South Sudan

Primary Science 4

Pupil's Book

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1. **Please cover with plastic or paper. (old newspaper or magazines)**
2. **Please make sure you have clean hands before you use your book.**
3. **Always use a book marker do not fold the pages.**
4. **If the book is damaged please repair it as quickly as possible.**
5. **Be careful who you lend your schoolbook to.**
6. **Please keep the book in a dry place.**
7. **When you lose your book please report it immediately to your teacher.**

Don'ts

1. **Do not write on the book cover or inside pages.**
2. **Do not cut pictures out of the book.**
3. **Do not tear pages out of the book.**
4. **Do not leave the book open and face down.**
5. **Do not use pens, pencils or something thick as a book mark.**
6. **Do not force your book into your schoolbag when it is full.**
7. **Do not use your book as an umbrella for the sun or rain.**
8. **Do not use your book as a seat.**

South Sudan

Primary 4

Science

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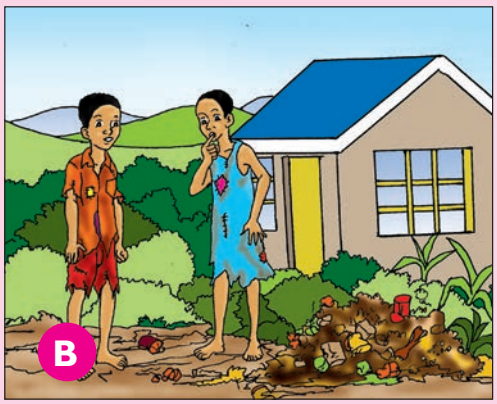
Unit 1 Caring for our environment

1.1 Importance of cleaning our surroundings

Activity 1.1 *In pairs*

What to do

Look at the pictures below.



1. Find out the meaning of the word environment.
2. Which environment would you like to live in? Why?
3. Why is it important to live and work in a clean environment?

Learning points

- The word **environment** means our surroundings. It is important that we clean our environment or surroundings.
- A clean environment is **safe** and **healthy** to live and work in.
- A dirty environment is **unsafe** and **unhealthy** to live in. We can get diseases or get injured in a dirty environment.

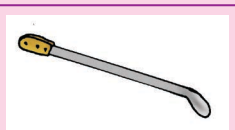
Check your progress 1.1

1. Why should we live in a clean environment?
2. Mention any four types of waste or rubbish you will find in a dirty environment.
3. What harm can a dirty environment cause?

1.2 Tools for cleaning and their uses

Activity 1.2 *In groups*

Fill the following table with your friends.

	Tool	Name	Use
a)			
b)			
c)			
d)			
e)			
f)			
g)			
h)			
i)			

	Tool	Name	Use
j)			

Learning points

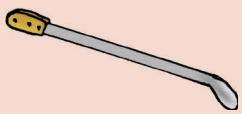
To clean our home, classroom or the school compound, we need cleaning tools.

Remember!

Some tools are dangerous and should be handled with care.

Check your progress 1.2

1. Look at the following tool.



   (a) Name the tool.

   (b) What is the tool used for?

   (c) How is the tool important for the environment?

2. Observe your classroom and school compound. Can you identify surfaces that are:

   (a) Swept (b) Mopped (c) Dusted

3. Match the following tools with where it is most likely to be useful.

Tool	Where it is mostly likely to be used
(i) Rake	(a) Classroom
(ii) Mop	(b) School compound
(iii) Wheelbarrow	(c) Areas around the school

1.3 How to clean our environment

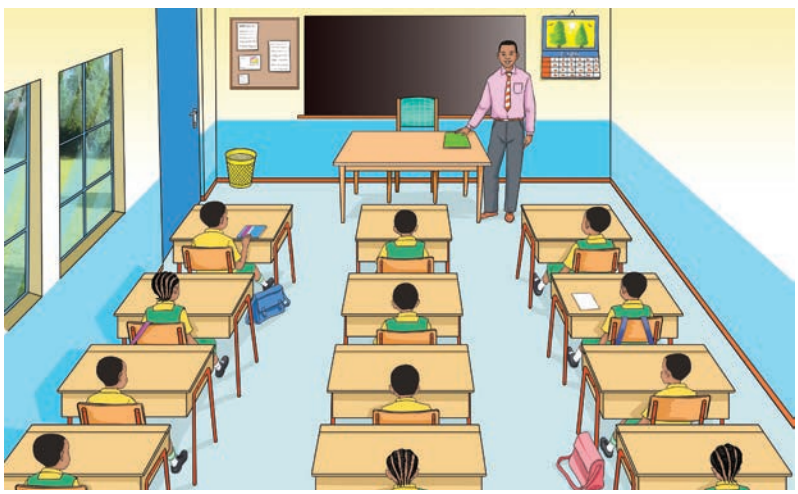
Activity 1.3 *In groups*

What to do

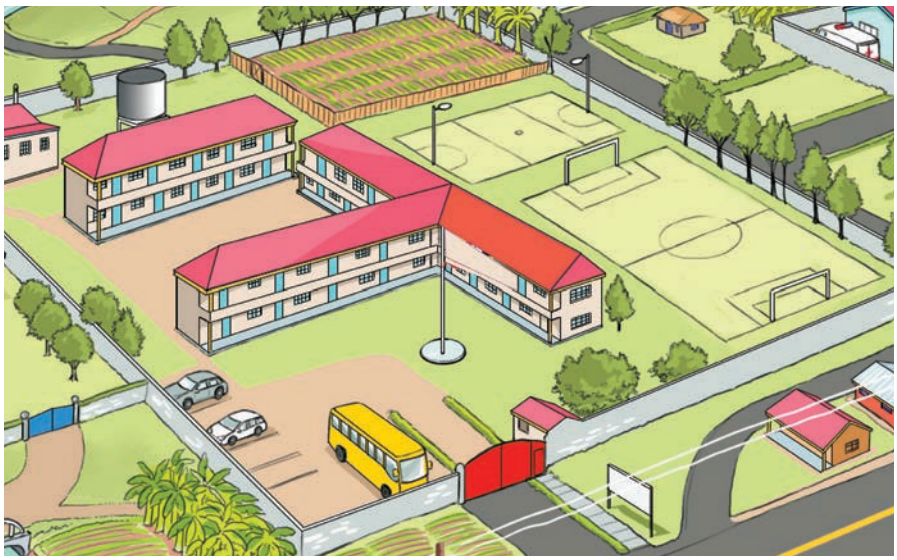
1. In your groups, discuss and name the tools you are going to use in cleaning the environment. What is the work of each tool?
2. Discuss and write down the steps you are going to follow as you do the cleaning.
3. Move to your working area and start the cleaning.
4. When you complete your work, report to your classmates what your group did.

Learning points

To clean different parts of the school, we need different tools and materials.



A clean classroom



A clean school compound

Check your progress 1.3

1. In Activity 1.3, your teacher asked you to clean different parts of the school. List three things you used to clean:

   a) Classroom

      i. _____

      ii. _____

      iii. _____

   b) School compound

      iv. _____

      v. _____

      vi. _____

   c) School surrounding

      i. _____

      ii. _____

      iii. _____

2. When you were cleaning the school and the school surroundings what did you use the following for?

a) Rake _____

b) Bucket _____

c) Dust bin _____

d) Mopper_____

3. Which tool is the odd one out in the list below?

a) Slasher, rake, panga.

b) Dustbin, broom, bucket.

Remember!

Always clean tools after use!

1.4 Safety and hygiene when cleaning

Activity 1.4 *In pairs*

What to do

Study the two pictures below.

1. Tell your friend what these two people are doing.
2. Which picture shows a person who is properly dressed for the work?
3. What are the effects of working in unsafe conditions?

4. Name some of the things the person in picture A is wearing and why they are important.
5. What is likely to happen to the person in picture B.

Learning points

It is important to wear protective clothing when we are cleaning.

The following are some of them.

- Overalls – Protect our clothes from getting wet or stained or dirty.
- Gumboots – Protect our feet from injuries, for example, getting cut by broken bottles or sharp stones.
- Dust mask – Stops dust particles and bad smells from entering our nostrils.
- Goggles – Protect our eyes from injuries caused by dust particles and soaps.

Check your progress 1.4

1. When cleaning what should we wear to protect our:

   Feet? _____

   Hands? _____

   Eyes? _____

2. Match the following safety clothing with their work.

Safety gear	Function
	Protects our eyes from injury.

	Protect our clothes from getting dirty or stained.
	Stops dust particles and bad smell from entering our nostrils.
	Protect our feet from injury.

Remember!

Always wear protective clothing when cleaning.

1.5 Proper disposal of different types of waste

Activity 1.5 *In groups*

What to do

1. Collect rubbish from your school.
2. Bring all the rubbish to an open space and sort them into three groups.
   - Which rubbish can be used again?
   - Which rubbish can be used to make new products?
   - Which rubbish will rot and which will not rot?
3. Dig pits in the ground. Burry some of the rubbish in the pits. After a few days, dig up the rubbish. Which ones are rotten and which ones are not?

4. Use your observation to fill them into a table like the one drawn below.

Can rot	Cannot rot	Can be used again

5. Discuss the methods you can use to best dispose off each type of rubbish.
6. List down the disposal methods. Discuss which methods are safe and which ones are not safe and why?
7. Look at your school compound after this activity. Describe how it looks.

Learning points

The two main groups of wastes are **biodegradable** and **non-biodegradable** wastes.

a) **Biodegradable wastes** – These are wastes which can rot or be decomposed by natural methods. They include kitchen garbage animal dung and vegetable remains, among others.

b) **Non-biodegradable wastes** – These are wastes that cannot be decomposed. They remain in the environment for a long period of time. Examples include plastics, polythene bags, glass and rubber, among others.

Note: Some of the non-biodegradable wastes can be re-used, reduced or recycled.

Fun corner

Make flash cards and use them to label the dustbins in your school. This is to help your schoolmates separate garbage into biodegradable and non-biodegrade wastes.

Check your progress 1.5

1. The two main categories of wastes are _____ and _____.
2. _____ waste cannot rot by natural methods.
3. A teacher wrote the following list on the chalkboard as examples of wastes: glass, rotten cabbage, plastic bottle, nails, rotten mangoes, stale bread, spoilt onions and broken plastic plate. Put them in two lists of biodegradable and non-biodegradable wastes?
4. When biodegradable wastes decomposes, they turn into _____.
5. _____ waste materials can be used again.

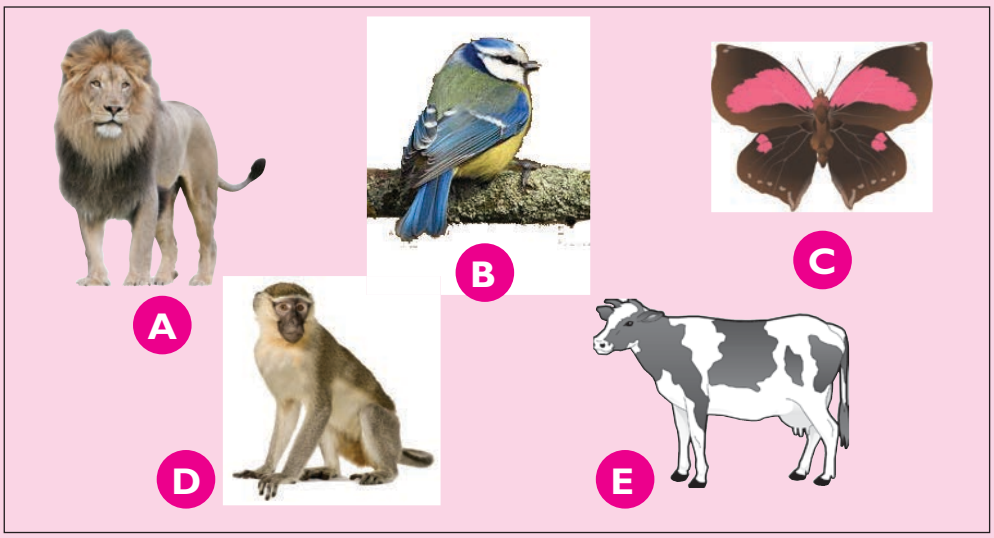
Unit 2 Grouping plants and animals, their conservation and food chain

2.1 Grouping of animals according to their feeding habits

Activity 2.1 *In groups*

What to do

Study the animals in the following pictures.



1. Name the animals shown in the picture.
2. What do each of the animals feed on?
3. Name other animals that feed on the same type of food as each of the animals in the pictures.
4. Where do each of the animals get their food from?

Learning points

Animals can be grouped according to the type of food they eat. These three groups are:

- **Herbivores** – these are animals that eat plants and plant materials only. Examples of herbivores are cattle, goats, sheep, gazelles, elephants and zebras.

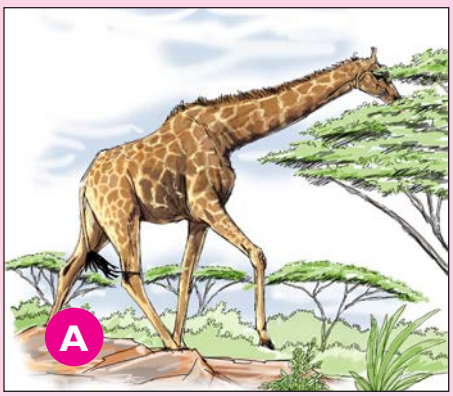
- **Carnivores** – these are animals that feed on meat or flesh from other animals. Examples of carnivores are lions, wolves, leopards, cheetahs and tigers.
- **Omnivores** – these are animals that feed on both flesh and plants. Examples of omnivores are human beings, pigs, baboons, gorillas and monkeys.

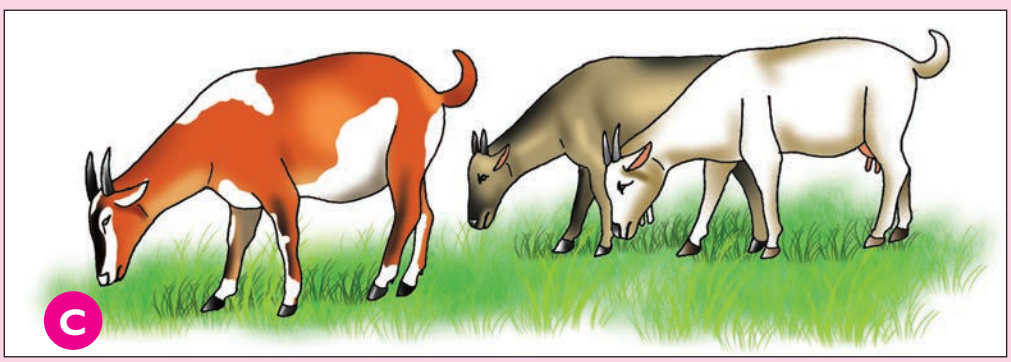
Herbivore

Activity 2.2 *In pairs*

What to do

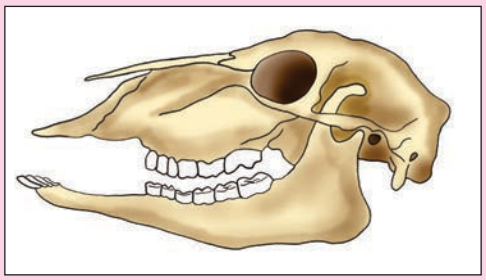
Study the following pictures.





1. Name the animals in the pictures above.
2. Describe what the animals are doing. Are the animals feeding in the same manner?
3. What is the difference in the feeding methods of the animals in picture A, B and C?

4. Study the picture below.



a) How many teeth can you see on the upper jaw?

b) How many teeth can you see on the lower jaw?

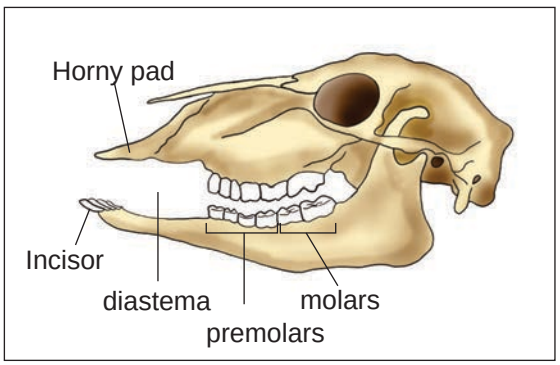
c) Does the animal have the same number of teeth on both jaws?

d) What do you think the animal whose teeth are shown in the skull above eats?

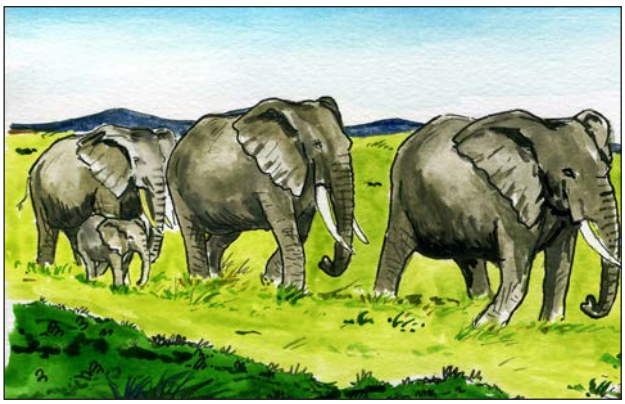
Learning points

- Herbivores can be classified into two groups. These are:
  - **a) Grazers** – These are herbivores that eat grass. Examples of grazers are cattle, sheep, gazelles and buffaloes.
  - **b) Browsers** – These are herbivores that feed on leaves, shrubs and trees. Examples are giraffes, dik-dik, antelopes and elephants.

  Note: Goat is a browser as well as a grazer.
- Herbivores have sharp and flat incisor teeth on the lower jaw. These teeth help the animal in biting, holding and cutting plants. Some herbivores have no incisors on the upper jaws. They have a very **hard horny pad** instead. This helps them to hold food firmly.



- Herbivores have large molars and premolars. These teeth are used for chewing and grinding plant parts.
- Some herbivores have a toothless gap between the incisors and the premolars in the lower jaw. This space is called **diastema**. It helps the animals in turning food in the mouth for proper chewing.
- Some herbivores such as giraffes have long necks and elephants have long, flexible trunks. These help the animals to reach and get soft leaves and twigs found high up on trees.



- Some herbivores do not chew their food completely. The food is stored in a special part in the stomach. The food is later brought to the mouth for proper chewing when the animal is resting. This is known as **chewing cud**. These herbivores have a special stomach which has four chambers. Therefore they are called **ruminants**. Examples of ruminants are cattle, goats, sheep and camels. Herbivores which do not chew cud are known as non-ruminants. Examples of a non-ruminants are rabbits.

Remember!

Herbivores are animals which feed on plants or plant materials only. They can also be referred to as herbivorous animals.

Check your progress 2.1

1. The following are examples of herbivores: elephants, goats, cows, gazelles, sheep, and giraffes. Fill in the table below according to how the animals feed.

Browsers	Grazers
a)_____	a)_____
b)_____	b)_____
c)_____	c)_____

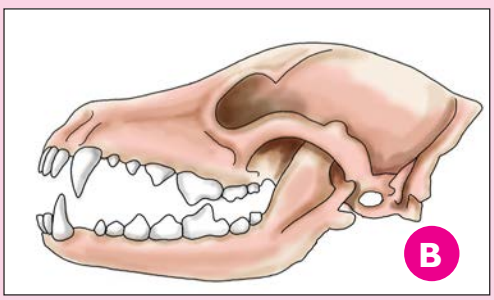
2. Write **true** or **false** in the following:
   a) All herbivores are grazers.
   b) All herbivores are browsers.
   c) A cow is a grazing animal.
   d) All herbivores are non-ruminants.
3. The diastema in a herbivore is found in the _____ jaw.
4. Mary was watching a goat chewing cud. The goat was using _____ and _____ teeth to chew.

Carnivores

Activity 2.3 *Individually*

What to do

Look at the following pictures



1. What is the name of the animal in picture A?

2. What is the animal doing? How did it get its food?
3. How can you group the animal according to what it is feeding on?
4. Which other animals belong to the same group as the animal in picture A? Tell your teacher.
5. Study the teeth of the animal in picture B. How are they different from a herbivore's teeth?
6. Look at the feet of the animal shown in picture C. What do you notice?

Learning points

- Carnivores are animals that feed on meat or flesh of other animals.
- Carnivores hunt and kill other animals for food, therefore, they are called **predators**. The animals they hunt and kill are called **preys**.
- Examples of carnivores are lions, wolves, leopards, cheetahs, hyenas and tigers.
- To hunt and kill their prey, they use many ways. These include:

  i) They have long and pointed canine teeth. Canine teeth are used to hold, choke, kill and tear flesh from their preys.

  ii) Some carnivores can run very fast and catch their prey easily. A good example is a cheetah.

  iii) Some carnivores such as hyenas and leopards have spots on their skins. They can use the spots to hide in the grass. This helps them to move very close to their prey before catching them.

iv) Most carnivores also have a good sense of sight and scent. This helps them to see and smell out their prey easily.

v) Many carnivores have strong and sharp claws in their paws. These helps them to catch and tear flesh from their preys.

vi) Some carnivores such as hyenas hunt together in groups called **packs**. This helps them to use less energy as they chase their preys, one animal at a given time.

Do you know!

The cheetah is the fastest animal on earth.

Check your progress 2.2

1. Carnivores are _____.
   A. predators B. preys
   C. plant eaters D. both plant and animal eater
2. The type of feeder that has sharp, pointed canine teeth used to tear into its food is _____.
3. Are carnivores male or female?
   A. They are females.
   B. They are males.
   C. A carnivore can be male or female.
   D. They are neither male nor females.
4. Which one of the following is a carnivore?
   A. Elephant. B. Chimpanzee. C. Pig. D. Crocodile.
5. Study the animal in the picture that follows.

What does the animal feed on?

6. A science teacher showed her class a documentary on cheetahs hunting preys. The learners found out that the cheetahs can kill their prey using their _____ and _____.

7. Choose the odd one out.

   (a) Leopard, Cow, Lion, Cheetah

   (b) Lion, Tiger, Fox, Giraffe

   (c) Killer whale, Man, Lion, Leopard

8. Write **true** or **false**.

   (a) A lion is a carnivore.

   (b) Giraffes eats flesh.

   (c) A carnivore is a meat eater.

Omnivores

Activity 2.4 *In pairs*

What to do

1. Name the animals shown in the picture above.
2. Study the teeth of the animal below. What do you notice?

3. What do you think the animals in the picture feeds on?
4. Now tell your friend to show you his or her teeth. Compare them with those of the animals in the picture. What do you notice?
5. Tell your friend the kind of food you eat. Compare your list with the list of the food the animal in the picture eats. What do you notice?

Learning points

- Omnivores are animals that feed on both flesh and plants.
- Examples of omnivores are human beings, pigs, baboons, gorillas and monkeys.
- Omnivores have small and chisel-shaped incisors teeth for cutting and biting food. Their canines are strong, sharp and pointed for tearing, gripping and piercing food. However, their canines are not as sharp as those of carnivores.
- They have ridged, flat and broad premolars and molars for chewing, crushing and grinding food.
- Some omnivores such as monkeys have long tails and legs. These help them to hold on to tree branches as they move from one tree to another looking for food.
- Man, monkeys, apes and baboons have fingers for gripping and grasping small foodstuffs such as grains, small insects, birds and fruits.

Check your progress 2.3

1. Look at the animal in the following picture.

a) How do the hands help the animal in feeding?

b) Name any three types of teeth the animal uses to feed.

c) How do these teeth assist the animal in feeding?

2. Select the animal that is the odd one out in the list below.

Goat, pig, gorilla, man, monkey.

Birds

Activity 2.5 *In groups*

Materials

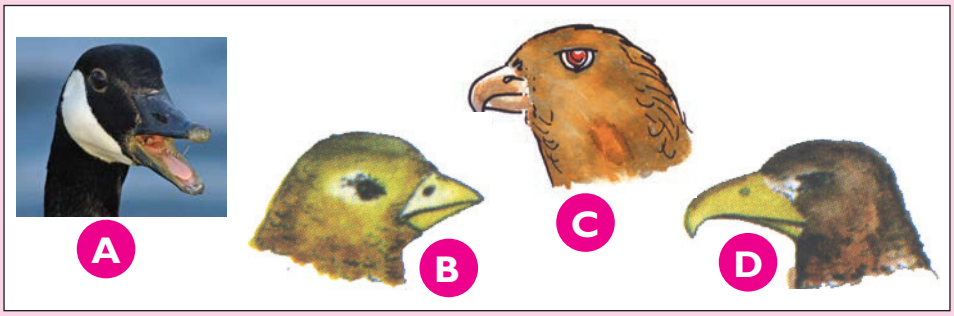
- Old newspapers and magazines with pictures of different birds
- A camera or a smart phone with a camera
- Glue or cellotape
- A pair of scissors or a razor blade
- Exercise book

What to do

1. Collect or cut pictures of different birds from old newspapers and magazines. You can also take some photographs of birds around your home or school.
2. Paste the pictures in your science books.
3. Study the pictures of each bird carefully.

4. a) Do you know the name of each bird in the pictures that you have? Write it down if you do.

b) Study the shape of the beak of each bird in the pictures below.

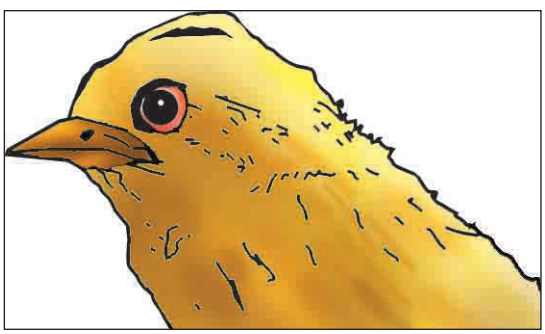


What do you think each bird eats? Find out by observing it while it feeds. Repeat this activity with many other birds.

c) Report what you have found out to your science group in class.

Learning points

- Birds can be grouped depending on what they feed on.
- To find out what a bird feeds on, we study its beak and its feet.
- **Grain eaters** are birds which feed on grains or seeds. They eat grains such as maize, millet, wheat and sorghum. Examples of grain eating birds are chicken, weaver birds, doves, pigeons and turkeys. They have a short strong, thick, straight and blunt beak.



- **Filter feeders** are birds which feed by filtering food from water and mud. Examples of filter feeders are ducks, flamingos, penguins, pelicans and swans. They have long, flat and serrated (saw-like) beaks for sieving food from the mud. They have webbed feet that help them to swim in water or walk in the mud.

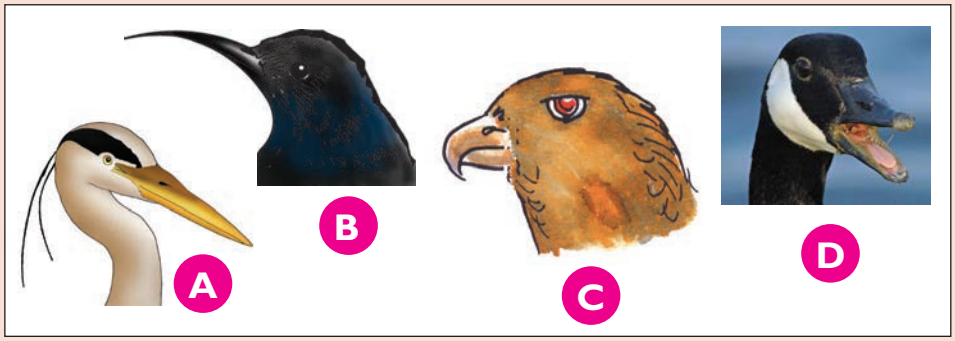
- **Flesh eaters** are birds that feed on fish or meat from small animals. Flesh eaters are also known as **birds of prey**. Examples of flesh eaters are owls, kites, eagles, crows and vultures. These birds have short, strong, sharp, curved or hooked beaks for cutting and tearing flesh. They have sharp claws called **talons** for gripping their prey. They also have good eyesight.

- **Nectar feeders** are birds that feed on nectar from flowers. They have long, thin, slightly curved beaks for sucking nectar from flowers. They are small in size and light in weight. These enable them to land on thin branches supporting the flowers. Examples of nectar feeders are humming birds and sunbirds.

- **Fruit eaters** are birds that have straight and sharp beaks. Example of fruit eaters are woodpecker and mockingbird.

Check your progress 2.4

1. Study the beaks of birds shown in the photographs below.



In which feeding group does each bird belong?

2. Match each of the following birds with its feeding class.

Bird	Feeding class
i) Chicken	Filter feeder
ii) Flamingo	Flesh feeder
iii) Owl	Grain eater

Insects

Activity 2.6 *As a class*

Materials

- A hand catching net for catching insects
- A hand magnifying glass
- Containers with lids

What to do

1. With the help of your teacher, walk around your school compound. Collect as many insects as you can using the hand catching net to trap insects that fly. Put the collected insects in the containers and close the lids.

   Warning! Do not touch some insects using your bare hands. Use a stick as some insects can bite for example termites while others can sting for example bees and wasps.

2. Bring the insects you have collected to class. In your science groups, use a hand magnifying glass to study the mouth of each insect and fill the following table.
3. Compare and discuss your table with other groups.

Name of insect	Has teeth	Has proboscis	What does it feed on?
Housefly			
Termite			
Butterfly			
Cockroach			
Tsetse fly			
Bee			
Ant			
Ladybird			
Grasshopper			

Learning points

- Different insects feed on different things as shown below.

- Insects with chewing mouthparts have teeth - like structures called mandibles, for example grasshopper, cockroaches and beetles. They all feed on hard plant materials.
- Insects with piercing and sucking mouthparts feed on blood, for example mosquitoes, bedbugs, tsetse flies, sand flies and blackflies.

- Some insects have a sharp mouthpart called proboscis. The mouthpart is used to suck blood from other animals or nectar from flowers. The proboscis can be short like in bees or long like in butterflies.
- Houseflies have a dubbing and sucking mouthparts for feeding on decomposing organic matter.

Remember!

Some insects like mosquitoes can spread diseases from one person to another.

Check your progress 2.5

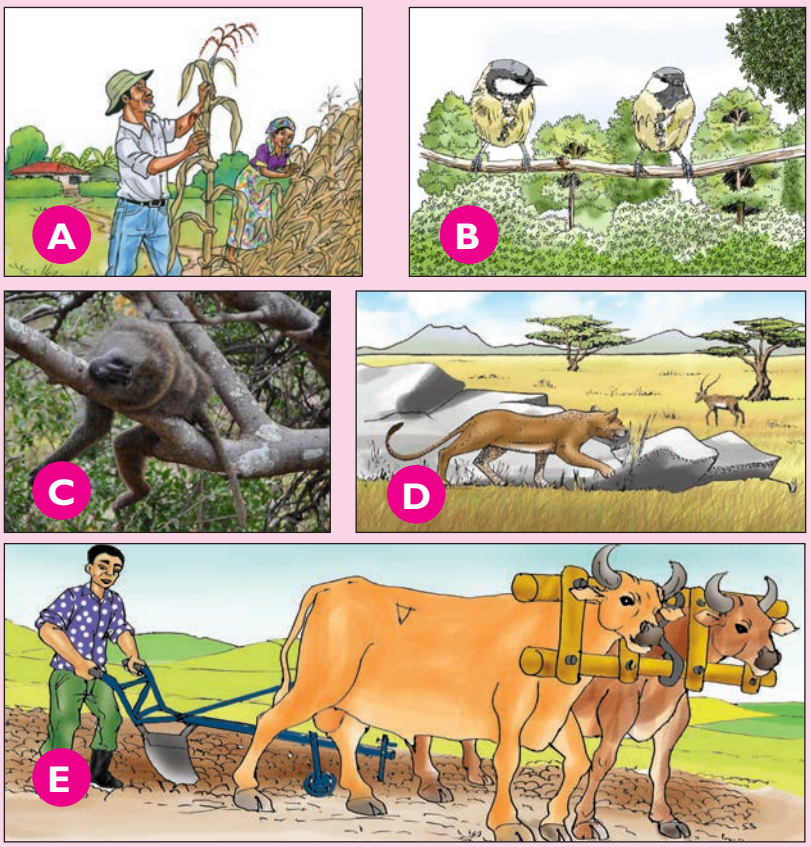
1. One of the following groups consists of insects that have similar feeding habits. Which one is it?
   - A. Tsetse fly, housefly, caterpillar.
   - B. Bee, mosquito, caterpillar.
   - C. Bee, butterfly, bedbug.
   - D. Housefly, cockroach, praying mantis.
2. Name two insects which can be found in our homes.
   - (a) _____
   - (b) _____
3. Which insect is the odd one out in the list?
   - (a) Housefly, cockroach, mosquito
   - (b) Beetle, bed bug, butterfly
4. Write **true** or **false**.
   - (a) Insects do not close their eyes.
   - (b) Only birds and spiders eat insects.
   - (c) All adult mosquitoes feed on nectar of plants.

2.2 Interdependence of living things

Investigating interdependence among living things

Activity 2.7 *As a class*

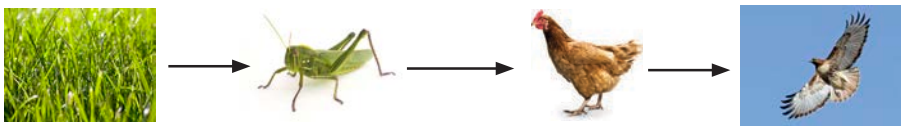
Study the following pictures.

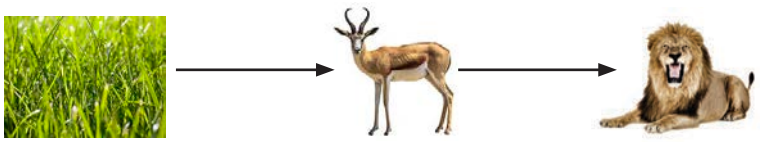


1. What are the people in Picture A doing? What do you think they will do with the crops?
2. Can you see birds in picture B? What is the monkey in picture C doing? How are the trees helping the monkey and the birds? Tell your teacher.
3. What is the leopard in picture D doing? How is the gazelle important to the leopard?
4. What is the person in picture E doing? How are the oxen important to farmers?
5. How are organisms in each picture important to each other?

Learning points

- An animal or a plant cannot live by itself. It depends on other animals and plants for survival.
- Plants and animals depend on each other for support and in their feeding habits. This is called **interdependence**. The interdependence between animals and plants can be shown using a **food chain**.
- A food chain shows who eats who. The arrow always points at the eater. A food chain, therefore, shows how animals get food directly or indirectly from plants.
- Examples of food chains are shown below.

a) 

b) 

Investigating interdependence between plants

Activity 2.8 *As a class*

Materials

- An exercise book to record findings.
- A pen or pencil to write.

What to do

1. Go outside your classroom and walk around the school compound.
2. Study and observe the plants to find out how they depend on each other.
3. Identify plants that are:
   - i) Growing on other plants.
   - ii) Growing under the shade of other plants.
   - iii) Climbing other plants.

4. Record your observation as shown in the table below.

Name of plant	Where the plant is found	Depends on other plants for (support, shade, habitat)

Learning points

Plants may depend on each other for:

- Some plants such as peas and passion fruits have soft and weak stems. Therefore, they cannot grow upright on their own. These plants depend on other plants which have stronger stems for support. These plants are called **climbers** or **creepers**. They have **hooks** and **tendrils**. These enables them to climb onto other plants.
- Some plants are parasites. Therefore, they grow on other plants called hosts. Parasites depend on their hosts for shelter and nutrients. Parasitic plants have their roots attached to the host plant. Examples are striga weed which depends on maize and sorghum for survival.
- Some plants grow under other plants. In this way, they are protected from strong sunlight. This helps them to reduce loss of water from their leaves.

Investigating how plants and animals depend on each other

Activity 2.9 *As a class*

Materials

- An exercise book to record your findings and observations.
- Pens and pencils to write and draw.

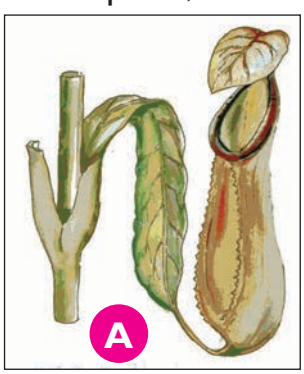
What to do

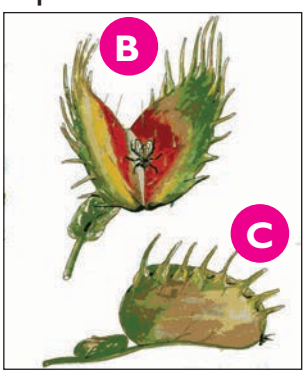
1. Go outside your classroom and observe the surrounding.
2. Observe plants and animals. Look out for the following:
   a) Any small animals plants. Look out for bees, grasshoppers, small creeping animals and butterflies.
   b) Large animals such as cows, goats, sheep and chicken feeding on grass or other plants.
   c) Observe whether there are any birds eating seeds.
   d) Observe the ground or soil. Look out for any animal droppings or manure and other small animals such as earthworms.
3. Identify other things in the environment, for example, crops, flowers, houses and playing fields that show how people depend on plants.
4. Discuss the following questions:
   a) What do you need from plants?
   b) What do plants need from animals?
   c) Which animals depend on plants and for what reasons?

Learning points

Plants and animals depend on each other for:

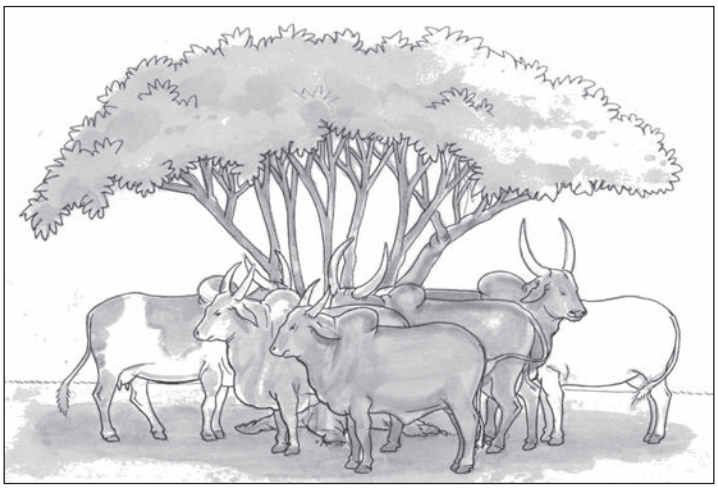
- Most green plants use sunlight to make their own food. Animals directly or indirectly depend on plants for food. Some special plants called **insectivorous** plants depend on animals for food. They trap and digest insects to obtain nutrients. Examples of insectivorous plants are pitcher plant, butterwort plant and venus fly trap.





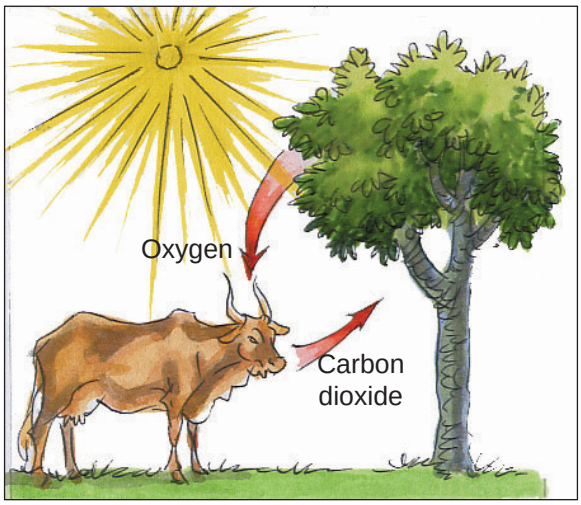
A - Pitcher plant B and C - Venus fly trap

- Forests provide a natural home for most bird and wild animals. Some animals such as birds build nests on trees. Animals lie or stand under the shade of trees when it is hot.



- **Nutrients:** nutrients are things required for the healthy growth of plants and animals. Plants obtain nutrients from the soil. These nutrients can be from animal wastes such as manure (dung and urine) or dead and decayed animals and plants.
- **Medicines:** we get herbal medicine from plants such as Neem tree, garlic, turmeric, gingers, seaweed, aloe vera, eucalyptus and many other plants.
- **Pollination:** many plants depend on animals such as bees and butterflies for pollination. These animals pollinate flowers as they move from one plant to another.

- Plants use carbon dioxide breathed out by animal to make their own food. In the process, oxygen is produced as a waste product. The oxygen is used by animals in breathing.



- Plants make our homesteads and environment beautiful.
- Plants rely on animals, wind and water to help scatter their seeds.

Check your progress 2.6

1. Write **true** or **false**.
   a. All animals depend on plants for food.
   b. All animals feed on plants directly.
   c. All food chains must start with plants.
   d. Some animals can survive without plants.
2. Draw a food chain showing a feeding relationship between the following: Antelope, lion and plants.
3. Draw food chains showing feeding relationships between plants and animals in your locality.

2.3 Conservation of plants and animals

Investigating ways of conserving plants

Activity 2.10 *Individually*

Materials

- An exercise book to record your observation and findings.
- Pens and pencils is to write and draw what you observe.

What to do

1. Go outside your classroom and observe the surrounding.
2. Look out for the following:
   a) Are there big plants?
   b) Are there small plants?
   c) Which of the plants grew naturally? Which ones were planted?
   d) What is the importance of these plants in the school environment?
3. Draw and complete a table like the one shown below. Fill in the missing details as you discuss in your science groups. You can also draw some of the plants. Note that you can use local names of plants.

Name of plant	Small plant	Planted or grew naturally	Importance of the plant to the environment
Grass			
Trees			
Flowers			

Learning points

- We should keep the grass in our compounds short. Gardens in our homes and school compound should be weeded regularly. Weeding should be done during the dry seasons. This will help the plants to grow well.

- Roots of many plants help to prevent soil erosion. **Soil erosion** is the removal of fertile topsoil by strong winds or moving water. Roots of plants hold soil particles together hence preventing soil erosion.

Did you know?

A botanic garden is a place where many different type of plants are grown.

Investigating ways of conserving animals

Activity 2.11 *As a class*

Materials

- An exercise book to record your findings and observations.
- Pens and pencils to write and draw what you observe.
- A camera or a smartphone with a camera.

Your science teacher will take you on a field trip or an educational visit to a national park, a farm or a zoo.

What to do

1. Observe the animals. Look out for the following:
   i) What are the names of the animals that you have observed?
   ii) Why are the animals kept in the zoo?
   iii) What kind of food does each of the animals feed on?
   iv) Classify the animals according to what they feed on.

v) Draw and complete the following table.

	Name of animal	What the animal eats	Classification	Reasons for keeping the animals
a)				
b)				
c)				
d)				
e)				
f)				
g)				
h)				
i)				

2. Discuss what you have filled in your table with members of your science group and with the rest of the class.

Remember!

Animals can be classified as herbivores, carnivores or omnivores.

Learning points

- To **conserve** means to protect, preserve or keep in a good condition for future use.
- It is important to conserve plants and animals because they are part of our **heritage**.
- Conservation of plants and animals also helps to stop them from becoming **extinct**. When an animal or plant becomes extinct it means it stops to exist.
- Animals and plants are conserved using different methods:
  i) Wild animals and plants can be conserved by keeping them in a national park or botanical gardens. In the parks, the animals

live in their natural habitats. They are protected from people who may want to kill them.

ii) Some animals are conserved by keeping them in a zoo. Zoos are protected areas. In the zoo, people may go to see the animals that are kept there.

iii) Domestic animals and plants are kept by people at home or in farms.

iv) Young animals without parents can also be kept in an animal **orphanage**. In the orphanage, they are protected and taken care of until they become big. Later on, they can be transferred to a zoo or a national park.

2.4 Effects of climate change on animals and plants

Activity 2.12 *In groups*

What to do

Study the following pictures.

1. What effects of climate change are shown in the pictures?
2. In your groups, discuss the effects of climate change on both animals and plants as shown in the picture.
3. Write down in your exercise book the effects of climate you have discussed from the photographs above
4. Think of other effects of climate change on plant and animals and write them down as you discuss with your teacher.

Learning points

- Climate change refers to the extreme changes in overall weather patterns on earth. It could be due to temperature changes or the amount of rainfall a place receives.
- Climate change affect both animals and plants.

Effects of climate change in plants include:

i) Drying up of plants when the weather is too hot.

ii) Rotting of some parts of the plants when there is too much water.

Effect of climate change in animals include:

i) Floods can kill animals by drowning. It can also lead to spread of diseases.

iii) Prolonged **droughts**, may force some animals to **migrate** or move to other places where they can find food.

Remember!

Climate change can also affect human activities such as farming and draught. These leads to lack of pastures and crop failure.

Check your progress 2.7

1. Write down two reasons why we conserve plants.
2. Write down two things we can do to take good care of flowers growing in the school compound.

3. A class 4 science teacher took his class on an educational trip. They visited a place where animals are conserved in their natural habitats. This place was most likely a _____.
4. What two animals are the pupils likely to observe when they visit the place mentioned in question 4 above?
5. How does climate change affect animals?

Unit 3 Seeds and germination

3.1 Structure of the seed

Activity 3.1 *As a class*

Materials

- Different kinds of fruits
- Sharp knife or razor blade
- Magnifying glass

What to do

1. Collect as many fruits as possible and bring them to the classroom.
2. Take one fruit at a time and carefully cut it open.

Warning!

Be careful when using sharp knives or razor blades. Knives and razor blades with fresh blood can transmit HIV.

3. Observe what you see inside each fruit. What do you see?
4. Count the number of seeds inside each fruit and record the number.

Learning points

- All flowering plants produce fruits. Fruits contain the seeds of the plants inside them.
- The fruit of each plant has a different size and shape from that of another plant. We eat many fruits.
- Some fruits have only one seed while others have many seeds. For example, a mango fruit has only one seed. However, an orange fruit has many seeds.

Tomato

Pawpaw

Fig

Avocado

Orange

- Different fruits produce seeds of different sizes and colours.
- Some of these seeds can also be eaten as food.

Remember!

Not all fruits can be eaten. Some fruits are poisonous

Parts of a seed

Examining maize and bean seeds

Activity 3.2 *In groups*

Materials

- Maize and bean seeds
- Sharp and clean razor blade
- Magnifying glass

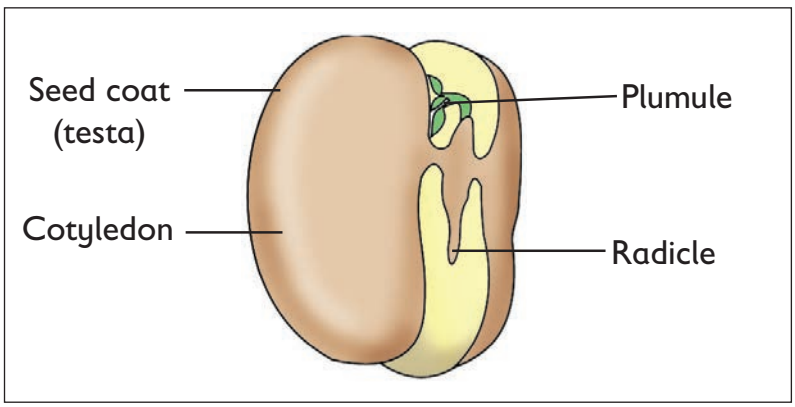
What to do

1. Soak maize and bean seeds overnight in water.
2. Observe each seed by using a magnifying glass. What do you see?
3. Open up each seed by cutting it using a razor blade.
4. Observe the inside of each seed. What do you see?
5. Draw and label the parts of the seeds.

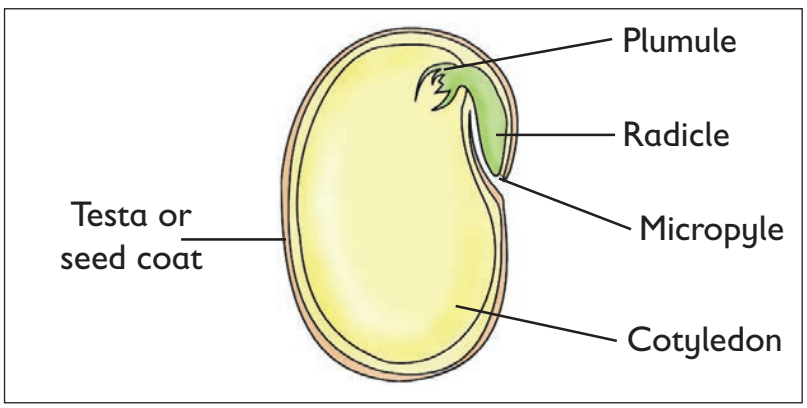
Learning points

Seeds are made up of different parts as shown below.

a) Parts of a bean seed



External parts of a bean seed

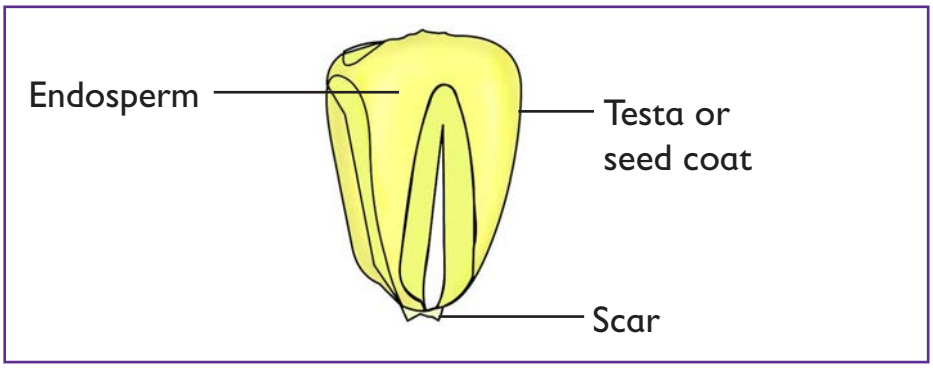


Internal parts of a bean seed

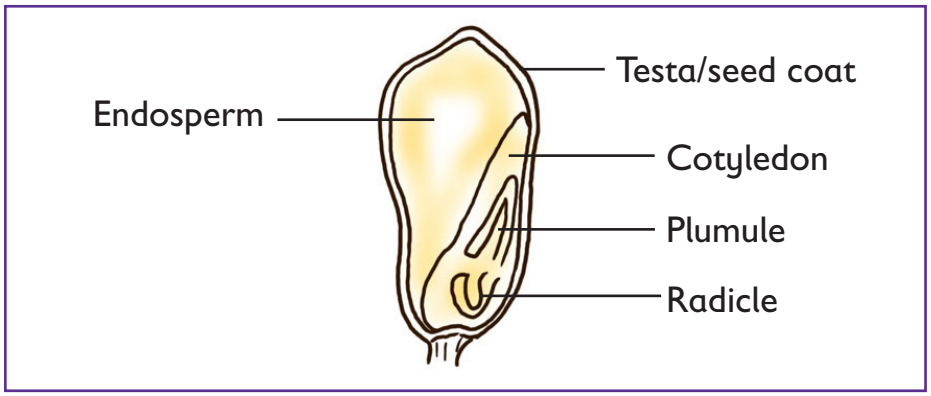
Note: A bean seed has two cotelydons (seed leaves). Therefore, it is called a dicotyledon. Examples of dicotyledons are beans and peas.

b) Parts of a maize seed

Like a bean seed, a maize seed also has internal and external parts.



External parts of a maize seed



Internal parts of a maize seed

Note: The maize seed has only one cotyledon.

The parts above serve different functions as follows:

- **Testa or seed coat** – Protects the inner parts of the seed.
- **Micropyle** – It is the small pore or opening in the seed coat of a seed. It allows water and air into the seed. It also allows the radicle to come out during germination.
- **Scar** – This is the point on a bean seed where it was attached to the pod.
- **Embryo** – It is the living part of the seed. It is made up of the plumule and the radicle. **Plumule** grows to form the shoot while **radicle** grows to form the roots.
- **Cotyledon** – Stores food for the developing seedling during germination.

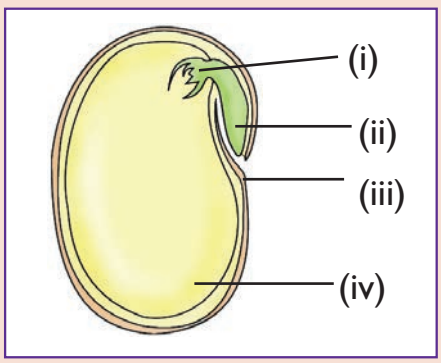
Remember!

Plumule and radicle together are called the **embryo**. This is because the two grow into the new plant (seedling).

Check your progress 3.1

1. Write **True** of **False**.
   a) All fruits can be eaten.
   b) All plants produce fruits.
   c) We should always wash fruits before we eat them.
   d) All seeds are the same size.

The diagram below shows the parts of a bean seed. Use it to answer questions 2, 3 and 4.



2. Which part represents the seed leaf?
3. The seed drawn above stores food in the part marked _____
4. The part of the seed above that was originally attached to a pod is called a _____

Activity 3.3 *In groups*

Materials

- Maize and bean seed
- Sharp clean razor blade
- Magnifying glass

What to do

1. Soak maize and bean seeds for a day or two.
2. Observe each seed using a magnifying glass.
3. Open up each seed by cutting using a razor blade.
4. Observe the inside of each seed.
5. Discuss and write down the differences you can observe between a maize and a bean seed.

Learning points

- The bean seed has two cotyledons. The maize seed contains only one cotyledon.
- Plants that produce seeds with two cotyledons are called **dicotyledons** or **dicots**. Example of dicotyledons are beans, groundnuts and peas.
- Plants that produce seeds with one cotyledon are called **monocotyledons** or **monocots**. Examples of monocotyledons are maize, rice, wheat, barley and millet.

Differences between monocotyledons and dicotyledons.

Activity 3.4 *In pairs*

Materials

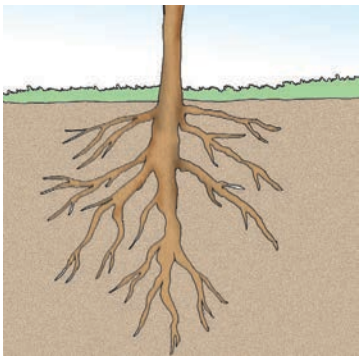
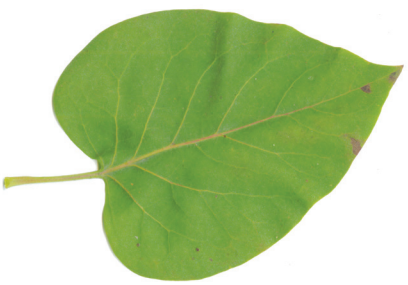
- An uprooted maize seedling or grass
- An uprooted bean seedling or groundnut
- A magnifying glass.

What to do

1. Using a magnifying glass, observe the roots and the leaves of each plant.
2. Draw the leaf of each plant and write down the difference between the two leaves.
3. Draw the roots of each plant and write down the differences between the two roots.

Learning points

Some of the differences between monocotyledons and dicotyledons:

Monocotyledons (monocots)	**Dicotyledons (dicots)**
The seeds have one cotyledon	The seeds have two cotyledons
The plants have a fibrous root system. 	The plants have a tap root system. 
Leaves have parallel veins. 	Leaves have network veins. 
Seeds store food in endosperms.	Seeds store food in cotyledons.
Mainly made up of cereals such as maize, sorghum, wheat, oats and barley.	Mainly made up of legumes such as beans, cowpeas, groundnuts and cashew nuts.

Fun corner

Ask your friend to spell these words: cotyledon, endosperm, monocotyledon, dicotyledon.

Check your progress 3.2

Use the picture below to answer questions 1 to 3.

1. The seeds are obtained from a _____ plant.
2. In which part do the seeds above store food?
3. Which type of roots are found in the plant whose seeds are shown in the picture?
4. Draw a leaf from a monocotyledon plant.
5. Draw and label a seed from a dicotyledon plant.

3.2 Germination of seeds

Observing germination and growth in maize and bean seeds

Activity 3.5 *In groups*

Materials

- Maize and bean seeds
- Glass jars, tins, boxes or plastic containers
- Cotton wool or soil or tissue paper
- Water
- Magnifying glass

What to do

1. Mark the two tins as jars A and B. Put cotton wool or soil or tissue paper in each jar or tin or plastic container.

2. Place maize seeds in jar or tin A.
3. Place bean seeds in jar or tin B.
4. Add a little water in each jar or tin to make the cotton wool or soil wet but not soggy. Keep the cotton wool or soil wet for 14 days.

5. Observe what happens in each tin or jar for 14 days. Draw the seeds in each tin or jar after 3 days, 5 days, 10 days and 14 days.
   - Which parts of the germinating seeds appear first?
   - Do they have the same structures?
   - Do they have the same number of leaves?
   - Do they have the same roots?
   - Which seeds have cotyledon above the cotton wool or soil?
   - Which seeds have cotyledons below the cotton wool or soil?

Learning points

- When you plant seeds in wet soil, they absorb water and swell up. Later, they grow into little plants called **seedlings**.
- The growth of seeds to form little plants or seedlings is called **germination**.
- For the process of germination to take place, the following must be present:

  i) Air (oxygen) ii) Water (moisture)

  iii) Suitable temperature (warmth)

- When seeds are germinating, they go through the following stages:
  1. The seed absorbs water through the tiny pore called **micropyle** and swells up.
  2. The outer cover (testa) bursts or opens.
  3. The radicle comes out first through the **micropyle** to form a tiny root.
  4. The cotyledons splits open to allow the plumule to grow into a shoot.
  5. A new plant called a **seedling** is formed.

Conditions necessary for seed germination

Investigating water as a condition necessary for generation

Activity 3.6 *In groups*

Materials

- Bean seeds
- Two identical glass jars
- Cotton wool
- Water

What to do

1. Label two glass Jars A and B.
2. Put dry cotton wool in Jar A and wet cotton wool in Jar B.
3. Put the same amount of bean seeds in each glass jar.
4. Observe for four to five days for any changes. Write them down.

Learning point

Bean seeds germinated in Jar B and not in Jar A. This shows that water or moisture is required for germination to occur.

Investigating oxygen as a condition necessary for germination

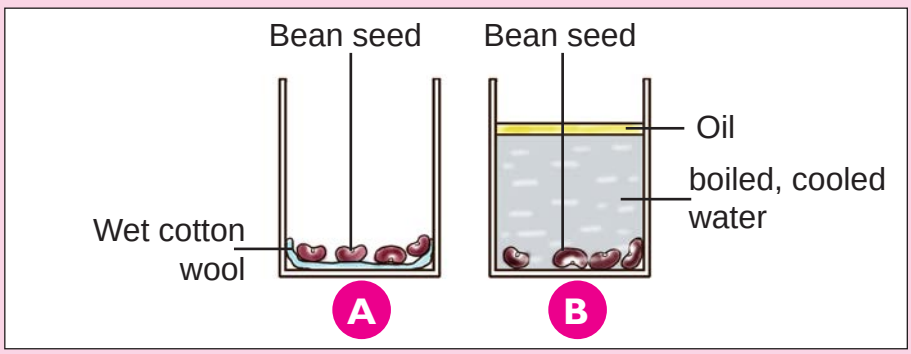
Activity 3.7 *In groups*

Materials

- Bean seeds
- Two glass jars
- Tap water
- Boiled water
- Oil
- Cotton wool or tissue paper

What to do

1. Set up the experiment as shown in the following diagram.



2. Put wet tissue or cotton wool in Jar A.
3. Put an equal number of bean seeds in the two jars labelled A and B.
4. Add boiled cooled water in Jar B. Then add a little oil onto the water.
5. Place Jars A and B safely in the classroom for five days. Do not move them during the five days.
6. Observe what happens to the seeds in each jar.

Learning points

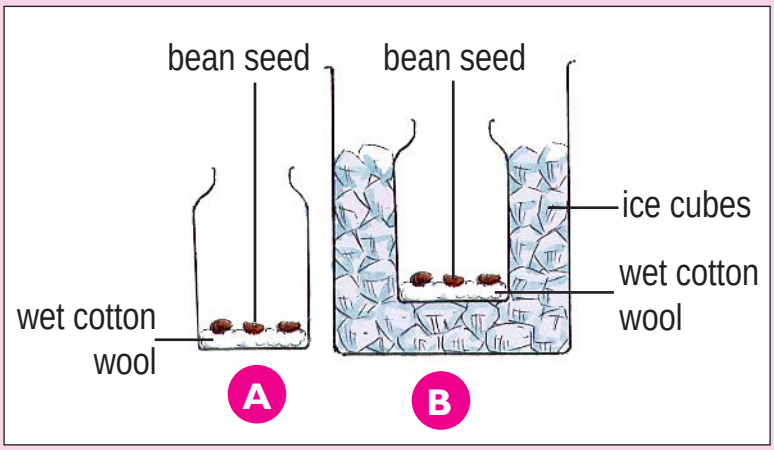
- When water is boiled, air is removed from it. Air contains oxygen. Oil is used to cover water so that air does not enter into it again.
- In this activity, seeds in Jar A will germinate. Seeds in Jar B will not germinate. The seeds will not germinate because they lack air.
- This shows that air (oxygen) is needed by seeds to germinate.

Investigating warmth as a condition necessary for germination

Activity 3.8 *In groups*

Materials

- Bean seeds
- Cotton wool
- Refrigerator
- Ice cubes
- Water
- Two identical glass jars



What to do

1. Put cotton wool in two glass jars, A and B.
2. Plant an equal number of bean seeds in the cotton wool in the two jars.
3. Add an equal amount on water on the cotton wool in the two jars.
4. Place Jar A safely in your classroom.
5. Place Jar B safely in a refrigerator or add some ice cubes into the jar.
6. Leave both jars where you have put them for five days.
7. Observe what happens to the seeds in the jars during this period.

Learning point

Germination will occur in the seeds placed in the classroom. However, germination will not take place in the jar with ice cubes or placed in the refrigerator. This is because the temperatures are too low. Temperatures that are too cold or too hot do not favour germination.

Remember!

We can measure temperature using a thermometer.

Investigating light as a condition necessary for germination

Activity 3.9 *In pairs*

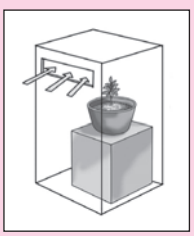
Materials

- Bean seeds
- Soil
- Box or cupboard or carton
- Glass jars or tins
- Water

What to do

1. Put soil in two tins, A and B.
2. Plant an equal number of bean seeds in the soil in the two tins.
3. Add an equal amount of water to the soil in the tins.
4. Place Tin A safely in your classroom.

5. Place Tin B in a dark cupboard and close it or cover it with a box on which you have made a small hole on one of the sides.



6. Leave both tins where you have put them for 7 days.

   After 7 days, open the cupboard or uncover tin B by removing the box or carton.

7. Observe the stems and leaves of the seedlings in both Tins A and B.
   - Do you notice any difference?
   - What do you think has caused the stems to grow differently?

Learning point

When seeds germinate with the right conditions, the seedling grows with the stems straight up in the direction of sunlight. This is what happened to the seedlings in Tin A which was placed in the classroom.

Healthy seedling growing under direct sunlight

On the other hand, the seedlings in Tin B will germinate. However, they will grow with stems bending in the direction of the hole you made in the carton or box. This shows that the seeds will grow towards the direction of light.

Remember!

What plants can be grown from stems or roots but not from seeds?

Check your progress 3.3

1. What conditions are required for seeds to germinate?
2. Write **True** or **False**.
   a) Seedlings can germinate anywhere?
   b) Light is necessary for germination?
   c) Air is necessary for germination?
   d) Soil is necessary for germination?
   e) The radicle is the first to grow during germination?

Unit 4 Water and its properties

4.1 Water in different states

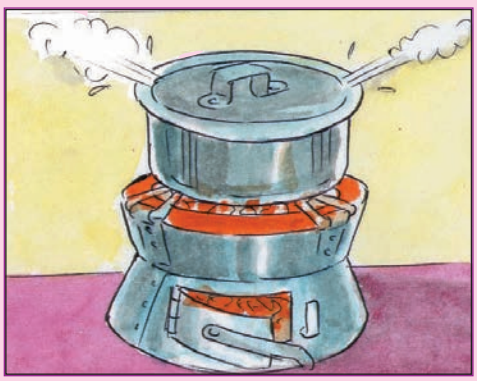
Activity 4.1 *As a class*

Materials

- Water
- Clear plastic bottles
- Cooking pot
- Stove
- Match box
- Refrigerator or freezer

What to do

1. Put water in one of the clear plastic bottles.
2. Pour water in the bottle into the cooking pot.
3. Observe as water pours into the cooking pot.
   - What so you see?
   - Can you put your finger into the water?
   - Is your finger wet or dry after feeling the water?
   - What is the state of water in the bottle and in the cooking pot?
4. Light the stove.
5. Place the cooking pot with water on the stove gently. Let the water boil.
6. Observe what happens. Can you see the steam (vapour)?



7. Record the observation in a table like the one below.

Water	State
Water in the bottle	
Water when boiling	

8. Put water in the second clear plastic bottle. What is the state of water as you pour it into the bottle?
9. Place the bottle of water in a freezer or refrigerator. Observe the water after a day. Record the observation in the following table.

Water	State
Water in the bottle before refrigeration.	
Water in the bottle after refrigeration.	

10. Discuss your observation in groups and present your results in class.

Learning points

- Water can exist in three states.
- Water that flows and can be held in a container is in **liquid** state.
- When water is heated until it boils, it forms steam (vapour). Steam is water in form of a **gas**.
- When water is put in a very cold place like in a refrigerator, it becomes ice. Ice is water in **solid** state.

Changes of state of water

Activity 4.2 *As a class*

Materials

- Cooking pot and lid
- Stove
- Match box,
- Ice cubes

What to do

1. Light the stove.
2. Put ice cubes in the cooking pot.

3. Place the cooking pot on the lit stove. What happens to the ice cubes? What is the name given to the change of state when ice cubes are heated?
4. Place the lid on the cooking pot. after some time. Remove the lid carefully after a few minutes. What do you observe in the inner surface (lower side) of the lid:
   A. What is the change of state when water boils and becomes steam?
   B. What is the change of state when steam is cooled and becomes liquid water?
5. Record your observations in a table like the one shown below.

Case	Observation	Conclusion
A		
B		

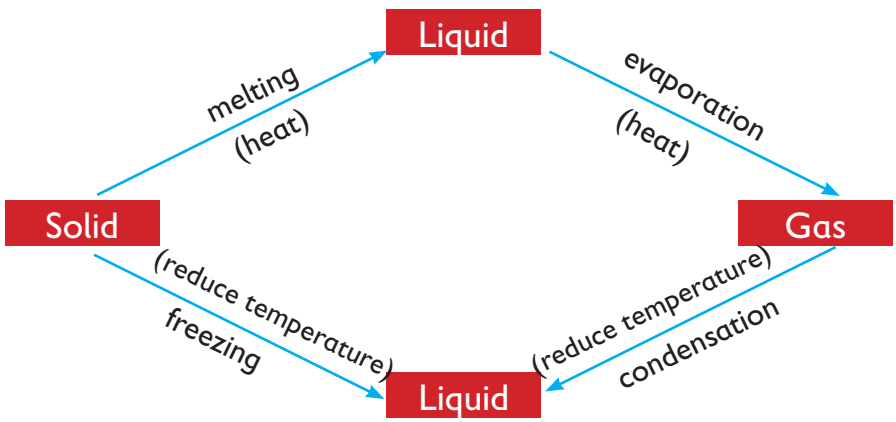
6. Discuss what would happen in A and B if:
   a) the source of heat is removed
   b) Amount of heat is increased
7. Record your results in a table like the one shown below.

	Prediction
Source of heat is removed	A.
	B.
Amount of heat is increased	A.
	B.

Learning points

- Water in solid state (ice) changes to liquid state when heated.
- The process of changing a solid to a liquid is called **melting**.
- Liquid water changes to vapour (steam) when heated.
- The process of changing a liquid to a gas like water vapour is called **evaporation**.
- Water vapour changes to liquid water when cooled.
- The process of changing water vapour back to liquid water is called **condensation**.
- Liquid water changes to ice when **frozen**.
- The process of changing a liquid to a solid is called **freezing**.
- Temperature determines the state in which water is.
- Increase in temperature makes water in solid state to become liquid. It also makes liquid water to become a gas. Low temperature makes water in form of a gas to beome liquid. Very low temperature makes liquid water to become solid.

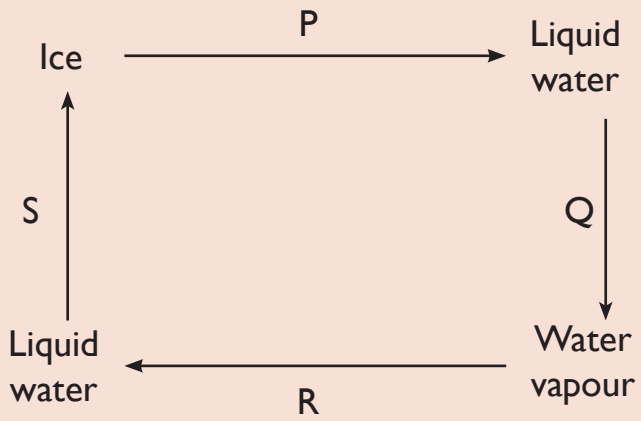
Below is a diagram that shows the changes of state that occurs in matter



Check your progress 4.1

1. The states in which water exists depends on.
   A. light
   B. temperature
   C. time
   D. volume

2. Name the process marked P, Q, R and S.



3. Write **true** or **false**.
   i) Condensation occurs when a solid changes into a liquid.
   ii) Ice is water in solid states.

4.2 Physical properties of water

Activity 4.3 *As a class*

Materials

- Water
- Bottles of different shapes

What to do

1. Pour equal amounts of water in bottles of different shapes.
2. Observe the appearance of water in the bottles.
3. Record your observation in a table like the one shown below.

Investigation	Observation	Conclusion
Shape of container		

- Was it easy to pour water into the bottles?
- Can water flow out in a bottle?
- How can you describe the shape of water in the bottles? Is it fixed or does it take the shape of the bottles?

Learning points

- Water does not have a regular or fixed shape. It takes the shape of the holding container.
- The volume of the water remains the same even when it is changed from one container to the other.
- The mass of the water remains the same even when it is changed from one container to the other.

Check your progress 4.2

1. Look at the diagram below.

The diagram show that

A. water has a definite mass.

B. water has no definite shape.

C. water has a definite volume.

2. Which one of the following is not true about water?

A. Water has a definite volume.

B. Water has a definite mass.

C. Water has a definite shape.

3. Write **true** or **false** for the following statements.

A. Water takes the shape of the container.

B. Water cannot flow when poured.

C. Liquids do not have definite volumes.

Remember!

- Water has a definite volume.
- Water has a definite mass.
- Water has no definite shape.

4.3 Solubility of substances in water

Activity 4.4 *In pairs*

Materials

- Water
- Glucose
- Sugar
- Salt
- Maize
- Flour
- Powdered milk
- Chalk dust
- Ash
- Soil
- Glass
- Bottles
- Stirring rod or spoon

What to do

1. Half fill the glass with clean water.
2. Put crushed sugar in the glass of water.
3. Stir the sugar in water using a stirring rod or spoon.

4. Make observations:
   - Why is the sugar no longer visible?
   - How can you be sure that the sugar is still there?
   - What do we get when a solid dissolves in a liquid?
5. Repeat the step 2 and 3 using different substances such as glucose, salt, maize flour, powdered milk, chalk dust, ash and soil.

- Which substances dissolved in water?
- Which substances did not dissolve in water?
- Does stirring substances help them to disolve faster?

6. Record your observations in the table below. Put a tick (✓) in the appropriate column.

Substance	Soluble	Insoluble

7. Discuss your findings in class.

Learning points

- **Solubility** is the ability of a substance to dissolve in a solvent at a given temperature and pressure.
- A substance that **dissolves** in a liquid is called a **solute**.
- A substance that does not dissolve in a liquid is said to be an **insoluble** solid.
- The liquid in which substances dissolve is called a **solvent**.
- Water is a good solvent because it allows many substances to dissolve in it.
- A mixture of a solute and a solvent is called a **solution**.
- Sugar + Water = Sugary water
- (Solute) (Solvent) (Solution)
- We can make substances to dissolve faster by:
  - Crushing particles to make them smaller.
  - Stirring the mixture.
  - Shaking the mixture.
  - Using warm water.
- When a substance mixes with water completely a **uniform solution** is formed. A uniform solution is called a **homogenous solution**.

Remember!

- A solute is also referred to as a **soluble substance**.
- Increasing the temperature of a solution, increases the solubility of a solute.

Some materials absorb or repel water

Activity 4.5 *In groups*

Materials

1. Describe each picture shown below.

2. What materials do we use to build our houses?
3. Why do we need an umbrella or rain coat when it rains?
4. What material is used to make our clothes?

Learning points

- We build our houses with materials such as bricks and make roofs from iron sheets. This is because they do not allow water to pass through. They protect us from the rain.
- We wear gumboots and raincoats to protect our bodies from rainfall. We use umbrellas when it is raining to protect ourselves from rainfall. They do not allow water to get to our bodies.
- Animals protect themselves against rainfall using their fur. When they are rained on, they shake their bodies and water falls off the fur. They become dry again. Birds also use their feathers to protect themselves against rain.
- Some materials such as cotton absorb water. They are, therefore, used to make the clothes that we wear This is because they are easy to wash.

Fun corner

Draw a house. Colour it to make it look real. Present your drawing to your class.

Check your progress 4.3

1. How can we increase solubility of a substances?
2. Fill in the missing substance.
   Solute + _____ = Solution
3. Which one of the following substances cannot dissolve in water?
   A. Sugar. B. Salt. C. Glucose. D. Chalk powder.
4. Which one of the following cannot reduce the time it takes for a substance to dissolve in water?
   A. Increasing the temperature of the solute.
   B. Crushing the solute into powder.
   C. Increasing the amount of the solvent.
   D. Increasing the temperature of the solvent.

5. Powdered charcoal completely mixes with water to make a uniform mixture. **True** or **false**.

4.4 Floating and sinking

Investigating floaters and sinkers

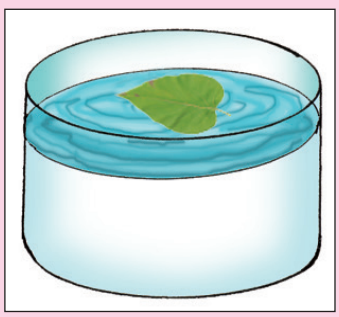
Activity 4.6 *In groups*

Materials

- Basins
- water
- Stones of different sizes
- Pieces of wood
- Wax (candles)
- Plasticine
- Glass
- Plastics
- Leaves
- Papers
- Feathers
- Polythene bags

What to do

1. Put water in a basin.
2. Place each object on water, one at a time. Does it float or sink?



3. Record the observations in the table below. Put a (✓) in the appropriate column

Objects	Floater	Sinker

Factors affecting floating and sinking

Activity 4.7 *In groups*

Materials

- Basin
- Water
- Bottle tops
- Maize cobs,
- Piece of metal
- Seeds
- Bowl
- Pieces of wood
- Plastics
- Stones

What to do

1. Put water in the basin.
2. Place a metallic bottle top on the water. What happens?
3. Remove the bottle top and hit it using a hammer or a stone.
4. Place the flat-shaped bottle top on water. What happens? Record the observation in the table below. Remove the bottle top.

Factor	Observation	Conclusion
Shape	a) bottle top	
	b) flat-shaped bottle top	

5. Put a maize cob, pieces of wood, stones, plastics, glass and a piece of metal together in the water. What happens? Did some objects sink? Did some objects float?
6. Record your observations in the table below.

Factor	Observation	Conclusion
Type of material		

7. Place a long stick and a short stick in water and observe. Place a small stone and a bigger stone in water and observe. Record your observation in the following table.

Factor	Observation	Conclusion
Size and mass		

9. Place a coloured paper and a white paper in water and observe. Place coloured stone and another that is not coloured in water and observe. Record your observations in the table below.

Factor	Observation	Conclusion
Colour		

Remember!

- RememberAvoid using objects that can be damaged by water.

Learning points

- Some materials **sink** in water while others **float** on water.
- Objects that sink are called **sinkers** and those that float are called **floaters**.
- The factors that affect floating and sinking are:
  a) Shape b) Type of material
  c) Mass d) Density
- The factors that do not affect floating and sinking are:
  a) Size b) Colour
- A sinker can be made to float by changing its shape. Likewise a floater can be made to sink by changing its shape.
- Ships float because they have a hallow shape.

Fun corner

Fill a jug with water. Place a stone into the water gently. Collect the water that pours out of the jug. Measure the volume of the water using a measuring cylinder.

Did you know?

The volume of the water you have collected is same as the volume of the stone.

Check your progress 4.4

1. When an object is put on water and it stays on the surface we say it is _____.
2. Write down three floaters and three sinkers.
3. Which one of the following does not affect sinking and floating?
   A. Size B. Material C. Shape D. Density
4. A sinker can be made to float by changing its _____.
   A. size B. shape C. mass D. height.
5. The bowl floats because of its _____.

Unit 5 Matter and materials

5.1 States of matter

Activity 5.1 *In pairs*

What to do

1. Look at the things found in your classroom.
2. List all the things you can see in your exercise book.
3. Discuss the things you have listed:
   (i) What is each object made of?
   (ii) Can you push or touch each of the objects?
   (iii) Does it keep the same shape throughout?
4. Use a dictionary to find the meaning of the word matter.

Learning points

- Matter is everything around us.
- Matter is anything that **has mass** and **occupies space**. This means that we can weigh or measure matter.
- **Mass** is the **quantity of matter** in an object.
- Examples of matter are clothes, plants, animals, water, food and air.
- We use different kinds of matter to make different objects. We can make something such as a metalic or plastic spoon. In this example, we say the material used was metal or plastic.

Activity 5.2 *In pairs*

Materials

- Exercise book
- Ruler
- Set
- Desk
- Water
- Ink
- Glue
- Inflated balloon

What to do

1. Study the materials. How do you classify these objects?
   (a) Do they have regular shapes or sizes? Compare them to shapes like squares, rectangles, circles, and ovals.
   (b) How hard or soft are they?
2. Record your observations in the table below.

Materials with a regular shape	Materials with an irregular shape

Learning points

- You noticed that the materials have different shapes and sizes.
- Matter can be put in three different groups namely:
  1. Solids 2. Liquids 3. Gases
- These groups are commonly called states of matter.
- One important way of classifying objects is by their states of matter.

Remember!

Some materials are solids, some are liquids and some are gases. A material will always be one of these three states.

Check your progress 5.1

1. Name any three objects we use at home that are made up of matter.
2. The amount of matter in an object is called _____.
3. Give reasons why a block of wood is an example of matter.
4. Write **True** or **False**.
   (a) Rain is made up of matter.
   (b) Air has no mass.

(c) The food we eat is made up of matter.

(d) We cannot see all matter.

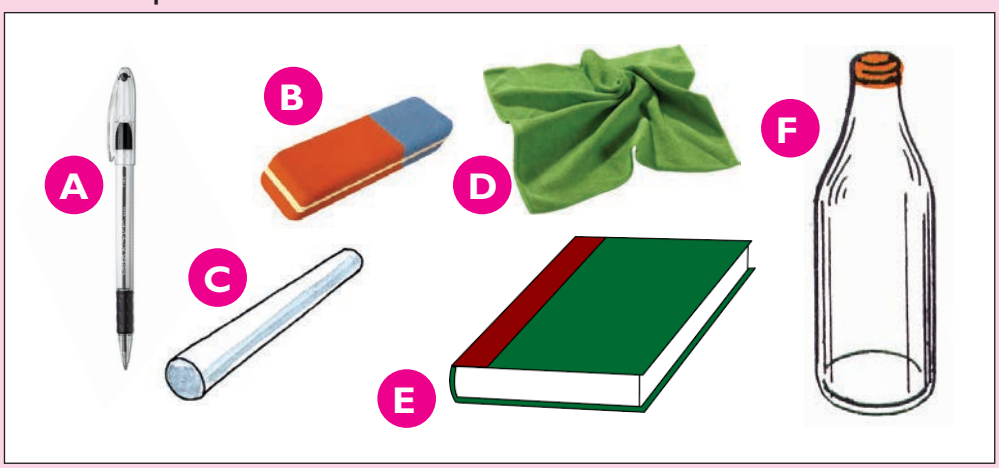
5.2 Physical properties of solids, liquids and gases

Solids

Activity 5.3 *In groups*

What to do

Look at the picture below



1. Describe the objects in the pictures above.
2. Your teacher will give you some of the objects.
   (a) Touch each object. Does it feel hard or soft?
   (b) Knock each object. Does it make a sound?
   (c) Can you put your finger through each object?
   (d) Put each object into something such as a basin or small container. Does it change its shape?
   (e) How would you describe the shape of each object? Is it fixed?
   (f) What do all the objects have in common?

Learning points

- You will notice that the shapes of the objects do not change. The shapes remain the same even after putting them into another

container. This also means that the space they occupy do not change.

- Materials which have fixed shapes and sizes are called **solids**.
- Solids have fixed volumes.
- Some solids are hard while others are soft.
- Examples of solids are trees, pens, pencils, stones, cooking fat and wood.

Did you know!

(a) Dust is a solid suspended on air.
(b) List down the food we eat that is solid.
(c) List down other solid items that we use every day.
(d) Draw any two solid objects found in your classroom..

Liquids

Activity 5.4

In groups

Materials

- Water
- Glue
- Methylated spirit
- Slanting platform
- Cooking oil
- Engine oil
- Containers of different shapes
- Pieces of cloth

What to do

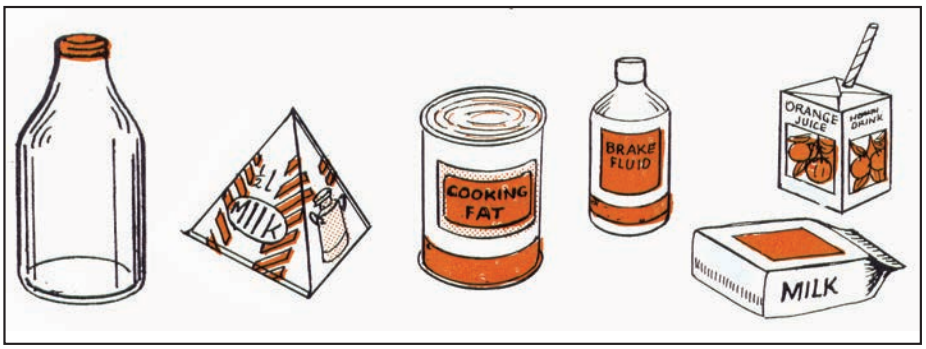
1. Fill all the containers with the same amount of water. What happens?
2. Pour different liquids on a slanting platform. What happens?
3. Using each liquid check for the following.
   - Do they flow? If yes, do they flow at the same speed?
   - How do the different liquids smell? **Do not taste the liquids.**

- Can you put your finger through the liquids?
- Can you soak the liquids up with a piece of cloth?

4. Record your observations.

Learning points

- You will notice that water fills up different containers.
- The shape of the containers and that of water are the same. This means that liquids do not have fixed shapes. They take up the shapes of the containers they are put in.



- When liquids are poured, they flow. Some liquids flow faster than others.
- We can, therefore, say, that matter that has a fixed volume, no fixed shape and can flow is called a **liquid**.
- Examples of liquids are water, cooking oil, juice, engine oil and methylated spirit.

Fun corner

(a) List down foods we drink in liquid state.

(b) List down other liquids commonly used in your home and what they are used for.

Gases

Activity 5.5 *In pairs*

Materials

- Balloons
- Strings

What to do

1. Blow air into the balloons. Then tie the mouths of the balloons using strings as shown in this picture.
   (a) What is the shape of the balloons after blowing air into them?
   (b) Is the air taking up space in the balloons?
   (c) Is the air made up of something? Does it have mass?
2. Hold your chest. Then take a deep breathe. Slowly let out the breathed air.
   (a) Can the air be seen?
   (b) What is the smell of air?
   (c) Does the air we breathe in take up space in our lungs?
3. What happens when you hit an inflated soccer ball on the ground?

Learning points

- When a balloon is filled with air it becomes bigger. This is because air occupies space. The balloon goes back to its original shape when the air in it is released.
- We cannot see air. We only see its effects, for example, making the balloon bigger and moving tree branches.
- Air is an example of a gas and so is steam also called water vapour.
- Gases do not have fixed shapes. They spread all over to fill the containers they are put in.
- Gases have no fixed volumes. They can, therefore, be pressed or squeezed to fill smaller spaces.

Fun corner

Get balloons of different colours. Blow air into the balloons and tie the mouths with strings. Then stick them on your classroom walls to decorate the walls.

Check your progress 5.2

1. Identify and group the materials in the list below as solid, liquid or gas. Fill in the answers in the table.

   Book, water, desk, chalk, juice, kerosene, air, milk, rubber, glue, porridge, cup, chair, ice, water vapour, pen, box, and ruler.

Solids	Liquids	Gases

2. Which of the following has a fixed shape?

   A. Stone B. Water C. Milk D. Kerosene.

3. Which one of the following takes up the shape of the container it is in?

   A. Pen B. Book C. Juice D. Chalk

4. Write **True** or **False**.

   (a) Solids do not take the shape of the container they are in.

   (b) Gases have no fixed shapes.

   (c) Liquids and gases change their shapes.

5.3 How some matter exists in all three states

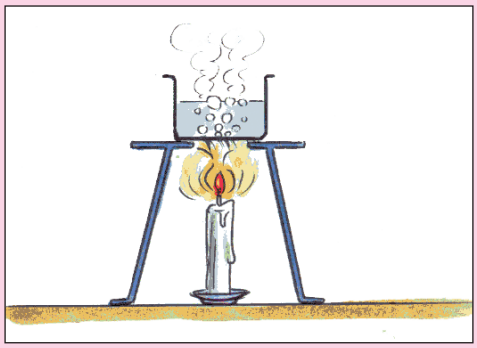
Activity 5.6 *As a class*

Materials

- Ice cubes
- Metallic tin
- Candle
- Matchbox

What to do

1. Put the ice cubes in the tin.
2. Place the tin on the window sill for five minutes. What happens?
3. Heat water gently using a candle. What happens?



Learning points

- Heat in the air (or sunlight on a sunny day) makes the ice cubes to change into water.
- When water is heated, it changes to steam.
- Steam (also called water vapour) is water in form of gas.
- Some materials such as water can exist in the three states of matter, that is, solid, liquid and gas.

  Ice ⟶ Water ⟶ Steam (vapour)

  (Solid) (Liquid) (Gas)
- The state in which water and other materials exist depends on the temperature of the surrounding.

Check your progress 5.3

1. The state in which water exists depends on _____.
2. The process that changes water from a liquid to a solid is called _____.
3. What would happen if you placed an ice cube on the palm of your hand for some time?

4. Palek bought ice lollies and placed them in a bowl. She left to go to the shop. When she came back, her ice lollies were gone. She found water in the bowl instead. Can you help explain to her what happened to her ice lollies?

Remember!

Air is a gas. There is air all around us but we cannot see it.

5.4 Methods of separating mixtures

Activity 5.7 *As a class*

Story of Ayol

Ayol was sent to buy salt by his mother from a nearby shop. As he was hurrying home, he tripped and fell. The packet of salt fell and burst open, spilling the salt on the ground. He quickly scooped the salt back into the packet. However, it was mixed with some soil.

Ayol needs to separate the mixture of salt and the soil. As a friend, what would you tell him to do?

Learning points

- A **mixture** is two or more different materials mixed together.
- There are many different types of mixtures. Examples are:
  - (a) **Solid mixtures** such as maize and rice mixture.
  - (b) **A solid and a liquid mixture** such as sand and water mixture.
  - (c) **Liquid mixtures** such as kerosene and water mixture.
- Some solids like sugar and salt dissolve in liquids like water.
- There are different methods of separating mixtures.
- The method used to separate a mixture depends on the things that make up the mixture.
- The methods of separating mixtures include:

1. Winnowing
2. Sieving
3. Using magnets
4. Dissolving and evaporation
5. Decanting
6. Filtering
7. Sorting (separating beans from maize, grain mixture)
8. Curdling (separating cheese from milk)

Check your progress 5.4

Pick the methods you can use to separate different mixtures from the puzzle below.

Z	A	R	U	Z	K	P	D	I	D
A	E	V	A	P	O	R	A	T	E
Z	W	B	M	E	A	I	Z	B	C
F	I	L	T	E	R	J	K	V	A
G	N	I	W	I	E	F	E	M	N
Y	N	L	Q	S	H	L	E	A	T
A	O	J	G	B	D	Z	P	G	B
C	W	K	C	L	K	S	I	N	T
T	I	U	A	Y	M	T	R	E	Z
V	N	M	Q	N	A	P	Y	T	I
R	G	S	I	E	V	E	K	Q	R

Winnowing

How do people in your community separate grains from chaff or husks after harvesting?

Activity 5.8

In groups

Materials

- Grains or seeds
- Chaff
- Tray

What to do

1. Mix the grains and chaff on the tray.
2. Go outside your classroom on a windy day.
3. Toss the mixture up and down continuously. What happens?

Learning points

- The chaff or husks are blown away by wind leaving the grains. This is because they are the light part of the mixture.
- **Winnowing** is used to separate light and heavy solids in a mixture.

- Winnowing is best done when strong wind is blowing.

Remember!

The husks blown away by wind should be collected and put in a litter bin. This keeps the environment clean.

Check your progress 5.5

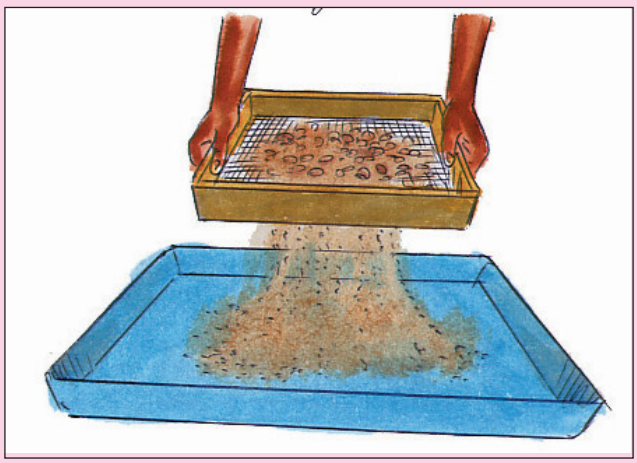
1. Why is it advisable to do winnowing when there is strong wind?
2. Why is it not possible to separate a mixture of maize and beans by winnowing?

Sieving

Activity 5.9 *In pairs*

What to do

1. Study the diagram below and discuss it.



2. What mixtures can you separate using the method shown above?

Activity 5.10 *As a class*

Materials

- Sieve
- A mixture of rice and flour
- Basin,

What to do

1. Place the sieve right above the basin.
2. Pour the mixture of flour and rice onto the sieve.
3. Shake the sieve. What happens?

Learning point

- Sieving separates large and small (fine) solid mixtures.

Check your progress 5.6

1. Draw and label a diagram showing how you can separate a mixture by sieving.

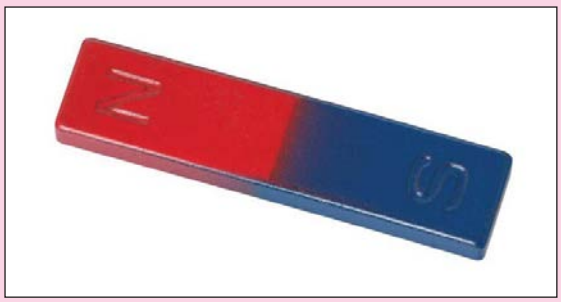
2. Nadima mixed beans and salt accidentally. Which method would she use to separate the mixture?
3. Why do you have to shake the mixture when sieving?
4. A mixture of maize and sand can be separated by.

Using magnets

Activity 5.11 *As a class*

Your teacher will give you a radio speaker.

1. Place a nail close to the speaker. What happens to the nail?
2. Explain the observation made.
3. Study the magnet below.



What happens when you place the magnet near some metals?

Activity 5.12 *In groups*

Materials

- Bar magnets
- Staple pins
- Sand
- Paper

What to do

- Pour the mixture of sand and staple pins on a paper.
- Place the magnet close to the mixture. What happens?

Learning points

- A **magnet** is a special type of metal that attracts certain materials.
- A magnet has two ends called **poles**.
- A magnet is used to separate mixtures made of **magnetic materials** and **non-magnetic materials**.
- The magnetic material is attracted by the magnet leaving behind the non-magnetic material.
- Examples of magnetic materials are iron, steel and tin.
- Non-magnetic materials are materials that are not attracted by a magnet.
- Examples of non-magnetic materials are sand, wood, aluminium and copper.

Check your progress 5.7

1. Write **True** or **False**.
   a) An iron nail is attracted by a magnet.
   b) A mixture of staple pins and sand can be separated by a magnet.
2. When a magnet is placed close to a material and it moves away we say it has been _____.
3. What happens when an iron nail is placed near a magnet?

Remember!

A mixture of two magnetic materials cannot be separated using a magnet.

Separating mixtures that contain a solid and a liquid

Activity 5.13 *Individually*

What to do

Group the materials into those that can dissolve and those that do not dissolve. Fill in the answers in a table like the one shown.

Sugar, salt, sand, flour, glucose and powder milk.

Materials that dissolve	Materials that do not dissolve

Learning points

- To dissolve is to mix completely into a liquid.
- Some solids dissolve in liquids and some do not dissolve.
- Solids that dissolve in liquids are called soluble solids.
- Solids that do not dissolve in liquids are called insoluble solids.
- Materials which do not dissolve can be separated by:
  1. Decanting
  2. Filtering

Decanting

Activity 5.14 *In groups*

Materials

- Water
- Two glass bottles
- Sand

What to do

1. Pour water into a glass.
2. Add sand to the water in the glass and shake.
3. Allow the mixture to settle as shown below. What do you notice? Can you still see the sand?
4. Lift the bottle carefully. Make sure you do not disturb the sand at the bottom.
5. Pour out the water gently, leaving the sand particles in the bottle.

Learning points

- When water and sand are mixed, the sand settles at the bottom of the bottle.
- Sand does not dissolve in water.
- A mixture of sand and water can be separated by **decanting**.
- The water is gently poured into a separate container leaving the sand behind.
- The sand particles that remain in the bottle are called **sediments**.
- Decanting can also be used to separate two liquids which do not mix. Examples are:
  a) Water and kerosene.
  b) Water and cooking oil.
  c) Milk and cooking oil.

Activity 5.15 *As a class*

Materials

- Water
- Kerosene
- Two bottles or containers.

What to do

1. Pour water into the bottle.
2. Add kerosene into the bottle and shake. Let it settle. What happens?
3. How would you separate the mixture of water and kerosene?
4. Carefully pour out the kerosene into an empty bottle or container. What do you observe?

Learning points

- To separate them, kerosene is carefully poured out into another container.
- This is called decanting.
- Decanting can be used to separate two liquids which do not mix.

Filtration

Activity 5.16 *In groups*

Materials

- Flour
- Two small clear containers
- Water
- Piece of cloth
- Rubber band or string

What to do

1. Mix flour and water in the container.
2. Shake well and leave the mixture to settle.
   - What happens to the flour?
   - Can you still see the flour in water?
   - How can you separate the mixture formed?
3. Tie a piece of cloth onto the mouth of a bottle using a rubber band or string.
4. Gently pour the mixture over the cloth.
   - What do you observe on the piece of cloth?
   - What do you see inside the bottle?

Learning points

- When a mixture of water and flour is poured through a piece of cloth, water passes through the cloth but the flour is collected on the cloth. This method is called **filtration**.
- Filtration is used to remove small insoluble solids in liquids.
- Filtration uses a **filter**. A filter is like a sieve with very small pores.

Remember!

Filtered water should be boiled to make it safe for drinking.
Boiling kills germs in the water.

Check your progress 5.8

1. Class 4 pupils collected the materials below:
   a) Piece of cloth
   b) Water
   c) Sand
   d) Bottle

   Which method of separating mixture where they likely to learn about?
2. Draw a simple diagram to show how you can separate a mixture of water and flour by filtering.
3. Draw and label diagrams to show how you can separate mixtures of sand and water.

Evaporation

Activity 5.17 *As a class*

Materials

- Water
- Sugar
- Small transparent bottle
- Source of heat
- Cooking pan

What to do

1. Pour sugar into the bottle.
2. Add water into the bottle and shake.
   - What do you observe in the bottle?
   - Can you still see the sugar in the water?
   - What happens to the sugar?
3. Pour the mixture into the cooking pot.
4. Put the cooking pot onto the source of heat. Let the mixture boil until all the water evaporates.
   - What do you notice in the cooking pot?
   - Where does the water disappear to?

Learning points

- Sugar dissolves in water. This forms a **sugar solution**.
- When sugar solution is heated, water evaporates. This leaves behind sugar in the cooking pot.
- Solids which dissolve in water are separated by **evaporation**.
- In evaporation, water changes to water vapour which is lost into the air.
- The solid is left at the bottom of the cooking pot.

Remember!

In evaporation, only the solid (solute) is recovered. The liquid evaporates and is lost in the air.

Check your progress 5.9

1. Fill in the table by ticking against solids that dissolves or do not dissolve in water.

Solid	Dissolves in water	Does not dissolve in water
Sand		
Sugar		
Salt		
Flour		
Chalk dust		

2. What does a liquid turn into when it evaporates?

   A. Liquid. B. Solid. C. Vapour. D. Paste.

3. How do we get sugar out of a solution?

   A. We can melt the sugar.

   B. By evaporating water so that sugar is left behind.

   C. By filtering it from the solution.

   D. By decanting.

4. Write **True** or **False**.

(a) Evaporation occurs after boiling.

(b) A mixture of salt and sand can be separated by evaporation.

(c) Evaporation is when a gas becomes a liquid.

Unit 6 Light and heat

Light Energy

6.1 Sources of light

Activity 6.1 *In pairs*

What to do

1. Can you name the sources of light in the picture above?
2. Where do you use these sources of light?
3. Which sources of light do you use at home and in school?
4. Which sources of light are natural?
5. Which sources of light are man-made?
6. Find out the sources of light used in your community. Which fuel do they use?

Learning points

- Light is a **form of energy**.
- Anything that produces light is called a **source of light**.
- The main source of light is the **sun**.
- Other sources of light commonly used in your locality are:

a) Torches b) Lamps c) Candles
d) Electricity e) Stars

- Lamps use fuel like paraffin and gas to give light. There are different types of lamps.


Gas lamp


Hurricane lamp


Pressure lamp


Tin lamp

- Which one do you use at home?
- Some sources of light are **natural**. Examples are sun, stars, glow-worms and fireflies.
- Some sources of light are **man-made**. Examples are torches, lamps, candles, and electric bulbs.
- Man-made sources of light are also called artificial sources of light.

Remember!

The moon is not a natural source of light. It reflects light from the sun.

Check your progress 6.1

1. The fuel commonly used in tin lamps and hurricane lamps is _____.
2. Classify the following sources of light as artificial or natural. Fill in your answers in the table.

   Stars, torch, sun, tin lamp, electric bulb, firefly and pressure lamp

Artificial sources of light	Natural sources of light

6.2 How light travels

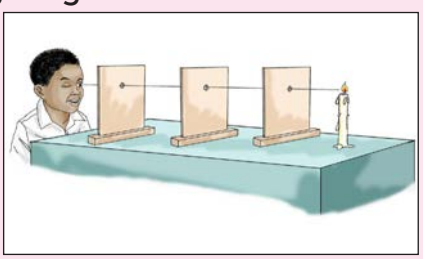
Activity 6.2 *In groups*

Materials

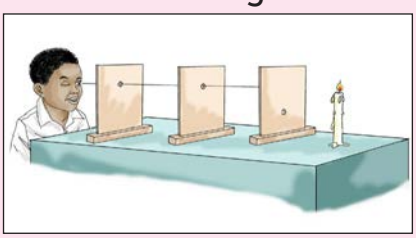
- Same size cards
- candle

What to do

1. Place same-size cards with holes at their centres in a line and source a of straight light at one end as shown below.



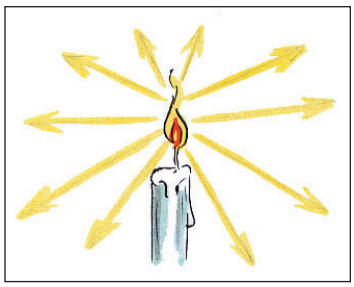
2. If one of the cards is displaced such that the holes are not in a straight line as shown below no light will be seen by the observer.



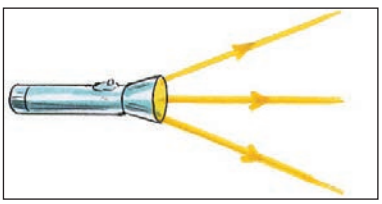
Learning points

- This shows that light travels in a straight line.
- Some sources of light are specifically made to direct the light in a particular direction. For example the the headlights of a vehicle and a torch.

- We are able to see things because light travels from them to our eyes.
- Light travels in all directions.



- We cannot see things in a hidden corner because light travels in a straight line.



- The straight path followed by light from its source is called a **ray**.
- Many rays of light form a **beam**.

A ray of light

A beam of light

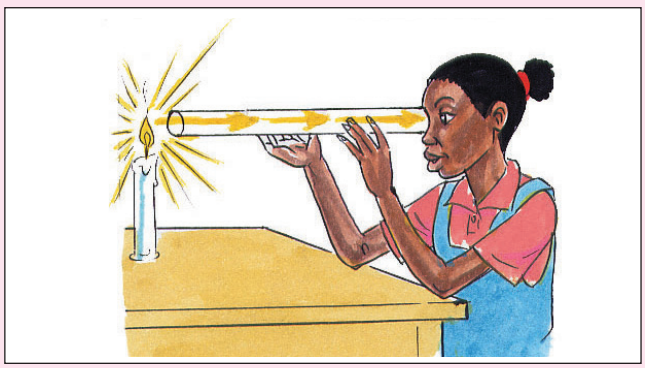
Activity 6.3 *In pairs*

Materials

- A candle
- A piece of flexible plastic tube about 30 cm long. This can be obtained from a hose pipe.
- A matchstick

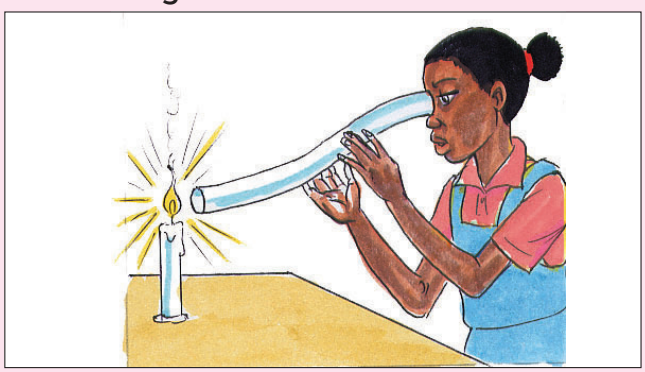
What to do

1. Light a candle and place it on the table
2. Observe the candle using straight (unbent) tube as shown.



- Are you able to see any light coming from the candle? What does this show you?

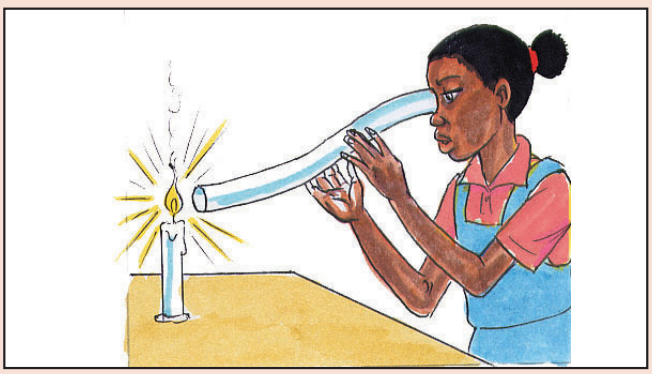
3. Now bend the tube and once again try to observe the candle. Do you see the candle light. What does this show?



4. At what position are light bulbs fixed in a house?
5. Find out why light bulbs are fixed in that position.

Check your progress 6.2

1. Class four pupils carried out the following experiment during a science lesson.



What property of light were the pupils investigating?

2. Write **True** or **Flase**.
   a) Light travels in only one direction.
   b) Light travels in all directions.
   c) Light travels around objects.

6.3 Behaviour of light in different materials

Activity 6.4 *As a class*

Materials

- A clear polythene paper
- A sheet of clear glass
- A block of wood
- White paper
- Mirror
- Sellotape
- Manila paper
- A piece of cloth
- A coloured glass
- Glass of water
- Torch

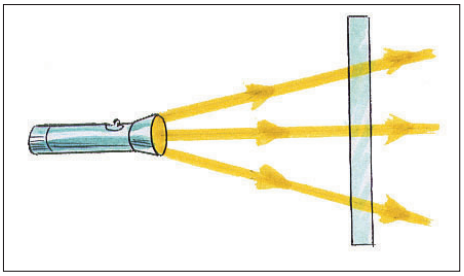
What to do

1. Tape a white paper on the classroom wall.
2. Light the torch and direct light rays onto the black paper.
3 Place each of the materials in front of the torch.
   - What happens when light falls on each object?
   - Does the light pass through the object?
   - Where are some of these materials found in our homes?
4 Record your observations in the following table.

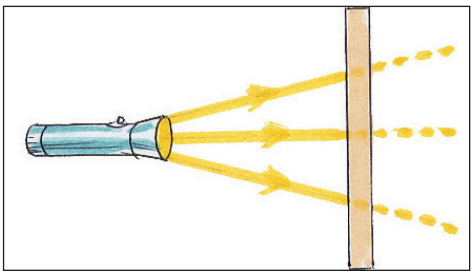
Light passes through	Light does not pass through
1. Clear glass	

Learning points

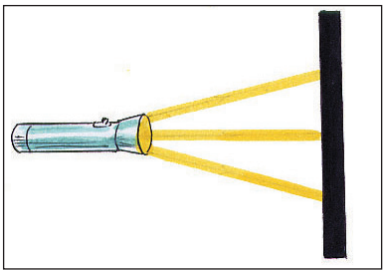
- Materials like water and clear glass allow light to pass through them. These materials are called **transparent materials**.



- We can see through transparent materials.
- Some materials allow some light to pass through them. These materials are called **translucent materials**.



- We cannot see clearly through translucent materials.
- Examples of translucent materials are thin tissue paper, car tinted windows and clouds.
- Some materials like wood and cloth do not allow light to pass through them. These materials are called **opaque materials**.



- Materials which do not allow light to pass through form **shadows**.
- A shadow is formed when the path of light is blocked by an object.

Activity 6.5 *In groups*

What to do

1. List down materials found around the school.
2. Predict whether each material is transparent, translucent or opaque. Record your prediction on a table.
3. Look for the different materials and fill a table like the one shown below.
   - Are they transparent, translucent or opaque?
   - Did you predict each item correctly?

Material	Prediction	Transparent	Translucent	Opaque	Uses

4. Think about items around the community or in your homes that are transparent, translucent, and opaque. Write them in your exercise books.

Learning points

- Transparent materials are used where light is needed. For example:
  1. Making windscreens in vehicles.
  2. Fitting window panes.
  3. In making spectacles.
- Opaque materials are used in making:
  1. Clothing to cover our bodies.
  2. Walls of houses.

Check your progress 6.3

1. Which of the following materials allows light to pass through?
   A. Clear glass.
   B. Block of wood.
   C. Your hands.
   D. Cardboard.

2. We can see clearly through _____.
   A. a clear empty class
   B. a glass with milk
   C. a classroom wall
   D. a wooden door
3. Give any two objects that do not allow light to pass through them.
4. Objects that do not allow light to pass through them form _____
5. Complete the table below. The first one has been done for you.

Object	Material
Car windscreen	**Materials that allow light to pass**
Clothes	
Walls of houses	
Mirror	
Clear polythene paper	

6.4 Uses of light

Seeing

Activity 6.6 *In pairs*

Materials

Heavy coloured piece of cloth

What to do

1. Blindfold your friend.
2. Lead him or her to the back of the class.
3. Let him or her walk slowly to the front of the class without being led?
4. Let your friend blindfold you and do the same.
   - What happens?
   - Can you or your friend find your way easily to the front of the classroom?
   - Can your friend see you? Can you see your friend?
   - How is light useful to us?

Activity 6.7 *Individually*

What to do

1. Switch off the source of light in your house at night.
   What happens? Are you able to see things around you?
2. Now put the light on. What do you notice?

Learning points

- Light helps us to see things around us.
- Light moves from objects to our eyes so we can see.

Healthy growth in plants

Activity 6.8 *In groups*

Materials

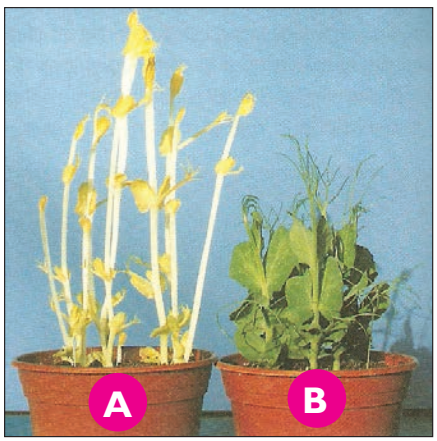
- Two identical containers
- Water
- Bean seeds
- Soil

What to do

1. Put some soil in the containers.
2. Plant the same number of seeds in each container.
3. Sprinkle some water into the containers.
4. Place one container on the window sill where it can recieve sunlight. Place the second container in a dark corner in the classroom.
5. Observe what happens after two weeks. Did the seeds germinate?
   - Which plants look healthier? The ones that were kept in the dark or in the sunlight?
   - Why do you think the plants look different?

Learning points

- Light is needed for healthy growth of plants.



- Green plants use light to make their own food. Plants growing in places with plenty of sunshine grow strong and healthy.

Light is used in communication

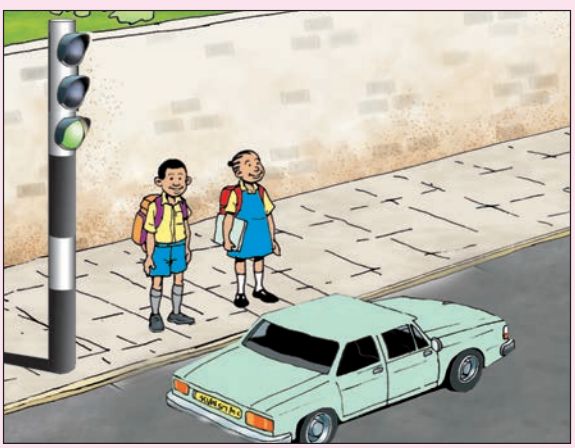
Activity 6.9 *As a class*

Materials

Charts on the traffic lights model.

What to do

1. Visit a town where movement of vehicles is controlled by traffic lights.
   - What are the colours on the traffic lighting system?
   - What does each of the colours mean to the road users?



2. Draw and label the traffic lights model.

Learning points

- Light is used to communicate in a traffic light system.
- The lights flash to send messages to the road users.
- Red light means stop.
- Orange (amber) light means get ready to stop or to go.
- Green light means go.

Check your progress 6.4

1. Plants growing in _____ will grow healthy.
   A. shade B. dark place
   C. plenty of sunchine C. a classroom corner
2. Our eyes cannot see without _____.
3. Draw and colour traffic lights model, indicate what each of the colours mean.
4. Look at this picture.

   We need light to take _____.
5. Write **True** or **False**.
   (a) When traffic lights turn red, a driver must stop.
   (b) Plants growing in a dark place appear long and thin.

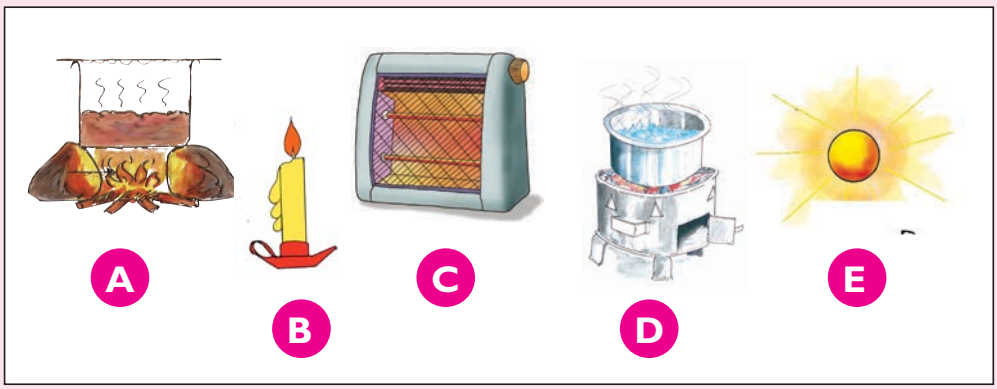
Heat energy

6.5 Sources of heat

Activity 6.10 *In pairs*

What to do

Look at the pictures of sources of heat below.



1. Can you name the source of heat in each picture? Write the names in your exercise book.
2. Can you think of sources of heat used in your community? Find out and write them down in your exercise book.
3. Discuss:
   a) What happens when you stay outside on a hot day?
   b) Why animals rest under shades of trees when the sun is shining?

Learning points

- The main source of heat is the sun. Heat from the sun makes us warm. Other sources of heat are fire, electricity and gas.
- Fire produces heat when firewood, charcoal, kerosene or gas burns.
- Heat is produced by kerosene stoves, candles, charcoal stoves, and gas cookers.

Electric stove

Charcoal stove

Fire place

- Electricity can be used to produce heat in electric cookers, heaters and irons.
- Sources of heat are either **natural sources** or **artificial sources**.
- The sun is a natural source of heat.
- Electricity and candles are examples of artificial sources of heat.

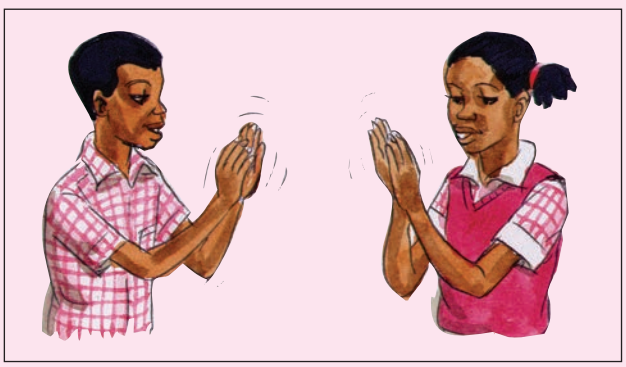
Activity 6.11 *Individually*

Materials

- Piece of stick
- Piece of wood

What to do

1. Rub your hand against each other very fast and repeatedly.



2. Stop rubbing and immediately touch your cheeks. Does it feel warm? Where does the heat come from?
3. Rub the stick against a piece of wood. Do it fast and repeatedly. Touch the stick. What happens? Does it feel hot? Be careful not to get burnt as you touch the stick.

Learning points

- Rubbing materials against each other produces heat energy.
- The heat is caused by a force called **friction**.
- Friction is the resisting force of an object as it moves over another object.

Check your progress 6.5

1. Identify and circle the sources of heat in the puzzle.

F	K	T	J	U	R	P	S
K	T	L	V	I	X	K	T
X	F	I	R	E	Z	E	O
H	M	O	T	B	W	E	V
E	X	C	A	N	D	L	E
A	D	A	G	H	M	U	O
T	G	H	A	P	Y	Q	E
E	P	E	S	T	F	G	W
R	G	M	J	K	P	R	Y

2. Name the things that use electricity to produce heat.

6.6 How heat travels

Activity 6.12 *In pairs*

What to do

1. Discuss why the following things happen.
   a) When you bask in the sun you feel warm.
   b) When cold water in a cooking pan is heated, it boils.
   c) A metal rod placed on fire becomes hot.
2. Record your findings in your exercise books.

Activity 6.13 *As a class*

Materials

- A source of heat
- 20 cm long metal rod
- 20 cm long wooden rod
- 20 cm long plastic rod
- 20 cm long glass rod
- Watch

What to do

1. Light a candle or a charcoal stove.
2. Place one end of the metal rod on the flame.
   - What happens?
   - Do you feel any heat immediately?
   - After how long does the heat reach your hand?
   - How does the heat reach your hand?
3. Repeat the activity using the wooden, plastic and glass rods.
   - What happens?
   - How long does it take for the heat to reach your hand?

4. Place your hands 20 cm away from the flame.,
   - What happens?
   - Do you feel the heat?
   - How does the heat reach your hand?

Learning points

- Heat travels through solids such as metals by **conduction**.
- When cold water in a cooking pot is heated, it becomes hot. This is because heat travels through water. Heat travels through liquids such as water by **convection**.
- When you place your hand close to a candle flame, you feel the heat. This is because heat travels through air by **convection**.
- Heat travels faster in solids than in **liquids**
- Heat travels faster in liquids than in gases.
- Heat from the sun travels through empty space to the earth. That is why we feel heat from the sun.
- Heat travels through empty space by **radiation**.

Remember!

Heat travels from a hot place to a cold place.

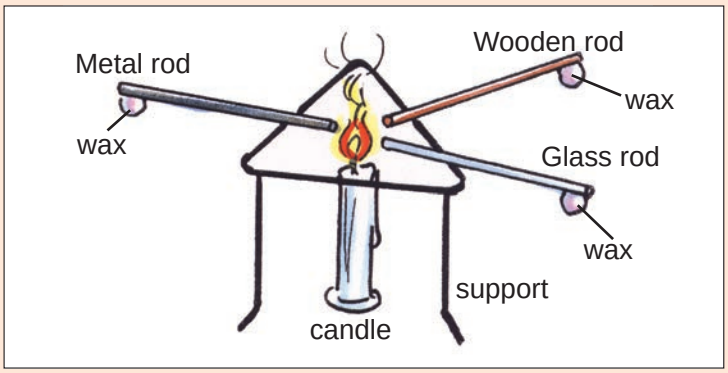
Check your progress 6.6

1. Which one of the following does not allow heat to travel through it?

   A. A wooden spoon. B. A metallic spoon.

   C. A metallic plate. D. A wire.

2. _____ allows heat to travel through it.
3. Heat travels through _____ faster than in liquids.
4. From which rod will the candle drop first in the setup below?

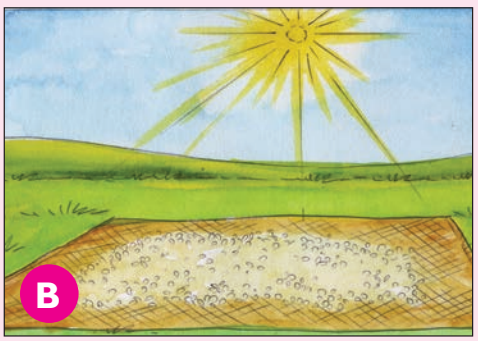


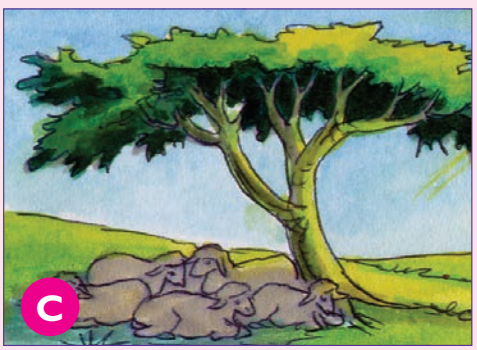
6.7 Uses of heat

Activity 6.14 *In groups*

What to do

Discuss with your group members on what is taking place in the pictures bleow.





Use the questions below as your guide.

- What happens when you hang wet clothes out in the clothes line?
- Why do animals hide under shades of big trees when it is hot?
- Why do farmers dry grains in the sun after harvesting?

Drying

Activity 6.15 *In groups*

Materials

- Clean water
- Basin
- Handkerchief

What to do

1. Use clean water and soap to wash your handkerchief.
2. Rinse the handkerchief and dry it in the sun.
3. Collect the handkerchief after ten minutes. What do you notice?
4. What other things are dried using heat from the sun? Record your findings in your exercise books.

Learning points

- Heat energy is used for drying.
- The heat from the sun helps to dry wet clothes.
- Heat from the sun also helps to dry some food like maize, rice and beans.

Warming

Activity 6.16 *In pairs*

What to do

Look at the following picture.

1. Discuss how heat is used in this picture.
2. List other sources of heat people use to warm themselves in your community.

Learning points

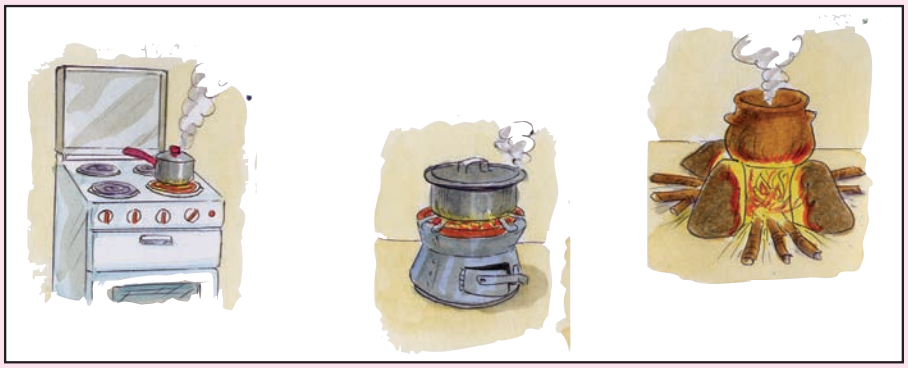
- Heat warms our bodies.
- When it is cold, people usually sit near a fire to get warmth.
- We can also warm ourselves using sunshine and electric heaters.

Cooking

Activity 6.17 — In pairs

What to do

Study the following pictures.



1. Name the source of heat used for cooking in each picture.
2. What source of heat is used for cooking in your home?
3. Discuss other sources of heat for cooking food that you know of.

Learning points

- Heat from various sources is used to cook the food. Examples of these sources are firewood, gas cookers, stoves and electric cookers.

Ironing

Activity 6.18 — In pairs

What to do

1. Name the items used in the picture.
2. How is the boy in the picture using heat?

Learning points

- Heat from an iron box is used to iron clothes.
- We can use a charcoal iron box or an electric iron box. Electric iron boxes use electricity while charcoal iron boxes use charcoal.

Check your progress 6.7

1. Why do we dry grains before storage?
2. The tool below uses _____ to produce heat.

3. _____ is the main source of heat energy.
4. Write **True** or **False**.
   a) Heat from the sun makes us warm.
   b) Drinking hot tea or porridge can warm our bodies.
   c) Heat from the sun causes food to rot.

Unit 7 Electricity and Magnetism

Electricity

7.1 Static electricity

Activity 7.1 *In pairs*

What to do

Discuss the following:

1. You hear a crackling sound when removing your pullover on a cold day.
2. You hear a crackling sound when combing dry hair.
3. What happens when you wipe window panes using a dry cloth on a dry day?

Activity 7.2 *In groups*

Materials

- Plastic ruler
- Pieces of paper
- Plastic pen

What to do

1. Cut the paper into small pieces. Place them on a working table.
2. Rub the plastic ruler gently on your dry hair or pullover.
3. Slowly lower the ruler near the pieces of paper.
   - What happens between the plastic ruler and the pieces of paper?
   - Why does this happen?
4. Now turn the ruler so that you are holding the end you rubbed. Try picking the pieces of paper again. What happens? Does this part of the ruler which was not rubbed pick up papers?
5. Repeat the activity using a plastic pen.
6. Observe and discuss what happens.
7. Record your observation in your exercise book.

Learning points

- Electricity is a type of energy. Electricity can be in one place or move from place to place.
- Electricity that gathers in one place is called **static electricity**. It is called static because it does not move. Static electricity is made up of electric charges that do not move.
- Static electricity often happens when we rub things together.

Activity 7.3 *As a class*

Materials

- Balloons
- Strings
- Pullover

What to do

1. Blow air into two balloons. Then tie off their mouths.
2. Put a mark as **X** on one side of one balloon. This will let you know which area you rubbed.
3. Rub one of the balloons against your pullover at the point mark **X**.
4. Try to stick the balloon on a wall near the point mark **X**.

   - What happens?
   - Does the balloon stick to the wall?
5. Now try to stick the balloon which was not rubbed on the wall.
   - What happens?
   - Does the balloon stick to the wall?
6. Record your observation in your exercise book.

Learning points

- Rubbing a balloon on a pullover gives it static electricity. This makes the balloon stick to the wall at the place that was rubbed.
- The balloon that was not rubbed did not stick on the wall.

Check your progress 7.1

1. Which of the following is an example of static electricity?
   A. Electricity for a light bulb.
   B. Your shirt sticking to your body.
   C. Electricity in an electric cooker.
   D. None of the above.
2. Clothes often stick together because of _____.
   A. Friction
   B. Electric charge
   C. Static electricity
   D. Current electricity
3. Write **True** or **False**.
   a) Static electricity moves in one direction.
   b) An inflated balloon rubbed on dry hair sticks to a wall.
   c) Lightning is not static electricity.

7.2 Current electricity

Activity 7.4 *As a class*

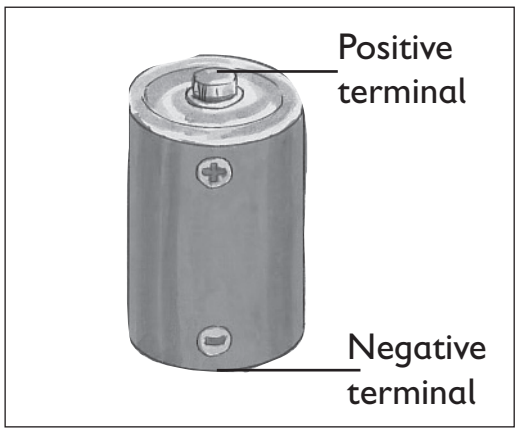
What to do

1. What do you use at home to give you light at night? Tell your teacher.
2. Name the items shown in the picture below.

3. Name five devices that use the items in the pictures.

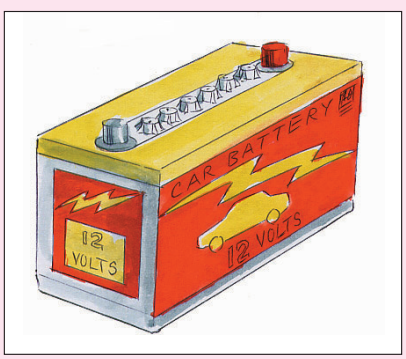
Learning points

- Dry cells are commonly used in torches, radios, cameras and remote controls.
- The end of a dry cell with metal caps are called **terminals**.
- The metal cap at the top forms the **positive terminal (+)**.
- The metal cap at the bottom forms the **negative terminal (-)**.



- Two or more dry cells make up a **battery**. Dry cells are also called **torch batteries**.
- Dry cells have chemicals inside.These chemicals produce electricity.

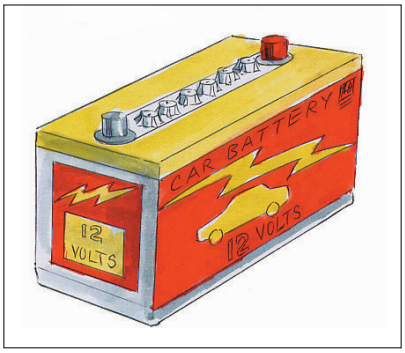
Activity 7.5 *In pairs*



1. Have you ever seen a battery like the one above?
2. Does the battery have anything similar with a dry cell?
3. Where else do you think the battery can be used?

Learning points

- A car battery is used to run a car.
- It can also be used to run other electrical equipment. Examples are radios, light bulbs and televisions.
- Like a dry cell, a car battery has positive terminal and negative terminals.



- A car battery also has chemicals that produce electricity.

Remember!

A car battery can be recharged and re-used. To recharge means to put electric energy back into a battery whose energy has been used up.

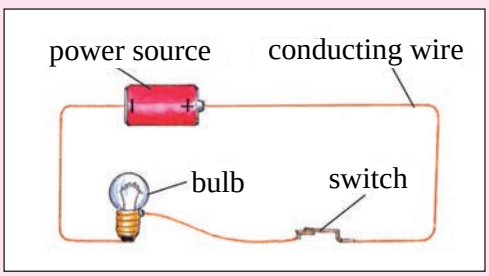
Activity 7.6 *In groups*

Materials

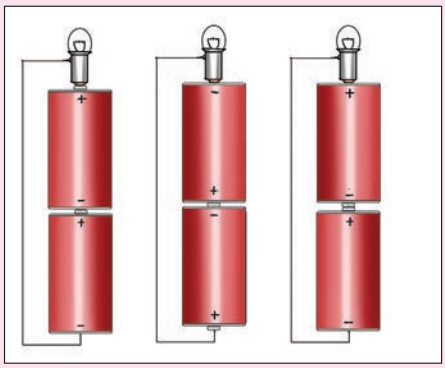
- Dry cells
- Bulbs
- Wire
- masking tape

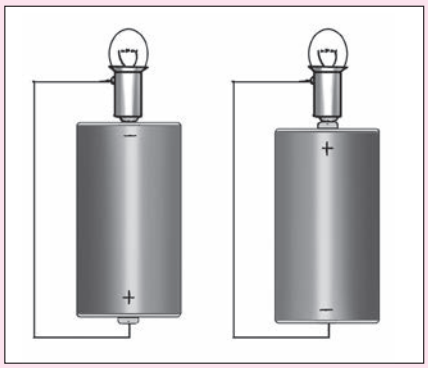
What to do

1. Study the following circuit showing connected dry cells.
2. How do you think we can make the bulb light? Tell your teacher.



3. Now connect your dry cells as shown in the diagrams. Test if your prediction was correct.





5. Try different connections. How many other ways can you connect for the bulb to light?
6. Draw connections that work and those that do not work in a table.

Learning points

- Electricity that moves from one place to another is called **current electricity**.
- For the bulb to light, the wire must touch the correct points of contact on the bulb.
- Connections that allow the bulb to light are called **simple electric circuits**.
- A circuit is the complete path that electricity follows.

Activity 7.7 *In groups*

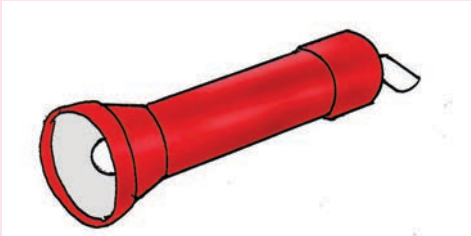
Materials

- A torch
- Dry cells

What to do

1. Put two dry cells in a torch. The positive terminal of one dry cell should be connected to the negative terminal of the next cell.

2. Now put on the switch. What happens after putting on the switch?



3. Put off the switch. What happens?

Learning points

- A **switch** is used to turn an electric device on and off.
- When the switch is on, **electric current** flows. This makes the bulb to light. We say the switch **completes** the circuit.
- When the switch is off, electric current stops flowing. This makes the bulb in the torch to go off. We say the switch has broken the circuit.

Check your progress 7.2

1. Name any three equipment at home that use electricity.
2. Why should we switch off lights when they are not in use?
3. Write **True** or **False**.
   a) When a switch is on, electricity does not flows.
   b) Two or more dry cells make up a battery.
   c) Torch batteries have chemicals that produce electricity.
4. Draw any two simple circuits that will light a torch bulb.

7.3 Connecting dry cells

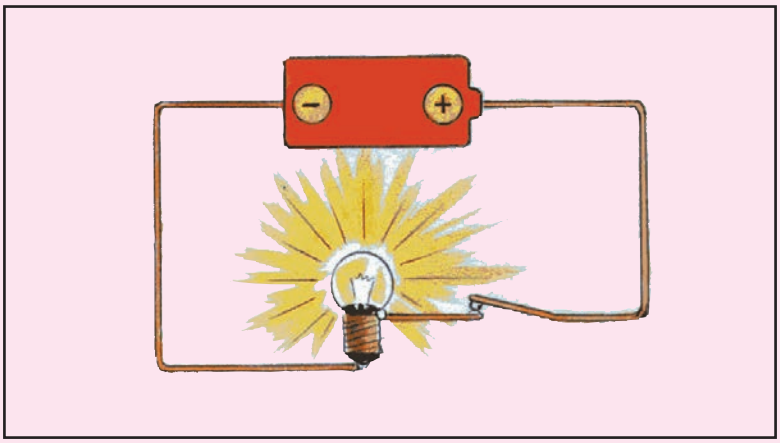
Activity 7.8 *In groups*

Materials

- Dry cells
- Torch bulbs
- Wire
- Masking tape

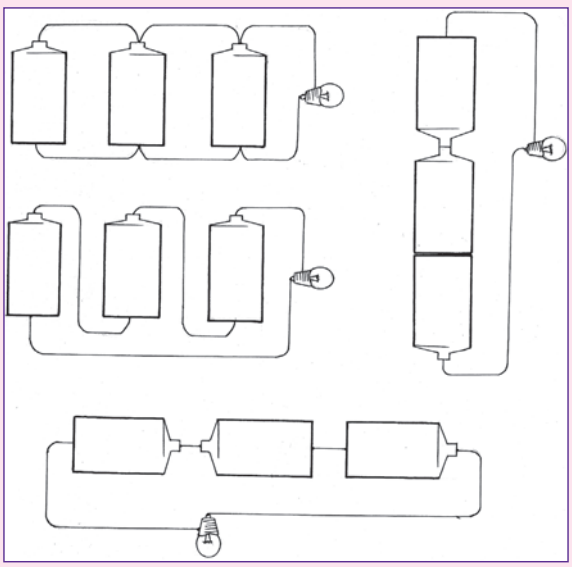
What to do

1. Arrange your circuit to look like the one shown below.



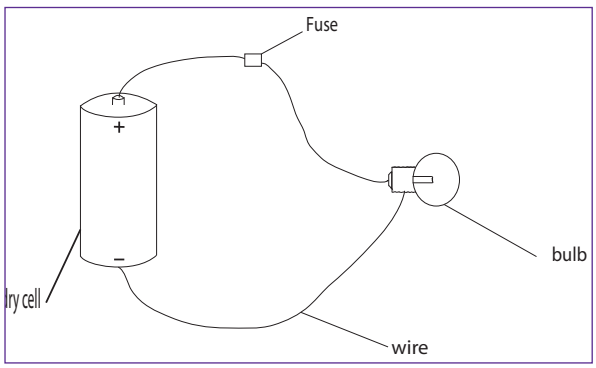
What happens to the bulb? Does it light?

2. Try out the connections in the following diagrams. Record your observations in your exercise books.



Learning point

- The bulb lights only when the connection is made correctly as shown in the connection in the following picture.



- When the dry cell is connected to the glass part of the bulb, the bulb does not light.

Number of cells and brightness of the bulb

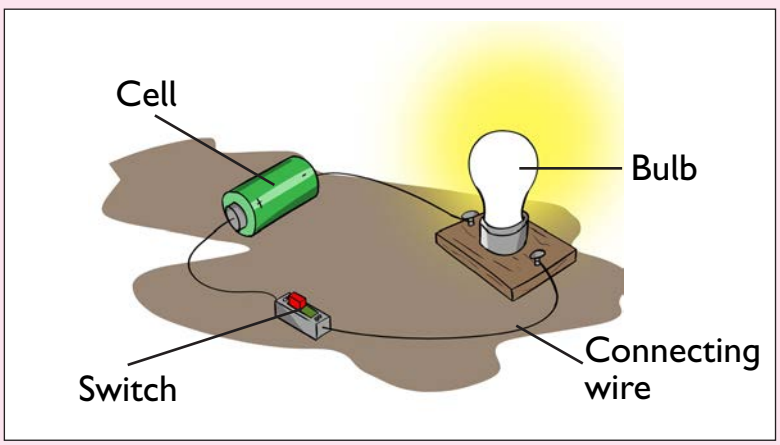
Activity 7.9 *In groups*

Materials

- Four dry cells
- Torch bulb
- Wire
- Masking tape

What to do

1. Connect your materials as shown below.



2. Observe the brightness of the bulb. How do you think we could increase its brigtheness?
3. Add a dry cell to the connection. What happens to the brightness of the bulb? Does the bulb become brighter or dimmer?

4. Keep adding a dry cell to the connection. What happens to the brightness of the bulb each time you add a dry cell? Does the bulb become brighter or dimmer?
5. Draw the arrangements you have made in your exercise book.

Learning point

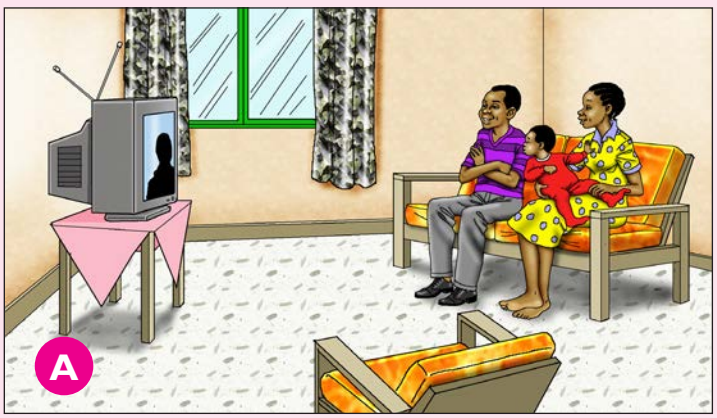
- As you add dry cells to the connection, the bulb lights brighter.

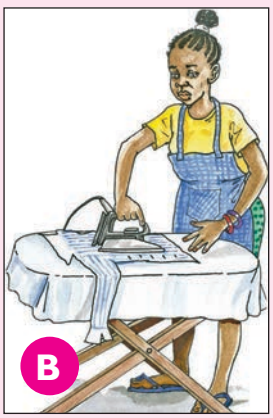
Safety precautions when dealing with electricity

Activity 7.10 *In pairs*

What to do

Study the following picture.





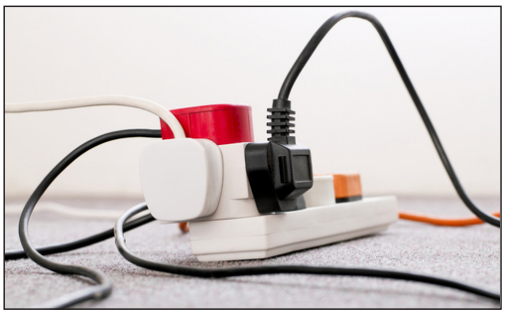
1. Observe the picture above. What is the girl in the picture doing?
2. How is the electricity used in the picture?
3. What are some of the uses of electricity in our homes?
4. Discuss and name devices which use electricity at home.
5. What harm can electricity cause?
6. How do we prevent harm from electricity?

Learning points

- Electricity can cause burns, shocks and even death.

Here ares some rules for using electricity safely.

- Do not touch any device connected to electricity with wet hands.
- Do not plug too many cords in a socket.



- Do not play below electric wires.
- Do not use electric cord that is broken or cut.

Did you know?

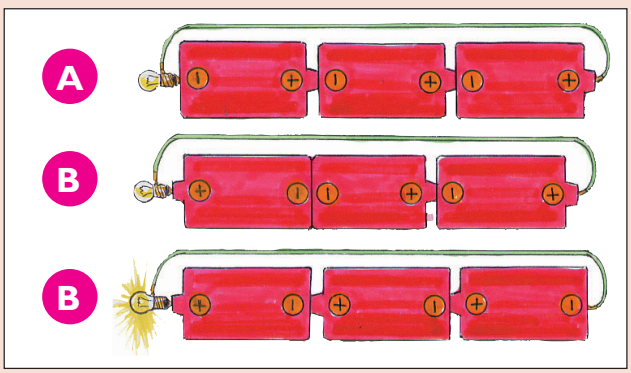
Electricity flows easily through our bodies. This is because our bodies are made of a lot of water. Electricity flows quickly through water.

Remember!

Switching off electricity during the day helps to conserve energy. It also reduces the cost of electricity.

Check your progress 7.3

1. In which of these conditions will the connections will the bulb light brighter?



2. Give any two dangers of touching electric wires with wet hands?
3. How safe is the activity below?.

4. Where are you likely to find the following sign.

Magnetism

7.4 How to make magnets

Activity 7.11 *In pairs*

1. Talk to your friend about the pictures below.

2. Have you ever played with magnets? What did you do with the magnets?
3. What are magnets used for?

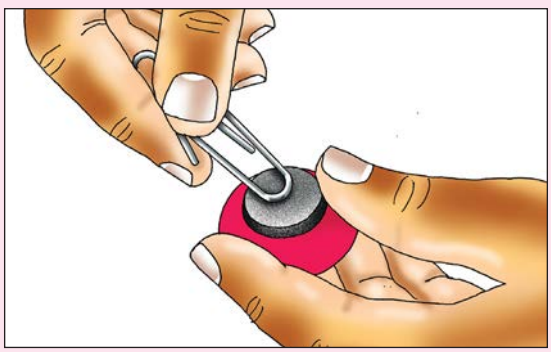
Activity 7.12 *In groups*

Materials

- A bar magnet
- Office pin or a needle
- Staple pins

What to do

1. Hold the needle or pin flat on the table.
2. Rub one end of the magnet along the needle from the eye to the tip continuously in one direction as shown below.



3. Continue rubbing quickly as many times as possible.

   Note: When rubbing do not move the magnet back and forth.
4. Bring the needle close to staple pins. What happens?

Learning points

- A magnet is a special type of metal that attracts certain metals as well as other magnets.
- We can make a simple magnet by continuously rubbing a magnet along a metal in one direction.

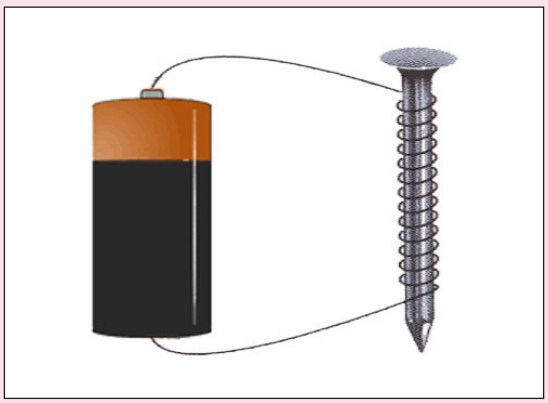
Activity 7.13 *In groups*

Materials

- Dry cells
- Insulated copper wire
- Masking tape
- An iron nail

What to do

1. Coil the copper wire on the nail. Make as many coils as possible.
2. Remove the plastic coating at the ends of the wire.
3. Bring the nail close to staple pins. What happens?
4. Attach the ends of the wire to the terminals of the dry cell. Use masking tape as shown below.



5. Now bring the nail close to staple pins. What happens?
6. Add another dry cell to the connection. Observe and record what happens to the staple pins.

Warning!

The ends of the wire may get hot when they touch the terminals of the battery. Be careful when taping them.

Learning points

- An electromagnet is a magnet that is made using electricity. It can be turned on and off.
- Adding dry cells makes the electromagnet stronger.
- The electromagnet stops working when the cells are removed.

Check your progress 7.4

1. Adding dry cells makes an electromagnet _____.
   A. stronger
   B. to stop working
   D. weaker
   C. a permanent magnet
2. What happens when you rub a needle using a magnet?
   A. It pushes away staple pins.
   B. It picks up staple pins.
   C. It becomes a permanent magnet.
   D. It picks up pieces of paper.
3. Name two ways of making a magnet.
4. Write **True** or **False**.
   (a) An electromagnet can be turned on and off.
   (b) Dry cells produce electricity in an electromagnet.
5. Draw a simple electromagnet.

7.5 Grouping materials using a magnet

Activity 7.14 *In groups*

Materials

- Spoon
- Aluminium foil
- Pen
- Piece of stick
- Rubber
- Copper coin
- Iron nail
- Plastic plate
- Office pins
- Silver coin
- Steel wool
- Pencil
- Paper
- Scissors

What to do

1. Place a bar magnet close to each of the materials above. What happens to each of the materials?
2. Record your observations in a table like the one shown below

Remember!

Use the the same magnet each time. Hold the magnet over each object for the same amount of time.

Materials attracted by the magnet	Materials not attracted by the magnet
1	
2	
3	
4	
5	
6	
7	

Learning points

- Materials attracted by a magnet are called **magnetic materials**. Examples are metal spoon, steel wool, office pins, and silver coin.
- Materials that are not attracted by a magnet are called **non-magnetic materials**. Examples are pieces of sticks, plastic plates and paper.

Check your progress 7.5

Group the following materials as magnetic or non-magnetic.

Silver coin, office pins, staple pins, paper, rubber, stick, iron nail, spoon, pencil, eraser, socks, paper-clip, book and clothes peg.

Magnetic	Non-magnetic

7.6 Magnetic poles

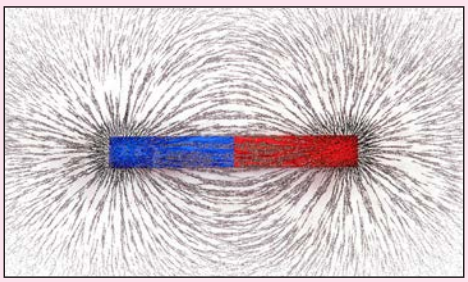
Activity 7.15 *As a class*

Materials

- Iron filings
- Pieces of paper
- Bar magnet

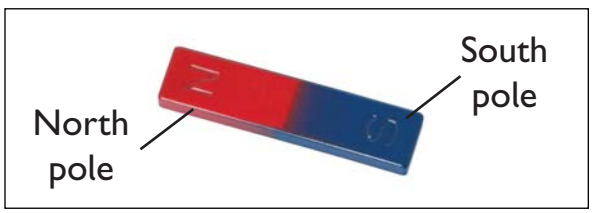
What to do

1. Put iron filings on a paper and place it on a table.
2. Move the bar magnet back and forth on the paper. What do you see?
3. Gently tap the paper with your finger. Can you see the pattern become clearer?



Learning points

- The ends of the bar magnet attract iron filings.
- The ends are called **poles**.
- The poles are called **north pole** (N) and **south pole** (S).



- Magnets are strongest at the poles. The poles attract more iron filings.

Activity 7.16 *In groups*

Materials

Bar magnets

What to do

1. Place the bar magnets on a table.
2. Slowly bring the north poles of the magnets close together. What happens to the magnets?

3. Slowly bring the south poles of the magnets close together. What happens to the magnets?
4. Now bring the north pole and south pole of the two magnets together. What happens to the magnets?
5. Record your observations in the table below

Poles	**They pull each other**	**They push each other**
North + North		
South + South		
North + South		
South + North		

Learning points

- Poles that are the same are called **like poles**. Poles that are different are called **unlike poles**.
- Like poles repel and unlike poles attract.

Check your progress 7.6

1. Which of the following is a magnetic material?
   A. Paper B. Plastic
   C. Iron nail D. Wood
2. Name any three non-magnetic materials used at home.
3. When a magnet pushes an object we say it has _____ the object.
4. Draw a bar magnet and label its poles.
5. Write **True** or **False**.
   a) A south pole of one magnet repels a south pole of another magnet.
   b) A north pole repels a south pole.
   c) A south pole can also be called a north pole.

7.7 Finding the strength of a magnet

Activity 7.17 *In groups*

Materials

- A paper
- Iron filings
- Tin plate
- Aluminium plate

What to do

1. Place the bar magnet on a table. Place the paper over the magnet. Then gently sprinkle the iron filing on the paper. What happens?

2. Carefully lift up the paper. Try to move a bar magnet underneath the paper. What happens to the iron filings?
3. Put the iron filings on the tin plate. Move the magnet underneath. What happens to the iron filings?
4. Repeat the activity using an aluminium plate. What happens to the iron filings?

Learning points

- Iron filings form a pattern on the paper. The pattern shows the **magnetic force** or **magnetic field** of the magnet.
- Moving a magnet underneath a paper moves iron filings. The iron filings move in the same direction as the magnet.
- Magnetic forces do not pass through magnetic materials for example Tin.
- Magnetic forces pass through non-magnetic materials for example Aluminium.
- The poles of the materials attract more iron filings.
- The magnetic force is strongest at the poles.

Did you know?

The earth behaves like a giant magnet. It has a magnetic north and south poles.

Check your progress 7.7

1. Class Four pupils sprinkled iron filings on a piece of paper. What happened when they moved a bar magnet underneath the paper?
   A. The iron filings moved in the direction opposite that of the magnet.
   B. The iron filings moved in the direction of the magnet.
   C. The iron filings did not move.
   D. The iron filings stuck to the paper.
2. Abdul sprinkled iron filings on a tin plate. Then she moved a bar magnet underneath the plate. Why did the iron filings not move?
3. Write **True** or **False**.
   (a) A magnet is strongest at the poles.
   (b) Iron filings are magnetic.
   (c) The middle of a magnet attracts more iron filings.

Unit 8 Earth, Gravity and simple Machines

8.1 How the earth looks like

Activity 8.1 *In pairs*

What to do

1. What do you know or think about the shape of the earth? Discuss with your friend.
2. Do you think the earth moves? Explain to your teacher.

Activity 8.2 *As a class*

Materials

- A soccer ball
- Clay or paper mache or plasticine
- Globe

What to do

1. Observe the shape of the ball.
   - What kind of shape is the ball?
2. Roll the ball on the table
   - How does it move?
3. List other things which have the same shape as the ball.
4. Now rotate the globe. How is the ball similar to the globe?
5. Make simple models of the earth using clay.

Learning points

- A soccer ball is round in shape. We say it is in the shape of a **sphere**.
- The earth is shaped like a huge ball.
- The earth is a sphere as observed from **space**.
- A globe is a model that shows what the earth looks like.

- Just as the globe rotates the earth **rotates**. To rotate is to move in a circle round a centre.
- The movement of the earth is called rotation.

8.2 The force of gravity

Activity 8.3 *In groups*

Materials

- A rubber
- Pencil
- Exercise book

What to do

1. When you let go of something, in what direction does it go? What makes it go in that direction?
2. Now take a pencil and drop it as shown below.
   - What happens to it?

3. Take a rubber and throw it upwards.
   - What happens to it?
   - Does it continue moving upwards or does it come back down?
4. Record and discuss your observations.
5. Discuss how the earth is similar to a magnet.

Learning points

- Objects fall towards the earth by a force called **gravity**.
- Gravity pulls objects towards the centre of the earth.
- The centre of the earth acts like a magnet. It pulls all objects towards the earth.
- The force of gravity is due to the rotation of the earth.

Activity 8.4 *In pairs*

Materials

- A book
- Pen

What to do

1. Take the book in one hand and the pen in another.
   - Which one is heavier?
   - Which one do you think will reach the ground first? Why?
2. Drop the two objects from the same height at the same time.
   - What happens?
   - Were the results what you expected?
3. Repeat the activity using different objects like a ball and a pencil. Observe and record what happens.
4. What do you think would happen if there was no gravity? Discuss.

Learning points

- Gravity attracts all objects equally towards the centre of the earth.

- The force of gravity on an object is called its **weight**.
- Gravity holds everything together. Without gravity everything would float around.

8.3 Effects of Gravity in Space

Activity 8.5 *In groups*

What to do

Study the following picture.

1. **Astronauts** appear to bounce around in their **spacecraft** when they are in space.
   - Why do you think this happens?
   - Is this because there is no gravity in space?
2. Find the meaning of the word weightlessness.

Learning points

- Astronauts wear special clothes in space. These help them remain in space, where gravity is less. They also protect them for very hot or very cold temperatures in space.
- There is no air to breathe in space. Astronauts carry oxygen to breathe.
- Astronauts weigh less in space because the effect of gravity is minimal.

Check your progress 8.1

1. What is gravity?
   A. A force that pulls objects towards the earth.
   B. A force that pulls objects upwards.
   C. A force that makes objects to disappear into space.
   D. A force that pulls objects into the sky.
2. What causes objects thrown upwards to come down?
3. John released a book and a pen from the same height. Which hit the ground first?
4. **True** or **False**.
   a) There is no gravity in space.
   b) Heavier objects fall faster than lighter objects.
   c) Without gravity we would all float around.

8.4 Overcoming force of gravity

Activity 8.6 *In groups*

Materials

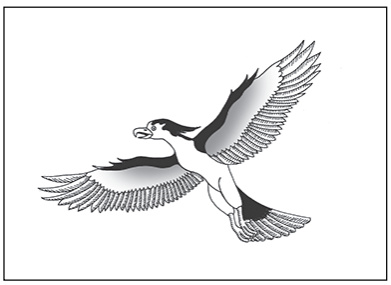
- A kite
- Picture of a bird and an aeroplane flying

What to do

1. Look at the picture of the bird and aeroplane flying.
   - What keeps them from falling off the sky?
   - Name other things that are able to fly.
2. On a windy day fly your kite outside the classroom.
   - What happens?
   - Does the kite fall down or does it keeps flying?

Learning points

- Some things are able to overcome gravity. For example:
  a) Birds have wings, feathers and hollow bones.



  b) Aeroplanes have wings that are curved at the top and flat at the bottom.

  d) Rockets take off by burning a lot of fuel. Burning fuels produces a gas. This gas escapes the rocket with a lot of force. this force powers the rocket upwards. Thus it overcomes force of gravity.
- The pressure of air holding them is greater than the pull of gravity.
- They also have **streamlined bodies**. Streamlined bodies are shaped to move quickly through air. They minimise air resistance. Air resistance is a force caused by air against moving objects.

Check your progress 8.2

1. _____ is a force caused by air against moving objects.
2. Hollow bones make a bird _____ for flying.
3. Streamlined bodies move freely and _____ through the air.
4. Write **True** or **False**.
   a) Aeroplanes have wings for flying.
   b) Lighter birds move faster trough air than heavier birds.
   c) Force of gravity do not affect flying objects.

Remember!

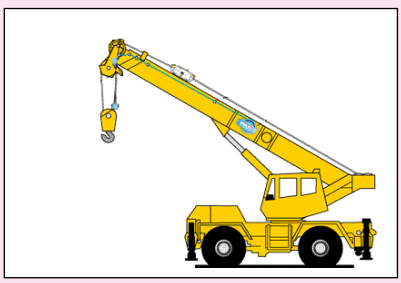
Birds have hollow bones which make them light enough to fly.

8.5 Constructing a simple pulley

Activity 8.7 *In groups*

Talk to your friends about the following questions.

1. Do you think force of gravity makes working difficult?
2. How would you lift a tank of water into a truck for transport?
3. How would you overcome force of gravity to make work easier?
4. What do you think is the work of the vehicle in the picture below?

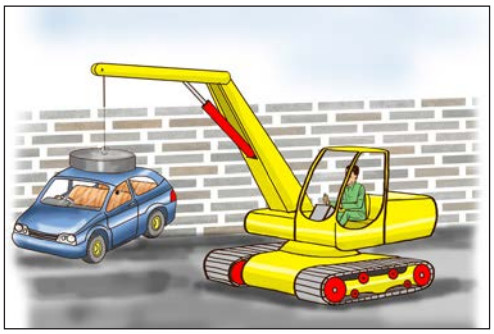


Learning points

- The force of gravity makes working difficult.
- **Simple machines** can help us to overcome force of gravity.
- Simple machines are devices that help to **make work easier**. For

example, we could use a crane to lift a tank of water into a truck. A crane is a simple machine that makes work easier.

- Simple machines help us to move, lift or lower objects.



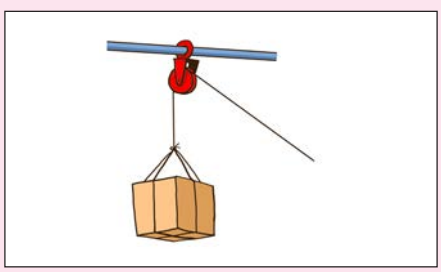
Activity 8.8 *In groups*

Materials

- A pulley or empty spool of thread
- Rope
- Hammer
- Nail
- Block of wood
- Tin can
- Sand soil
- Piece of timber

What to do

1. Fix the nail onto the piece of timber.
2. Bend the nail up using the hammer.
3. Fix the timber to the block of wood. Place it on the working table.
4. Slide the pulley onto the nail.
5. Fill a tin can with soil
6. Tie the can using a rope. Pass the rope over the pulley as shown below.



7. Pull the other end of the rope downwards. What happens?
8. Try to lift the tin can up without using the pulley. What did you notice when you lift without the pulley?

Learning points

- A pulley is a simple machine.
- It uses a grooved wheel and a rope to make work easier.

8.6 How to use a pulley

Activity 8.9 *In groups*

Materials

- Pulley
- Different loads
- A flag post

What to do

1. Take the pulley you constructed in activity 8.8. Place it on the working table.
2. Lift one load using only your hand. Does it feel heavy?
3. Now tie the load onto one end of the pulley.
4. Pull the rope on the other end downwards.
   - What happens?
   - Does the load feel heavier or lighter than lifting it with only your hand?
5. Repeat the activity with other loads.
6. Visit the assembly ground. Lift the flag up by pulling the rope downwards.
   - What happens?
   - Does the flag reach a height you cannot reach with your hands?

Learning points

- Friction is a force which exists when surfaces are in contact.
- The force of gravity and friction make working difficult.
- Pulleys help to reduce force of gravity and friction when working.

Check your progress 8.3

1. Which of these pairs consists only of pulleys?
   A. Clothes lines and ladder B. Clothes line and crane
   C. Ladder and crane D. Ladder and staircase
2. Pulleys help to overcome _____ and _____.
3. Which part of a pulley helps to reduce friction.
4. Write **true** or **false** in the following questions.
   a) Friction makes work difficult.
   b) A pulley is a machine which makes work easier.
   c) Pulley increases the amount of work done.

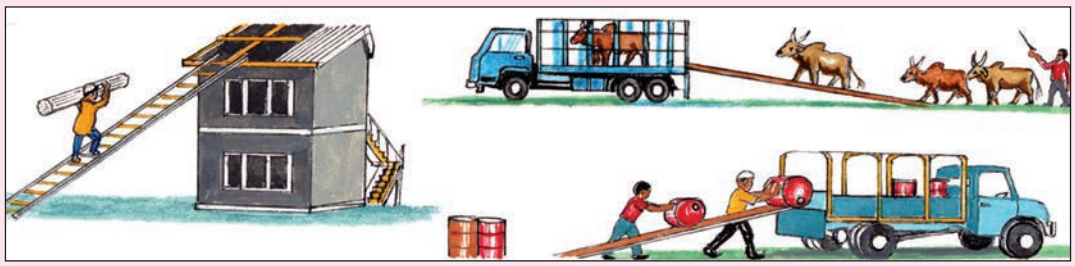
Remember!

A ladder should be strong enough. This enables it to withstand the weight of the person using it.

8.7 Making an inclined plane

Activity 8.10 *In pairs*

Study the pictures below.



1. What is going on in the pictures?
2. Which other things work like the above inclined planes?

Learning points

- A ladder is an example of a simple machines called an inclined plane.
- The word **inclined** means **tilted** or **slanted on a slope**. The word **plane** means a **flat surface**.
- Inclined planes help us to use less effort to move heavy objects up. For example, climbing a wall using a ladder uses less effort than climbing without it.
- Force is applied along the slope to do work.
- Other examples of inclined planes are:

a) Slides
b) Axes
c) Screws
d) Staircases
e) Ramps
e) Roads meandering or winding up hills

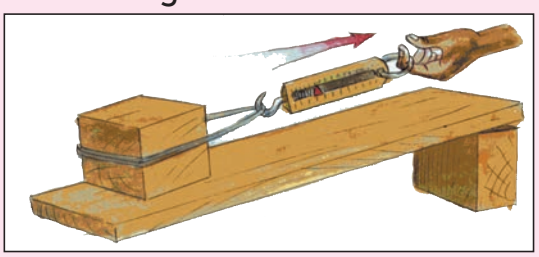
Activity 8.11 *In groups*

Materials

- A table
- A carton of books
- A plank of wood
- A rope

What to do

1. Discuss how you would lift the carton of books onto the table.
2. Now try lifting the box using your hands only.
   - Is it easy to lift the box?
   - How would you lift the box with less effort?
3. Place the plank of wood against the end of the table. this forms a slope as shown in the digram.



4. Tie the carton with the rope. Then pull it up along the plank of wood to the top of table.
   - Did you use more or less force when lifting the box with your hands only?
   - How does the plank of wood make work easier?

Learning points

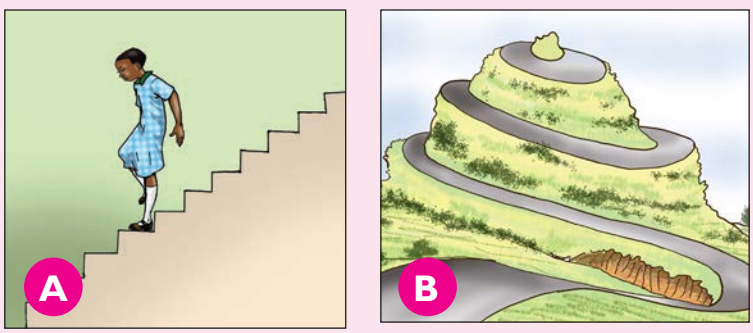
- In Activity 8.11 you constructed a simple machine called a **ramp**.
- A ramp is an example of an inclined plane.
- Lifting the carton using the ramp is easier than lifting it straight up onto the table.

8.8 How to use a simple inclined plane

Activity 8.12 *In groups*

What to do

Study and discuss the pictures below.

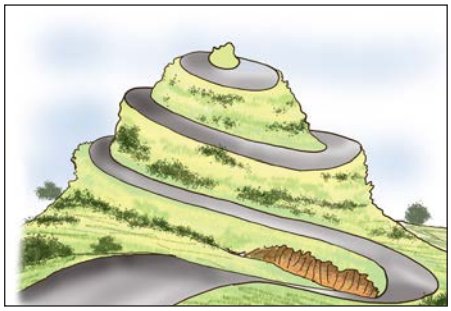


1. Which one is easier?
   - Climbing a hill straight up or using the winding road?
   - Using steep or gentle staircase to go up a tall building?
2. Name some places in the school where inclined planes are found.

Learning points

- Climbing a hill straight up is more difficult than using a winding road.

- Meandering roads or paths also make it easy to go uphill.



- Likewise, it is easier to use a gentle staircase to go up a tall building. Using a steep staircase needs more effort.

Using a ladder as an inclined plane

Activity 8.13 *As a class*

What to do

1. Visit a construction site.
2. Observe how ladders are used to climb walls.
3. Name other places where a ladder can be used.
4. Find other machines that work the same way as inclined planes. Look around your home and the community.

Learning points

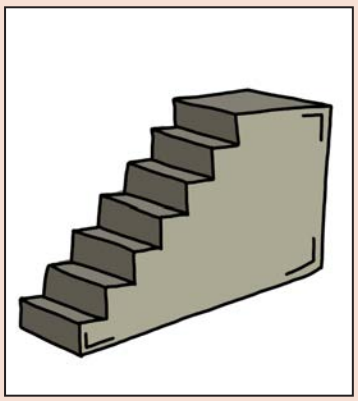
- Just like a staircase, a ladder has steps. These steps are also called **rungs**.
- A ladders is placed against a wall. This enables a person to climb the wall easily.

Remember!

Machines do not reduce the amount of work done. They make work easier.

Check your progress 8.4

1. An inclined plane is a machine that uses _____ to make work easier.
   - A. a flat surface raised at an angle
   - B. a wheel and rope
   - C. a bar that is free to turn around a fixed point
   - D. a flat surface
2. Which of these is not an inclined plane?
   - A. Slide.
   - B. Clothe line.
   - C. Ladder.
   - D. Ramp.
3. Which of these inclined planes is found in a school playground?
   - A. Ladder
   - B. Slide
   - C. Ramp
   - D. Meandering road
4. Look at the diagram below.



   (a) The machine shown in the diagram is called a _____.

   (b) It is used for _____.

5. Write **True** or **False**.
   - a) It is easier to move heavy objects without using inclined planes.
   - b) It is harder to climb a wall using a ladder than without one.
   - c) A screw is a type of an inclined plane.
   - d) An inclined plane is not a simple machine.

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