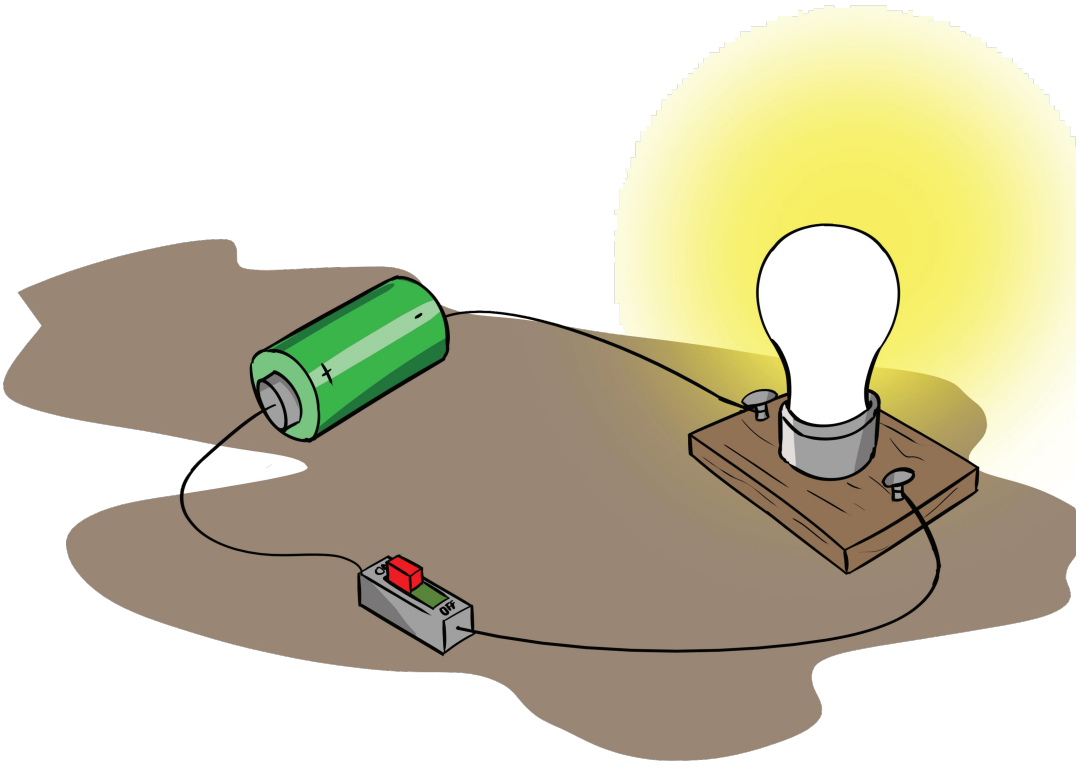
South Sudan

Primary Science 8

Pupil's Book



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4. **If the book is damaged please repair it as quickly as possible.**
5. **Be careful who you lend your schoolbook to.**
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South Sudan

PRIMARY
8

Science

Learner's Book 8

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Table of Content

Unit 1 The relationship between hygiene and diseases

Words to learn

Sanitation, germs, surplus, aflatoxin, brine

1.1: Importance of personal hygiene, home sanitation and food preservation

Personal hygiene

In previous classes you learnt about hygiene practises and causes of diseases. In this unit you are going to learn how to apply the knowledge of hygiene and diseases to personal hygiene, home sanitation and food preservation.

Activity 1.1 **Group work**

1. In groups of four:
   (a) Discuss personal hygiene practices you do to keep clean.
   (b) Discuss how you would apply the knowledge of hygiene and diseases control to your personal hygiene.
      - How important is practicing personal hygiene in preventing diseases?
2. Note down your findings.
3. Choose one member of the group to do a presentation of your findings to the class.

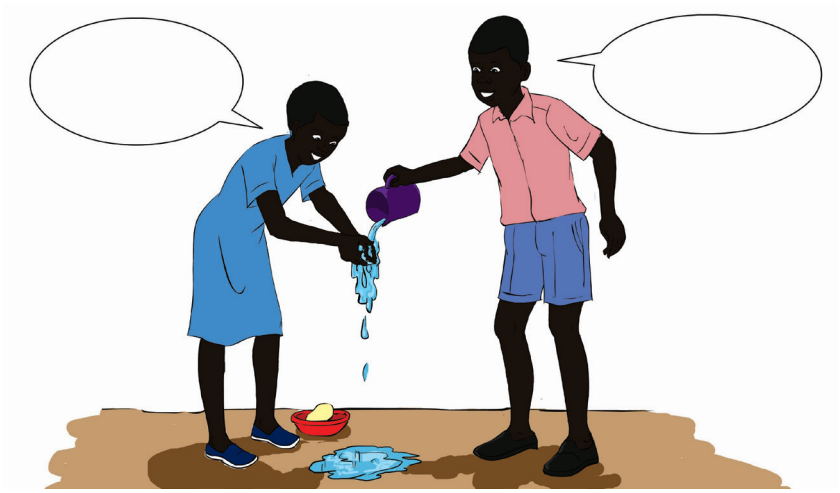
Learning points

- Personal hygiene ensures wellbeing of an individual. It helps to keep off germs that cause diseases.
- Germs are found in our entire environment. They are found in air, water, soil and on objects and things we touch.

- Germs cause diseases such as cholera, typhoid and dysentery. We should therefore practise good personal hygiene and home sanitation in order to keep germs away.
- Keeping our environment clean and tidy prevent germs from infecting us.

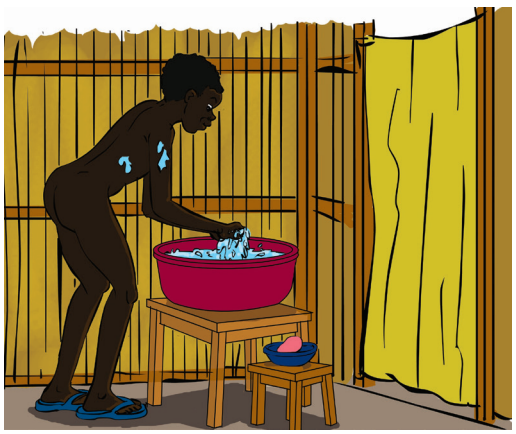
FUN CORNER

1. Fill in the speech bubbles. What is the boy telling the girl? What is the girl's response?



2. Describe diseases that can be prevented by practising personal hygiene methods shown below.

A



B

Did you know

Washing hands prevents over 80% of diseases!

Home sanitation

Activity 1.2 **Group work**

1. Your teacher will provide you with charts showing how diseases are spread.
2. Study the charts provided carefully.
3. Using the charts discuss the relationship between hygiene and diseases.
4. Prepare a news report of your findings.
5. Dramatise presenting your report in a radio station in your local language.
6. Share your findings with other groups.

Learning points

- Home sanitation is the cleanliness of the home environment.
- The home environment includes the house, the compound, the toilets and latrines, bathrooms and animal sheds.

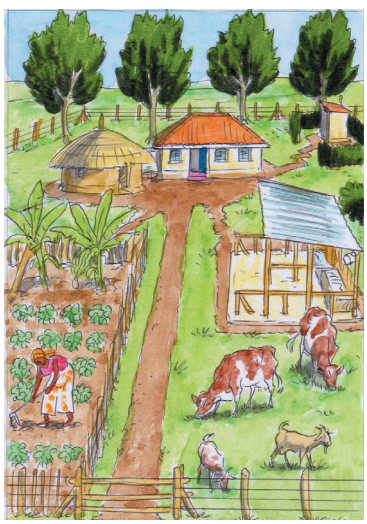
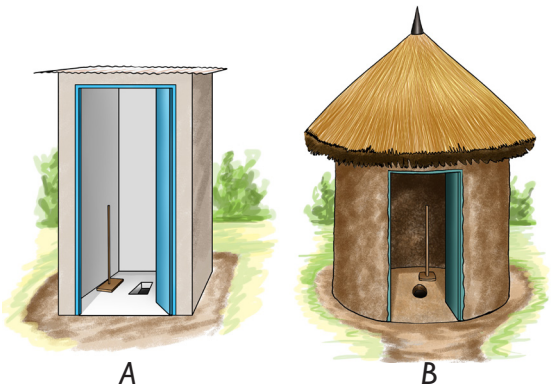


Fig 1.1 Home environment

- All the component of home environment should be kept clean.
- Domestic wastes should be properly disposed in a rubbish pit. Human wastes should be disposed in latrines or toilets.



A B

Fig 1.2 Latrines

- Inorganic waste such as plastics, glasses and paper bags should be placed in bins for recycling, reuse or reduction.

Fig 1.3 The 3 R's of conservation symbol

- Organic wastes such as kitchen waste and animal waste should be converted into compost manure to be used in farms. This therefore saves money that could have been used to buy chemical fertilisers. Compost manure, like other organic manure conserves our soil.

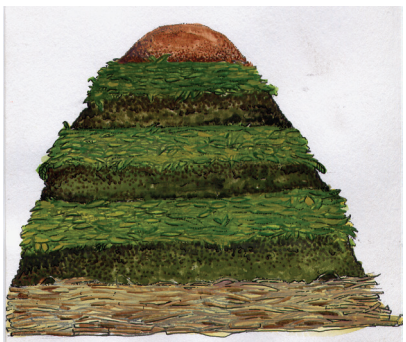


Fig 1. 4 compost manure

- When our home environment is clean, we are free from germs that cause diseases.
- A clean home environment also discourages pest and parasites which can also spread diseases.

FUN CORNER

Write a message to your community about the importance of disposing wastes properly.

Did you know

A mature tapeworm is more than 1 m long!

Activity 1.3 Individual work

1. Perform a food safety check at home, at school or at the local shops.
   - How are the foods preserved, stored or kept?
2. View the food packages.
   - Are the products wrapped properly?
   - What 'use by date ' or expiry dates are displayed?
   - Are meat products separated from dairy products?
3. Do a write-up about your investigations.
4. Using the observations you have made, give reasons why mishandling food is unsafe and a potential food poisoning risk.

Learning points

- Food is oftenly contaminated because of poor handling, bad storage practices and lack of personal hygiene.

- Contaminate means spoil, pollute, taint or infect by something else.
- Any surplus food should be preserved properly for future use. Food that is not properly preserved can easily cause diseases such as food poisoning.
- Food poisoning is an illness of the stomach that is caused by chemicals and micro organisms.
- Some chemicals such as **aflatoxin** occur in food that is not properly stored such as maize grains.

Fig 1.5 Maize infected with aflatoxin

- Food poisoning can kill if not quickly and properly treated.

FUN CORNER

Draw a poster about food poisoning. On the poster write a message to the community informing them that food poisoning can kill.

Project Activity

Make simple grain drier using wire mesh and pieces of wood. Spread grains on wire mesh and put the drier under the sun. When the grains dry completely put them in containers and store them in a dry place.

Check your progress 1.1

1. How do you dispose different kind of waste in your local environment?
2. Identify ways in which a person can practice good personal hygiene to prevent diseases.
3. Pick an example below which outlines poor use of personal hygiene.
   A. Taking off jewellery before washing hands and leaving the off.
   B. Washing hands before entering the kitchen.
   C. Shower daily and wear clean clothing.
   D. Leaving long hair out.
4. If you have a cold and you are working as a chef, waiter or kitchen hand, you turn up to work, what is the best thing to do?
5. Why do food handlers wear apron?
6. Write True or False statement regarding importance of personal hygiene.

1.2: Disease control through hygiene and food preservation

Activity 1.4 **Group work**

In groups of four:

1. Discuss the following
   - How can you prevent food contamination and spread of diseases?
   - How do you ensure good health of people working in a hotel?
2. Suggest methods of controlling diseases through hygiene and food preservation.

3. Write a report of your findings.
4. Choose one member to do a class presentation of your findings.

Learning points

- Germs breed in dirty places. We should therefore practice personal hygiene and home sanitation to keep off germs.
- We should clean our bodies and environment to destroy the breeding places of germs.
- We should practice good food hygiene to avoid water-borne diseases and food poisoning.
- We should educate the community about the need for proper sanitation and food handling practices to avoid endangering others. Everyone should be involved in order for us to reduce infections. It all begins with an individual.

Fig 1.6 Public meeting

- Health education can be done through campaigns against diseases through the media, public meeting and advertising.
- Communal activities such as cleaning streets, separating waste and unclogging drainage plays a vital role in controlling the spread of diseases.
- It is possible to reduce germs and hence control diseases.

FUN CORNER

Draw people chasing germs on a Manila paper and hang in your class notice board for display.

Did you know

Scientists carry out research and come up with solutions to problems facing the world.

Further Activity

1. Using the internet and reference books investigate ways of controlling diseases.
2. Record your findings.
3. Compare your findings with other class members.

Check your progress 1.2

1. How do we control diseases?
2. Why is it important to store food on a shelf above the floor?
3. Infant food should not be stored at all but must be used immediately. Explain why?

1.3: Food preservation methods

Activity 1.5 Ways of preserving food in our community

1. Find out how people preserve food in your home area. You can ask your parents, older relatives, people in the market places, butchers, farmers and fishmongers.
2. Record the information you get in a table like the one shown below.

Name of food	Method of preservation used	How long the food can stay without getting spoilt
1.		
2.		
3.		

Learning points

Foods such as grains, vegetables and fruits are produced every season. These foods cannot stay for long. They soon decompose i.e. rot. We say that such foods are **perishable**.

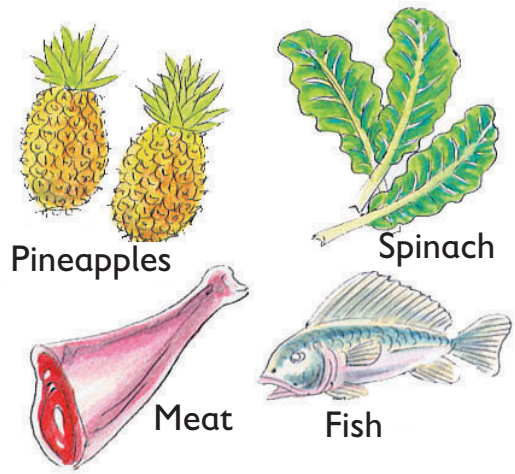


Fig 1. 7 Perishable foods

To prevent **perishable** produce such as vegetables and fruits from **decomposing** when they are plenty, they should be preserved so that they can last longer.

Similarly when plenty of fish are caught or animals have been slaughtered for meat, it is not always possible to eat or sell all the fish or meat at once.

Meat and fish are also highly perishable products which can decompose within a very short time. To avoid loss and waste, fish and meat need to be preserved so that they can last longer.

To **preserve** means to keep in good condition for a long time without decomposing.

When foods are preserved, it is often possible to:

- Retain nutrients in the food.
- Retain the colour of the food.
- Retain the flavour of the food.
- Protect the food against attack by bacteria and pests during storage.

Activity 1.6 **Class work**

1. Your teacher will invite a resource person to talk to you about food preservation methods or organise a visit to a food storage facility nearby.
2. Prepare a questionnaire to use during the talk or tour.
3. Ask questions concerning:
   - Methods of food storage and preservation methods.
   - Why food is stored?
   - Traditional and modern methods of food storage.
4. Compare traditional and modern methods of food preservation and storage. Summarise your findings in a table format.
5. Compare your findings with other groups in class.

Learning points

Food is preserved to:

- Reduce food wastage when there is surplus production.
- Be transported easily.

There are two main methods of preserving food. These are:

(i) The traditional methods

(ii) The modern methods

Traditional methods of preserving food

They include:

- smoking
- drying
- salting
- use of honey
- use of wood ash to preserve grains

Most of these methods have been in use for many years.

1. Smoking

Smoking food involves passing smoke over food. This method is used to preserve fish and meat. When smoke passes over the fish or meat it removes moisture. Bacteria which are responsible for spoiling food cannot reproduce or grow in the absence of moisture and therefore the meat or fish remains good for a long time without decaying.

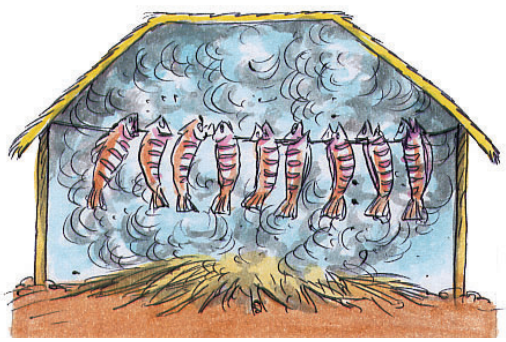


Fig. 1. 8 Smoking fish in a hut

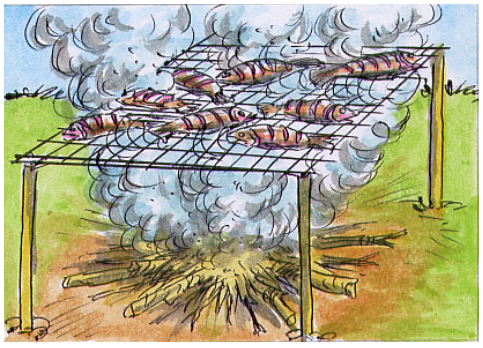


Fig. 1. 9 Smoking fish in the open

2. Drying in the sun

Food is spread in the sun to dry. The sun's energy removes moisture from fruits and vegetables, fish, meat and grains. This inhibits the growth of bacteria and the foods can stay for long without getting spoilt.

The food is turned from time to time to ensure even drying. After drying the food is put in containers.

Fig. 1.10 Sun drying peeled cassava, carrots and unripe bananas

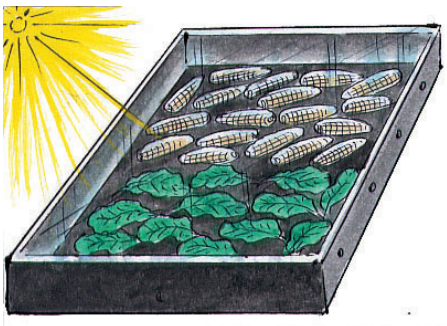


Fig. 1. 11 Sun drying green maize and vegetables

Dried maize and other seeds are prone to attack by **weevils**. To keep weevils away, the dried produce can be mixed with sifted ashes. Special chemicals can also be bought for this purpose but used strictly according to the manufacturer's instructions.

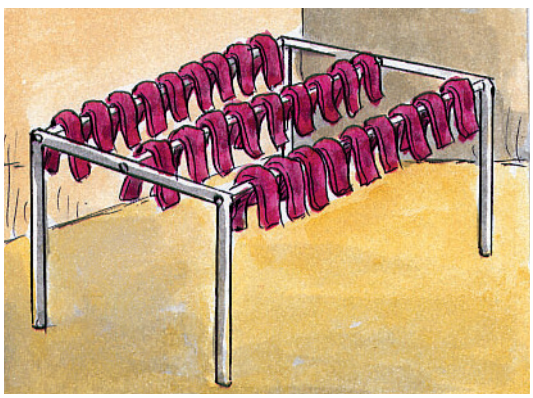


Fig. 1.12 Drying meat

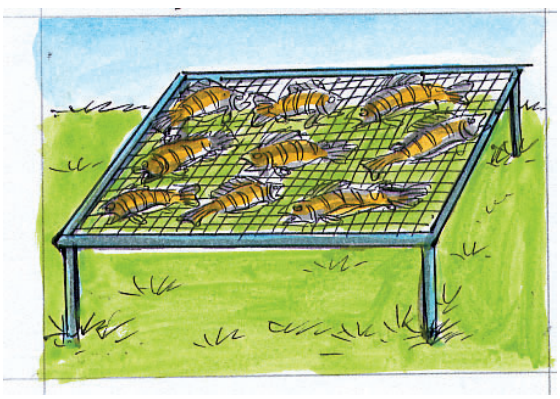


Fig. 1.12 Drying fish

3. Salting

Salt can be used to preserve fish and vegetables.

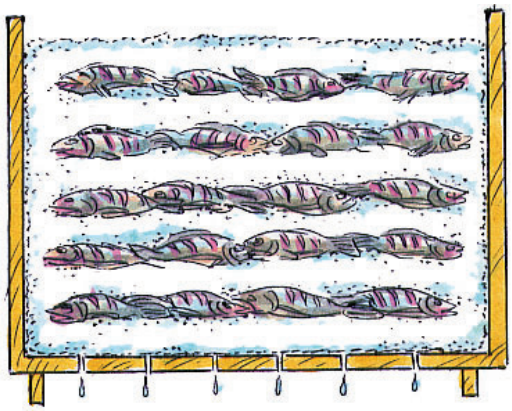


Fig. 1.13 Salting fish

4. Use of honey

This is one of the traditional methods of preserving food. Many communities have used honey for a long time to preserve foods such as meat and fruits.

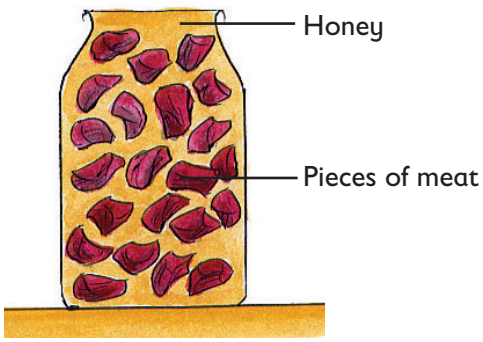


Fig. 1.14 Meat preserved in honey

Modern methods of preserving food

Activity 1.7 **Individual work**

1. Visit a market or shopping centre near you.
2. Observe how vegetable and fruit sellers preserve their vegetables or fruits.
3. Go to a shop that sells drinks.
   - Which method do they use to keep the drinks cold when there is no electricity?

- How do they keep perishable foods for long without spoiling?
- Compare the method used when there is no electricity and the use of refrigerators and freezers?

4. Write a report of your findings.
5. Compare your work with others in class.

a) Use of low temperatures

i) Cooling by evaporation

Vegetable sellers in the market preserve their vegetables such as okra, spinach, cowpea leaves in a sisal bag. They then sprinkle water on the bag. As the water evaporates it takes the heat from the bag and from the vegetables. The vegetables stay cool and fresh much longer.

ii) Use of a charcoal cooler

A charcoal cooler is used in places where their is no electricity.

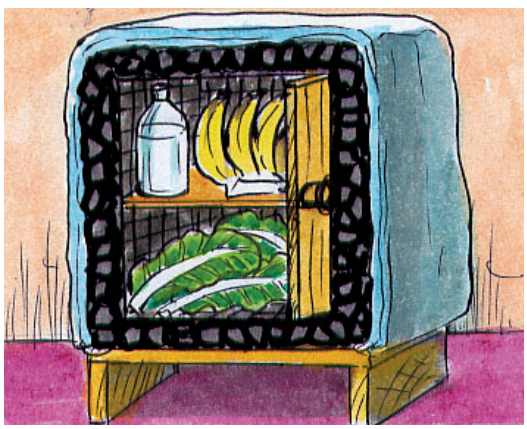


Fig. 1.16 Charcoal cooler

iii) Use of refrigerator or deep freezer

Food can also be preserved using modern coolers for example a refrigerator or a deep freezer. Low temperatures can be used to preserve fish, meat, chicken, some fruits and vegetables.

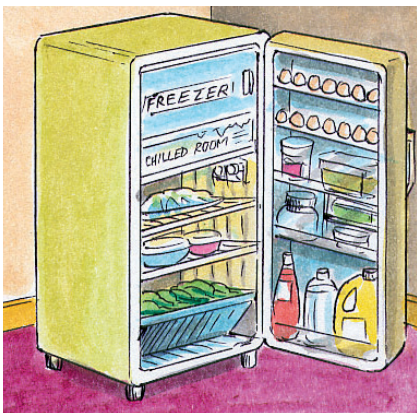


Fig. 1.17 A refrigerator

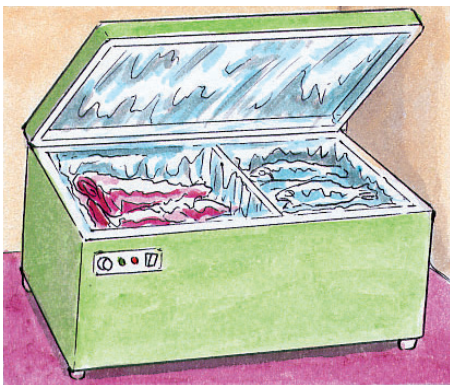


Fig. 1.18 A box freezer

Note: Use of low temperatures is an expensive method because refrigerators, deep freezers, gas, paraffin and electricity are expensive. Note that nowadays we have gas and paraffin refrigerators.

Activity 1.8 Class Activity

1. With the help of your teacher, visit large butcheries or large hotels which preserve foods on a large scale.

   (a) Observe the:

   - Equipment used for preserving foods such as refrigerators and deep freezers.
   - Cold rooms.
   - Foods that are preserved.
   - The temperatures under which the foods are kept.

   (b) Find out:

   - Where and when they obtain their various foods.
   - What they do to the food before preserving them.
   - How long the different foods are preserved.
   - The cost of preserving foods and risks involved.

Discuss the advantages and disadvantages of preserving food using low temperatures.

c) Canning

Canning means putting food that is to be preserved in a can. A can is a thin metal container usually made of aluminium. Foods that are preserved using the canning method include fruits, vegetables, fish and meat.

Note: Canning is usually done in factories. It is an expensive method.

d) Use of chemicals

Some of the chemicals used to preserve food include wood ash, sugar syrup, sulphur dioxide, vinegar and pesticides.

FUN CORNER

1. Coat a piece of meat at home using honey. Keep it in a lockable cupboard and make observation after four days. Report to the class your observation.
2. Using the internet investigate the use of low temperature in food preservation. Compare it with a charcoal cooler.

Did you know

Long time ago our forefathers were preserving food. They were using ash, honey, salting and drying methods.

- Name foods that could be preserved using the above methods.

Check your progress 1.3

1. Match the following methods of food preservation with the principle behind them. Use arrows to match.

Methods	Principle
Drying	Dehydrates germs.
Use of honey	keeps off germs and air.
Salting	Dehydrates food.

2. Give reasons why the use of low temperature for preserving food is not common in many homes.
3. What are the objectives for food preservation?

1.4: Importance of science knowledge in improving personal and food hygiene

Activity 1.9 Class debate

Motion: Knowledge of Science is key to improving personal and food hygiene

1. In two groups carry out debate on the motion above.
2. Choose members to represent proposers and opposers of the motion.
3. One member in each group will note down the points.
   - Which group carried the day.

Learning points

Science knowledge is important and plays a great role in improving personal and food hygiene.

1. It informs us on the presence of germs in our environment.
2. It makes us aware that germs cause diseases. We therefore practice personal hygiene to keep off germs. When we keep off germs, we

avoid catching diseases.

3. We became aware of how germs get into our body mostly through contaminated food and water. We should therefore ensure food hygiene practices in order to prevent diseases such as **cholera, typhoid**, **amoebic dysentery**, **food poisoning** and **human intestinal worms**.

4. It enables us to practice food hygiene measures that include proper cooking and storage of food, washing hands before eating and handling food and after visiting the toilet or latrine.

Further Activity

1. Using the Internet investigate the signs of the following diseases.
   (a) Cholera
   (b) Typhoid

2. Record the signs and symptoms of cholera and typhoid in a table like the one shown below.

Disease	Signs and symptoms
Cholera	
Typhoid	

3. Using the information gathered from the Internet draw a chart showing how diseases spread from sick people to healthy people.

4. Visit a local hospital and record how sick people are treated.

5. Report your findings to the rest of the class.

Check your Progress 1.4

1. How would you use the knowledge of science to improve personal and food hygiene?

Unit 2 Reproduction and sustainability

Words to learn

Sustainability, zygote, embryo, foetus, placenta, amnion, implantation, gestation, parturition

2.1: Mammals and their common characteristics

Activity 2.1 **Individual work**

A

B

C

D

1. Identify characteristics of mammals displayed by each animal.
2. Record your observation as shown in the table below.

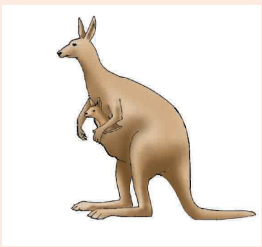
Picture of mammal	Characteristic displayed
A	
B	
C	

3. Discuss the common characteristics of mammals.
   - Are these characteristics similar to all animals?
   - Which characteristic ensures sustainability of animals?
   - How do mammals propagate?
4. Write a report of your findings.
5. Present your work to the rest of the class.

Check your progress 2.1

1. Give reasons why the animals below are considered mammals.

A



B

C

2. The two major characteristics of mammals are _____ and _____.
3. Which animal below is not classified as a mammal?
   A. Man
   B. Bat
   C. Shark
   D. Leopard
4. Is fertilisation in mammals internal or external? Give reasons for your answer.

2.2: Reproduction in mammals

In earlier grades, you learnt that living things are able to produce young ones of their own kind. The process of producing young ones is known as **reproduction.** Human beings belong to a group of animals called mammals. Reproduction in mammals involves a male and a female animal. Like other mammals, human beings give birth to live young ones.

Activity 2.2 Group work

1. Using reference books and other resources (Internet) carry out a research on reproduction in mammals.
2. Find out the following information from your research.
   (i) The parts of male and female reproductive system.
   (ii) How conception and fertilisation occurs?
   (iii) The functions of the placenta.
   (iv) The process of birth.
3. Write a report of your findings.
4. Present your findings to the rest of the class.

Learning points

The things that enable living things to produce young ones are known as sex cells. Sex cells are produced in the male and female reproductive organs. The sex cells from mature male animals are called **sperms.** The sex cells from mature female animals are called **ova** (or **ovum** - singular). The other name for ovum is egg. The sperm and the ovum combine in a process known as fertilisation to form a **zygote**. The zygote later develops into a young animal or foetus.

Reproduction is the process of giving rise to new offspring. The process is important because it ensures continuity of organisms.

Reproduction in human beings involves the male and female sex cells.

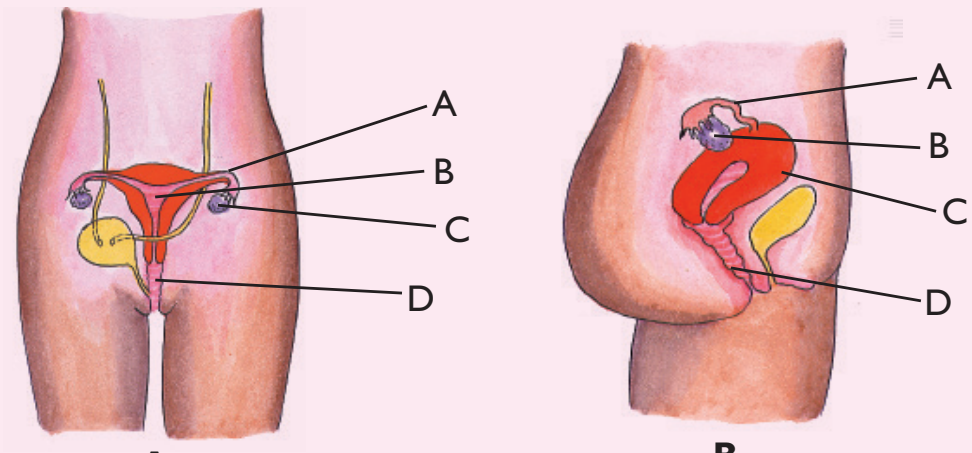
Parts of the human reproductive system and their functions

The female reproductive system is different from the male reproductive system in both appearance and function.

Parts of the female reproductive system

Activity 2.3 Group work

1. Identify parts of the female reproductive system labelled with letters.



2. Discuss in your group the function of each part.
3. Draw the structure of the female reproductive and label it correctly.

Learning points

The female reproductive system is made up of:

- ovary
- oviduct
- uterus
- vagina

Functions of the female reproductive system

i) Ovaries

A human female has two ovaries which are located below the abdomen. The ovaries produce the female sex cells or ova. Each ovary produces one ovum every alternate month. This means that if the left ovary produces an ovum this month, it does not produce one the following month. Instead, the right ovary does it.

ii) Oviduct

Oviduct is a tube with a funnel-like opening connecting it to the ovary. It is also referred to as **fallopian tube**. When an ovum is released from

one of the ovaries, it passes through the oviduct before reaching the uterus. Fertilisation of the ovum normally takes place in the oviduct. However, the fertilised egg moves to the uterus from where it develops into an embryo.

iii) Uterus

The uterus is the bag or space surrounded by mascular walls in which the zygote (fertilised egg) develops into a foetus or baby. It narrows towards the oviduct and widens towards the birth canal (vagina). It is also called the **womb**.

iv) Vagina

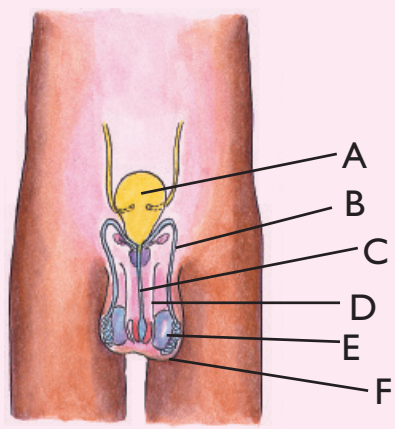
This is a passage which opens to the outside of the female reproductive system.

- It receives sperms from the male during sexual intercourse.
- It is the opening through which the baby passes during birth. For this reason it is also known as **birth canal**.

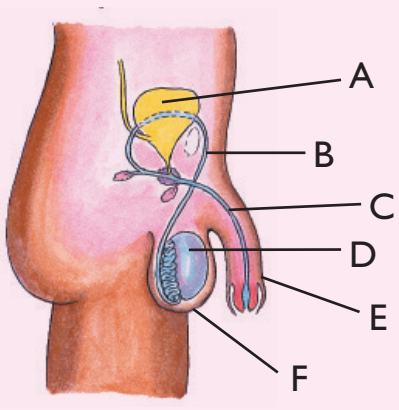
Parts of the male reproductive system

Activity 2.4 **Group work**

1. Identify the parts of the male reproductive system labelled with letters.



A



B

2. Discuss in your group the function of each part.
3. Draw the structure of the male reproductive system and label it correctly.

Learning points

The main parts of the male reproductive system include:

- testis
- sperm duct
- urethra
- penis

The functions of the male reproductive system

i) Testes (**singular**: testis)

These are two oval-shaped organs which hang outside the body. They are enclosed in a small sac called **scrotum.** The male sex cells (sperms) are formed in the testes. The function of the testes is therefore to produce sperms.

ii) Sperm duct

This is a tube connecting each testis to the urethra. It is the tube through which sperms pass during ejeculation. Ejaculation is the release of the sperms from testis.

iii) Urethra

Urethra is the tube through the penis. It acts as a pathway for sperms. Also, urine from the urinary bladder passes to the outside through the urethra.

iv) Penis

Penis is located on the outside of the body. It is used to put sperms into the vagina during sexual intercourse. It is made up of erectile muscles.

Activity 2.5 Pair work

1. Using reference materials and the Internet find out about the male and female sex cells.
   - What are their functions?
   - How are they adapted to their functions?
   - How do they bring about fertilisation?
2. Draw and label the male and female sex cell in your notebooks.
3. Compare your findings with other groups.

Learning points

Males, after attaining the age of puberty, become sexually mature due to hormonal changes in their bodies. These hormonal changes lead to the production of male sex cells called sperms or spermatozoa.

A sperm has three main parts:

- The head for penetrating the ovum.
- The nucleus which fuses with egg nucleus during fertilisation.
- The tail that propels the sperm.

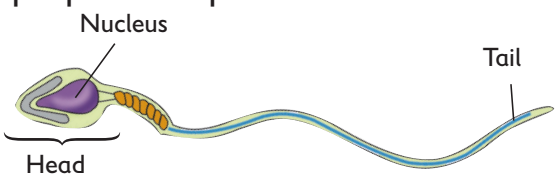


Fig 2.1 Structure of sperm

Sperms are carried in a liquid called **semen**. This liquid is produced in the male sex glands as earlier discussed in lower Grade. Its function is to:

- Transport sperms.
- Keep the sperms moist.
- Provide nourishment to the sperms.

When girls reach puberty, their reproductive systems mature and their ovaries start producing eggs or ova (singular - ovum). The ovary releases an egg to the oviduct in a process called **ovulation**. Ovulation occurs after every 28 days (about one month). The ovaries ovulate alternately

that is each ovary takes about 56 days to produce an ovum.

The ovum (plural - ova) has two main parts:

- The yolk which contains stored food for growth of the zygote.
- The nucleus which fuses with the sperm nucleus during fertilisation to form the zygote.

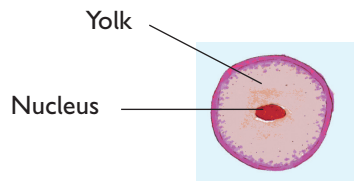


Fig 2.2 Egg or Ovum

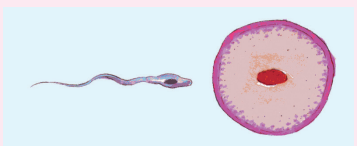
Note: When a mature male and female engage in sexual intercourse immediately after ovulation, fertilisation occurs leading to pregnancy.

You should AVOID sexual intercourse! It may lead to unwanted pregnancy and/or HIV and AIDS infection.

Fertilisation

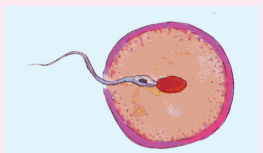
Activity 2.6 **Individual work**

A



B

C



1. Describe what is taking place in:
   A. _____
   B. _____
   C. _____
2. How is the process relevant in reproduction?
3. Share your findings with the rest of the class.

Learning points

Fertilisation refers to the fusion (union) of the nucleus of the male and female sex cells to form a zygote. During sexual intercourse (also known as copulation), sperms are introduced into the female birth canal through the penis. This process is known as **ejaculation**. Once deposited, the sperms swim through the uterus (womb) using the tail to the fallopian tube (also known as oviduct) where fertilisation takes place.

In the fallopian tube, only one sperm penetrates the ovum and fertilises it.

When the sperm meets an ovum, the head of the sperm dissolves the wall of the ovum. The nucleus of the sperm and that of the ovum then meet and fuse (unite) forming one cell. The cell formed is called a zygote and fertilisation is said to have taken place.

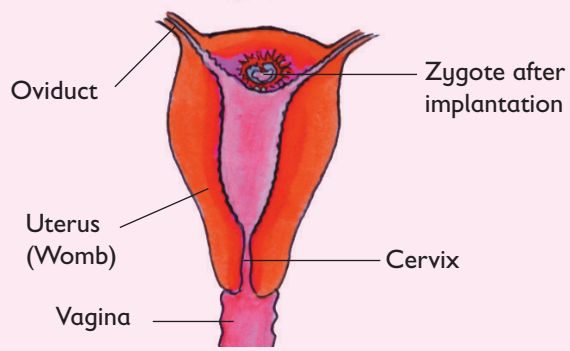
After fertilisation, the zygote starts to develop into a new individual in the uterus (or womb) inside the body of the female.

The type of fertilisation that takes place inside the female body is known as internal fertilisation. External fertilisation occurs outside the body of a female e.g. in fish and frogs.

Development of the foetus

Activity 2.7 **Individual work**

1. In groups discuss what happens after fertilisation?
2. Now look at the diagram below.



- What changes do you notice in the diagram as compared to the diagrams in Activity 2.3?
- What has taken place? What do we call this process?

3. Draw diagrams in your notebook of the next two stages that will take place after the stage shown above.
4. How do you suppose the developing child gets its food and dispose waste products?
5. Which structure is responsible for this? What are its functions?
6. Share your findings with other class members.

Learning points

The zygote undergoes rapid development as it moves through the oviduct into the uterus (womb). At this point, the woman is said to be pregnant. At first, the zygote floats freely, absorbing nutrients from the uterine wall. The zygote starts subdividing into many cells as it develops. Four to seven days after fertilisation, it attaches itself onto the walls of uteus. This is called **implantation.**

Note: Sometimes the zygote fails to move down to the uterus for implantation. Instead, it implants in the fallopian tube. This results in what is known as **ectopic pregnancy**.

Once implantation has occured, the zygote develops into an embryo. The embryo begins to form finger-like structures that attach it to the walls of uterus. The finger-like projections become the placenta. The umbilical cord then develops. The umbilical cord connects the developing embryo to the placenta. The embryo obtains its food nutrients from the mother through the placenta and the umbilical cord.

A placenta contains several capillaries which join together to form two arteries and a vein. The arteries and the vein are connected to the embryo through the umbilical cord. The umbilical cord joins the placenta and the embryo on the abdomen as shown below.

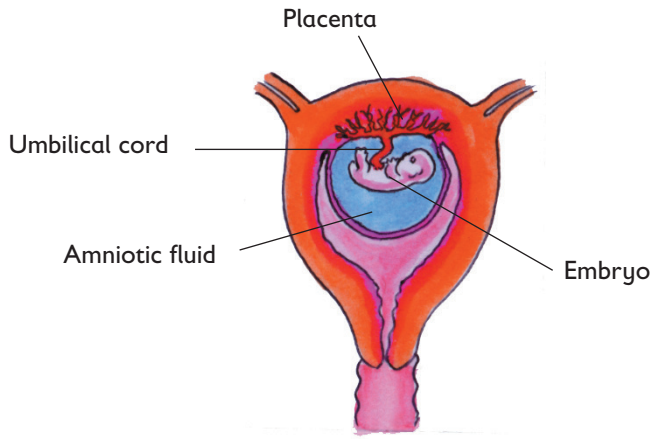


Fig 2.3 Foetus developing in the uterus.

Functions of the placenta and umbilical cord

- Food nutrients and oxygen get into the blood in the blood capillaries in the placenta and reach the embryo through the vein in the umbilical cord.
- Carbon dioxide and other waste products get out of the embryo to the placenta through the arteries in the umbilical cord and enter the mother's blood circulation system. The exchange of nutrients, oxygen and waste products between the foetus and the mother takes place in the placenta.
- **Antibodies** also pass from the mother to the foetus through the placenta. These would later help to protect the new-born baby from diseases until it makes its own antibodies.
- The placenta acts as a barrier stopping infections and harmful substances from reaching the foetus.
- The placenta also produces hormones that stop ovulation and menstruation.

The mother's blood vessels are not directly connected to those of the foetus. Therefore, the foetus blood does not in any way mix with that of the mother. This is the reason a foetus does not get infected with HIV and AIDS during pregnancy incase the mother is infected.

As the embryo develops, it becomes surrounded by a thin membrane called amnion. Amnion is also known as amnionic bag. The membrane encloses a fluid-filled cavity. This fluid is known as **amniotic fluid**.

Functions of the amniotic fluid

- The amniotic fluid gives the foetus a watery environment. This prevents the foetus from drying up.
- It acts as a shock absorber, protecting the embryo against injury.
- It acts as a lubricant during birth.
- It enables the embryo to move about freely.

After about a month, most of the organs of the embryo are developed. At this stage, it is referred to as foetus. The foetus continues to grow and develop until all its organs are fully formed after which **parturition** occurs. Parturition is also known as giving birth.

The time from fertilisation to birth is known as pregnancy or gestation period. During pregnancy the following things happen:

- The menstrual flow stop.
- The woman may experience morning sickness in the first month.
- Abdomen enlarges to accommodate the growing foetus.

In human beings, gestation period lasts 9 months (or about 39 weeks). At the end of the nine months, the baby is ready to be born. A few weeks before birth, the foetus turns so that its head faces downwards as shown below.

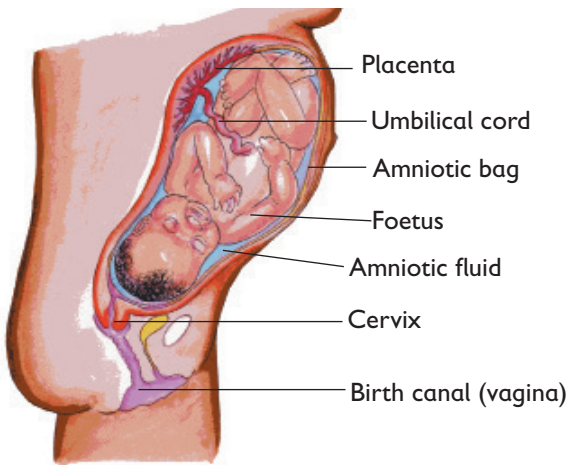


Fig 2.4 Foetus ready for birth

Note: Sometimes the baby's head does not face down and the mother therefore cannot give birth normally leading to birth complications.

The process of birth

Activity 2.8 **Class work**

1. Your teacher will invite a nurse or a midwife to talk to you about the process of childbirth.
2. Prepare questions to ask the resource person.
3. Write short notes during the talk.
4. Hand in your findings to the teacher for assessment.

Learning points

The process of birth is also known as parturition or delivery. When the baby is fully developed and ready to be born, the birth canal (vagina) starts to widen in preparation for birth. Also, the uterus walls have thick muscles which contract powerfully causing the mother to experience some pain. The pain experienced by the mother at this stage is usually referred to as labour pains.

When the contractions become faster and stronger, the cervix dilates (widens). The amniotic bag bursts allowing the amniotic fluid to flow out through the birth canal. (This is the fluid that flows out just before birth). The amniotic fluid lubricates the birth canal making delivery of the baby smooth and easier.

The contraction of the uterus muscles assisted by the abdominal muscles pushes the baby out through the birth canal. After the baby is born, it usually cries due to change of environment.

Note: Parturition may be induced in some circumstances depending on the mother's health.

The baby is still connected to the mother by the umbilical cord at birth. The umbilical cord is then tied and cut as shown in the following diagram

in order to separate it from its mother and prevent excessive bleeding.

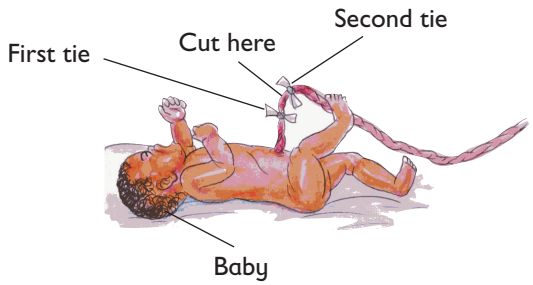


Fig 2.5 Position to cut the umbilical cord

The afterbirth

The uterus muscles continue to contract after the baby is born. This helps to push out the placenta and part of the umbilical cord and the collapsed amnion (amniotic bag). All these are called afterbirth.

Care has to be taken during the birth process to avoid infection to the baby, mother and the birth attendants. The baby should be born in a clean environment. As such,

- Only sterilised instruments should be used.
- The birth attendants should use sterilised protective gloves.

If the mother is not infected with HIV, she is allowed to breastfeed the baby. If the mother is infected with HIV, she is advised not to breastfeed the baby as this may lead to the baby getting infected. In such a case the doctor advises the mother on how to take care of the baby and herself.

Remember HIV and AIDS can be transmitted through contact with body fluids. Birth attendants must wear protective gloves when attending to pregnant women.

During the process of birth:

The **baby** can get infected with HIV when:

- The body fluids from the mother, if infected, mix with the baby's body fluids.

- The body fluids of the attendants, if infected, mix with the baby's body fluids.
- The cutting tools used are shared without sterilising.

The **mother** can get infected with HIV if the body fluids of the birth attendants, if infected, mix with the fluids of the mother.

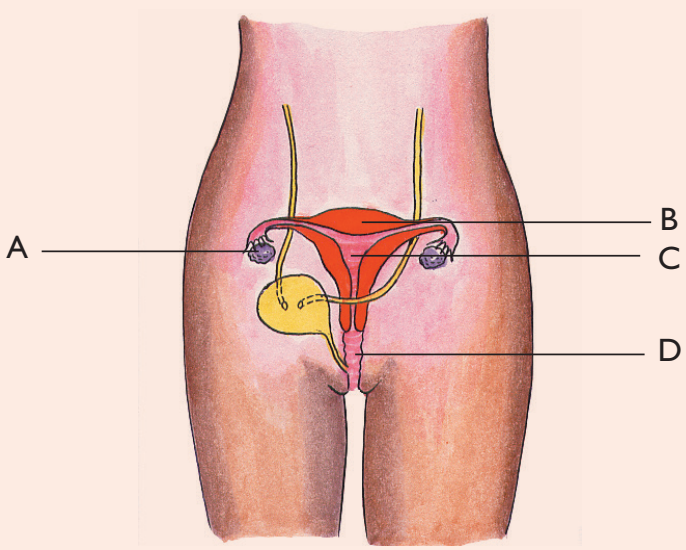
The **birth attendants** can get infected with HIV if the fluids of the mother, if infected, mix with attendant's body fluid.

Premature birth or miscarriage

The normal gestation period in human beings is nine months. Sometimes, a baby may be born before the expiry of the nine months when it is not ready for birth. In such a case, the baby is said to be born prematurely or a miscarriage is said to have occured. Premature birth and miscarriages are common in mothers who abuse drugs especially people who smoke. It can also occur due to diseases or poor health of the mother. Also, accidents during pregnancy can cause premature birth or miscarriage.

Check your progress 2.2

1. Study the female reproductive system below.



Answer the questions below.

(a) Name the process that takes place at the part Labelled A.

(b) Describe what happens at the part labelled B.

(c) Name part C and explain briefly what happens in it.

(d) Describe the process that takes place in part D.

Present your work as follows

Part	What happens
A	
B	
C	
D	

2. How does the part labelled A work. Explain briefly their functions.

2.3: Ovulation

Activity 2.9 **Individual work**

1. Investigate using the internet and reference books the signs of ovulation in:
   (i) Female human beings.
   (ii) Mammals.
2. Compare your findings with rest of the class.

Learning points

Ovulation refers to the release of an egg during menstruation in females. Part of the ovary discharges an egg. The egg is also known as an ovum. It is only released upon reaching maturity. After release, the egg travels down the fallopian tube, where it may be met by a sperm and become fertilised.

There are several indications that a woman is ovulating. They include:

- Light bleeding known as **spotting**.
- Slight cramping or pain on one side of the pelvis.
- Breast tenderness.
- Abdominal bloating.
- Increased sex drive.
- Heightened sense of smell, taste or vision.

Ovulation in female animals include:

- Mounting other animals.
- Mucus discharge.
- Swelling and reddening of the vulva.
- Bellowing, restlessness and trailing other animals.

2.4: Reproduction in birds

Activity 2.10 **Class activity**

1. Visit a farm near your school or home where chickens are reared.
2. Monitor a brooding hen for about a month till it hatches.
3. Record your observations.
4. Your teacher will provide you with charts, pictures or a video showing reproduction in birds.
5. Watch the charts or video provided.
   - How does reproduction occur in birds?
6. Write a report and share it with the rest of the class.

Learning points

Birds reproduce by means of internal fertilisation.

Birds have courtship behaviour which serves to attract opposite sex of the same species.

The male bird mounts the female and copulation occurs. Sperms from the male bird are ejaculated directly inside the female's body. Sperms swim up the oviduct and meet the newly formed eggs and fertilisation occurs.

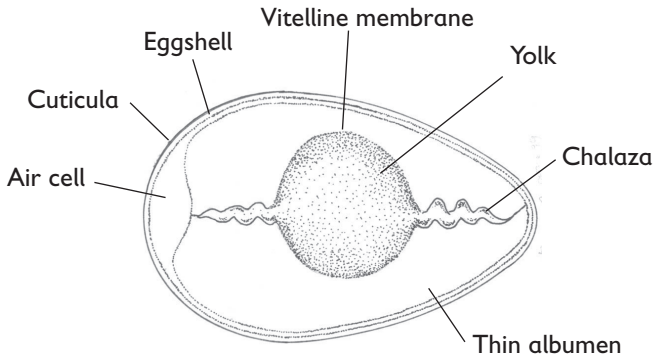


Fig 2.6 Parts of an egg

The fertilised eggs have albumen and a shell enclosed over them. The fertilised egg moves along the oviduct where albumen, shell and other substances are added. The shell hardens and the egg is then laid.

The bird then keeps the eggs warm by sitting on them. This process is called **incubation**. During incubation the germ cell carries out cell division to produce new cells. These cells differentiate to form an embryo.

The embryo is surrounded by a fluid filled sac called amnion. Figure below shows a chick embryo at day 10 of development.

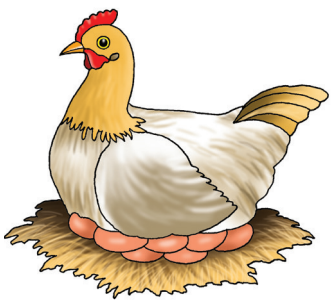


Fig 2.7 Incubation

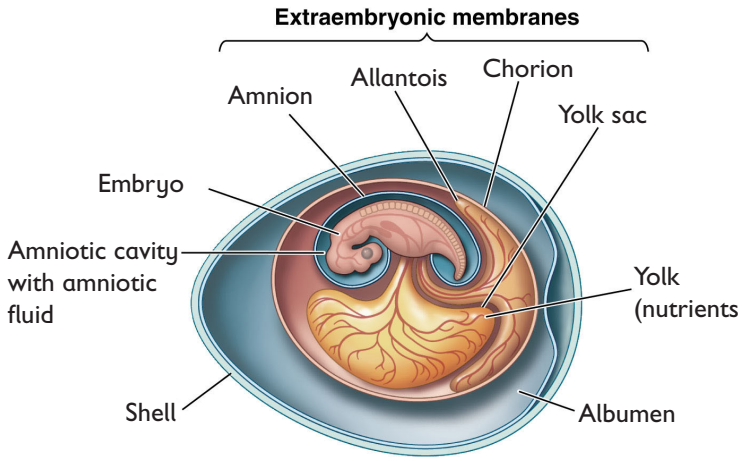


Fig 2.8 Embryo development

In two or three weeks the eggs hatch. A chick breaks the egg shell and emerges from it. The young chicks are called nestlings and are fed and kept warm by their mother for some time.

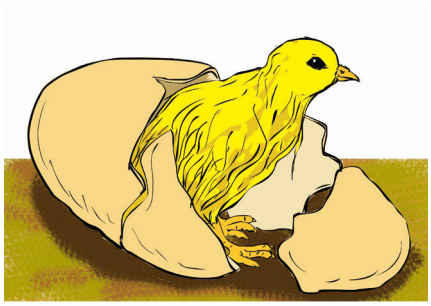


Fig 2.9 Hatching

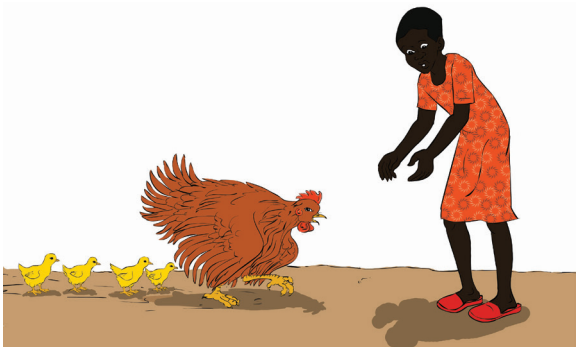


Fig 2.10 Mother hen protecting her chicks

FUN CORNER

Draw the reproductive cycle of a hen. Mount it on a Manilla paper and hang it in your class notice board.

Did you know

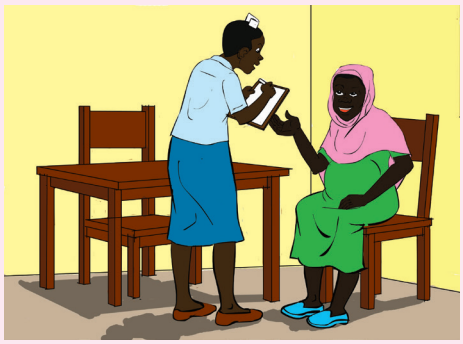
Both the mother and the baby do not feel pain when umbilical cord is being cut since it has no sensory nerves.

Check your progress 2.3

1. In mammals both the male and the female are involved in reproduction. How true is this statement?
2. Arrange the following stages of birth in order.
   (i) Baby comes out.
   (ii) Cervix dilate.
   (iii) Uterine walls contract.
   (iv) Umbilical cord is tied and cut.
   (v) After birth comes out.
3. Give the reason why birds sit on their eggs before they hatch.

2.5: Characteristics of good childcare and support

Activity 2.11 **Pair work**



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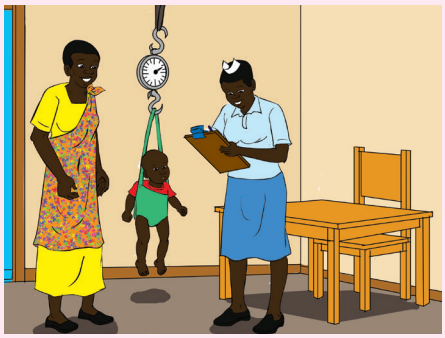


B

1. Study each picture at a time in pairs.
2. Fill in the tables below with your findings.

	Reasons for visiting the dispensary
Expectant mother	
Mother (s) with the babies	

3. Discuss what would happen if the expectant mother or nursing mother does not attend clinics.
4. Ask your parents or guardians to provide you with your immunisation card.
5. Fill the following table.

Age	Diseases	Vaccine

6. Present your findings to the class and in your presentation stress the importance of immunisation.

Learning points

Prenatal care is the care given to an expectant mother before giving birth.

- The expectant mother is advised on the diet, she is advised to take a balanced diet.
- It is aimed at protecting both the mother and the unborn baby.
- The position of the baby is checked to ensure it is correct to avoid still birth.

The post-natal is care given to the mother and baby after giving birth.

- The health of the mother and the baby is also monitored
- The baby is immunized against diseases such as:
    (a) Tuberculosis
    (b) Polio
    (c) Diphtheria
    (d) Pertussis
    (e) Tetanus
    (f) Measles
    (g) Yellow fever

FUN CORNER

Dramatise in pairs an expectant mother and a nurse. As a nurse what advise would you give to an expected mother?

Did you know

An expectant mother should be immunised against tetanus?

Why do you think this is necessary?

Check your progress 2. 4

1. How important is:
   (i) Prenatal care?
   (ii) Post-natal care?
2. What would happen if a mother does not attend clinics?

2.6: Conditions for a sustainable environment

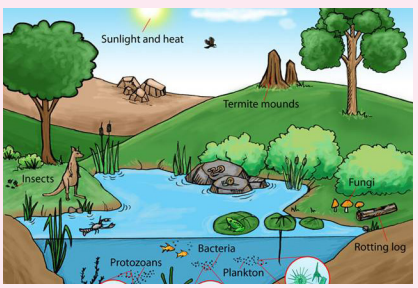
Activity 2.12

1. Study the pictures below.

A 

B 

C 

D 

2. Identify the environmental components shown in the pictures.
3. What should you do to protect each component?
4. Which picture shows diversity in the environment?
5. Suggest ways of sustaining the environment.

6. Present your findings as shown below.

Picture	Importance	We should do	We should not do
A			
B			
C			
D			

Sustainability

Learning points

- Sustainability is the capacity to endure.
- Environmental sustainability is the responsible interaction with the environment to avoid depletion or degradation of natural resources and allow for long-term environmental quality.
- The practice of environmental sustainability helps to ensure that the needs of today's population are met without endangering the ability of future generations to meet their needs.
- When we look at the natural environment, we see that it has the ability to recover by itself. For example, when a tree falls, it decomposes, adding nutrients to the soil. These nutrients help sustain suitable conditions so future plants can grow.
- When nature is left alone, it has the ability to care for itself. However, when man enters the picture and uses many of the natural resources provided by the environment, things change. Our actions can deplete natural resources, and without the application of environmental sustainability methods, we can destroy nature.
- One way environmental sustainability is being applied is through **sustainable agriculture**. This is defined as the use of farming techniques that protect the environment.

- Sustainable forest is another method for environmental sustainability. This is the practice of regulating forest resources to meet the needs of the society and industry while preserving the health of the forest. Forests are important to local and national economies. Wood can be used as a source of fuel, timber and paper manufacture.
- It is upon us to maintain the well-being of the natural resources.
- The natural recourses include: wetlands, forests, invisible chemical cycles that redistribute water, oxygen, nitrogen and carbon through the living and non-living things.
- Ways of living more sustainably involves:
    - Reorganizing living conditions
    - Using science to develop new technologies that are efficient.
    - Conserving natural resources.

FUN CORNER

Go to the school garden. Practice mulching and drip irrigation.

Check your progress 2.4

1. Follow the instructions below to answer the Environment puzzle below.

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

Circle the words

Across

1. A living component of environment that provide food.
2. A component of environment.
3. A staple food.
4. What we get from plants.
5. A source of water.

Down

1. Animals like bees helps plants in _____.
2. A component of the environment_____
3. We should conserve our_____.

Unit 3 Interdependence between Plants and Animals

Words to learn

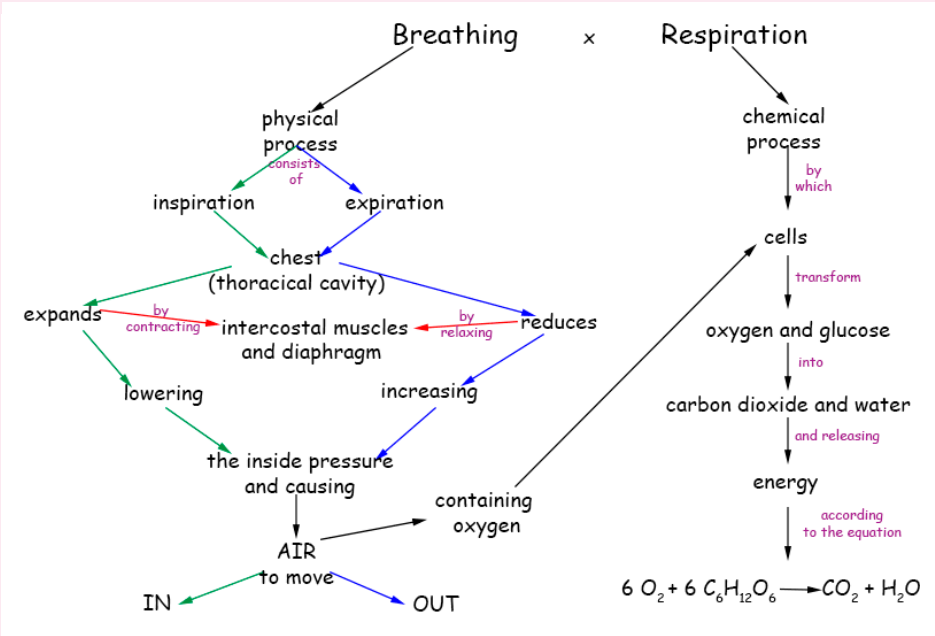
Respiration, photosynthesis, interdependence, carbon cycle, inhale, exhale, oxidation, excretion

3.1: The process of respiration

The food we eat gives us energy. Have you ever asked yourself how the body gets this energy?

Activity 3.1 **Class activity**

1. Jog on the spot for 1 minute. Discuss the changes to your breathing rate and why this happens.
2. Using textbooks and the Internet discuss the following questions in class.
   - How does breathing rate relate to fitness and health?
   - What is the connection between breathing and respiration?
   - What is the difference between respiration and breathing in?
   - What are the raw materials and products of respiration?
3. Write a report of your findings.
4. Study the diagram below.



- Where does the two processes occur in the body?
- What is the importance of the processes?

5. Choose one member to do a class presentation of your findings.

Activity 3.2 In pairs

1. Role play the following conversation between Mariek and Achan in pairs.

   Mariek: Hello, Achan.

   Achan: Hello Mariek.

   Mariek: Where does the food we eat go?

   Achan: The food we eat goes into the stomach. It only stays there for about 3 – 4 hours. The food is digested partly in the stomach as it moves to the small intestines. Actually its digestion begins in the mouth. Once it is fully digested it is absorbed into the blood stream.

   Mariek: Does it stay in the blood?

Achan: Once it gets into the blood, the blood carries the digested food to all body cells. Apart of the air you breath called **oxygen** gets into the blood, while the other gases are exhaled.

Mariek: Where does that oxygen go?

Achan: The blood carries oxygen to all body cells. The food is carried by the part of blood called plasma and oxygen is carried by the part of blood called red blood cells.

Mariek: Achan, what happens once the food and oxygen are in the body cells?

Achan: Oxygen burns the food chemically. This kind of burning is called **oxidation**.

Mariek: Does it affect the cells.

Achan: No. When the food is burnt energy is released as the main product.

Mariek: Are there other things that are released?

Achan: Yes there are by products such as carbon dioxide and water.

Mariek: Does it mean our body produces carbon dioxide?

Achan: Yes.

Mariek: That sounds interesting!

Achan: Sure! This process of burning food chemically to release energy, water and carbon dioxide is called **respiration**.

Mariek: Does that carbon dioxide help us?

Achan: No! Carbon dioxide and some water are excreted through the lungs, some water through the skin as sweat and through the kidney as urine. The carbon dioxide is used by the green plants to make food through a process known as photosynthesis.

Mariek: Thank you Achan. I have known where the body energy comes from.

Achan: Welcome Mariek. It has been good talking to you.

2. What have you learnt from the above conversation?
3. Trace using a diagram the path of food from the mouth to expulsion from the body.
4. Discuss with your friend, then compare your findings with the rest of the class.

Learning points

- Respiration is a chemical reaction that takes place in cells and allows them to release energy. The chemical reaction can be summed up with the following equation:

  Glucose + oxygen ⟶ water + carbon dioxide (+ energy)

- Reactants are the substances that react together in a chemical reaction. In respiration the reactants are glucose and oxygen.
- Glucose is a sugar and is removed from our digestive system into the blood in the small intestines.
- Oxygen is a gas that is needed for respiration. We take it from the air when we breathe in. It moves from our lungs, to our blood to be carried wherever it is needed in the body.
- Products are the substances that are made during a chemical reaction. In respiration the products are water and carbon dioxide.
- Water is a product of respiration that goes into the surrounding tissues.
- Carbon dioxide is a gas that is made during respiration. In the lungs carbon dioxide moves from the blood to the lungs. When we breathe out we get rid of the carbon dioxide from our body into the air.

- Respiration occurs in all cells of living things.
- The carbon dioxide released during respiration is used by green plants to make food.
- The air we breathe in (inhale) has more oxygen than the air we breathe out(exhale) since some oxygen is used during respiration.
- The air we breathe out has more carbon dioxide since some carbon dioxide is produced by the body during respiration.

FUN CORNER

Draw a cell of a living thing with oxygen burning food.

Did you know

Much carbon dioxide emmitted by greenhouses are absorbed by forest and seas.

Check your progress 3.1

1. Concentration of oxygen is _____ in the lungs _____ in the tissues.
2. The air we breathe in is rich in _____ while the air we breathe out is rich in _____.
3. Fill the table below.

Process	Reactants	Products
Respiration	_____, food	Water, _____, _____
Photosynthesis	Water, _____, _____	Food,_____

4. During exercise, the heart rate increases. Why does this happen?

3.2: The process of photosynthesis

Activity 3.3 **Class discussion**

1. How do plants make their own food?
2. What raw materials do plants need to make their food?
3. Compare how plants and animals obtain their food.
4. Write a report and present your findings in class.

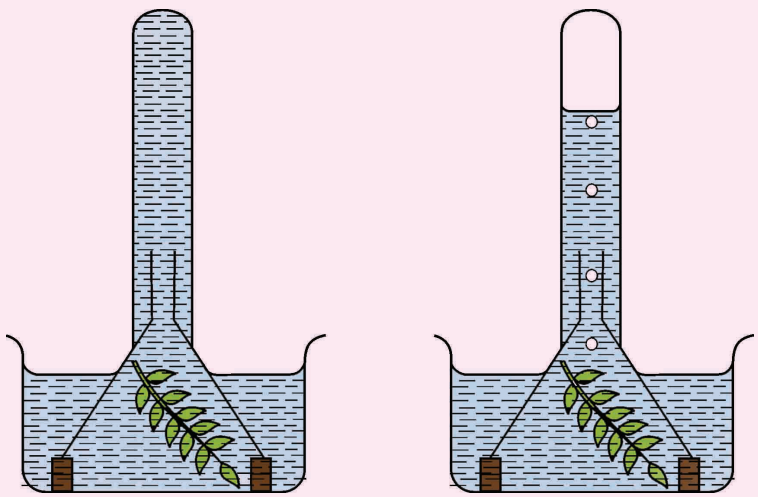
Activity 3.4 **Group activity**

What you need

Two large beakers, two funnels (glass), two test tubes, water with sodium hydrogen carbonate dissolved in it, splints, match box, water weed e.g. Elodea or Spirogra

What to do

1. Your teacher will assist you to prepare two set ups as shown below.



A B

2. Place one set-up in bright sunshine and the other in a dark cupboard for 2-3 hours.
3. Observe the set – up in the dark cupboard. What did you notice?
4. Test any gas produced using a glowing splint.

Study questions

1. What do you think is the role of sodium hydrogen carbonate dissolved in the water?
2. What happens to the glowing splint when it is exposed to the gas in the test tube?
3. Which conclusion can be made from the observations?
4. What was the role of the set – up that was placed in the dark cupboard?

Learning points

- Photosynthesis is a process by which plants synthesise glucose from water and carbon dioxide using light energy. Oxygen is usually released as a by-product. Through this process plants are able to make their own food.
- All life on earth depends on photosynthesis directly or indirectly.
- Photosynthesis occurs through a series of chemical reactions.
- The process of photosynthesis can be summarised by the following word equation.

Water + carbon dioxide ⟶ glucose + oxygen

- Note that photosynthesis only provides plants with carbohydrates, which are important sources of energy to living organisms. However, plants needs proteins and mineral salts as well in order to grow. These are obtained in the soil through the roots.

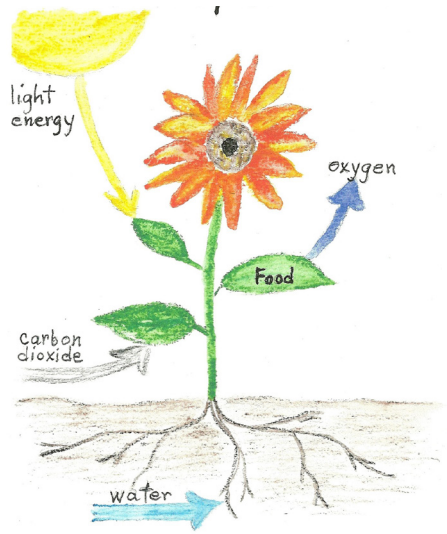


Fig 3.1 Photosynthesis in plants

- Photosynthesis occurs mainly in leaves because they contain **chlorophyll:** the green colouring matter. It creates a good medium for photosynthesis to take place.
- Water combines with carbon dioxide to form sugar (starch) which forms the basis of all other carbon products or compounds. Light energy enables the process to take place.
- During the process of making starch, oxygen and water are released as by-product.
- Oxygen and water are released to the atmosphere through the tiny holes in the leaves called **stomata**.
- The word equation of photosynthesis is shown below;

Water + carbon dioxide ⟶ starch (sugars) + water + oxygen

Did you know

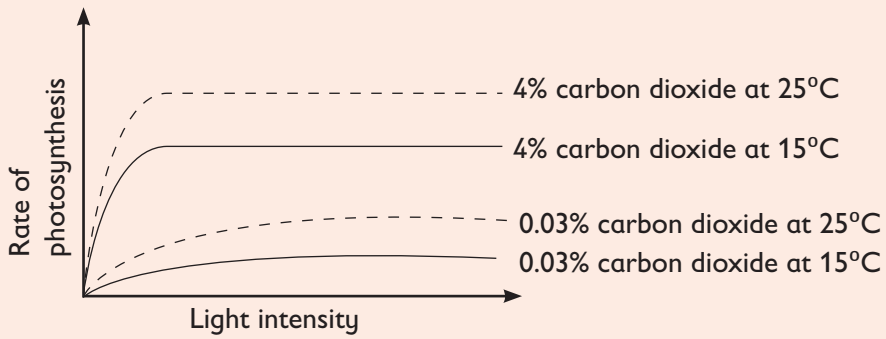
Green plants ensure balance in the atmosphere. They take in carbon dioxide and produce oxygen.

Further Activity — Individual work

1. Investigate using textbook and the internet:
   (a) The importance of light during photosynthesis.
   (b) How non-green plants make their food?
2. What do you think would happen in the atmosphere if there were no green plants?
3. Present your findings in class.

Check your progress 3.2

1. Which of the following is not a raw material needed by the plant to make their food?
   A. Starch
   B. Carbon dioxide
   C. Water
   D. Sunlight
2. Tomatoes in a greenhouse grow faster if the carbon dioxide concentration is increased. How do you explain this?
3. Explain how the products of photosynthesis are used.
4. The graph below shows how the rate of photosynthesis is affected by different conditions.

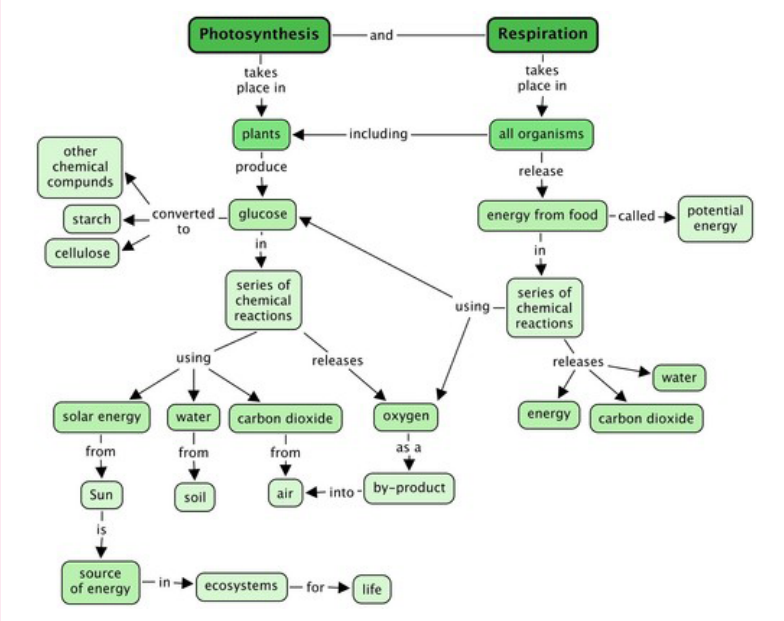


   (a) What patterns can you find from this graph?
   (b) How is this information useful to a farmer?

3.3: Relationship between photosynthesis and respiration

Activity 3.5 **Group work**

1. Study the diagram below.



2. Identify the relationship between photosynthesis and respiration.
3. Discuss your findings with your group members
4. Choose one group member to present your findings in class

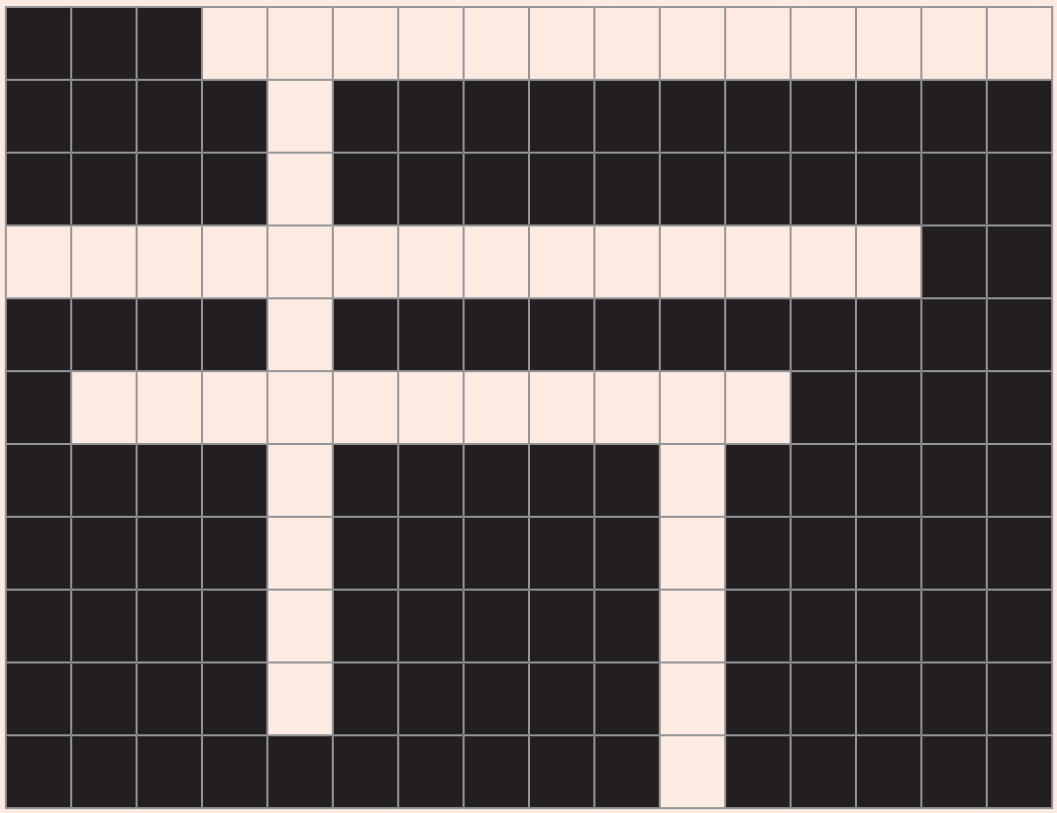
Learning points

- Respiration and photosynthesis are related.The two processes depend on each other for gases as raw material.
- During respiration oxygen is used up.This oxygen comes partly from photosynthesis process and partly from the atmosphere.
- During photosynthesis carbon dioxide is used up.This carbon dioxide comes from respiration process and partly from the atmosphere.
- Respiration and photosynthesis processes supplement each other in balancing the atmosphere.

- Respiration removes excess oxygen from the atmosphere while photosynthesis removes excess carbon dioxide from the atmosphere.

Check your progress 3.3

Fill the crossword puzzle.



Across

1. Photosynthesis gas.
3. Plants food.
4. Breaking food in the cells

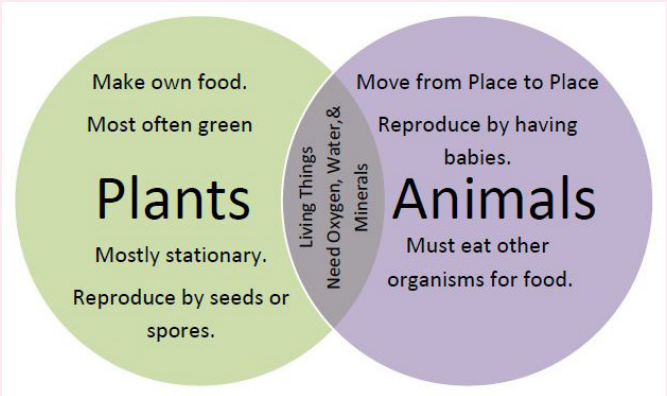
Down

2. The air of a place.
5. Photosynthesis gas

3.4: The difference between plants and animals

Activity 3.6 **Pair work**

1. Study the diagram below and answer the question below.



   - What are the characteristics of plants and animals?
   - What are the differences between plants and animals?
   - What are the similarities between plants and animals?
2. Record your findings in a table.
3. Share your findings with the rest of the class.

Learning points

- Green plants make their own food through the process of photosynthesis in their leaves.
- The manufactured food is stored in various parts in different plants, for example:
   - Sweet potatoes - roots
   - Sugar cane - stems
   - Onion- leaves.
- Animals do not make their own food. They look for food in their environment to eat.
- Different animals feed on different types of food depending on their adaptation

- Some animals eat vegetation. They are called **herbivores**.
- Some animals feed on meat only. They are called **carnivores**.
- Other animals feed on both plants and meat. They are called **omnivorous**.

Note: Plants make their own food while animals do not make food.

- Animals move about. They move about for various reasons such as looking for food, moving away from predators, looking for mates and moving away from unfavourable conditions like bad weather and fire.
- Plants do not move about from place to place naturally they grow on one point. The conditions for their survival are found within their habitat.

Activity 3.7 Class debate

Motion: Plants are more important than animals.

1. In two groups carry out debate on the motion above.
2. Choose members to represent proposers and opposers of the motion.
3. One member in each group will note down the points.
   - Which group carried the day?

Further Activity Carbon cycle

1. Using the internet research on the processes involved in the carbon cycle.
2. Present your findings to the teacher for assessment.

Did you know

Photosynthesis occurs only in green plants. Do not destroy plants. They balance the atmosphere.

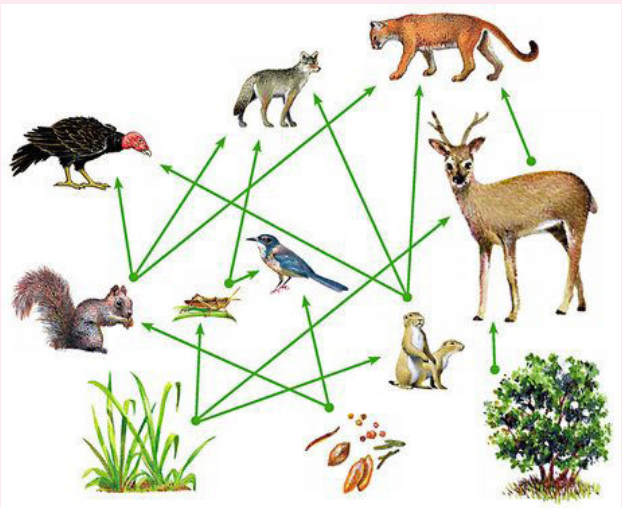
Check your progress 3.4

1. Animals move about while plants remain stationary. Explain this statement.
2. Which external features do plants and animals have in common?

3.5: Interdependence between plants and animals

Activity 3.8 **Group work**

1. In groups of four study the food web below and answer the questions below.



- How do plants and animals dependent on each other?
- How can the relationships between plants and animas be maintained without conflicts?
- How do we affect the relationships between plants and animals?
- Give examples of relationships between plants and animals.

2. Write a report and present your work to the teacher for assessment.

Learning points

Plants and animals depend on each other for survival. The dependency of organisms upon each other is called **interdependence**.

a) Plants dependence on animals

1. Plants depend on animals for carbon dioxide. When animals breathe out carbon dioxide during respiration, plants take it in to use during photosynthesis.
2. Plants depend on animals for pollination. Animals such as bees, butterflies and birds carry pollen grains from one flower to another while searching for nectar.

Fig 3.2 Pollination

Fig 3.4 Venus fly trap plant

3. Plants depend on animals for nutrients, for example, **insectivorous plants** such as Venus fly trap, Pitcher plant and sundew plant, trap small animals such as insects and digest them to get nutrients.

   Manure from animals such as farm yard manure or any animal dropping provides nutrients to plants.

b) Animals dependence on plants

Animals similarly depend on plants for various things.

1. Animals receive **oxygen** that is released by plants during photosynthesis. They use the oxygen during respiration.

2. Animals depend on plants for food either directly, for example, herbivores eat plants while carnivores depend on plants indirectly since they feed on animals that eat plants, for example, a zebra feeds on grass while a lion feeds on a zebra that eats grass.

Fig 3.4 A zebra is herbivorous

Fig 3.5 A lion chasing after a zebra

3. Animals also depend on plants for medicine, for example human beings depend on plants such as Neem tree, Aloe Vera and Cinchona tree for herbal medicine.

Note: Quinine that was used to treat malaria was extracted from Cinchona tree.

Fig 3.6 Neem tree

Fig 3.7 Aloe vera is used as a medicine

4. Animals depend on plants for habitat. Animals such as birds and monkeys live on trees.

5. Animals also depend on plants for shade. When it is hot they rest under trees.

Fig 3.8 A monkey

Fig 3.9 Animals under the shade of a tree

Further Activity

Use the Internet to investigate the importance of Neem tree to human beings.

FUN CORNER

Draw a billboard with a message to the community on the importance of conservation of nature.

Did you know

You have a duty to conserve the environment!

Check your progress 3.5

1. Draw the interdependence between a cow and a tree.
2. How is the plant shown below important to human beings?

3. What do you think will happen if all plants are destroyed?
4. Why do predators need plants such as grass in their ecosystems?

Unit 4 Weather and Climate

4.1: Differences between weather and climate

Activity 4.1 **Group work**

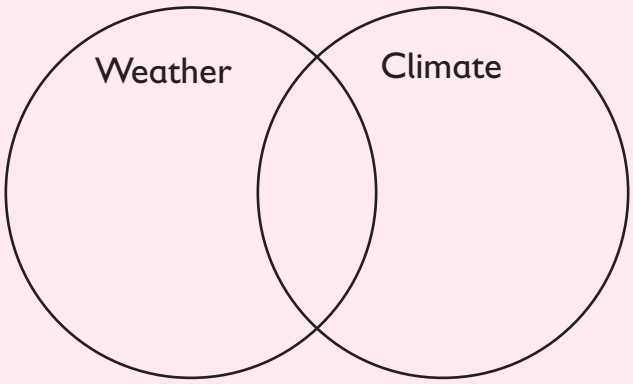
What you need

- Set of temperature data for a particular area (daily, monthly and yearly)
- Graph paper
- Coloured pencils

What to do

1. Your teacher will provide each group with a set of temperature data for a particular area.
2. Study the given data carefully. You will be required to draw a graph using the data given.
3. Create graphs form the data given.
    - What kind of graphs did you draw?
    - What kind of pattern does the graphs show?
4. Each group to arrange all their graphs end-to-end and hang them on a wall where the class can easily see the entire length of the new graph.
5. Look for daily, weekly, monthly and yearly patterns in the graphs displayed.
6. Discuss in your groups what patterns is shown by the graphs over a period of time.
    - Can you now diffentiate between weather and climate?

7. Note the differences and similarities in circle like the one shown below.



8. Choose one member do to a class presentation of your findings.

Activity 4.2 Individual activity

1. Recite the poem below in class.

Today in the morning
The sky was covered by some white clouds that looked like cotton wool.
What a beautiful sight it was.

Light from the sun sneaked through the clouds,
The sun could hardly be seen.
Sun oh sun, why are you hiding behind the clouds.

By midday the clouds have disappeared,
The sun can now be clearly seen,
The temperatures are now very high, and clouds oh clouds please come back.

All over sudden a cool breeze comes and
Our bodies are saved from the pangs of intense heat from the sun.
What could we have done without you oh wind.

By evening very heavy dark grey clouds appear from the blues
The sun can no longer be seen at all.

It is almost dark the temperatures are now very low, everybody is shivering.
Sun please come out of your hiding and warm us.
Suddenly the skies open up to a heavy downpour of rainfall.
It is now raining cats and dogs.
The farmers can now plant crops we will have no more dust,
Human beings and other animals will have enough food to eat.
Rain oh rain where have you been hiding we cannot survive without you.

Class activity

1. Discuss the various changes in weather described in the poem above.
2. What are their effects of weather changes to people and animals?

Learning points

- Weather is the condition of the atmosphere at any given time or short period of time. Weather conditions can change suddenly. It may be warm and sunny; tomorrow may be cool and cloudy. Weather conditions include rain, sunshine, wind, temperature and thunderstorms.
- Climate describes surface and atmospheric conditions over a long period of time or over a large geographical area. The climate of an area is concerned with the average weather conditions, which are taken over a year or more.
- Climate changes slowly, usually over decades, centuries and thousands of years. The Earth has many climatic regions. Some places experience different climatic conditions such as winter and summer.
- Three main things cause the weather to change i.e Heat, wind and moisture.
- Heat comes from the sun that is why places near the equator get more heat from the sun than places near the North and South poles do.
- Land heats up quicker than oceans but oceans hold heat longer than the land. Land aslo cools quicker than the oceans.

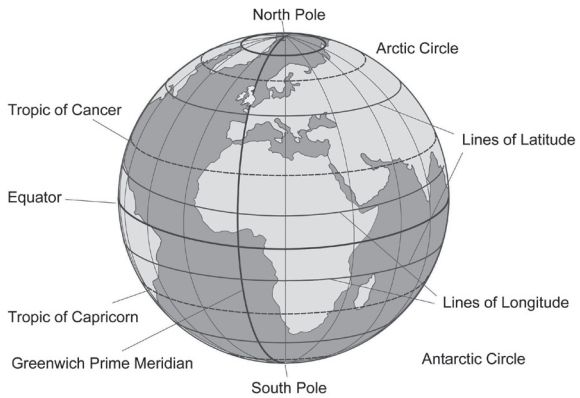


Fig 4.1 The Earth

- The uneven heating and cooling of different parts of the Earth causes winds. Winds move clouds from place to place. Clouds carry moisture that falls as rain or snow. Warm air can carry more moisture than cooler air can.

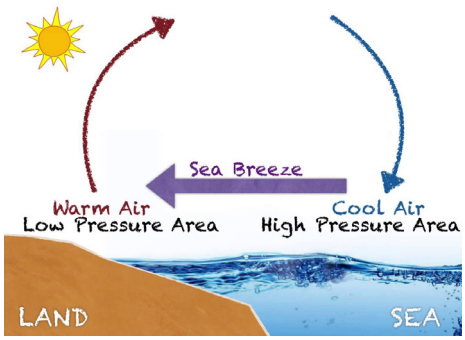


Fig 4.2 Sea breeze

The elements of weather and climate are temperature, atmospheric pressure, wind, humidity and precipitation.

The following factors influence the weather and climate of different places around the world:

- Ocean currents that involves movement of water at different temperatures through the oceans.
- Amount of water and dust in the atmosphere.
- The direction that winds usually blow from.
- Altitude i.e. height above sea level.

- Latitude i.e. angle of sun's rays and effect on day length.
- Distance from the sea.
- The influence of slopes e.g. different sides of a valley.

Climate change in some parts of the earth is as a result of human activities such as cutting down trees and use of fossil fuel.

Fig 4.3 Desertification

Fig 4.4 A desert

- Desertification refers to the cutting down of trees for various purposes without planting others making that place a desert (an area without vegetation). Trees attract rainfall as mentioned earlier this means that without trees an area may not experience enough rainfall or none at all.
- Trees and other plants also help to remove excess carbon dioxide from the atmosphere by using it during photosynthesis. The excess carbon dioxide is introduced into the atmosphere through respiration by animals and burning of fuels such as paraffin, petrol and diesel. Excess carbon dioxide causes **global warming**.
- Global warming is a condition that is brought by excess carbon dioxide that traps a lot of heat from the sun. The carbon dioxide does not release the heat as fast bringing about very high temperatures. Therefore, planting of trees is a way of avoiding the changing climate conditions that results to the problems discussed earlier.

FUN CORNER

1. Observe and record the weather changes around your school and home every day a for a week by use of various weather signs. Make a weather chart for the week and compare with those made by your classmates. You can use three columns, in your table: morning, afternoon and night.
2. In groups of four have a discussion about the main climatic regions of South Sudan? Compare with other countries. Use your Atlas for this activity.

Did you know

During the olden days, people did not use weather instruments? They instead used weather scales which included:

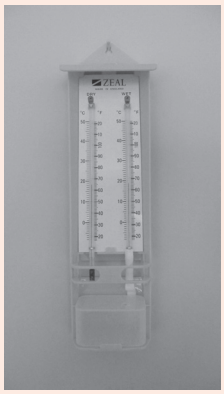
- Looking at the movement of trees, their leaves and branches to tell the direction of wind.
- Looking at how smoke behaved as it moved upwards to tell the direction of wind.
- Observing movement of certain animals such as safari ants to signify the onset of rains.
- Cracking of the ground to signify onset of drought, croaking of frogs among others.

Further Activity

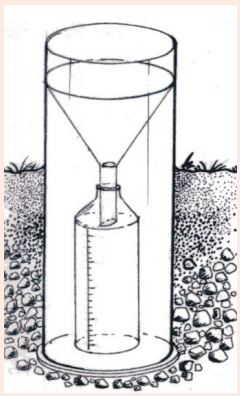
1. Ask your grandparents how they used to tell weather patterns and changes.
2. Compare your findings with the rest of the class.

Check your progress 4.1

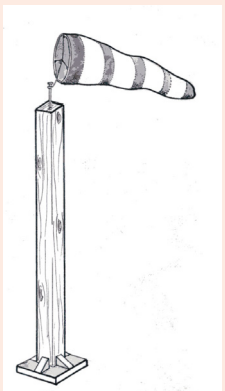
1. Write down the aspect of weather measured by each of the instruments drawn below.



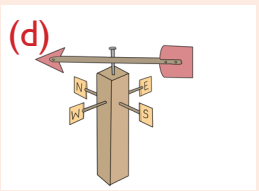
(a)

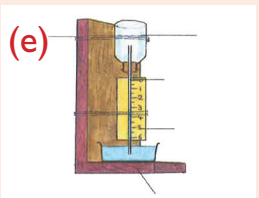


(b)



(c)





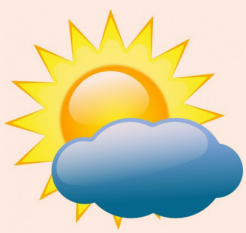
2. Write true or false for the following statements.

   (a) People in the olden days did not know anything about weather.

   (b) People in the olden days used the behaviour of certain animals to predict the weather.

   (c) There is only one aspect of weather every day.

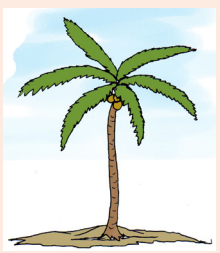
3. Which aspect of weather is represented by each of the weather signs drawn below.



A

B

C



D

4. Why does the regions around equator experience about the same temperature year-round?

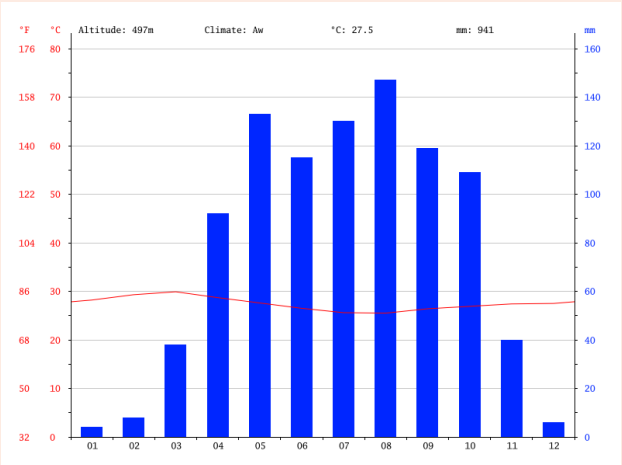
5. Write **true** or **false** for the statements below.

   (i) Excessive use of fuels such as kerosene can lead to global warming.

   (ii) Global warming cannot cause flooding.

   (iii) Climate is the same across the world.

6. Study the graph shown below. The graph shows the weather patterns in Juba for one year.



Describe the weather patterns of Juba from the graph.

Did you know

Global warming may result to melting of ice caps. This increases the levels of water in oceans and seas. This can lead to flooding at coastal regions and very high temperatures that leads to death of human beings and other animals and plants.

4.2: How weather and climate affect land use and human population in South Sudan

Activity 4.3 **Class activity**

1. Your teacher will organise for a meteorologist to talk to you about weather and climate in South Sudan.

2. Prepare a questionnaire that you will use to ask questions.
3. Listen carefully during the talk; ask questions and note down the answers.
4. Write a report and present it to the teacher for assessment.

Did you know

South Sudan has a total population of between 12,000,000 and 14,000,000 million people.

Poverty, diseases, high mortality rates, drought, floads, heat waves, conflicts between pastoralist and farmers are all negative effect of weather and climate change they are instrument in land use and human population in South Sudan.

Learning points

- The majority of the population of South Sudan entirely depend on Agriculture.
- Land in South Sudan is mainly used for growing of crops and keeping of livestock.

Fig 4.5 Herding

Fig 4.6 Coffee farm in South Sudan

- The right amount of rainfall and temperature determines the types of crops grown and where the crops are grown.

- Major crops grown in South Sudan are sorghum, millet, maize, rice, sunflower, cotton, cassava, beans, peanuts etc. Crops grown in small scale farms include coffee, tea, sugar tobacco etc.
- Unreliable rainfall and total lack of it may lead to prolonged periods of drought affecting human population negatively.
- Floods from overflowing River Nile as a result of heavy rains from the Ethiopian plateaus results to migration of people to urban areas.

Fig 4.7 Flooding displaces people

- Flash floods from high rainfall areas of South Sudan causes a lot of damage to crops and this affects soil fertility. Soil erosion affects food production hence human population.
- Diseases such as cholera, bilharzia and malaria are associated with floods. This also affects human population negatively.
- Heat waves and dust storms brought about by weather and climate change affect human population in South Sudan.
- Lack of rainfall due to weather and climate change leads to famine. This causes migration of people to other parts of the country and other neighbouring countries (Refugees).
- Migrants live under very harsh conditions. This leads to psychological suffering and social conflicts. The conflicts affect the security and stability of the country.

Check your progress 4.2

1. From the puzzle below search and circle some of the crops that are grown in South Sudan.

Hint: The words are written forward, backwards, upwards and downwards.

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

2. What are the two main climate factors that determine land used in South Sudan?

   A. Wind and clouds

   B. Sun and wind

   C. Soil and clouds

   D. Temperature and rainfall

3. What are the effects of floods along River Nile?

4. Write true or false for the following statements.

   (a) Heat waves and dust storms are experienced by people of South Sudan every day.

(b) Flash floods can cause soil erosion.

(c) The study of weather of a place is called metrology.

5. Explain in your words the main cause of conflicts between pastoralists and farmers in South Sudan.
6. Write down a short composition on how the people of South Sudan can adapt and strengthen their resilience to be able to better prepare for natural disasters such as floods, droughts, famines, heat waves and dust storms.

4.3: Conservation of water

Activity 4.4 **Individual activity**

1. Move around in your home area and observe:
   - How water is used.
   - How water is harvested and stored.
   - How water is recycled.
2. Record the different ways of conserving water you may have observed.
3. Discuss your findings with your friends.
4. Suggest ways by which you can teach the community on water conservation methods.

Learning points

Conserving water ensures that water is spared for future use. There are several ways of conserving water. They include:

- harvesting
- using water sparingly
- recycling
- mulching and shading
- re-using
- storing water in dams

a) Harvesting water

There are different methods of harvesting water.

(i) Using a gutter to collect rain water from roofs of houses as it rains.

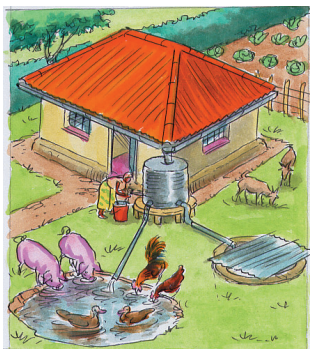


Fig 4.8 Harvesting rain water

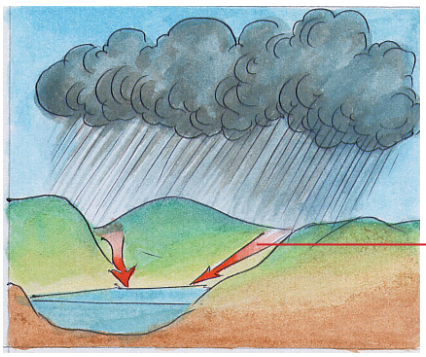


Fig 4.9 Rock catchment

(ii) Water can also be harvested by constructing **catchment rocks**. This method is mostly used in rocky areas. A wide hole is dug on the ground until the base rock is reached to form a dam.

Shallow trenches are dug in the area surrounding the dam to direct run off water into it. When it rains, the run-off water flows into the rock catchment.

b) Recycling water

Used water or waste water from factories and sewers can be recycled. The waste material in the water is removed and the water treated to kill germs. Such water is then fit for use.

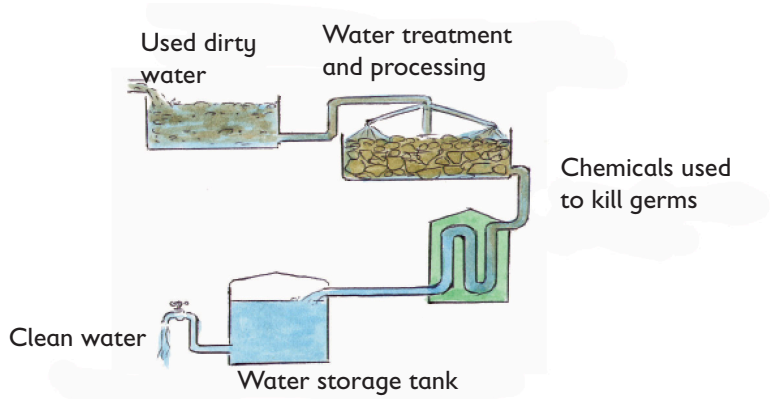


Fig 4.10 Recycling water

c) Reusing

It is the using of water, which has already been used for another purpose. Water can be used for a number of times before being discarded. For example, water can be used for washing clothes and then be re-used to clean toilets.

Further Activity

Suggest other ways in which water can be reused at home.

d) Using water sparingly

To conserve water, the amount of water we use should be just enough for our need. Unnecessary usage of water should be avoided. For example, there are things we can do to avoid wastage of the little water available.

- Instead of washing a cemented floor, it can be mopped with a wet piece of cloth.
- Taps should be turned off when not in use.
- Leaking pipes and taps should be repaired to avoid wastage of water.
- Plants can be watered using the drip method. This ensures that the plants use little water for a long time.

Fig 4. 11 Drip irrigation

Fig 4. 12 Seedlings growing under a shade

e) Mulching and shading

Mulching is the use of dry plant materials to cover soil around the base of a plant. Mulch reduces evaporation of water from the soil. This helps to conserve soil water. We therefore do not have to water the plants frequently.

Shading is covering young plants in a nursery or seedbed. Shading reduces evaporation or water loss from seedbeds due to direct sunlight.

f) Storing water in dams

Run-off water from rain can be conserved by storing it in dams. A dam is made across a valley by putting heaps of soil or concrete to make a barrier. Run-off water that enters the valley from the surrounding slopes is held back, forming a large **water reservoir**. This water reservoir is called a dam.

A dam can also be made by digging out large quantities of soil in a valley to make a huge hole. The soil dug out is heaped on the lower side to make a barrier. The barrier prevents run off water from flowing down the slope, instead, the water is held back and fills up the huge hole.

Water stored in dams can be used for:

- watering livestock.
- irrigation during dry season.
- generation of electricity.
- household and industrial purposes.

Other ways of storing water

In most homes water is commonly stored in containers of different shapes. Water is stored in containers such as pots, jerrycans, drums, tanks, cooking pots among others.

Further Activity

Name other containers that you use to store water.

Did you know

You can survive for several weeks without food but you cannot survive for more than seven days without water!

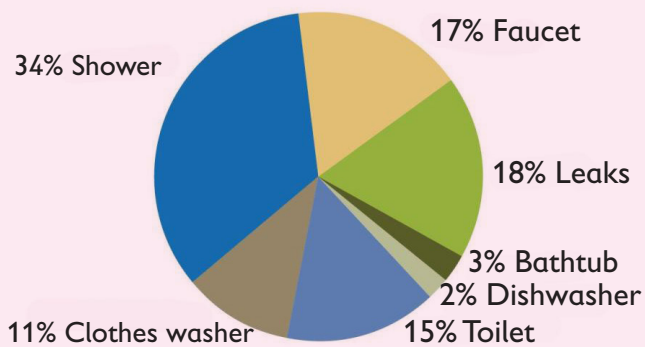
FUN CORNER

Draw the diagram of a person using improvised drip irrigation method.

Importance of water conservation

Activity 4.5 Group Activity

1. Draw a pie chart that shows how water is used at home for different activities.
2. Compare your pie chart with the one shown below.



3. How do you conserve water at home.
4. In groups of four, discuss why there is a concern about water and its conservation.
5. Note down your findings.
6. Compare your findings with other groups.

Learning points

- Water conservation makes a big difference for the environment. Water conservation means using water wisely and caring for it properly.
- Water conservation is a personal responsibility and not other people's problem. Our water supply is limited, which means that we do not have an endless supply. We only have the water that we have now.
- Ninety-seven percent of all the water on the earth is salt water, which is not suitable for drinking. Only three percent of all the water is fresh water, and only one percent is available for drinking water. The other two percent is locked in ice caps and glaciers.

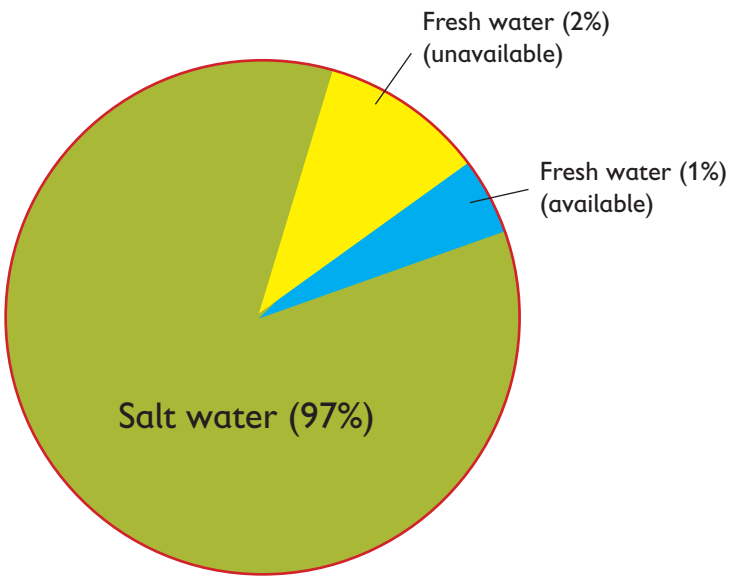


Fig 4.13 Percentage of water available on Earth

- All the people on Earth rely on such a small percentage of all the water on Earth. Therefore, it only makes sense that we must preserve and conserve our water.
- We must not pollute our water because it is the only water we will ever have. Some people do not realise the importance of water. They therefore, continuously pollute it.
- The quality of water is very important. We have the same amount

of water now as there was when the earth was created. This is the water we have, and we must preserve its quality.

- Water is the foundation of food and life, therefore it is a precious resource. We cannot live without water.
- Saving water helps to preserve our environment. It reduces the energy required to process and deliver water, which helps in reducing pollution and in conserving fuel resources.
- Saving water now means having water available in the future for recreational purposes, too.
- Conserving the water we have, minimises the effects of water shortages and helps build a better defence against future drought years. If we save water now, we are helping to ensure a water supply adequate for future generations.

Remember!

Saving water saves money.

Check your progress 4.3

1. Write true of false for the following statements.
   (a) To conserve water give your livestock only a small amount every day.
   (b) People should bathe only twice a week in order to conserve water.
   (c) Plants and animals will die without water.
2. Which one of the following does not show water being re-used.
   A. Using water for washing toilets after washing clothes.
   B. Watering plants with water used for washing utensils.
   C. Using water that remains after bathing for cleaning latrines.
   D. Filtering and boiling dirty water for drinking.

3. Why do you think in recent years the need for water has risen so much.
4. What can you do to save water at home?
5. Give reasons why watering of crops is usually preferred early in the morning and late in the evening.

4.4: Relationship between temperatures, pressure and volume of air

Activity 4.6 **Group activity**

What you need

- Balloon
- Pressure pump
- Source of heat
- Tin with a lid
- If possible a car or a bicycle tyre
- Pieces of paper or two tennis balls

What to do

1. Fill a balloon with air using the pressure pump until it fills up. Tie the mouth of the balloon with a string. Hang it outside on a sunny day. Observe what happens.
   - Why did the balloon burst?
2. Fill another balloon using the pressure pump. Pump air into it until it bursts.
   - Why did it burst?
3. Take two sheets of paper and blow between the two sheets of paper.
   - What did you observe?
4. Suspend two tennis balls, using a string. Blow air in between them.
   - Observe and record what happens.

5. Open a closed tin then place the lid tightly. Place the closed tin on a source of heat. Observe what happens.
   - Why did the lid pop out?
6. Observe inflated tyres of a car or bicycle.
   - What is inside the tyres?
7. Try riding a bicycle that does not have air in it. Now ride one that has inflated tyres.
   - In which case did you find it easy to ride?
8. Cut small pieces of paper from one of the two sheets of paper; drop them directly from above the source of heat as shown alongside. The pieces of paper are seen to move up and down and out of the source of heat.
   - Explain why they were moving up and down and out on the source of heat.
9. Spray a perfume at the centre of the class.
   - What happens?

Learning points

- Air pressure is a force that exists when air is put in a closed container or in the atmosphere.
- Air temperature refers to how hot or cold air is at day one give time.
- Volume is the space that air occupies at a certain temperature.
- Temperature, pressure and volume of air are interrelated. Changing one affects the other.
- Air is made up of small particles called **molecules**.

- Air does not have a definite volume. The small particles of air (molecules) occupy every available space. That is why when you spray perfume at the middle of a class the smell of the perfume spreads to the rest of the class.
- As the pressure on a gas increases, the volume of the gas decreases because the gas particles are forced closer together.

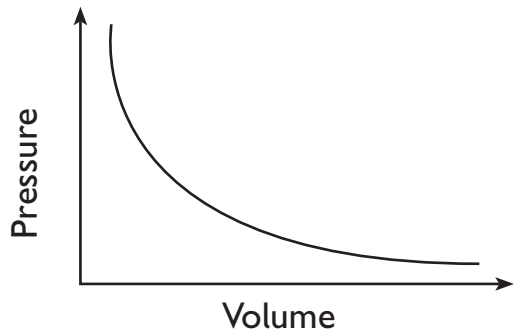


Fig 4.14 Graph of volume against pressure

- As the pressure on a gas decreases, the gas volume increases because the gas particles can now move further apart.
- Weather balloons get larger as they rise through the atmosphere to regions of lower pressure because the volume of the gas has increased; that is, the atmospheric gas exerts less pressure on the surface of the balloon, so the interior gas expands until the internal and external pressures are equal.
- Hot air rises, which is why hot-air balloons ascend through the atmosphere and why warm air collects near the ceiling and cooler air collects at ground level.
- The reason for this behaviour is that gases expand when they are heated. Because the same amount of substance now occupies a greater volume, hot air is less dense than cold air. The substance with the lower density (hot air) rises through the substance with the higher density, the cooler air.
- We can conclude that the volume of a gas is inversely proportional to its pressure and directly proportional to its temperature and the amount of gas.

$$\text{Volume} = \frac{\text{Temperature}}{\text{Pressure}}$$

- Wind is the flow of a huge amount of air, usually from a high-pressure area to a low-pressure area.
- As the earth is affected by an unequally heat energy from the sun, the state of the air differentiate between different regions. Warm air expands and rises up while cold air condenses and sinks, hence resulting in the flow of air and forms wind.

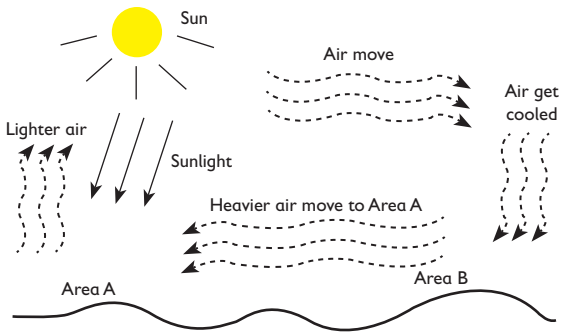


Fig 4.15 Flow of air

- Each time there are differences in atmospheric (air) pressure; there will be wind. This is because air will move from the high-pressure area to the low-pressure area. It also means that winds may be even stronger where the difference in the air pressure is greater.
- When you increase the temperature of air in a closed container, the air expands (volume increases). It therefore occupies a large space than before. Pressure of air in the container increases (this explains why the balloon burst when placed outside in the sun. It also explains why the lid popped out of the container).
- When the temperatures of air increases, its volume increases and the air moves up to occupy the space of the risen air.

FUN CORNER

Fill two balloons with air; tie the mouth of the balloons with long strings. Suspend one of the balloons outside in the classroom and the other balloon inside the class. Observe and record what happens.

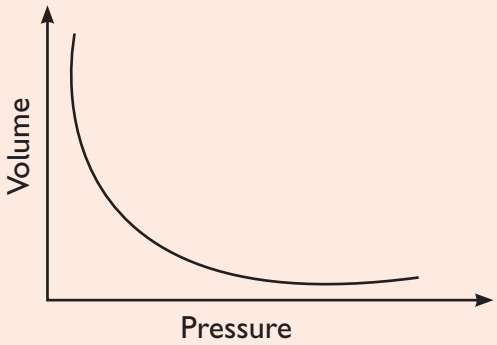
Did you know

Land and sea breezes are formed as a result of difference in air pressure due to changes of air temperature.

Check your progress 4.4

1. Explain the meaning of the following words
   (a) Volume
   (b) Temperature
   (c) Pressure
2. Write true or false in the following statements.
   (i) When the temperature of air in the atmosphere increases pressure and volume also decrease.
   (ii) When the temperature of air in a container increases the volume and pressure decrease.
   (iii) Air moves from an area of high pressure to an area of low pressure.
   (iv) High air pressure in the tyre of a car helps the car move easily on a road.
   (v) When air is heated in a container the small particles that make the air move about knocking on each other.
3. Which one of the following is true about volume of air?
   A. It is fixed
   B. It is not definite
   C. Has no volume
   D. Is the same
4. Explain why it is dangerous to heat a small quantity of water in a sealed container.

5. Describe the graph below.



4.5: Vacuum

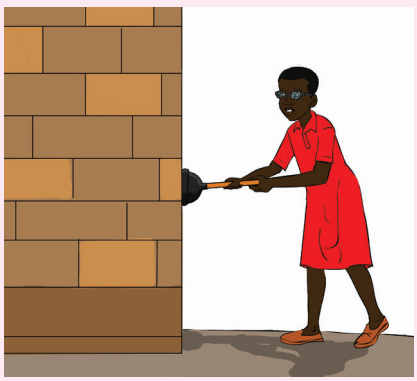
Activity 4.7 **Group activity**

What you need

- Suction pad
- Vacuum flask
- Water
- Cooking pot
- Cooking pan with a plastic handle
- Pictures of some animals with feathers and fur

What to do

1. Take suction pad, press it hard against a smooth wall and release it.



- Were you able to remove the suction pad? Was it easy?

2. Boil some water in a cooking pot then put the boiled water in a vacuum flask. Replace the cap. Leave the water in the flask for several hours. Find out if the water is still hot.
    - Explain how vacuum in the flask conserves heat of the water in the flask.
3. Observe an improved charcoal stove and identify the main part that helps in conserving heat. Compare the improved charcoal stove with the usual charcoal stove.
4. Observe a frying pan and explain the reason as to why it has a plastic handle.
5. Observe pictures of some animals that have feathers, for example, birds such as domestic fowl and those that have fur such as sheep and goat.
    - Explain how the feather and fur help the animals conserve heat.
6. What do you think is inside an empty bottle? What if you sucked the air inside an empty bottle? What will remain inside?

Learning points

- A vacuum is a space that does not have any matter. This means that it has no air, solid or liquid.
- Vacuum is a space in which there is no matter or in which the pressure is so low that any particles in the space do not affect any processes being carried on there.
- A vacuum can be created by removing air from a space using a vacuum pump or by reducing the pressure.
- Animals and plants cannot survive in an area that does not have air (oxygen and carbon dioxide) and water. This explains why there is no life in a vacuum.
- Cooking utensils such as frying pan have handles made of plastics

to **insulate** them from heat, this protects the cook from heat during cooking.

- Some animals have fur or feathers, which helps them prevent loss of heat form their bodies. When it is very cold, birds raise their feathers so that they can trap a column of air between the feathers and their bodies. Air being an insulator will not allow heat to pass through. The bird therefore remains warm. Animals that live in very cold places have fur (Seals, polar bears etc) that traps a column of air that prevents loss of heat from their bodies.

Did you know

The space is a very good example of a vacuum. No animals or plants can be found in space as there is no oxygen or water.

Check your progress 4.5

1. A vacuum is a place that does not have
   - A. Matter
   - B. Mass
   - C. Weight
   - D. Force
2. There can be no life in a vacuum mainly because
   - A. It is very cold.
   - B. It is very hot.
   - C. There is very heavy rainfall.
   - D. No air or water.
3. The vacuum in a flask prevents loss of heat by
   - A. Radiation
   - B. Convection

C. Conduction only

D. Conduction and convection

4. A cooking pot has a plastic handle to

A. Make it look attractive

B. Plastic is cheap

C. Plastic is an insulator

D. Plastic is readily available

5. Which of the three methods of heat transfer does not need any material for heat to travel through?

Unit 5 Acids, Bases and Indicators

Words to learn

Indicators, litmus paper, neutral point, corrosive, antacid, pH

5.1: Properties of acids, bases and indicators

Activity 5.1 **Pair activity**

Discuss the following questions.

1. Come up with three things you know about acids and bases.
2. Name some examples of acids and bases commonly used at home?
   - Where have you seen them in real life?
   - Are the examples you have given above useful or harmful to us?
3. Why do you get more teeth cavities from drinking soda, eating sweets, biscuits or cakes?
4. The swimming pool is a shared facility. How is it made germ free.
5. Some people take wood ash when they have heartburn.
   - How does it help?
6. Why should we brush our teeth at least twice a day using a tooth brush and toothpaste?

Learning points

The sour and bitter tastes we find in food are due to the presence of acids and bases. Some naturally occurring acids are: vinegar (acetic acid) and citric acid (present in orange and lemon).

Vinegar

Orange

Lemon

Fig 5.1 Examples of substances containing acids

Our stomach also produces hydrochloric acid, which helps in the digestion of food. Some commonly used bases are baking soda and tooth paste. Toothpaste is a basic substance used for cleaning the teeth and it neutralizes the excess of acids present in the mouth and prevents tooth decay.

Toothpaste

Baking soda

Fig 5.2 Examples of substances containing bases

Although most acids are harmless, some are harmful, for example, some acids eat through plastics, clothing and skin while others corrode metals. Sometimes these properties of strong acids are useful, for example, hydrochloric acid in your stomach helps digest food.

- Sulfuric acid is used in car battery.
- Phosphoric acid is used in preservation of cold drinks.
- Lactic acid is found in milk.

Bases are used at home tool, for example:

- Ammonia is used as household cleaners.
- Sodium bicarbonate as baking soda.
- Potassium hydroxide used to make liquid soap.
- Aluminum hydroxide used in the manufacture of antacid.

Fig 5.3 Antacid syrup

Activity 5.2 Group activity

What you need

- Oranges
- Lemons
- Vinegar
- Sour milk
- Baking powder
- Toothpaste

What to do

1. Taste these substances and record your observations in a table format like the one shown below.

2. What did you find out?

Learning points

- Acids and bases can be classified into various classes. Some are natural while others are artificial.
- Strong acids such as sulphuric acid and nitric acid are dangerous.
- Strong bases such as sodium hydroxide are dangerous too.
- Some examples of weak bases are saliva, wood ash and toothpaste.

- Example of weak acids are vinegar and citric acids. They are found in some fruits.
- Acids and bases have properties some of which are shown in the table below.

Acids	Bases
Have a sour taste	Have bitter taste and soapy feel
Neutralise bases	Neutralise acids
Are corrosive	Some a corrosive (Strong base)
Can conduct electricity	Strong bases can conduct electricity

- It is difficult to tell if a substance contains an acid or a base and to what extent, except for the foodstuffs that we can consume. This then means we must have another substance that we can use to test if another substance is a base or an acid. Such a substance is known as **indicator**.

Indicators

Activity 5.3 **Pair discussion**

Discuss the following.

1. The meaning of different colours produced by traffic lights that guide motorists and pedestrians in busy towns.
   - Why are the colours different? What do they indicate?
2. How can we apply this knowledge to differentiate between acids and bases?
3. Now research from reference materials the meaning of acid-base indicators.

Learning points

Acid –base indicator is a substance which shows one colour when in an acid solution and a different colour when in a basic solution. Therefore, an indicator can be used to classify substances as either acids or bases.

Indicators can be classified as either naturally occurring or commercial indicators. The most common commercial indicator is litmus paper, **phenolphthalein** and **methyl orange**.

Many other plant materials contain dyes which can be used as acid-base indicators. Examples are red cabbages, coloured flower petals of *hibiscus* or *bougainvillea*. They show one colour in an acid solution and another different colour in a basic solution.

Did you know

All acids and bases are liquids.

Activity 5.4 **Group activity**

1. Using reference books fill the table below.

Indicator	Colour change in acids	Colour change in bases
Red litmus		
Blue litmus		
Phenolphthalene		
Methyl red		
Methyl orange		
Red cabbage		
Black berries		
Curry powder		
Blue grapes		
Morning glory		
Red onion		
Turmeric powder		
Red hibiscus		

FUN CORNER

Look for brightly coloured petals of some flowers. Make an indicator from them and used it to find out if a substance is an acid or a base.

Do you know

Never taste or get into contact with strong acids and bases. They are highly corrosive.

Check your progress 5.1

1. Write true or false for the statements below.
   (i) You can taste all substances to find out if they are acids or bases.
   (ii) Acids taste sour while bases taste bitter.
   (iii) The stomach produces an acid that is highly corrosive.
   (iv) Acids found in lemons, oranges, sour milk are not corrosive.
   (v) Acid found in a lemon can produce small amount of electricity.
2. Which one of the following is not true about bases?
   A. They neutralise acids.
   B. They have a bitter taste.
   C. They have a pH of less than 7.
   D. Some of them are corrosive.
3. One of the following cannot be used to make an indicator. Which is it.
   (a) Red tea
   (b) Red cabbage
   (c) Coffee leaves
   (d) Rose flower petals

4. _____ changes the colour of _____ litmus red.

   A. Acids, blue

   B. Acids, red

   C. Bases, blue

   D. Bases, red

5.2: Using indicators to find the strength of an acid

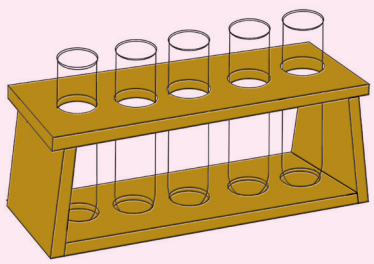
Activity 5.5 **Group activity**

What you need

- Acids such as dilute hydrochloric acid, dilute sulphuric acid
- Bases such as sodium hydroxide solution
- Distilled water
- Rain water
- Lemon juice
- Universal indicator
- Test tubes or clear containers or glass
- pH scale or chart
- Droppers

What to do

1. Place small portions of acids, bases, distilled and rain water, and lemon juice into different test tubes.



2. To each test tube, add 3 drops of the universal indicator and observe the colour of the solution.

3. Place each test tube and its contents against a pH chart. Match the colour of the indicator in the solution against the shade on the pH chart and record the pH values of each solution in a table.

Solution	Colour of universal indicator in the solution	pH value
Hydrochloric acid		
Sulphuric acid		
Sodium hydroxide		
Distilled water		
Rain water		
Lemon juice		

4. Discuss in groups the findings of your experiment.
5. Present your findings in class.

Learning points

- The universal indicator is a mixture of several indicators. It shows a range of colours in acids and bases depending on the degree of acidity or alkalinity. Some acids are more acidic than others while some bases are more basic than others.
- By use of a universal indicator and the pH chart, we can get pH values of various solutions.
- The pH scale measures how acidic or basic a substance is. It has numbers ranging from 0 to 14. A pH of 7 shows that a solution is neutral whiles a pH below 7 shows that a solution is acidic. A pH higher than 7 indicates that a solution is basic.
- Example of a standard pH colour chart is shown below.

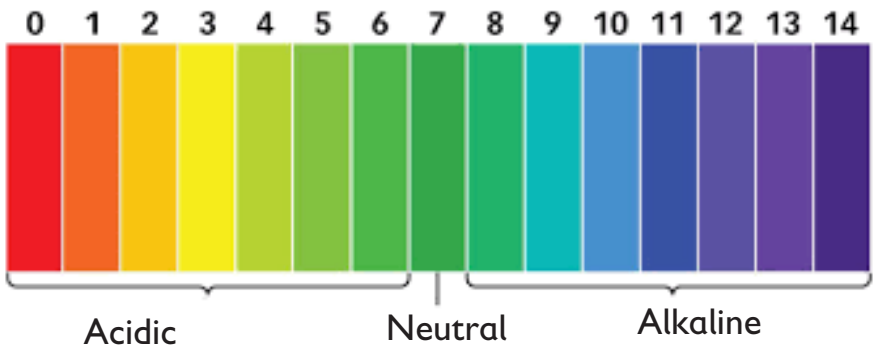


Fig 5.4 Standard pH scale

- The pH values of acids range from 0 to just below 7. Substances such as rain water and lemon juice are considered acidic and have pH values, which range between 4 and 7. They are said to be **weak acids**. Solutions of hydrochloric acid and sulphuric acid have pH values, which range between 0 to 4. These solutions are said to be **strong acids**. As the pH values decreases from 7 to 0, the strength of acids increases.
- A pH value of 7 implies the solution is neither acidic nor basic and it is hence said to be **neutral.** Distilled water is neutral.
- The pH values of bases range between 7 and 14. Hence bases such as ammonia solution and wood ash are **weak bases**. Sodium hydroxide and potassium hydroxide solutions have pH values above 10. They are said to be **strong bases**. As the pH values increases from 7 to 14, the strength of the bases also increases.

FUN CORNER

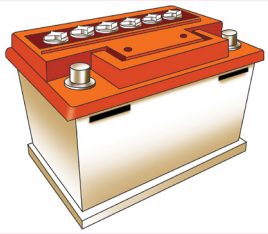
Using an acid and an indicator write a secret message. Use an unripe lemon and write a message to your friend on a piece of paper. Allow it to dry. Let your friend paint an indicator with a paint brush over the message to reveal it.

Check your progress 5.2

1. Write down some commonly available basic substances at your home environment.
2. Pupils used 10 drops of acid Y to change the colour of indicator B. They used 4 drops of acid X to change the colour of indicator B. Which of the two acids was stronger?
3. Write true or false for the statements below.
   (i) An acid can neutralise a base.
   (ii) A base can neutralise an acid.
   (iii) Excess acids produced in the stomach can be neutralised by taking a little amount of wood ash.
4. Which one of the following cannot be used to neutralise an acid?
   A. Water
   B. Lemon juice
   C. Wood ash
   D. Sodium hydroxide
5. All the following will not change the colour of an indicator except.
   A. Salt
   B. Urine
   C. Sugar
   D. Water
6. Strong acids are used to be _____ while weak acids are said to be _____
7. An acid was found to have a pH of 3. Was it a strong or a weak acid?

5.3: Uses of acids and bases

Activity 5.6 **Individual activity**



A

B

C

1. Mention the applications of acids and bases in the product shown above.
2. What other ways are acids and based applied in day-to-day life?
3. Compare your findings with others in class.

Learning points

Acids and bases are useful in our lives for example:

- Ascorbic acid which is naturally found in citrus fruits such as oranges and lemons control **scurvy** disease.
- Vinegar is an acid that adds flavour to food.
- In the making of fire extinguishers, acids are combined with **carbonates** to form carbon dioxide. The carbon dioxide is used to extinguish fire because it does not support burning.

Fig 5.5 Fire extinguisher

- Nitric acid is used to purify gold, make explosive and detergents.
- We also use acid such as sulphuric acid in car batteries to produce electricity.
- Our stomach lining produces hydrochloric acid that kills germs and creates a good environment for digestion to take place.
- Caustic soda is a base that is used in making soap.
- When soil becomes acidic we neutralise using a base called lime. We also neutralise acid in the stomach using antacids such as Actal.
- We use toothpaste to neutralise the acid produced by bacteria in our mouth to prevent tooth decay.

FUN CORNER

Create an advertisement for toothpaste you use at home. Compare your creation with other classmates.

Check your progress 5.3

1. A bee sting contains methanoic acid. That is why it is so painful. How then can you treat someone who has been stung by a bee?
2. Which base can we use if our soil becomes acidic to make it neutral?
3. Achol is feeling some burning pain along her gullet.
   (a) What do you think she is suffering from?
   (b) What can be done to help relieve the burning feeling?

Unit 6 Sound and Light

Words to learn

Translucent, reflex action, nerves, pitch, receptor, stimuli, volume

6.1: The pinhole camera

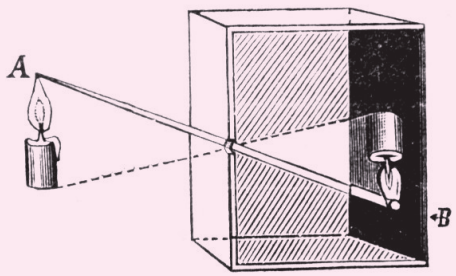
Activity 6.1 **Making a pinhole camera**

What you need

Cardboards, translucent paper, black paper, nail, hammer, pin, candle, matchbox, black paint and brush.

What to do

1. Using the materials above make a pinhole camera shown below.



2. Light a candle and place it at a distance from the pinhole.
3. Observe the image on the translucent paper.
4. Repeat the activity by varying the size of the pinhole and the distance of the candle.
5. Discuss your observations and record them as shown below

	Variable	Description of image
A	Tiny hole	
B	Bigger hole	
C	Object nearer to the hole	
D	Object far from the hole	

Learning points

- Pinhole camera uses light to form images.
- The light passes through a tiny hole and then it falls on a screen usually made up of a translucent material.
- The image formed on the screen is upside down and it is smaller than the object.

Activity 6.2 Observing and drawing parts of the human eye

1. Your teacher will invite an optician.
2. Design questionnaire you will use to engage the optician concerning the eye; its structure, functions and malfunctions.
3. Note down points during the talk.
4. Write a report and do a class presentation.

Learning points

A human being has two eyes in order to improve the focus and to supplement each other in the formation of a common image. This is also due to body symmetry and thus we have two eyes, two ears, two legs, two hands, two nostrils etc.

The human eye works like a pinhole camera.

6.2 Differences between pinhole camera and the human eye

Activity 6.3 Pair activity

What you need

Pinhole camera and pictures or model of human eye

What to do

1. Compare the pinhole camera and the human eye model.

2. Note your findings in a table like the one shown below.
3. Share your findings with the rest of the class.

1		
2		
3		
4		

Learning points

- The human eye and the pinhole camera have the following similarities:
  (a) They use light to form images.
  (b) The images are formed at the back.
  (c) The images are upside down (inverted).
  (d) The images are smaller than the object (diminished).
  (e) When the object is far the image is blurred.
  (f) When the object is near the image is clear.
- The human eye and the pinhole camera have the following differences:
  (a) The eye has a lens while the pinhole camera does not have a lens.
  (b) In the eye, light passes through the cornea membrane, fluid and lens while in the pinhole camera it passes through the tiny hole only.
  (c) In the eye the amount of light entering the eye is controlled by the iris while in the pinhole camera it is not controlled.
  (d) The eye has a wider perspective since both eyes work together while a pinhole camera has a smaller perspective.
  (e) The eye sends the impulse about the image to the brain for interpretation while the camera does not send the impulse to any device for interpretation.

FUN CORNER

Make a pinhole camera and use it to observe the images of different objects.

Did you know

Hawks have the best eyesight since in their retina they have millions of light sensitive cells. Explain why it is important for the hawks to hake a sharp eyesight.

Check your progress 6.1

1. Draw an eye, on it indicate:
   (a) Where images are formed.
   (b) Parts of the eye that control the light entering the eye.
   (c) Optical nerves
2. The eye has a better perspective than a pinhole camera. Explain.
3. The eye sends an impulse to the brain through_____.
4. Read the passage below and answer questions that follow.

   When we pass under a tree covered with many large leaves, we notice small patches of sunlight under it. These circular images are, in fact, pin hole images of the Sun. The gaps between the leaves, act as the pinholes. These gaps are all kinds of irregular shapes, but we can see circular images of the Sun. This is called natural pinhole camera.

   (i) Which of the following act as pinhole in the natural pinhole camera?
      A. Leaves
      B. Gaps between the leaves
      C. Water droplets
      D. None of these

(ii) Which of the following is true about natural pinhole camera?

A. The circular patches of lights formed on the ground are examples of images.

B. The circular patches are pinhole images of the sun.

C. We see circular images of the Sun irrespective of the irregular shapes of the gaps between the leaves.

D. All the above.

(iii) Pinhole camera produces?

A. An erect and small image.

B. An erect and enlarged image.

C. An inverted and small image.

D. An inverted and enlarged image.

6.3: The structure of human ear and sound perception

Activity 6.4 **Individual activity**

1. Observe ears of animals around you.
2. Compare the structure of their ears with other animals from other places.
   - How is the structure of their ears?
   - Discuss the reasons why the ears are raised or erected.
3. Compare the structure of animal ears and yours.
   - Are they similar or different?
4. Record your findings.

Activity 6.5 **Group activity**

What you need

- Charts with pictures of the human ear
- Model of the human ear

What to do

1. Observe pictures of the human ear and models in groups of four.
2. Draw and label the ear using the picture charts.
3. Discuss the functions of the parts of the ear and record them in the table like the one shown below.

A		
B		
C		
D		
E		

4. Discuss why we have two ears

Learning points

- The ear is divided into the outer ear, middle ear and inner ear.

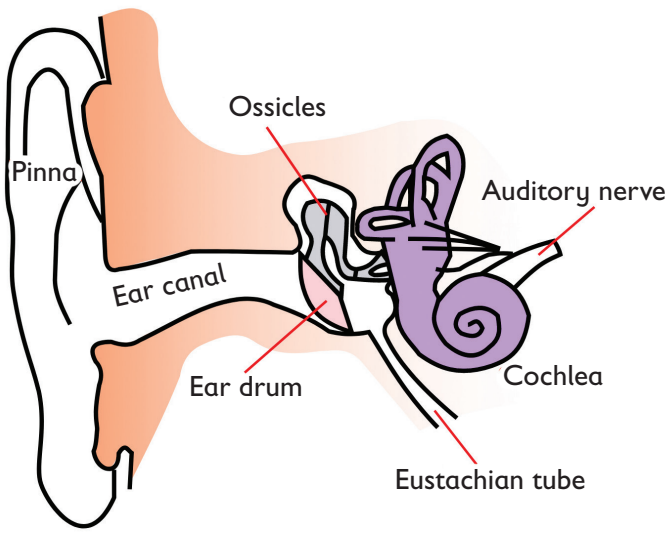


Fig 6.1 Structure of the human ear

- The **outer ear** is a tube opening on the side of the head and the other end goes to the ear drum.
- The outer ear has an extended skin (ear lobe) that helps to capture the vibrations. It also helps a person or an animal to know the direction of the sound.
- The **middle ear** is filled with air. It opens to the back of the mouth cavity through a tube called **Eustachian tube**.
- There are three small bones known as the **ossicles** which link the ear drum to a small opening in the scull which is called the oval window
- The inner ear has a fluid and a coiled tube known as **cochlea**. The cochlea tube has many sensory nerve endings.
- When sound is produced, for example, by plucking, beating, hitting or blowing, it moves in waves. The **sound waves** are then captured by the outer ear and directed to the ear drum.
- The ear drum vibrates making the three bones to vibrate. The inner most bone vibrates more against the oval window which is an opening into the inner ear.
- The vibrations of the ear drum and the small bones (ossicles) make the fluid and the cochlea in the inner ear to vibrate. These vibrations are converted into nerve impulse.
- The cochlea has fibers of different lengths that responds to sound of different pitches.

  (a) Short fibres respond to sound of high pitch.

  (b) Intermediate fibers respond to sound of medium pitch.

  (c) Long fibres respond to sound of low pitch.
- The nerve impulses are sent to the brain through the auditory nerve. The brain determines the pitch.
- Most mammals are able to move the pinna (outer ear) to be able to concentrate the sound waves like the ones of the dog below.

Fig 6.2 A dog with erected outer ear

- We have two ears to be able to detect sound from different sides
- The other reason for having two ears is because the body is symmetrical.

Did you know

Sound from a single source is heard more loudly in one ear than the other ear!

Check your progress 6.2

1. Match the information in column A with those in column B.

A	B
(a) Outer ear	Acts as a lever
(b) Ear drum	Transmit impulse
(c) Auditory nerve	Determine pitch
(d) Brain	Vibrate
(e) Small bones	Capture vibrations

2. Distinguish between pitch and volume.

6.4: The nervous system

Activity 6.6 **Class work**

Carry out the following activities and answer questions that follow.

1. Dim the lights in a room. After a few minutes, look at the eyes of the other person and note the changes in the pupil.
2. Turn the room lights back on. Check the size of the pupils again.
   - What did you observe?
3. Suddenly slam a book on a table to create a loud noise. Ask your partner to count the number of learners who:
   - Twitched
   - Moved their heads
   - Blinked their eyes
   - Put their hands up
   - Screamed
4. Have a partner sit with his or her legs crossed so that the leg can swing freely. Hit his or her leg gently just below the knee with the side of your hand.
   - What was your observation?
5. Let one pupil stand behind a class window, while others are observing him or her. Throw a folded paper towards the pupil.
   - Observe his or her reaction?
6. In groups answer the following questions
   (a) Why do you think you salivate when you see or smell food?
   (b) What happens when you touch a hot or sharp object?
   (c) What do you conclude from the observations and questions regarding the nervous system?
   (d) Write a report and present it to the teacher for assessment.

Learning points

- The nervous system is made up of all the nerve cells in the body. It is through the nervous system that we communicate with the outside world and, at the same time, many mechanisms inside our body are controlled.
- The nervous system takes in information through our senses, processes the information and triggers reactions, such as making your muscles move or causing you to feel pain.
- The nervous system consists of the brain, spinal cord, sensory organs, and all of the nerves that connect these organs with the rest of the body. Together, these organs are responsible for the control of the body and communication among its parts.

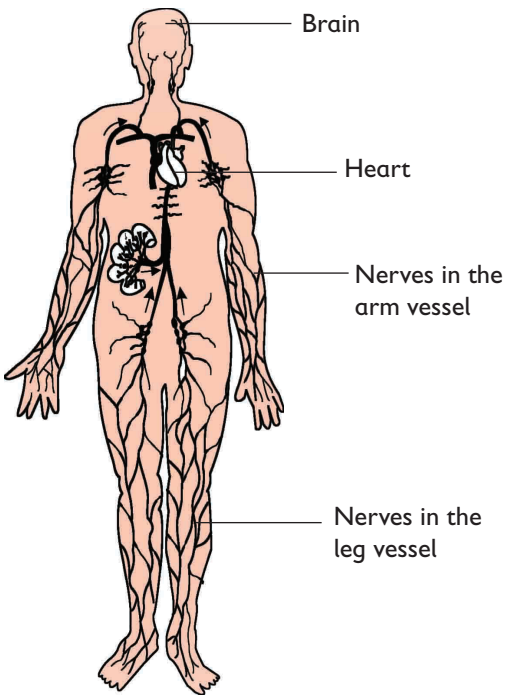


Fig 6.3 The human nervous system

- The brain is like a computer that controls the body's functions, while the nervous system is like a network that relays messages to all parts of the body.
- Our brain sends a motor impulse to the organs concerned for action.

- The nervous system is made up of **nerve cells**. The nerve cells have a body, an extension and filaments.
- The extension is called **axon** and the filaments that branches from axon are called **dendrites**.

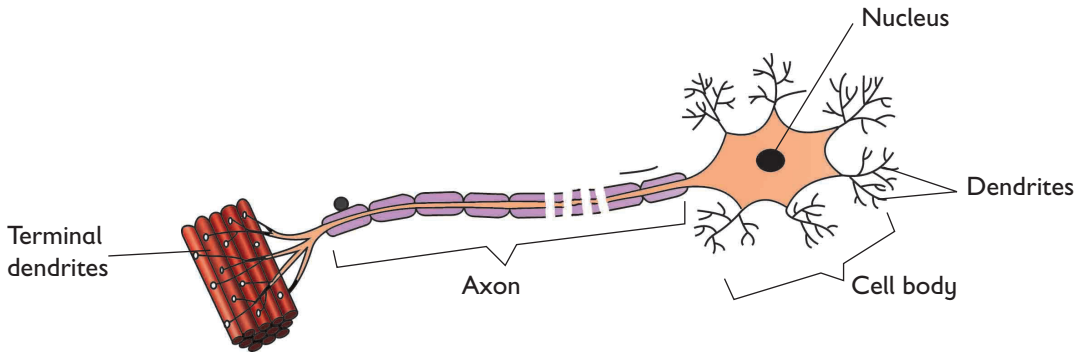


Fig 6.4 Nerve cell

- Our nervous system coordinates our body functions.
- When sense organs are triggered by stimuli they send an impulse to the brain or spinal cord where the cell bodies of nerve cells are located.
- Some actions in our bodies are **automatic**. They are commanded by our brain. Examples are blinking of an eye and sneezing. The automatic actions are called **reflex actions**.
- Our brain also stores information so that behaviour can be changed according to experiences.
- Our brain can be conditioned to respond even in the absence of the real stimuli, for example, we can salivate when we hear the bell for lunch even without the food. This is known as **conditioned reflex**.

FUN CORNER

Draw a waiter dropping a hot plate of food in a restaurant. Caption it .

Did you know

Nerve cells transmit impulses in one direction only.

Check your progress 6.3

1. Malik stepped on a sharp object then removed his foot very quickly. What made him do so?
2. A man kept a rope on the path of sheep; the sheep jumped the rope several times. He removed the rope on the path and let the sheep pass through the same path.
   (a) What do you think the sheep did when they reached where the rope was?
   (b) What is the name of the condition?
3. What causes our eyes to be wet when we cut onions?
4. Sort the following as either reflex action or condition reflex in a table format.

   Sneezing, salivation after seeing food, riding a bicycle, blinking an eye,

Unit 7 Electromagnetism

Words to learn

Electromagnet, dynamo, circuit, kinetic, transformation, magnetism, induction, coil, series connection

7.1: Making an electromagnet

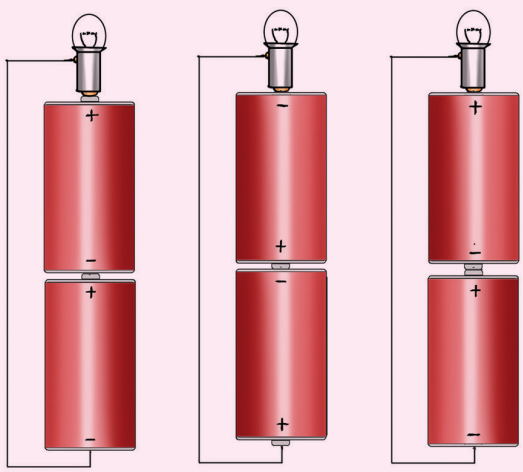
Can you recall what you learnt about electromagnets in Grade 4?

Activity 7.1 **Group activity**

What you need

- Torch batteries
- Bulb
- Copper wire
- Battery holder

1. Connect circuits as shown below.



A B C

2. Record your observation.

Circuit	Observation
A	
B	
C	

Study questions

(a) Which one shone the brightest? Why?

(b) Which one did not light? Why?

Making an electromagnet

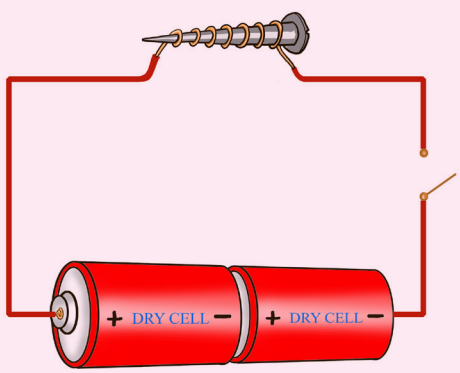
Activity 7.2 **Group activity**

What you need

1. Long copper wire
2. Dry cells
3. Long nails
4. Office pins
5. Cell holder

Procedure

1. Arrange the set-up as shown below.



2. Repeat the activity using more cells and increase the number of coils on the wire.
3. Record the observation in a table as show below.

Set-up using	How many clips does it hold	Remark on magnetism
3 cells		
6 cells		
9 cells		

Note: On the remark column indicate as strong, stronger or strongest.

4. Discuss the observations made.
5. What happens when the wire is disconnected?
6. What kind of energy transformation takes place in an electromagnet?

Learning points

- An **electromagnet** is a temporary magnet made using current electricity. It comprises of a source of electricity, wire and a nail.
- The sources of current electricity include:
  (a) dry cells
  (b) car battery
  (c) generators
  (d) bicycle dynamo
  (e) solar panels
- When the wire is connected to the source of electricity such as dry cells the energy is transformed into electrical energy.
- In the dry cells there is **chemical energy** which is transformed into **electrical energy.**
- The electrical energy flows through the wire. When it reaches the nail the electrical energy is transformed into **electromagnetic energy**. The nail is magnetised through **induction**.

- The electromagnetic energy is transformed into energy and therefore it pulls magnetic materials such as paper clips, pins and staples.
- The more the number of pins the nail can hold the stronger the magnet.
- The following flow diagram shows energy transformation in an electromagnet

  Chemical energy (in dry cells) ⟶ **Electrical energy** (in wires) ⟶ **Electromagnetic energy**(in pins/clips) ⟶ **kinetic energy** (in dry cells)

Note: The electromagnet is temporary because when the wire or the cell are disconnected the nail loses magnetism.

Further Activity

1. Investigate using the internet the uses of an electromagnet.
2. Compare your findings with the rest of the class.

FUN CORNER

1. Make an electromagnet in pairs and investigate the materials it can attract and those it cannot attract.
2. Record your findings in a table like the one shown below.

Materials attracted	Materials not attracted

Did you know

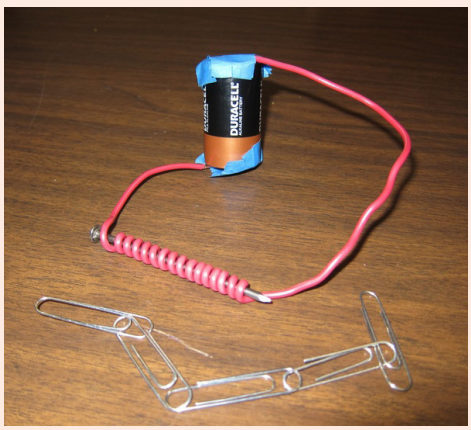
Changing the variables such as the number of cells affects the strength of an electromagnet.

Energy can be transformed from one form to another, for example, electrical to electromagnetic energy. It cannot be destroyed though.

Check you progress 7.1

1. Electromagnet is temporary. True or false
2. What happens to an electromagnet when the wire is disconnected?
3. Which form of energy is found in a dry cell?
4. (a) State the energy transformation in the electromagnet shown alongside.

   (b) Can you identify a mistake in the set-up.



5. Name any two ways in which electromagnetism can be increased.
6. Explain the term polarity.

7.2: Changing the strength of an electromagnet

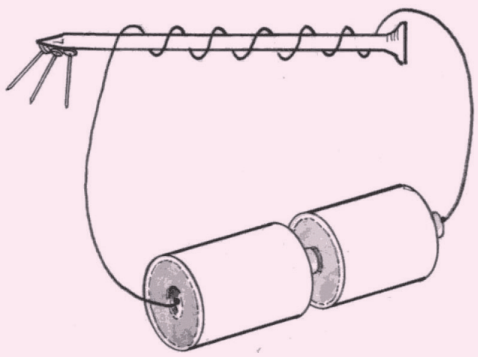
Activity 7.3 Group work

What you need

1. Dry cell
2. Wires
3. Long nails
4. Cell holders
5. Office pins/ paperclip/ staples

What to do

1. Arrange the cells in series in the cell holder.
2. Make several coils on the nail using the wire.
3. Connect the wire to the cell. One end to the positive terminal and the other one on negative terminal.
4. Place pins near the pointed end of the nail.

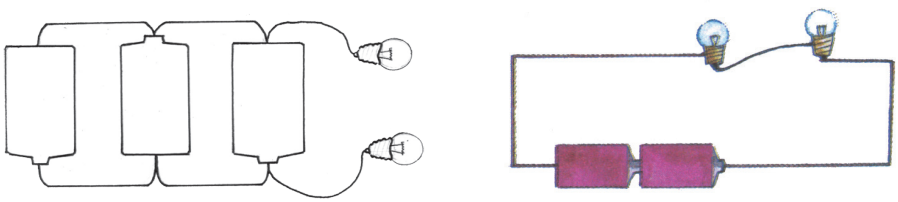


5. Record the number of pins it holds.
6. Repeat the activity by first making the following changes. One at a time:
   (a) Increase the number of cells in series.
   (b) Increase the number of coils.
   (c) Arrange the cells in parallel connection.
   (d) Reduce the number of cell.
   (e) Reduce the number of coils.
7. Record observation as shown in the table below and make conclusions.

Set-up	Observation	Conclusion
A		
B		
C		
D		
E		

Learning points

- We can know the strength of an electromagnet by observing the number of pins or clips it holds. If it holds more pins or clips it is a strong electromagnet.
- We can increase the strength of an electromagnet by:
  (a) Increasing the number of dry cells arranged in series connection. The higher the number of **cells in series** the higher the amount of voltage. For example if one cell has 1.5 volts (V) and we use 10 cells the total amount of voltage will be 15. Increasing the number of cells for example to 20 cells will increase the voltage to 30 V. 30 V will result in a stronger electromagnet than 15 V.
  (b) Increasing the number of coils. When we increase the number of coils more electrical energy is transformed into electromagnetic energy. The nail therefore becomes a stronger magnet.



(a) Parallel connection *(b) Series connection*

Fig 7.1 Circuit connections

- We can also reduce the strength of an electromagnet. An electromagnet can be made weaker by;
  (a) Arranging the cells in **parallel connection**. When cells are arranged in parallel the amount of voltage is less. In parallel connection the total amount of voltage is equal to the voltage of one cell.
  (b) Reducing the number of coils. When we reduce the number of coils the amount of electrical energy being transformed into electromagnetic energy is reduced and therefore the magnet becomes weaker.

(c) Reducing the number of cells. Using fewer cells reduces the amount of voltage and therefore the amount of electrical energy being transformed into electromagnetic energy is less.

Further Activity

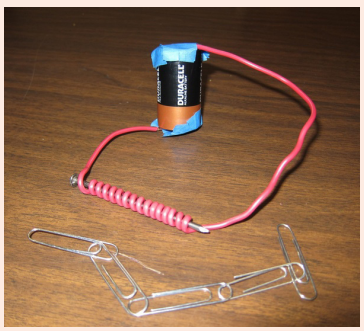
Investigate using the internet ways of changing the strength of an electromagnet.

Did you know

We can increase the strength of an electromagnet by increasing the number of cells arranged in series and increasing the number of coils.

Check your progress 7.2

1. What can be done to the electromagnet below to make it stronger?

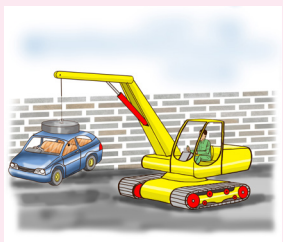


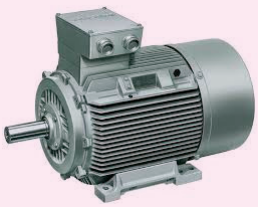
2. What would happen if the nail is replaced with a plastic?
3. A car battery can make a stronger electromagnet. True or false?
4. Show how the following can be done:
   (a) The best way of connecting cells in making of an electromagnet.
   (b) Reducing the strength of an electromagnet.
   (c) Increasing electromagnetism.
   (d) Making the nail lose its magnetism in an electromagnet.
5. Why is it advisable to arrange the cells in series than in parallel?

7.3: Application of electromagnetism

Activity 7.4 **Individual work**

Copy the table and complete it.

	Picture	Name	Use
a.			
b.			
c.			
d.			
e.			

	Picture	Name	Use
f.			
g.			
h			
i			
j			

Learning points

- Electromagnetic energy is produced using electricity.
- We use electromagnetic energy in cranes to lift loads.
- In radios, the electromagnetic energy is used to produce sound.
- The electric bells use electromagnetic energy to ring.

- Bicycle dynamo uses electromagnetic energy to produce electricity for lighting.
- Computers stores information in the hard disk using electromagnetic energy.
- Generators produces electromagnetic energy to produce electricity
- Other device that uses electromagnetic energy includes: microphone, microwaves and transformers.

FUN CORNER

Identify electromagnets used at home and in school.

Remember!

Electromagnetic energy can be controlled by changing the variables such as number of coils and cells.

Did you know

We can use electromagnetic energy to move a train!

Check your progress 7.3

1. Match the devices in column A with the information in column B. Use arrows.

	A	B
A	Computer	To lift loads
B	Crane	To produce sound
C	Television	To produce electricity
D	Radio	To store information

E	Bicycle dynamo	To direct the beam of light
F	Train	To ring
G	Electric bell	To move

2. What is the importance of electromagnetic energy in a bicycle dynamo?
3. Which form of energy makes electric bell to ring
4. Unscramble the words below. They use electromagnetic energy to function.

   (a) eancr

   (b) pcteomr

   (c) telcceri lelb

   (d) droai

South Sudan

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