical reaction in which the gas carbon dioxide is produced. Chemically, plaster of Paris is a white solid called calcium sulphate. This occurs naturally as gypsum. On heating, gypsum loses water and becomes plaster of Paris. When mixed with water the plaster of Paris can be moulded before it sets hard.

Many common occurrences include both physical and chemical changes. When a sandwich is eaten, the biting and chewing are examples of physical changes, while the digestion of the food into new, simpler chemical substances that can be absorbed by the body is an example of a chemical change. Similarly, when rock is broken down by alternate freezing and thawing, that is an example of a physical change. But limestone rocks dissolve slowly in rainwater which contains dissolved carbon dioxide gas, a weak acid, forming a chemical change. Indeed this type of weathering is called chemical weathering.

Safety

It is not wise to heat the various plastic substances in the classroom since some give off toxic fumes.
The children should be warned not to invent their own experiments on heating materials unless they are closely supervised by a responsible adult.

Children should not touch ice cubes that have come straight from the freezer with their bare hands.

Answers

Everyday materials: **Rapid fire, pg 21.**

1) Natural materials: cotton, leather, rubber, stone, wood and wool. (Nowadays much rubber is man-made)

   Man-made materials: brick, concrete, polyester, glass, metal (gold is the only metal commonly found in its natural state), paper and plastic.
2) True: a), c) and e). False: b) and d).
3) Some clothes that might be made of cotton include vests and other underwear, T-shirts, socks, dresses, nightwear, shirts, jumpers, shorts and trousers.

   Cotton is a good material for these clothes because it is cool and allows sweat to pass away from our skin and, unlike some woollen and synthetic materials, it does not irritate the skin.

Everyday materials: **Try it out, pg 20.**

1) Wood, rubber and cotton are natural materials. Plastic and paper are made by people.

More natural materials: **Rapid fire, pg 23.**

1) Examples of objects made from the following materials:
   a) Wood—doors, window frames, furniture, pencils, cricket bats, some musical instruments, tool handles, sheds and other buildings.
   b) Leather—shoes, boots, belts, handbags, purses and wallets.
   c) Rubber—boots, tyres, hot-water bottles, erasers, balls.
   d) Cotton—socks, underwear, T-shirts, jumpers, dresses, nightwear, shirts, shorts, trousers and skirts.
   e) Clay—cups, saucers, plates, bowls, vases, bricks, tiles, flower pots.
2) Some uses of silk include making gowns, scarves, stockings or tights, hats, wedding dresses, ladies nightwear and underwear, and for silk-screen printing. Before the discovery of artificial silk and other man-made fibres, parachutes were made from silk, while silk was also used in the nose-cone of the supersonic aircraft *Concorde.*

   Some uses of stone include as a building material for houses and walls, for road-making, for sculpture, for making concrete and, in the case of precious and semi-precious stones, to make jewellery.
3) Things that might be made from wool include jumpers, jackets, skirts, socks, coats, some underwear, shirts and dresses, shorts and trousers, blankets, rugs and carpets.

Heating and cooling materials: **Rapid fire, pg 25.**

1) Water turns to water vapour or steam when it is heated and returns to liquid water when it is cooled.
   An ice lolly, candle wax and tar melt when they are heated and turn solid when cooled again.
   Clay, bread dough and an egg solidify when heated and do not change back when cooled.
   Paper, wood and coal burn if heated strongly enough and turn to ash, a process which is not reversible.
2) True: a), b), d) and e). False: c).

Making new materials with heat: **Rapid fire, pg 27.**

1) a) Materials which melt when you heat them include ice, ice cream, chocolate, butter, margarine, candle wax and tar.
   b) Materials that go hard when you heat them include clay, bread dough and an egg.
   c) When water is heated it turns to water vapour or steam (a gas).
2) Materials which burn easily include wood, paper, straw, candle wax, cooking fat, coal and oil.
3) An egg solidifies when heated. This change is irreversible.

Making new materials with heat: **Try it out, pg 27.**

1) Toast has a different colour, texture and taste from the bread it is made from.

Going further

Make a class exhibition of common materials. Include natural and manufactured materials. Let the children observe and describe the materials and then find ways of grouping them into sets, including by shape, colour and texture.

Make ice lollies from either fruit juice and water or orange squash and water. Freeze them in the freezing compartment of a refrigerator.

Experiment with clay—moulding, rolling, flattening and shaping it. Try joining pieces of clay together by various methods, including wetting the clay. How can you make the strongest join? Discuss what the clay feels like when you touch and shape it.

Compare baked clay with the unbaked material. Devise a method of comparing the strengths of objects made from baked and unbaked clay.

Make a simple dough by mixing flour and water. Examine its shape, colour and texture. Bake it. How does the resulting unleavened bread compare with the unbaked dough? Make some fresh dough rise by adding either yeast or, quicker, baking powder. How does it compare with the simple flour-and-water dough? Bake it. How does the resulting bread compare with the unleavened bread?

Most stone is natural. Concrete is a stone which has been made by people. Copy this chart. Look around your home, school and the area round about. Write down or draw the things made from natural stone. Write down or draw the things made from concrete.

Things made from stone	Things made from concrete

Make a ‘feely box’ containing different kinds of materials that are safe for the students to handle. Ask them to describe what each material feels like. How many of the items can the students identify by touch alone?

1. What material is it made from?

What you need:

- pencil

What you do:

Look around your school. Draw some objects that are made from these materials:

wood	**rock**
plastic	**metal**
paper	**glass**

2. Which materials?

What you need:

- pencil

What you do:

Choose a favourite toy or something which is made from lots of different materials.

Draw a picture of your chosen object.

Label the different materials in it. Use some of these words to help you write your labels.

plastic	metal	wood	glass	leather	paper	clay	stone

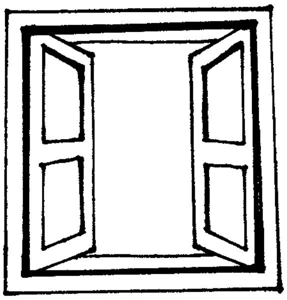
3. Using materials

What you need:

- pencil

What you do:

Look at the pictures carefully and then finish the sentences.



The window is made of glass because ....

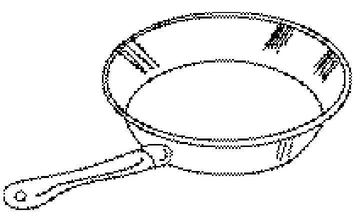
....

....

The boots are made of plastic because ....

....

....



The frying pan is made of metal because ....

....

....

The bridge is made of concrete because ....

....

....

The jumper is made of wool because ....

....

....

4. Heating materials

What you need:

- pencil

What you do:

Think about each of these materials. What happens when you heat them?

Material	What happens?	Drawing
bread		
candle		
ice cube		
egg		
chocolate		

Work with an adult to test them. Draw what happens in the table.

5. Melting ice cubes

What you need:

- pencil
- ice cubes
- saucers or tin lids
- a clock or watch

What you do:

Leave an ice cube in each of these places.

Look at the ice cube every 10 minutes. Each time draw what the ice cube looks like.

Place	**After 10 minutes**	**After 20 minutes**	**After 30 minutes**
on my desk			
on a window sill			
inside a cupboard			
inside a fridge			

Which ice cube melted completely first? ……………………

Which ice cube lasted longest?..

Notes on individual worksheets

1. What material is it made from?

Key idea To identify some of the materials to be found around the school.
Extension Discuss why the particular materials identified have been used in those places.
Safety Warn the students that they may look at materials found around the school but not touch them.

2. Which materials?

Key idea To identify the materials that were used to make a favourite toy.
Extension Make a display of different types of packaging materials.
Safety It may be necessary to provide a selection of toys or other suitable objects for those students who, for any reason, do not bring a toy to school.

3. Using materials

Key idea To relate the uses of materials to their properties.
Outcome The window is made of glass because we can see through glass (or it is transparent).
The Wellington boots are made of plastic because plastic is waterproof.
The frying pan is made of metal because metal does not burn, does not melt/carries heat.
The bridge is made of concrete because concrete is strong/can carry heavy weights.
The jumper is made of wool because wool is warm.
Extension Make a collection of common materials and see how they behave when they are placed, individually, in water. Include some materials which dissolve and others which float and sink.

4. Heating materials

Key idea Many materials change when they are heated.
Outcome Bread becomes toast; candle wax melts; ice cube melts; egg solidifies; chocolate melts.
Extension Discuss which of the above changes can be reversed and how you could do this.
Safety This activity should be strictly supervised and the children should be warned not to invent and carry out experiments of this type unless they are in the care of a responsible adult.

5. Melting ice cubes

Key idea To investigate the conditions under which ice cubes melt.
Outcome The ice cubes will melt fastest near a window sill and last longest inside a refrigerator.
Extension Discuss the results of this activity. Introduce the idea of temperature as a measure of hotness or coldness.
Safety The students should not be allowed to touch ice cubes straight from the freezer as these can stick to the fingers and cause injury. Ideally the students should wear gloves for this activity.

Lesson objectives

- To demonstrate the essential role electricity plays in everyday life.
- To explore the sources of electricity and construct and test simple circuits.
- To emphasize the potential hazards associated with mains electricity.

Background information

The technical definition of electricity is a 'flow of charged particles or electrons'. Electrons move or flow through certain kinds of materials. Materials through which electrons (i.e. electricity) can flow are called conductors. With one exception all conductors are metals, such as copper, zinc, steel, tin, gold, silver, and even platinum. The exception is the non-metal graphite, the so-called pencil 'lead', which is a form of carbon and a good conductor of electricity.

Materials that do not conduct electricity are called electrical insulators. Insulators are usually made of non-metallic materials such as rubber, wood (when it is dry), plastic, and porcelain. Insulators are used for confining electricity within conductors. Wires and other parts of appliances carrying an electric current always have an insulating cover to prevent the current from taking a 'wrong' pathway and to protect the user from electric shocks or burns.

Electricity generation

Mains electricity is made at the power station in machines called generators, which work on the same principle as cycle dynamos. Inside steel cages are huge coils of wire in the middle of which are electromagnets. Fuel is used to heat water and turn it into steam. This then turns turbines connected to the generators. When the latter are turned they produce an electric current. Because large quantities of electricity cannot be stored, it must be made as it is needed.

Batteries or cells

Another way of producing an electric current is by means of chemical action in a cell or battery. There is no difference between the electricity that comes from a generator at the power station or that comes from a cell or battery; it is simply the method of production that is different. Although the terms are often used synonymously, strictly speaking a battery is two or more cells connected together. Electricity is not stored in a battery; the chemicals within it react and cause a flow of electrons when wires are connected to it. A car battery, and other rechargeable batteries, produce electricity in the same way as an ordinary battery. The chemical reaction can, however, be reversed by passing an electric current through the battery in the opposite direction to the current obtained when the battery is being used.

Electric circuits

It should be remembered when working with electric currents that electrons (electricity) must have a complete conducting path from their source, through a device that will use some of the current, and back to the source. This flow is known as an electric current. If there are any gaps in the circuit, the electric current cannot flow. A torch bulb will use the electricity produced by a cell if they are both part of a circuit. Copper wires, or metal strips, are needed to conduct the electricity from the battery, to the torch bulb, and back to the battery again.

In a simple electrical circuit we can judge the size of the current by the brightness of the bulb. A large current will make the bulb grow brightly while a small current will make the bulb glow only dimly, if at all. For more accurate measurements of current, an instrument called an ammeter is used. This measures the rate at which the current flows through the circuit, or the amount of electricity flowing through it in a given time, in units called amperes (amps for short).

It sometimes helps to think of a battery as a kind of pump, forcing an electric current around the circuit. The harder the pump works, the more electricity will flow. In other words, the amount of current flowing depends on the pressure behind it. Electrical pressure is termed voltage and is measured in volts. The voltage of most domestic supplies is between 200 and 250 volts, while a battery of the kind used in a torch gives only 1.5 volts.

Heat and light from electricity

Whenever an electric current flows through a wire, heat energy is produced. The heating depends on the current flowing and the resistance of the wire. In an electric fire, the connecting cable has a very low resistance, but the wire of the heating element has a high resistance so virtually all the heat is produced at the element. Electric cookers have a similar kind of heating element.

If the temperature rise is great enough when electricity flows through a low resistance wire, light is produced. This effect is used in electric lamps. Modern electric lamps have coiled filaments made of extremely thin tungsten wire which becomes white hot.

When trying to explain the nature of electricity, it is wise to avoid comparing electricity with water in a pipe under pressure. The students can easily see that a water pipe is hollow whereas a wire is solid. The nearest analogy is to compare the movement of electricity along a wire with the passage of heat along the metal handle of a saucepan, but even that analogy has its limitations—electricity travels instantaneously, heat takes time.

Safety

While it is perfectly safe to experiment with torch batteries and bulbs, the students should be warned that it is extremely dangerous to interfere with mains electricity and they should not touch electrical appliances connected to the mains supply.

Answers

Useful electricity: **Rapid fire, pg 29.**

1) Table lamp, electric fire and toaster—light and heat
   Electric kettle—heat
   Electric stove—heat (also light from the electric rings)
   Washing machine and electric drill—sound and movement
   Television set and computer—light and sound
   Radio and iPod—sound
2) Open answers.
3) We use electric trains, trams and trolley buses to move us from place to place. There are a few electric cars and buses, but electricity is also used to work the lights, heater, air conditioning, starter motor, ignition, etc. in most cars and other vehicles.

Useful electricity: **Try it out, pg 28.**

3) A supermarket or large shop would mainly use electricity for lighting and heating or air conditioning. Lifts, refrigerators, freezers, telephones, tills and cash registers and any system of making announcements to the staff and customers would also use electricity.

Mains electricity: **Rapid fire, pg 31.**

1) True: a), c) and e). False: b) and d).
2) Pylons are tall to prevent people, farm machinery and other large vehicles touching the cables. In towns and cities electric cables are underground for safety reasons, to prevent people and vehicles touching or damaging them. However, it is easier and cheaper to find and repair broken cables on pylons than it is those that are underground.

Mains electricity: **Try it out, pg 31.**

2) We could use less electricity by, for example, switching off lights in unoccupied rooms, not leaving television sets and computers on 'standby', putting the exact amount of water we need in an electric kettle, putting on an extra jumper instead of turning on an electric heater, not leaving a freezer or refrigerator door open for more than a few seconds and using energy-efficient light bulbs.

Electricity from batteries: **Rapid fire, pg 33.**

1) Battery-operated—car, laptop computer, torch, small radio, calculator, watch, mobile telephone, most clocks, iPod.

   Mains electricity—hair dryer, table lamp, toaster, desktop computer, washing machine, refrigerator, electric fire.
2) The advantage of battery-operated machines is that they are completely portable. The disadvantages are that the batteries are relatively expensive, quickly run out and then have to be recharged or replaced.
3) Some of the objects that use tiny batteries are watches, hearing (deaf) aids, and some cameras and calculators.

Making a circuit: **Rapid fire, pg 35.**

1) a) A power station.
   b) Mainly chemicals.
   c) The first battery was invented by Count Volta, an Italian, in 1780.
   d) A circuit is the loop of wire electricity flows along from a battery to a bulb (or some other device) and back to the battery again.
   e) An American, Thomas Edison, invented the first electric light bulb in 1879.
   f) Wires
   g) The bulb will not light/goes out.
2) The word 'electric' means of or worked by electricity. Some pairs of words that include 'electric' are: electric light, electric motor, electric guitar, electric train/bus/car, electric iron, electric circuit, and hydroelectric.
3) Things that use batteries include: a car, laptop computer, torch, small radio, calculator, watch, mobile telephone, most clocks, an iPod.

Making a circuit: **Try it out, pg 35.**

2) Not all torch bulbs are the same. They differ in size, shape, and the arrangement of the filament. Most have a screw fitting, but a few have a bayonet fitting.

Circuits and switches: **Rapid fire, pg 37.**

1) True: a), b), d), e), f) and g). False: c).
2) A switch acts as a movable gate or bridge in a circuit. When the switch is 'on' the gate or bridge is closed, the circuit is complete and electricity can flow. When the switch is 'off' the gate or bridge is open, there is a gap in the circuit and the electricity cannot flow.
3) Like electricity in a circuit, an electric train can only run right round the track if there are no gaps in it.

Circuits and switches: **Try it out, pg 37.**

3) The materials which will make the circuit light up are metals, and objects made of metal, and the graphite ('lead') in a pencil. Metals and graphite are called conductors of electricity. No other materials will allow electricity from a battery to pass through them easily. They are called electrical insulators.

Going further

Carefully remove the cardboard or plastic casing from a battery. Use a hacksaw, and pliers or wire cutters, to cut open the metal casing. Do this on newspaper. Show the students, but do not let them touch, the contents and structure of the battery.

Make a large wallchart display for the classroom. Draw a large outline of a house and then include the students' pictures of various items of electrical equipment in the correct rooms.

Let the students find out about the animals which make electricity. What is the electricity used for?

Carry out a survey of the students in your class. Ask them whether they use electricity, wood, coal, oil, gas or some other fuel to cook their food. Make a block graph of your results. Which fuel is the most popular? Why?

Collect pictures of electrical appliances from magazines and catalogues. Let the students make sets of them, based perhaps on the different uses of the appliances and whether they are worked by batteries or mains electricity.

Discuss with the students the dangers of the misuse of electricity.

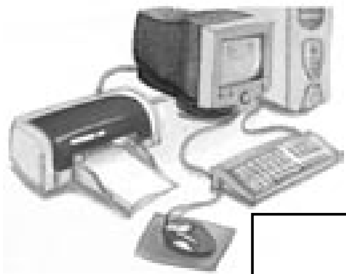
1. Using electricity

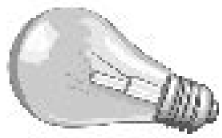
What you need:

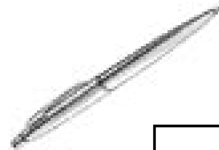
- pencil

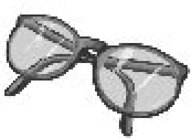
What you do:

Look at the pictures. Write **YES** against the things that need electricity to work. Write **NO** against the things that do not need electricity to work.









Now look around your home or school. In the box below, draw or write the names of some other things that use electricity.

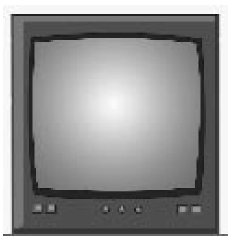
2. Mains electricity or batteries?

What you need:

- pencil

What you do:

Which of these things use mains electricity? Write **mains** against each one. Which of these things use batteries? Write **battery** against each one.



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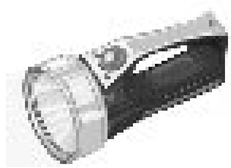

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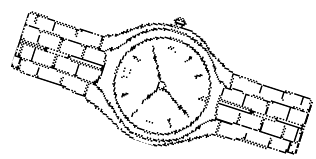

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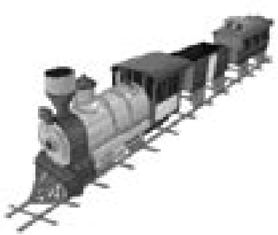

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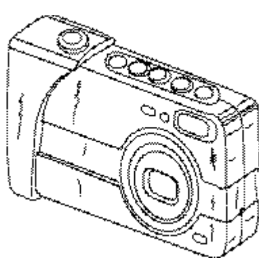

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3. Making things happen with electricity

What you need:

- pencil

What you do:

Look around your home, school and the local area.
Which things that use electricity give out a light? Which get hot? Which make a noise and which move around?

Draw or write in the boxes below:

give out light	**get hot**
make a noise	**move around**

Safety: do not touch anything that uses mains electricity.

4. Electricity in the home

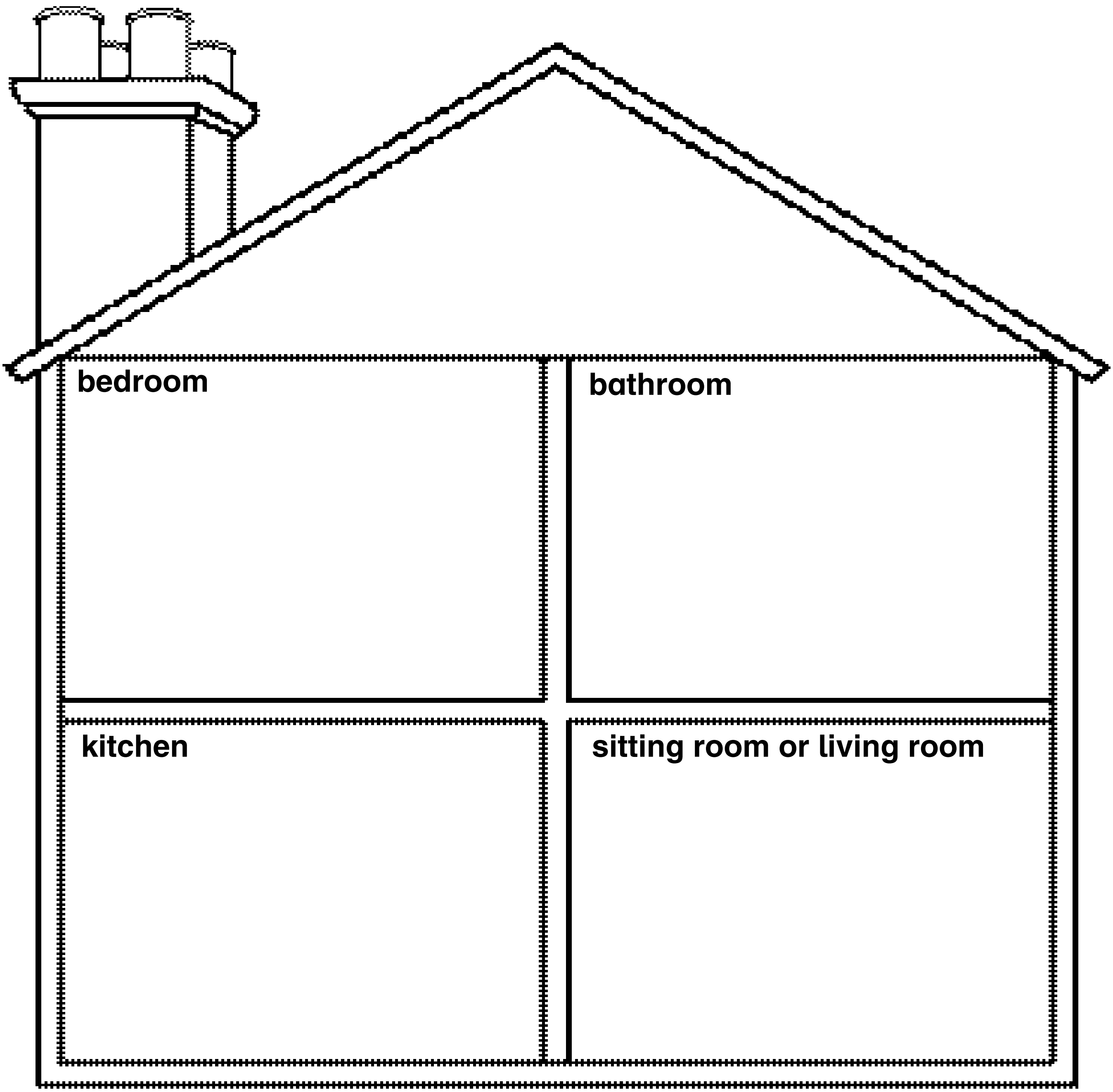
What you need:

- pencil

What you do:

Look around your home. What things can you see that use mains electricity?

Draw pictures of them in each room.



Safety: do not touch anything that uses mains electricity.

5. Making a circuit

What you need:

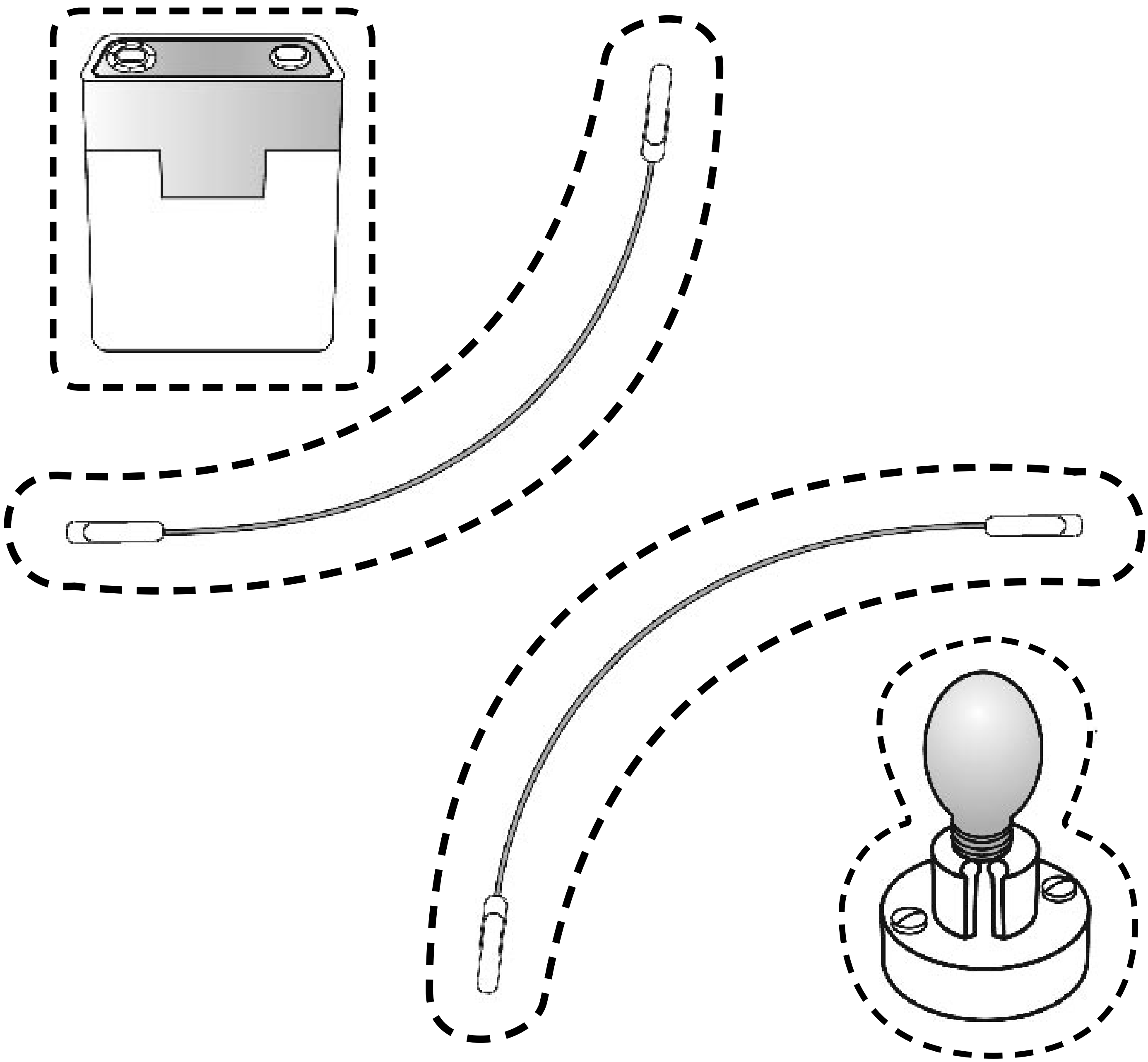
- pencil
- scissors
- glue or paste
- paper or card

What you do:

Cut along the dotted lines.

Make the pieces into a circuit so the bulb will light.

Stick the circuit onto a sheet of paper or card.



6. Circuits

What you need:

- pencil

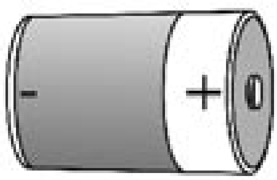
What you do:

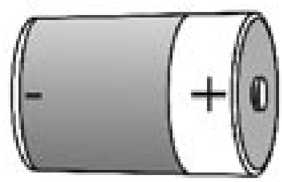
Make up this circuit

a) With the lamp ‘off’.

b) With the lamp ‘on’.

Draw the two circuits. The batteries and bulbs have been drawn for you. (Hint: use a switch)





Notes on individual worksheets

1. Using electricity

Key idea To identify some of the everyday objects that need electricity to work.

Outcome The objects that need electricity to work are: vacuum cleaner, light bulb, toaster, computer, calculator, camcorder.

Extension Divide the objects that need electricity into two sets: those that use mains electricity and those that use batteries.

2. Mains electricity or batteries?

Key idea To identify some of the everyday objects that use mains electricity and some which use electricity from batteries.

Outcome Use mains electricity: electric table lamp, television set, desktop computer, electric toaster, hair dryer, electric kettle.
Use batteries: watch, torch, calculator, train set, digital camera, iPod.

Extension Discuss the advantages and disadvantages of mains electricity and electricity from batteries. Compile a table of the results of your discussion.

3. Making things happen with electricity

Key idea To show some of the ways in which electricity can be used to produce light, heat, movement and sound.

Outcome It is not possible to predict the outcome of this activity, but remember that many items will appear in more than one of the boxes.

Extension Discuss how we use electricity to pass on information—telephones, radios, televisions, computers, etc.

4. Electricity in the home

Key idea To examine some of the objects in the home which use electricity.

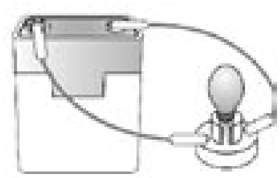
Extension Discuss which of the objects selected use mains electricity and which use batteries. Make a class summary chart of the results of this activity.

5. Making a circuit

Key idea To compile a diagram of a simple electrical circuit from its component parts.

Extension Let the children examine a torch to see how it is constructed and how the electricity flows from the battery to the bulb and back again.

Outcome

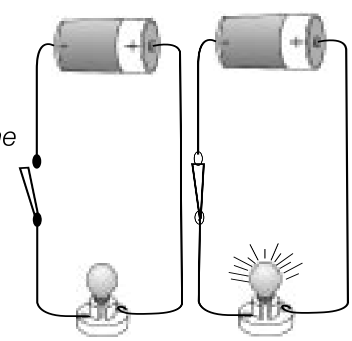


6. Circuits

Key idea To be able to follow instructions to make a simple circuit with a switch.

Extension If the materials are available, provide groups of children with just a torch bulb and a battery and let them try to get the bulb to light, using only materials they can find around them in the classroom.

Outcome



Lesson objectives

- To explore what starts things moving and makes moving objects change direction, and to show that forces can change the shape of objects.
- To demonstrate that the forces of wind and moving water can be harnessed for human use.

Background information

Forces

A very simple introduction to the concept of forces and motion, developed by Sir Isaac Newton, is given here. The topic of forces often worries the non-specialist teacher, largely because of unhappy experiences with this area of physics in secondary school. However, it may be reassuring to know that the abstract term 'force' quite simply describes a push or a pull. Forces are applied to objects as pushes or pulls. Forces, or pushes and pulls, can:

- make a stationary object move;
- make a moving object slow down or speed up;
- make a moving object change direction;
- bend, twist or change the shape of an object.

Anything that does one or more of these things is a force. Put simply, every type of movement is caused by a force. Forces can cause things to accelerate and slow down, to swerve, grip, skid and jump, to expand and contract, to fall and rise, to float and sink, to vibrate, and even come to rest! Every type of movement in the universe is caused by a force—and yet, surprisingly, forces are invisible. We cannot see them, only their effects.

Moving things

A footballer makes the ball move by kicking it. A tennis player hits the ball with a racquet. These are examples of a contact force. Other contact forces include a bulldozer pushing along a heap of soil or rock, or a child dragging a toy across the carpet. A contact force is one where the object applying the force is touching the object being moved. Magnetism and gravity are both non-contact forces. A magnet can push or pull an object without having to touch it, while gravity pulls objects down towards the centre of the Earth without there being any contact.

Large and small forces

Large objects, such as oil tankers or railway trains, need large forces to move them. A huge jumbo jet aircraft has four immensely powerful engines to produce a push big enough to move it at speeds up to 850 km per hour. By contrast, small objects only need a small force to move them.

Direction of movement

Usually when you move an object away from you, you do it with a push. You bring it towards you with a pull. But, as the students will soon discover, this is not always true. Sometimes things can be moved towards you with a push and away from you with a pull. It all depends on how the object is held. A piece of string tied to an object and pulled around a post, or table or chair leg, makes a simple pulley, which can change the direction of motion. You can thus get a toy truck or model car to move away from you by pulling the string towards you.

Turning forces

We often use forces to turn things. When changing a car tyre it is impossible to undo the wheel nuts without what is basically a long-handled spanner. If the nuts are too tight we might even have to fit a piece of metal tubing over the handle of the wheel brace to make it longer and so increase the force we can exert on the nuts.

A door also acts as a lever. It is almost impossible to open a door very close to its hinges, but quite easy to open it the normal way near the handle. This is because the door acts as a long 'lever' from the hinge to the handle.

Forces in pairs

Although it is much too difficult for students to understand at this stage, forces always come in pairs, working in opposite directions. A simple example helps to demonstrate this. If you sit on a chair, your weight presses down on it. The chair must be pressing up with a force equal to your weight, otherwise the chair would collapse. If the forces in a tower, crane, bridge, or some other structure are unequal, then the structure will collapse. If the forces balance each other, things stay still. When you throw a ball in the air, it is acted on by a force from the muscles of your arm. The ball moves upwards because the force from your arm is greater than the downward force of gravity. As the ball moves upwards, friction with the particles of the air slow it down. Eventually the upward force is equalled by this air resistance, and then the largest force acting on the ball is the downward pull of gravity. So the ball falls back to Earth, or to the hands of the catcher. The difficult part of this to imagine is the force of air resistance—because we cannot see it (or the pull of gravity) we assume it is not there.

Safety

Care will be needed to avoid damage and injury if the children experiment with heavy weights. Stretched elastic bands and springs can cause eye and facial injuries.

Answers

Pushes, pulls and forces: **Rapid fire, pg 39.**

1) The obvious answers are to pull or push it. However, it would be easier to move on rollers or wheels, or even to slide it along on slippery paper or plastic if the floor is smooth.
2) Open answers.
3) When riding a bicycle, the pushes include pushing the ground with the feet to start off, pushing down on the pedals to turn them, and pushing the handle of the bell. The pulls include those on the handlebars to change direction and pulling on the brakes to stop the bicycle.

Changing direction, *changing shape:* **Rapid fire, pg 41.**

1) We can change the shape of a drinks can, a cake and a soft rubber ball by pushing down on them. The bristles of the toothbrush bend if we push them against our teeth or some other hard surface. We can bend a plastic comb, a drinking straw, a paper clip and a ruler by pulling on the ends. The shape of a balloon is changed by blowing (pushing) air into it. An empty balloon can also be stretched by pulling on the ends of it.
2) Open answers.
3) If a speeding car crashes into a large tree, the front of the car will be dented badly. The tree might break or would be certain to be dented or scarred where the car hit it.

Changing direction, changing shape: **Try it out, pg 40.**

3) One way would be to pull on the car with a spring balance while reading the scale. Alternatively the car could be pulled with an elastic band and the increase in length of the elastic band could be measured. Another method would be to hang small weights (e.g. paperclips) onto a piece of thread that came from the front of the car and over the edge of the table until the car just started to move.

The force of the wind: **Rapid fire, pg 45.**

1) Assuming the wind is less than hurricane or cyclonic strength, the objects that could be moved by the wind are a kite, leaves on a tree, a sailing boat, balloon and washing on a clothes line.
2) Strong winds include gales, storms, hurricanes or cyclones, and tornadoes.
3) Wind turbines do not pollute the air and unlike energy sources such as coal, oil and gas, the wind will not run out.

The force of moving water: **Rapid fire, pg 45.**

1) As lumps of rock are pushed along by a river or stream they bump into each other and into the bank. The river is slowly widened and the fragments of rock become smaller and smaller. They are eventually deposited near the mouth of the river as sand, silt or mud.
2) Most modern flour mills now use steel rollers that are driven by electric motors to grind corn into flour.
3) Hydroelectric power stations need fast-flowing rivers to turn their turbines and generators. Such fast-flowing rivers are only found on hills and mountains.

Faster and slower: **Rapid fire, pg 47.**

1) A sailing yacht and the sails of a windmill are pushed by the wind; a car is pulled along by its engine; a bicycle is pushed forwards when the rider pushes down on the pedals; an airliner is pushed along by its powerful jet engines.
2) When the boy pushes against the wall, he will move forwards (away from the wall). The wall does not move because it is much heavier than the boy but, since it doesn't move it does, in effect, push the boy.

Faster and slower: **Try it out, pg 47.**

1) The ball could be made to roll faster by hitting or kicking it hard or by rolling it down a slope. The ball could be made to roll slowly by hitting or kicking it gently, or by making it roll up a slope or over a rough surface. The rolling ball could be made to change direction by hitting, kicking or pushing it at right angles to its direction of movement.

Going further

Let the students experiment with pushes and pulls to shape clay or Plasticine. Ask the following questions: What shapes can be made by using pushes only? What shapes can be made using pulls only? What shapes can be made using both pushes and pulls?

Ask the students to look at some of the things a force can do to a piece of soft rubber or a sheet of paper. In the case of the rubber, the students might bend it, twist it, squeeze it, stretch it and try rubbing (erasing) with it. In the case of the paper the students might pull (tear) it and squeeze or crush it. Ask them to think carefully about each of the forces they use and the effects it has. Is each force a push or a pull?

Use toys and construction kits to make wheeled vehicles that can be pushed and pulled.

During a PE or games lesson, ask the students how many ways they can find of starting a ball moving. Some examples include giving it a kick, a push, a punch, a flick or a shove. You could also hit the ball, throw it, blow it, pull it or lift it. What happens to a ball of clay or Plasticine if you carry out these same actions?

Ask the students to think about all the things they have done today. Which was the biggest push they made? Which was the biggest pull?

1. Push or pull or twist?

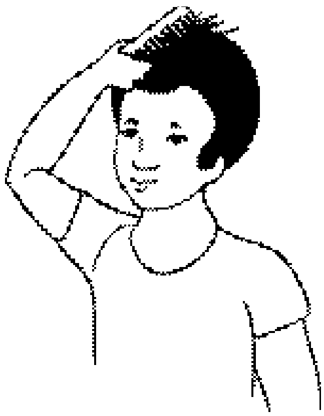
What you need:

- pencil

What you do:

Name the force that is being used in these pictures.

Is it a pull, a push or a twist? Write **pull, push** or **twist** below each picture.



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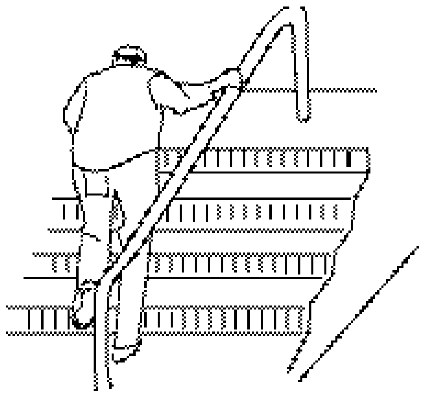

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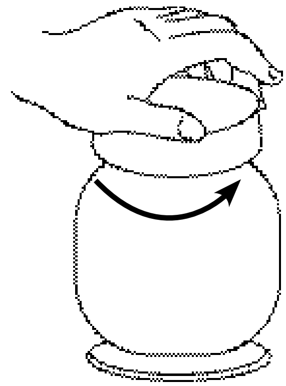

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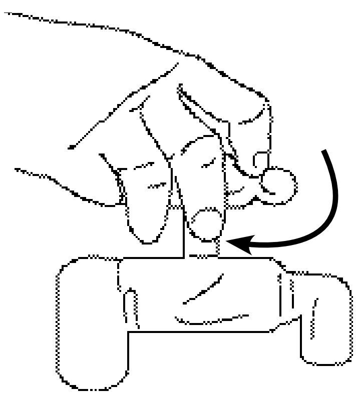

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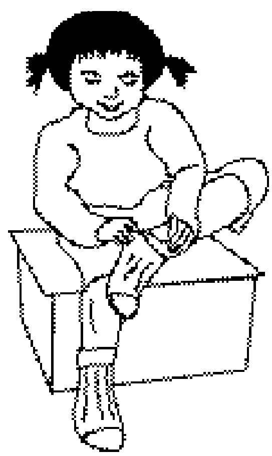

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Colour the pictures once you have filled in the words.

2. Pushes and pulls

What you need:

- pencil

What you do:

Look around your classroom or school. What things can you move by pushing? What things can you move by pulling? What things can you both pull and push? Write them in the table below.

Things I can push	Things I can pull	Things I can push and pull

3. Small forces

One of the smallest forces you can make is by blowing.

What you need:

- drinking straws
- objects from around the classroom
- pencil

What you do:

Look around your classroom. Try to move objects by blowing them through a drinking straw.

Fill in this chart.

Objects which move when I blow gently	Objects which move when I blow hard	Objects I could not move by blowing

Finish these sentences:

Small forces can move……………………………………………........

Small forces cannot move………………………………………........

4. Changing shape

What you need:

- pencil
- elastic band, Plasticine, rubber, paper, strip of plastic bag, sponge, rubber ball.

What you do:

Test these different materials. Put a tick in the table to show how can you change the shape of each of them.

Now try some more materials of your own choosing.

Material	Bend	Stretch	Twist	Squash
elastic band				
Plasticine				
rubber				
paper				
plastic bag				
sponge				
rubber ball				

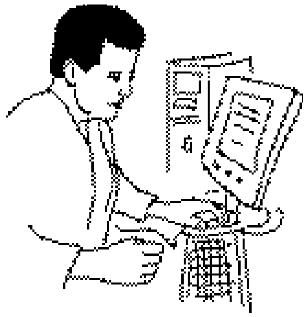
5. The force of the wind

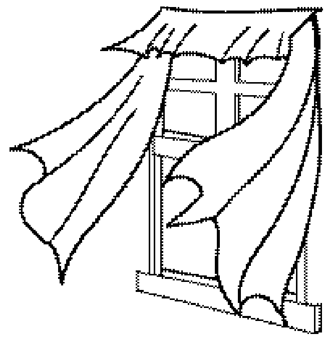
What you need:

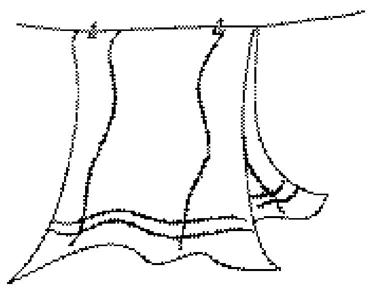
- pencil

What you do:

Circle **ONLY** those pictures that show how the wind can make things move.




Now draw some other things that can be moved by the wind.

6. Safe and unsafe forces

What you need:

- pencil

What you do:

Some forces are safe, some are unsafe.
Look at the chart below.
Write **SAFE** against those forces which are safe. Write **UNSAFE** against those forces which are unsafe.

A car going along the road	
A bicycle travelling fast	
A ping-pong ball rolling along the corridor	
A train driving along the tracks	
Someone pushing a swing	
A crisp packet blowing in the wind	
A can of fruit falling off a shelf	
A small stone falling off the table	
A large rock rolling down a hill	
A tennis ball rolling across the playground	

Which three forces are the most dangerous? For each one, say why.

a)……………………………………………………………

b)…………………………………………………………..

c)…………………………………………………………..

Notes on individual worksheets

1. Push, pull or twist

Key idea To identify three kinds of force: push, pull and twist.

Outcome Pushing: supermarket trolley.
Pulling: combing hair, pulling on handrail to climb the stairs, pulling on a sock.
Twisting: unscrewing the top of a jar and turning a tap.
Remember that in some cases more than one type of force can be applied. For example, if a child is on a swing, you could pull the swing and child back and let them go, rather than pushing the child and swing together.

Extension Make a collection of objects, or pictures of objects, which can be pushed, pulled or twisted. Use the collection to investigate further.

2. Pushes and pulls

Key idea To identify some forces to be found in action in the classroom or around the school.

Extension Make a list of pushes and pulls that occur in the home.

3. Small Forces

Key idea There are small forces as well as large ones.

Extension Collect pictures of very large and very small forces at work and make wallcharts with them.

4. Changing shape

Key idea To investigate how forces can be used to change the shape of objects.

Outcome In most cases more than one type of force can be applied to change the shape of an object. Here are the most likely answers:
elastic band—bend, stretch and twist; Plasticine—bend, stretch, twist and squash; rubber (eraser)—bend, and twist; paper—bend, twist and squash; sponge—bend and squash; plastic bag—bend, twist and squash; rubber ball—squash.

Extension Discuss, or investigate, which of the above objects and materials will revert back to their original shape when the force is removed (elasticity).

5. The force of the wind

Key idea To examine objects that can be moved by the force of the wind.

Outcome The following objects can be moved by a normal-strength wind: sailboat, curtains, tree leaves, sails of a windmill, washing on a line, the steam from a kettle, but not the kettle itself.

Extension Investigate which objects can be moved by a small jet of water, such as water squirted from a clean washing-up liquid bottle.

6. Safe and unsafe forces

Key idea To compare safe and unsafe forces in relationship to road safety and other personal safety issues.

Outcome A few of the items are open to discussion. For example, someone pushing a swing or walking in front of someone on a swing could be in danger. However, the main unsafe forces are: a car travelling along the road; a bicycle travelling fast; a large rock rolling down a hill; a train driving along the tracks; a can of fruit falling off a shelf. In the latter case, the higher the shelf the more dangerous the force.

The most dangerous forces are the car, the fast bicycle, the train and the large rock.

Extension Discuss why some of these forces are more dangerous than others. Emphasise that it is the combined weight and speed of these objects which makes them dangerous. Ask the children which would be the most dangerous, being struck by a car travelling at 20 mph, or by the same car travelling at 40 mph?

PLANTS AND ANIMALS IN THE LOCAL ENVIRONMENT

Lesson objectives

- To introduce the concept of a habitat.
- To observe and point out different aspects of habitats.
- To make simple comparisons between habitats.

Background information

The plants and animals that live together in a certain place, or habitat, are dependent upon each other and their environment. Whatever habitat they live in, most living things have the same basic needs: food, water, oxygen, shelter and protection. Plants and animals are adapted to meet these needs, but each species' adaptations allow it to compete successfully with other species. In that way, many species can live together in a habitat, and all can be successful. The mark of success of a species is that it produces enough offspring to keep its species going.

Life under logs and decaying leaves

The animals living under rotting logs or heaps of decaying leaves, for example, feed either on the decaying material around them or on other animals which themselves feed on these materials. Most of them are dependent on the dark, damp conditions for shelter and their water requirements. Nearly all breathe air, although woodlice have gills like their relatives the crabs, and can only survive where the air is moist. To ensure that they do not dry up, woodlice emerge only at night. Many other animals living in dark places are also nocturnal and only emerge when there are few large predators about.

Life in grassy habitats

The plants of grasslands and lawns are also well adapted to their habitats and to the levels of human disturbance. The grasses that grow, or are sown, on lawns and pastures generally have short or creeping stems, which are left undamaged by cutting or chewing. This is because, unlike all other plants, grasses have their growing buds at the base of their leaves rather than at the tip of the leading shoot. When the leaves are mown, or bitten off by a grazing animal, grasses can regrow from the base of the plant. The plants which grow as weeds in lawns and grasslands, including dandelions, daisies, and yarrow, show their own adaptations. When the grass is mown, bitten off, or heavily trampled, these plants grow and flower close to the ground; where the grass is allowed to grow long, these plants also grow tall.

Wildlife in town and city

For the town- or city-dweller, the variety of wildlife near his home is often as great, or even greater, than for the person who lives in the country. Truly urban wildlife exists because of its ability to adapt and live in close proximity to people. Wild plants in towns, for example, have to be able to tolerate the reduced light intensity caused by smoke, dust and exhaust fumes in the air, and the shading effects of tall buildings. They also have to be able to withstand the corrosive effects of acids, produced by atmospheric pollution, on their leaves. It is these acids which also make the soil sour. Yet in spite of these hazards, some plants not only survive but actually thrive in urban environments.

Birds have similarly adapted to the artificial cliffs, ledges and sills provided by buildings, and they seem unaffected by the never ending noise and pollution. The buildings provide roosts and nesting sites for many bird species, including the ubiquitous crows, sparrows and pigeons, together with the less common birds such as house martins, kestrels and owls. Towns and cities have the added advantage to wildlife that in winter they are several degrees warmer than the nearby country areas.

PLANTS AND ANIMALS IN THE LOCAL ENVIRONMENT

The parks and cemeteries in city suburbs are often richer in wildlife than the countryside surrounding the city. In addition, railways, roads and streets reach into the centres of cities from the open country, often acting as corridors along which plants and animals can move unhindered to colonize new areas. The embankments of these lines of communication provide ample plant cover where mice, voles, shrews and rabbits can search for food in relative safety.

As well as feeding the birds in their parks and gardens, town-dwellers throw out huge quantities of food in their dustbins, and produce vast amounts of other waste. Sewage farms and rubbish tips are an important source of food for birds and mammals on the outskirts of towns and cities. Rats, foxes, badgers, hedgehogs and rabbits, as well as crows and gulls, scavenge rubbish tips for food. In addition, the decomposing sewage and refuse acts as a breeding ground for flies. These attract huge flocks of insect-eating birds.

The other necessity of a city or large town is vast quantities of fresh water, and the reservoirs that supply this need are a home for a wide variety of fish and other aquatic animals. These in turn are food for herons, grebes and cormorants, together with big flocks of ducks, geese, swans and wading birds.

Even indoors, in town or country, the average householder shares his domain with a large number of animal species, perhaps 50 or more, which take advantage of the warm, dry conditions, and adequate supplies of food to be found there.

The importance of trees

In both town and country, trees are of vital importance. They not only look attractive, they also provide food, shelter and nesting sites for a large number of animals and a substrate on which smaller plants can grow. Trees provide valuable materials in the form of fruits and nuts, timber, and the wood pulp from which paper and rayon are made. In addition, they have an important role in helping to purify the air. In doing this, they absorb carbon dioxide gas from the air when they make their food and replace it with life-giving oxygen. In towns and cities, particles of soot and other pollutants stick to tree leaves, and thus help to make the air cleaner for us to breathe.

Safety

Students should always wash their hands thoroughly after handling soil, plants and small animals, and particularly before touching food. Remember that a few children may be allergic to certain plants—if in doubt, let them wear gloves.

Answers

Plants and animals around the school: **Rapid fire, pg 49.**

1) Swim in water: shark, octopus, tadpoles, salmon.
   Live on land: dog, snail, horse, butterfly, elephant, tiger, eagle, lion, crow, bee.
   Fly in the air: crow, eagle, butterfly, bee.
   Note: some snails also live in water.
2) goldfish—pond; earthworm—soil; bird—nest; spider—web; dog—basket.
3) The difference in plants and animals on the two sides of the wall could be due to the fact that one side is in shade more than the other and, therefore, has a lower average temperature and greater humidity. A thermometer (or better, a maximum-minimum thermometer) would provide some evidence of this.

Plants and animals around the school: **Try it out, pg 49.**

3) The small animals probably collect under the corrugated iron, black plastic or plank of wood because they prefer dark, moist conditions. They are also protected from predators there.

Wildlife in town and city: **Rapid fire, pg 51.**

1) More pigeons: a), d), and h). Fewer pigeons: b), c), e), f), and g).
2) Larger predators such as tigers and leopards, and animals which live in large herds, such as deer, are unlikely to make their homes in cities. They would be very conspicuous to their human enemies but also would not find the large areas of land over which to hunt or feed.
3) Small animals can be trapped inside old bottles and drinks cans, particularly if these are filled with water. Larger animals can be cut or injured by broken bottles or when they try to eat the contents of old food cans. Hedgehogs and foxes, for example, have been known to get their heads stuck inside old food cans while attempting to eat.

Wildlife in town and city: **Try it out, pg 51.**

1) The difference in bird species recorded between two seasons is probably because many birds migrate to another part of the country, or even to a different country, at certain times of the year.

The importance of trees: **Rapid fire, pg 53.**

1) True: a), c), e), f), and g). False: b) and d).
2) Trees are planted by the side of roads because they look attractive and provide shade, but mainly because they can help to purify the air that is polluted by traffic fumes, factories, power stations, etc.
3) Things that are made partly or completely from wood include doors, window frames, furniture, pencils, rulers, pianos, violins and other musical instruments, brooms and brushes, tool handles, hockey sticks, cricket bats, stumps and bails, and football and hockey goalposts.

Going further

Look for animal homes. Divide the school grounds up into broad habitats, such as walls, pavements, grassland, flower beds, and bushes and trees. Choose a small group of children to explore each habitat and record the animals living there.

Search all the ‘cosy corners’ around the school, looking in crevices, under stones and wood, in tussocks of grass, and in other places for small animals. Carefully collect one small animal of each kind. Do not handle the animals but use a plastic spoon and small brush to transfer them to collecting pots. Examine the small animals, looking to see how many parts they have to their bodies, how many legs, what colours they are, and so on. Identify the animals as far as possible, and record where and when they were found. Afterwards, return the small animals to where they were found.

Compare the vegetation of trampled or mown grassland or lawn with adjacent unaffected areas. Measure the heights of some of the plants in the two areas and, if possible, use simple mapping techniques to compare them.

Use a strong net to sweep through long grass and other tall vegetation. Collect and identify the small animals caught. Do they differ from the species living in trees and shrubs? Return the small animals to where they came from when you have finished with them.

Lay one, two or three rotting logs in an out-of-the-way part of the school grounds. Treat them as a miniature nature reserve. Make simple sketch-maps of the logs at regular intervals so that you can see the changes that take place as the logs decay. Alternatively, keep a diary of the rotting log nature reserve, recording the animals and plants that colonize the logs as they decay.

1. Where they live

What you need:

- pencil

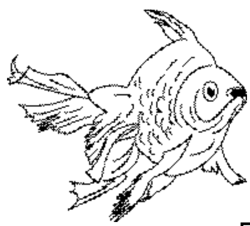
What you do:

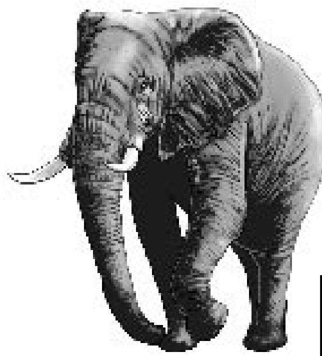
Look at the pictures below. Where do these animals live?

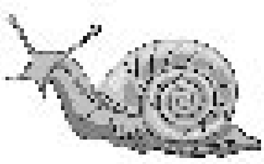
Which live on the land? Write ‘L’ in the box.

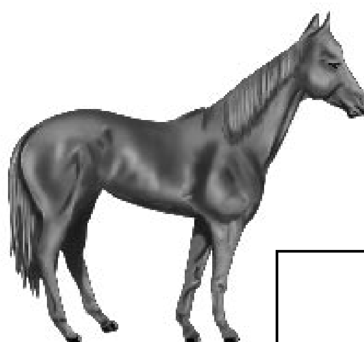
Which swim in water? Write ‘W’ in the box.

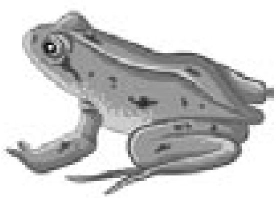
Which fly in the air? Write ‘A’ in the box.

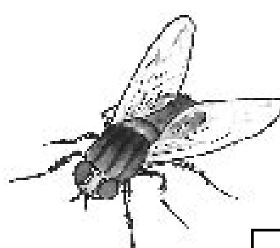












2. Habitats

What you need:

- pencil
- animal books
- ruler

What you do:

Draw a line to join each animal with the habitat in which it normally lives.
Use reference books to help you.

Some of the animals may share a habitat.

Write down what a fox in the wild needs from its habitat:

a) for food:……………………………………………………

b) for shelter:…………………………………………………

3. Plants and animals around the school

What you need:

- a hoop
- pencil

What you do:

1) Place a hoop on the ground in one part of the school grounds.

   Try to name all the plants and animals you find.
   Draw a picture in the space below.

2) Now do the same thing in another part of the school grounds.

Compare your two sets of results.

4. Cosy corners

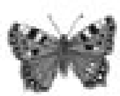
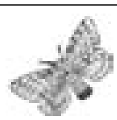
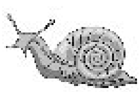
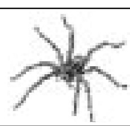
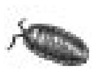
What you need:

- pencil
- hand lens or magnifying glass
- small trowel

What you do:

Search the school grounds for small animals. Each time you find a small animal, tick the chart below to say where you found it.

Look at each animal carefully with a hand lens. Take care not to harm any of the animals. Carefully put back any bricks, wood or soil that you move.

Kind of animal	**Where I found it**					
	In the soil	On the soil	Under stones	Under wood	On a plant	Somewhere else
beetle 						
butterfly 						
moth 						
snail 						
spider 						
woodlouse 						
ant 						

Where did you find most animals?..................................

What kind of animals did you find most of?…………………

Notes on individual worksheets

1. Where they live

Key idea To introduce the idea that animals differ in where they spend most of their lives.

Outcome Live on land: elephant, horse, snail, frog.
Live in water: goldfish, frog (in the breeding season), dolphin.
Fly in the air: sparrow, dragonfly, housefly.

Extension Use reference books and the Internet to research the food and other requirements of these animals to find out what determines where they live.

2. Habitats

Key idea To introduce the idea of an animal's home or habitat.

Outcome duck—pond; lizard—desert; frog—pond; squirrel—forest; crab—sea; fox—forest; dolphin—sea.
For food the fox needs a supply of small animals, such as rabbits, mice, and young birds etc. It also needs a burrow or den in which to shelter from its enemies and to rear its young.

Extension Discuss why scientists are concerned that so many animal habitats are being destroyed for roads, houses, factories, etc.

3. Plants and animals around the school

Key idea To compare the plants and animals to be found in two different habitats within the school grounds.

Extension Carry out this investigation in a different season and compare the results.

Safety Use a paintbrush and teaspoon to pick up the small animals. Return them to where they were found after examination.

4. Cosy corners

Key idea To examine the small animals that are to be found living in different parts of the school grounds.

Extension Compare the small animals that live in or on two different species of trees.

Safety Use the paintbrush and teaspoon to pick up the small animals. Return them to where they were found after examination.

Lesson objectives

- To demonstrate the huge variety of living things in the environment and some of the differences between them.
- To demonstrate simple methods of sorting living things into groups.

Background information

The features of living things and the differences between plants and animals have already been dealt with, briefly, under the heading *Life and Living* (page 7). As a result, the background notes here will deal almost exclusively with the topic of variation, particularly variation within the human species.

Individuals within any species, plant or animal, are all slightly different from each other. It is these variations that form the basis of the theories of Evolution, put forward in 1868 by Charles Darwin and Alfred Russel Wallace, that are generally accepted today. More important from the point of view of primary school children is the fact that although there are more than six billion people living on the Earth, and although we all have the same basic features, no two people are exactly alike.

We inherit characteristics from our parents, sometimes in a different form and sometimes altered by influences such as diet, activity, and health. The limit to a person's height is inherited, yet children may grow taller than their parents because of a more nutritious diet. Children may inherit a tendency to have good teeth, but if they have a diet high in sugar and sticky foods, or fail to clean their teeth properly, tooth decay could occur anyway.

We all share characteristics with our parents and ancestors, including the colour of the skin and hair, the shape of the nose, and sometimes unfortunate inherited characteristics such as the bleeding disease, haemophilia.

An understanding by students of the great range of variation shown by all individuals will help them to cope with the rapid growth and mood swings of adolescence. Treated tactfully and sensitively, this topic could also help to promote racial tolerance and understanding, as well as tolerance of those who have physical or mental disabilities or who are otherwise disadvantaged.

Genes and inheritance

As we have seen, living things resemble their parents. An excellent example of the effects of inheritance is shown by the cuckoo. As is well known, cuckoos lay their eggs in the nests of other birds. Although cuckoos are reared by birds of another species, they grow up to resemble their parents in every way. This is true of all living things. They inherit much of their appearance, behaviour, internal anatomy, and physiology from their parents.

Inherited characteristics are controlled by genetic instructions—genes—which are carried on chromosomes, microscopically small thread-like structures in the nucleus of every cell. Body cells contain two matching sets of chromosomes—and hence two sets of genes. One set of genes comes from each parent during reproduction. Many of our features, including hair and eye colour, are controlled by a pair of genes. The colour of our eyes and hair were determined at fertilization, one set of genes coming from our mother and one from our father. If, at fertilization, two genes for blond hair came together, then we ourselves would be blond. Of course, the genes could carry different instructions, for instance one for blond hair and one for dark brown hair. The result is not striped hair or hair of an in-between colour. What actually happens is that one gene will be dominant over the other and will control the character. The other gene is said to be recessive. As it happens, dark brown hair is dominant over blond hair, so that if we receive a blond hair gene and a dark brown hair gene, our hair will be dark brown. The gene for brown eyes is similarly dominant over the gene for blue eyes.

When we look at a person we cannot always tell what sort of genes he or she possesses. A brown-eyed person could, for example, have one dominant gene for brown eyes and one recessive gene for blue eyes. In the latter case, only if two blue-eyed genes come together in subsequent generations will an offspring with blue eyes be born.

This transfer of sets of genes from each parent during fertilization produces most variation. However, sometimes a completely new variation occurs—variation that can be inherited, but could not possibly be caused by a combination of the parents' genes. Such striking variations are caused by an altered gene—a mutation. Mutations are caused by a change in the chemistry of a gene or in the structure of a chromosome, and these constantly occur. In the case of plants, mutations are often easily spotted. In a field of blue linseed flowers, for example, a white or pink flower may suddenly appear among the masses of normal coloured blue flowers. This has arisen as a result of mutation. In the case of the blue linseed flowers, a mutation caused an obvious change. Some mutations have only slight effects, or no noticeable effects at all. On the other hand, most mutations are harmful or even lethal.

One example of a harmful mutation is haemophilia, an inherited blood disorder. It is caused by a mutation in a gene that affects the way the blood clots. The blood of the haemophiliacs clots very slowly, so they may bleed to death from minor injuries.

We can now begin to summarize some of the causes of the variation between individuals of the same species. Some variation is controlled by genes and can be passed on from generation to generation. Much of the variation we see is a result of both the environment and genes.

Selective breeding

It is possible to select the variations which are of aesthetic or economic benefit to us. Among domestic plants and animals, selective breeding is used to produce desired traits in a new generation. Apples, for example, can be red or yellow, sweet or tart. Cattle can be selected for high milk production, rapid growth of meat, or a combination of these characteristics. By contrast, wild populations of plants and animals are adapted to give their offspring the best chance of survival. Even so, most of their offspring perish before reaching maturity. In general, only the fittest and best adapted are able to survive to produce the next generation.

Safety

Within this topic, comparisons are made between individual children. It is important to emphasize that we are all different. Children are built differently and grow at different rates. One physique, rate of growth or eye or hair colour is not better than another. Care is also needed when discussing eye colour and hair colour, and whether tall children have tall parents, that children who are adopted, fostered or members of one-parent families do not feel unfortunate, abnormal, unusual, or in any way odd.

Answers

Grouping living things: **Rapid fire, pg 55.**

1) Two legs—boy and bird; four legs—frog, horse, elephant; six legs—fly; eight legs—spider; no legs—fish.
   Other ways of grouping animals include: colour; have/do not have fur or hair; method of movement; lay eggs/do not lay eggs; live on land/water/in the air.
2) Has fur: rabbit, dog, cat, and mouse. Does not have fur: crow, snake, goldfish, and eagle (crow and eagle have feathers).
   See 1) above for more criteria for classification.

Grouping living things: **Try it out, pg 55.**

3) Feed mostly on or from plants: snail, bee, slug, earthworm, butterfly, pigeon, ant, woodlouse and some beetles.

   Feed mainly on animals: some beetles.

   Feed on plants and animals: crow, mosquito (males feed on nectar from flowers, females feed on animal blood).

Plants are different: **Rapid fire, pg 57.**

1) Have flowers: daisy, rose, grass, and oak tree.

   Do not have flowers: moss, fern, and seaweed.

   Some possible sets are:

   Produce flowers (daisy, grass, rose, oak tree). Do not have flowers (moss, fern, seaweed).

   Produce seeds (daisy, grass, rose, oak tree). Produce spores (moss, fern, seaweed).

   Have woody stems (rose and oak tree). Do not have woody stems (daisy, grass, moss, fern and seaweed)

   Have brightly coloured flowers (rose and daisy). Do not have brightly coloured flowers (grass, oak tree, moss, fern, seaweed).
2) Open answers.
3) Plants provide us with food, some clothing (clothes made from cotton, linen and some rayon), ropes (jute), building materials (wood, straw, bamboo, and reeds), and paper. They purify the air and provide food for domestic and wild animals.

You are unique: **Rapid fire, pg 59.**

1) Things that humans can do which animals cannot include reading, writing, mathematics, using tools, and using computers and other complex machines.
2) Open answers.
3) There is unlikely to be any correlation between the sizes of the hands and feet, although it would be necessary to take a large number of measurements of each to be sure.

You are unique: **Try it out, pg 59.**

1) Look particularly at the ridges and grooves which make up our unique fingerprints and also at any scars. The middle fingers are unlikely to be exactly the same length.

Going further

Find two plants that are growing near your home or school. How many differences can you find between the two plants?

Look around the school grounds carefully. How many non-flowering plants such as mosses, liverworts and ferns can you find?

Ask the students to make an animal scrapbook. Collect pictures of animals and paste them in your book. Below each animal write:

a) its name
b) where it is found
c) how it moves

d) what it eats
e) what kind of home it makes for itself

Visit a zoo, wildlife park, botanical garden or the natural history section of a museum to give the students some indication of the wide variety of living things on the Earth today.

Set up a bird table in the school grounds. Keep a daily record of the number of birds of each species which visit the bird table.

Record the colour of everyone's hair. Which students have curly hair and whose hair is straight? Who has long hair and whose hair is short? Record these hair characteristics on a simple chart.

Use a small plastic mirror to let the children examine and count their teeth. How many teeth does each student have?

Follow up the work on measuring height by asking the questions: Do tall children have tall parents and do short children have short parents?

Let each student start a book called 'All about me'. Let them write their name on it. You could also ask them to say how old they are. Tell them to draw their faces. Draw a picture of their eyes. Colour them. They could draw how they look when they are happy, sad, angry, surprised. Ask them what else they can put in their books.

1. All about me

What you need:

- pencil

What you do:

Fill in the spaces or put a tick in the correct box.

My name is……………………………………

I am a ☐ boy ☐ girl

My eyes are:		My hair is:	
brown	☐	brown	☐
blue	☐	black	☐
green	☐	blonde	☐
grey	☐	red	☐

I am………………......centimetres tall.

I weigh…………….....kilograms.

My shoes are size………………......

Now compare your chart with those of your friends. How are they the same? How are they different?

2. Body measurements

What you need:

- tape measure or ruler and piece of string
- pencil

What you do:

Measure the length of your arm, hand, thumb and middle finger.

Now measure the length of your leg and foot.

Write down your results.

1. My arm is .... cm long.
2. My hand is .... cm long.
3. My thumb is .... cm long.
4. My middle finger is .... cm long.
5. My leg is .... cm long.
6. My foot is .... cm long.

Compare your measurements with your friend's measurements.

Which parts of your body are longer?..................................

....

Which parts are smaller?...

....

Which parts are the same size?...

....

3. Hands and feet

What you need:

- pencil
- scissors
- two pieces of thick paper or thin card

What you do:

Take a piece of thick paper or card and carefully draw around your hand.

Cut out the shape of your hand.

Put your cut-out against those of your friends. Are they the same size?

Now do the same thing with one of your feet.

Is your foot the same size as your friends' feet?

4. Hands

What you need:

- pencil
- marbles

What you do:

Put your hand on this page and carefully draw round it.

Name the parts of your hand from the list below.

hand finger thumb knuckles wrist fingernail

Work with a friend.

How many marbles can you each pick up with your right hand?

How many marbles can you each pick up with your left hand?

Fill in the table below.

My right hand	**My left hand**	**…….. right hand**	**…….. left hand**

5. My fingerprints

What you need:

- ink pad (used for rubber stamps) with washable ink.
- white drawing paper
- hand lens
- pencil

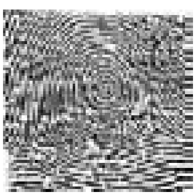
What you do:

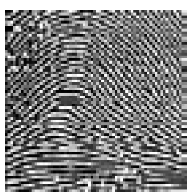
1. Make fingerprints of the fingers of one hand in the box below. Label them saying which finger made each print.

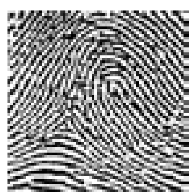
2. Look carefully at your fingerprints through a hand lens.

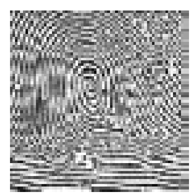
   Are any two of them exactly the same?..............................

3. Look at the four main kinds of fingerprints:


whorl


arch


loop


composite

   Which kind are yours?...

4. Compare your fingerprints with those of your friends.

   Are your fingerprints the same as anyone else's?..............

   ....

Notes on individual worksheets

1. All about me

Key idea To introduce the idea that we all have individual qualities and differences.
Extension Collect pictures of famous people and compare their individual qualities and differences.

2. Body measurements

Key ideas Name some of the parts of the body. Even among children of the same age, there are large variations in the measurements of parts of the body.
Extension Measure the variation in other parts of the body, such as head or chest circumference, or big toe length.

3. Hands and feet

Key idea To compare the sizes of students' hands and feet.
Extension Carry out a class survey to see who is right-handed and who is left-handed. Encourage the students to write with the 'wrong' hand for a few minutes. Do they find it difficult?

4. Hands

Key idea To name the main parts of the hand and to compare the sizes of hands.
Outcome Even among students in the same class, there are quite large differences in the measurements of the hands. In addition, there are often small differences between the size of the left and right hands in the same student.
Extension Use hands for measuring lengths and distances. Compare results for different students. Discuss the merits of standard units of measurement.

5. My fingerprints

Key idea We all have different fingerprints.
Outcome No two fingerprints are exactly alike. Fingerprints are produced by tiny ridges and pores in the skin.
Extension Make toe prints and/or palm prints using the same technique. Are any two toe prints or palm prints exactly alike? (No)
Safety To avoid possible problems, it is best to allow students to take home all of their prints for parents or guardians to either keep or destroy as they wish.

This glossary gives brief definitions of some of the most important scientific words in the text.

Acid One of a class of sour-tasting substances that contain hydrogen, neutralize alkalis and turn blue litmus red.

Acquired characteristics Characteristics, such as knowledge, skills and scars, that are acquired during a person's lifetime.

Adaptation The process by which organisms change to increase their chances of survival.

Animal A living organism that is not a plant and which moves about in search of food.

Atmosphere The layer of air that surrounds the Earth.

Battery A series of two or more electric cells which produce electricity when the chemicals within the battery react together.

Carbohydrates Sugary and starchy foods which are the main source of energy for humans and most animals. Carbohydrates are made by green plants.

Cell (1) The basic unit of living matter. It contains a jelly-like material, called protoplasm, surrounded by a thin cell membrane. Plant cells also have a stiff cell wall on their outside made of cellulose. (2) A container with materials for producing electricity.

Chemical change A change in a material that produces another material.

Chromosome One of a number of paired, microscopic threadlike structures found in the nucleus of a cell. Chromosomes contain the hereditary material, or genes.

Circuit The complete path of an electric current around a series of wires and connections. If there is a break in the circuit, the current will not flow.

Classification The grouping together of plants, animals or objects that have similar characteristics.

Competition The struggle among living organisms for a limited supply of such things as food, water, oxygen, mates or a space in which to live.

Control A standard of comparison for checking the validity of the results of an experiment. (Often an additional experiment where any possible variables are not allowed to vary, and which is run alongside the experiment under investigation.) It is used to eliminate possible sources of error.

Current A flow of electricity (electrons) through a 'conductor', e.g. a wire.

Digestion The process by which food is made soluble by the action of digestive juices containing enzymes.

Drug A chemical, other than a food, taken into the body which has an effect on the body.

Electricity A supply of energy provided by a flow of electrons.

Energy The power and ability something or someone has to do work.

Environment The surroundings in which animals and plants live.

Experiment A test carried out in order to discover something unknown or to demonstrate something that is already known.

Explanation A statement or circumstance that explains something.

Fair test A test or experiment in which only one thing (called a variable) at a time is allowed to change or be tested.

Fibre (1) A thin strand or thread of a material. (2) Plant fibre or cellulose which forms a very important part of our diet and helps to keep the digestive system healthy and functioning properly.

Flower The reproductive part of a seed-bearing plant.

Force A push or pull that starts or stops the movement of an object, changes its direction when it is already moving, or changes the shape of an object.

Fuel A material that is used to produce heat or power by burning or nuclear fusion. Most fuels (with the exception of nuclear fuels) are carbon compounds.

Gene A small part of a chromosome which controls or causes the development of a characteristic of an organism.

Generator A machine for changing mechanical energy into electrical energy.

Growth An increase in size or development of a plant or animal.

Habitat The local environment occupied by a plant or animal.

Heat A form of energy (contrast it with temperature). Heat energy can only be transferred from a hotter 'body' to a colder 'body'.

Hypothesis A principle put forward to serve as the starting point for an argument or an experimental procedure; an idea that can be tested.

Invertebrate An animal that does not have an internal skeleton or backbone.

Joint A place in the body where two bones are joined, usually so that they can move freely.

Mammal A vertebrate animal that is warm-blooded and usually covered with hair or fur. The female produces the young inside her body and feeds them on milk.

Material Any matter from which other things can be made.

Medicine Any substance taken into the body that is used to treat illness or pain.

Melt To change a solid into a liquid by heating.

Metal A shiny solid substance (with the exception of mercury which is a liquid at room temperature) that conducts heat and electricity.

Micro-organism A living organism, such as a bacterium, which can only be seen through a microscope.

Mineral salt A soluble mineral substance needed by living organisms to stay alive.

Muscle A special tissue in animals which, when stimulated by a nerve impulse, can contract i.e. becomes shorter and fatter.

Photosynthesis The process by which green plants make their food from simple raw materials, using the energy from sunlight.

Physical change A change in shape, form or state that does not result in a new material being formed.

Plant A living organism; a member of the plant kingdom. All plants make their own food by photosynthesis. Like animals, plants respire, grow, reproduce, excrete, and respond to stimuli; but unlike animals, they cannot move from place to place.

Plastic Any synthetic material that can be moulded into a shape when heated, and then sets hard when cooled.

Pollution The act of spoiling and poisoning any part of the environment.

Population The total number of organisms of a species living in a particular area at any one time.

Prediction Fortelling or prophesying; suggesting an outcome.

Protein One of the main body-building materials in foods.

Reproduction The process by which living organisms produce offspring.

Respiration A sequence of chemical reactions, in which oxygen usually takes part, that release energy in living cells.

Rust The reddish-brown coat, a form of iron oxide, which forms on iron when it is exposed to moist air.

Science The ever-growing body of knowledge about the physical or natural world.

Soil The small loose particles, formed from weathered rock and humus, in the top layer of the Earth's crust.

Species A group of similar organisms that can breed with each other to produce fertile offspring.

Switch A device used to start or stop the flow of electricity in a circuit.

Temperature A measure of the relative hotness or coldness of something. If heat energy is added to a system its temperature will rise. If heat energy is removed, the temperature will fall.

Theory A general view based on a number of hypotheses or suppositions (often with widespread support).

Universe Everything that exists, including the Sun, Earth, planets, galaxies and other bodies in space.

Variable Any classifiable feature of the subject to be investigated: light intensity, temperature, height, weight, etc.

Variation The differences between the individuals of a race, subspecies, or species.

Vertebrate An animal that has an internal skeleton of bone or cartilage with a backbone, a skull and a well-developed brain.

Vitamin A nutrient, needed in minute quantities, which speeds up some chemical reactions in the body and helps to keep us healthy.

Voltage The work done to drive an electric current around a circuit—an indicator of the energy carried by the current.

Water vapour The gaseous form of water.