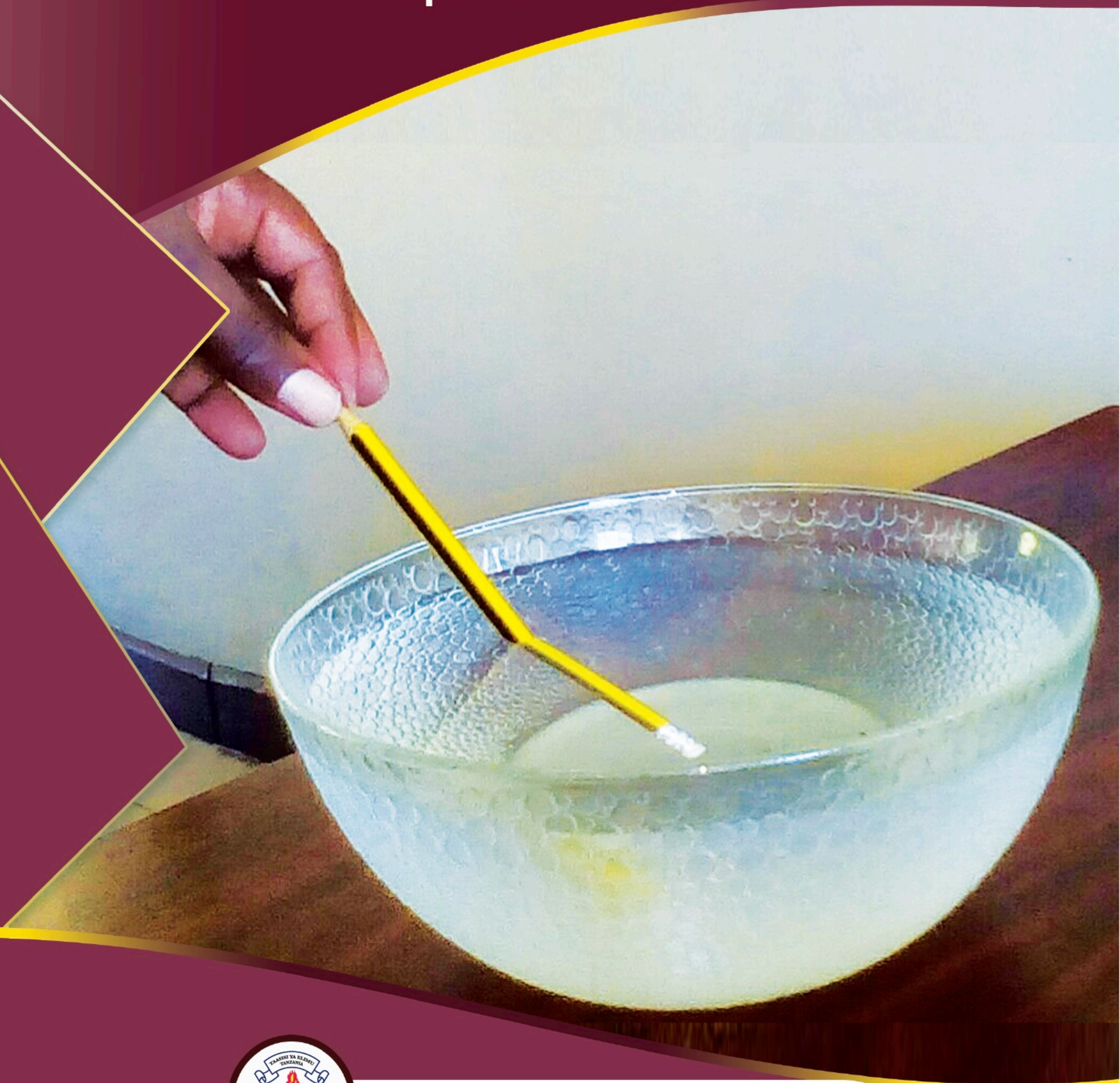


# Science and Technology

## Standard Four

### Pupil's Book



Tanzania Institute of Education



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Dr Aneth A. Komba  
Director General  
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## Introduction

This is the second book in a series of five books for Science and Technology for primary schools. The text book is prepared according to the 2016 Science and Technology Syllabus for primary schools issued by the Ministry of Education, Science and Technology. The book aims at developing pupil's competences in investigations, innovations and curiosity. It is also geared to develop creativity and the use of scientific and technological skills in day-to-day activities. The book comprises of eleven chapters that have been prepared to cater for the current subject syllabus. These chapters are Environment, Energy, Energy and its use, Water, Communication, Scientific experiments, Body immunity, Diseases, HIV and AIDS, First aid and The digestive system. The book uses illustrations and practical activities to help you in developing the required competencies. Also, the book is intended to help you in developing competencies in reading, writing and arithmetic.



# Chapter One

## Environment

### **Introduction**

*In Standard Three, you learnt about living and non-living things in the environment. In this chapter, you will learn about environmental safety and activities that threaten the safety of the environment. You will also learn about activities that maintain the safety of the environment.*

### **Meaning of environment**

Environment includes all things that surround us including living and non-living things. Examples of living things are animals and plants. The non-living things include sand, stones, air and water.

### **Safe environment**

Safe environment for living things is one that has not been polluted or affected by other environmental threats. Such environment allows living things to live and flourish. A polluted environment is not safe for living things because it affects their health and growth.

The environments that are safe for living and growth of living things include clean soil, air, and water. If the environment is polluted it becomes unsafe for living things.

Observe Figure 1, then answer the questions in Activity 1.



Figure 1: Environmental pollution

**Activity 1: Investigating the activities that threaten the environment**

1. Which activities shown in Figure 1 can threaten the safety of living things?
2. Suggest ways of preventing environmental pollution.

**Soil pollution**

Carefully read the passage below, then answer questions in Exercise 1.

One day a teacher at Kidete Primary School gave his pupils an assignment. The assignment involved investigating the activities that cause soil pollution. Pupils had exercise books, pens, and pencils for recording their findings. The teacher instructed the pupils to submit their work immediately after completion of the investigation. After submitting their work, the teacher chose one of the pupils named Shukrani and they had the following conversation:

**Teacher:** In your investigation, which activities can threaten the safety of the soil?

**Shukrani:** I discovered that there is uncontrolled burning and dumping of solid waste around the environment.

**Teacher:** Fine. What objects did you find scattered in the environment that caused soil pollution?

**Shukrani:** I saw plastic bags, plastic containers, bottles, and iron nails. Other objects were razor blades, pieces of iron sheet and broken glass. These objects were scattered everywhere in the environment. Also, I saw sewage from residential houses being drained into the soil.

**Teacher:** What effects do you think these scattered objects have on living things?

**Shukrani:** These objects affect the health of animals and plants in different ways. They also provide breeding sites for mosquitoes which cause malaria. In addition, the sewage from residential houses may facilitate the spread of diseases such as cholera and typhoid.

**Teacher:** Very good. What should be done to solve the problem?

**Shukrani:** We are supposed to clean the littered areas by collecting and keeping all the solid waste in dustbins. Then, the solid waste should be safely disposed off or burnt. We can also dig a hole in the ground and bury the solid waste which can decompose.

**Teacher:** Where can we safely burn the solid waste?

**Shukrani:** We can burn solid waste in a pit. We can also use special furnaces constructed for that purpose.

**Teacher:** Good. Burning of waste is regarded as a good method of reducing the quantity of wastes. However, it releases a variety of toxic pollutants that affect health and the environment. Therefore, it is important

to burn waste far away from residential houses. Can you mention other types of waste that can pollute the soil?

**Shukrani:** Household waste such as waste water and sewage effluent.

**Teacher:** You are right. Oil spill from vehicles and heavy machinery can also affect the soil.

**Shukrani:** Thank you teacher. I promise to be a good ambassador in protecting the environment.

**Teacher:** Thank you Shukrani. I believe that you and your fellow pupils will be good ambassadors in protecting the environment. Safe environment including soil is a suitable habitat for microorganisms that fix nitrogen and help decomposition of organic matter which is used by plants. Therefore, there is a need for conserving the soil.

### Exercise 1

Answer the following questions in your exercise book.

1. What have you learnt from the conversation between the teacher and Shukrani?
2. List activities that can cause soil pollution.
3. What are you supposed to do to keep your environment clean?
4. Describe the effects of disposing things that cannot decompose.
5. Explain what you can do at home to keep the environment safe and clean.

### Water pollution

When you observe the environment in which you live, you will find that some people throw waste in water sources. Domestic sewage, industrial and mining effluents are also released into

the water sources. Wastewater from industries, factories and mines may contain harmful and toxic chemicals. Releasing this toxic waste pollutes water bodies and the environment.

Daily human activities may pollute water sources. These activities include washing of clothes, bathing, defecating, urinating and farming near water sources or along river banks. Also when animals pass along or across rivers, ponds, wetlands and lakes can pollute the water.

Polluting water sources affects people and other living things. Polluted water can cause diseases such as typhoid and cholera. Water polluted by chemicals from industries, mining and farming activities can cause cancer.

Observe Figure 2, then answer the questions in Exercise 2.



Figure 2: Activities that pollute water sources

## Exercise 2

Answer the following questions in your exercise book.

1. Which harmful effects can be caused by the activities in Figure 2?
2. How can you avoid the activities shown in Figure 2 that pollute water?

## Air pollution

Air is a mixture of various gases that are found in the atmosphere. Air can be clean or polluted. Clean air has no pollutants harmful to health and environment. Polluted air has contaminants which are harmful to human beings, animals, plants and the environment.

Dust, bad or noxious smell, chemicals and disease causing agents can pollute air. Human activities such as burning of forests and garbage can contribute to air pollution. Air pollution can also be caused by toxic smoke from industries, factories, motor vehicles and aeroplanes.

### Exercise 3

Observe Figure 3, then identify activities that cause air pollution.

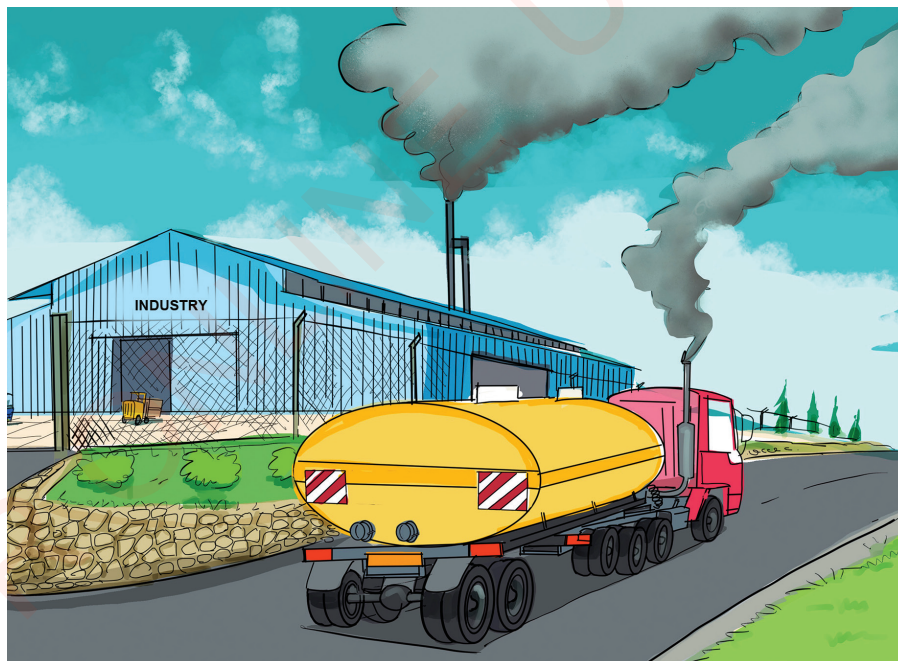


Figure 3: Some sources of air pollution

## Effects of environmental pollution

### Activity 2: *Investigating the effects of environmental pollution*

Investigate your school surroundings then list the effects of environmental pollution.

*Read carefully the following passage, then answer the questions in Exercise 4.*

One day the teacher invited an environmental expert from Mima Ward to visit the school. The aim of the visit was to explain the effects of environmental pollution. The expert explained that, the environmental pollution causes death of animals and plants. The deaths are due to either air, water or soil pollution. Also, release of wastewater from residential houses, industries, and factories to water bodies affects organisms living in it.

The expert continued saying that polluted water can be infested with disease causing organisms. Disease causing organisms in infested water can cause diseases such as cholera, typhoid and schistosomiasis.

Chemicals from industries, mining and agricultural activities can cause soil pollution. The contaminated soil affects plants and animals.

The expert also explained that cutting of trees increases the amount of carbon dioxide gas in the atmosphere. The gas is used by plants to manufacture their own food through the process of photosynthesis giving out oxygen gas which is used by human beings and other animals. Similarly, burning of forests increases the amount of carbon dioxide in the atmosphere. However, excessive carbon dioxide is harmful to the environment as it contributes to global warming.

Pupils asked the expert about the effects of smoke from industries or factories to the environment. The expert explained

that smoke from industries or factories affects human lungs and causes diseases such as lung cancer. Other diseases such as coughing and flu are also caused by air pollution.

The expert thanked the pupils for their attention and advised them to protect the environment. The teacher thanked the expert for the nice presentation which increased pupils' awareness about environmental pollution.

### Exercise 4

**Answer the following questions in your exercise book.**

1. Name diseases that can be caused by water pollution.
2. Which activities when performed in the environment may lead to the death of living organisms?
3. What can you do to keep your home environment safe and clean?
4. Explain what will happen if we do not clean and keep the environment safe.

### Protecting the environment

It is important to keep our environment clean and safe. Solid waste which can decompose and that which cannot decompose should be kept separate. Solid waste which does not decompose but can be recycled, such as pieces of glass and plastic should be taken to factories for recycling. Solid waste that can decompose such as food remains, paper, grass and leaf litter can be buried in the ground where they will decompose and form manure.

It is important to direct wastewater to established sewage systems. If there is no such system, the wastewater should be kept in special wastewater pits. When the wastewater pits are full, wastewater bowsers should collect and dispose off the wastewater in designated locations. In areas where there are no wastewater bowsers, the filled wastewater pits should be covered and replaced by new ones.

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Observe Figure 4, then answer the question in Exercise 5.



Figure 4: A pupil dumping waste in a dustbin

### Exercise 5

What have you learnt from Figure 4?

Observe Figure 5, then answer the questions in Exercise 6.



Figure 5: Pupils planting and watering tree seedlings

## Exercise 6

Answer the following questions in your exercise book.

1. List the activities in Figure 5 that are being done by pupils.
2. Explain the importance of the activities shown in Figure 5.
3. Can you do the activities shown in Figure 5 at your school?

## Cleanliness and safety of air

Observe Figure 6, then read the conversation between Neema and Musa.



**Figure 6:** A clean environment

Neema and Musa are pupils from Miembeni Primary School. One day while on their way home from the school, Neema started a conversation, as follows:

**Neema:** Why is it advised to plant trees in our environment?

**Musa:** Because trees are important to the life of living things.

**Neema:** What makes them important?

**Musa:** Trees are important because we get firewood, charcoal, oxygen, fruits and shade from them. Also, trees provide medicines, timber, and a habitat for birds, animals and insects.

**Neema:** Thank you Musa. I am pleased to know the importance of planting and keeping trees in our environment. If so, why then do some people cut trees?

**Musa:** People cut trees for various purposes. Trees are cut for firewood, charcoal and building materials.

**Neema:** If people continue cutting trees for these purposes without replacing them, what will happen?

**Musa:** Prolonged cutting of trees can cause desertification. Forest fires pollute the air by increasing the amount of carbon dioxide gas in the atmosphere.

**Neema:** Thank you Musa for your explanation. Is charcoal making the only cause of air pollution?

**Musa:** No. There are other causes of air pollution. These include dust and bad smell from sewage. Smoke from factories, poorly maintained vehicles and heavy machinery that use fuel can also cause air pollution.

**Neema:** Thank you Musa for your explanation. It is good to educate the community on how to keep air clean.

**Musa:** Exactly, the community is responsible for maintaining cleanliness and safety of the environment. People should not burn forests. It should also reduce charcoal making and use alternative clean energy sources such as gas, solar power, biogas, wind, and hydroelectric power.

### Exercise 7

Answer the following questions in your exercise book.

1. What have you learnt from the conversation between Neema and Musa?
2. Explain the effect of using poorly maintained vehicles which produce a lot of smoke.
3. What effects do charcoal making have on people?
4. Which source of energy do you use for cooking at home?
5. Describe what will happen to the environment if people continue using firewood and charcoal as sources of fuel for a long time.
6. What kind of activities can cause air pollution at your school?

### Exercise 8

Answer the following questions in your exercise book.

1. Describe the effects of disposing wastewater into water sources.
2. List human diseases which are caused by air pollution.
3. Explain the importance of planting trees.
4. What should be done to reduce the use of firewood and charcoal as fuel?
5. How can you maintain clean and safe air in your environment?
6. List the types of waste materials that can be recycled.

### Vocabulary

**Recycling** - the process of using waste material to form new products

**Fuel** - any material that is burnt to produce energy

## Chapter Two

### Energy

#### **Introduction**

*In Standard Three, you learnt about the uses and the importance of three types of energy. These types of energy were heat energy, sound energy and light energy. In this chapter, you will learn about electrical energy. You will learn about the sources, uses and importance of electricity in our daily lives. You will also learn the concept of 'optics' which includes the general properties of light energy.*

#### **Electrical energy**

The sources which generate electricity are waterfalls, sunlight, wind and fossil fuels. All these energy sources are converted into electricity using different energy conversion systems. These energy conversion systems include solar panels, wind turbines and water turbines, dynamo and fueled generators.

#### **Generating electricity using waterfalls**

Electricity generated using waterfalls is called hydro-electricity. Hydro-electricity is generated when water falls from a height to water turbines connected to an electric generator. Water turbines are devices which rotate when water falls on them, in turn the turbines generate electricity.

A hydro-electric power plant uses water stored in a dam or water reservoir. The dam is constructed in such a way that a barrier is put to collect water. Then, the water stored in the reservoir is allowed to fall on blades of a turbine connected to the shaft. The falling water on the blades of the turbine rotates the shaft which activates a generator to produce electricity.

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Hydro-electricity is generated in well-engineered locations called water dams. In Tanzania, hydro-electricity is generated at Kidatu and Kihansi in Morogoro and Mtera in Iringa. Other areas where hydro-electricity is generated are Nyumba ya Mungu in Kilimanjaro and Pangani and Hale in Tanga. Figure 1 shows a picture of water falls capable of producing hydro-electricity.

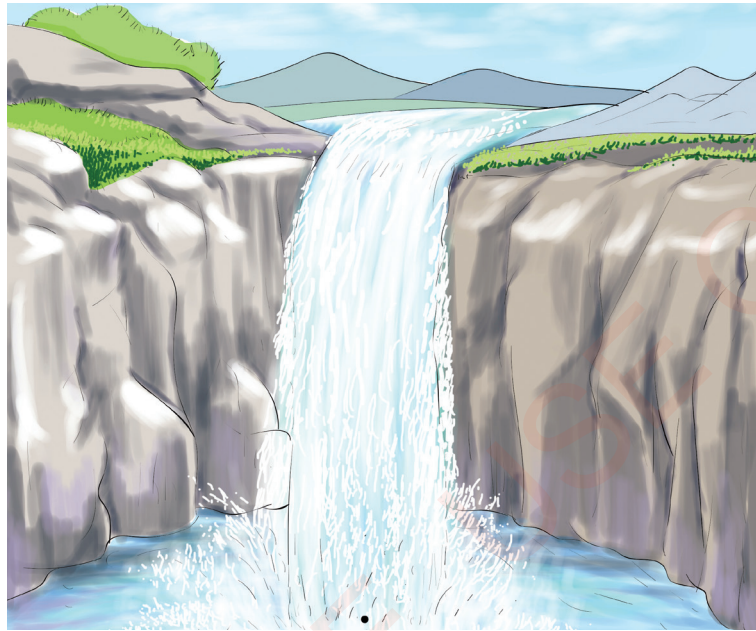
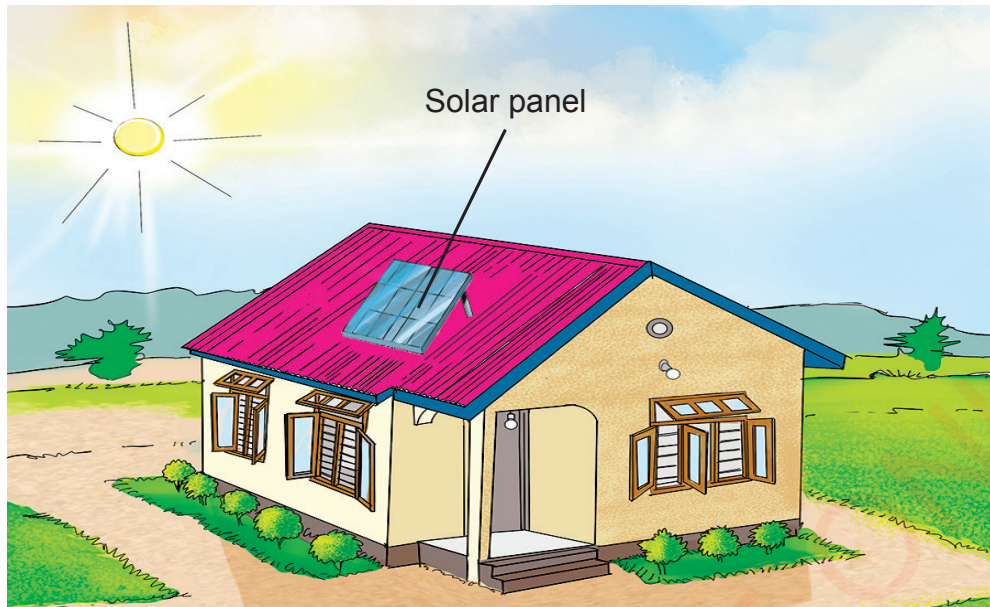


Figure 1: Waterfalls that could be used to generate electricity

### **Generating electricity using sunlight**

Electricity generated using sunlight is called solar electricity. This type of electricity is obtained from sunlight using a solar panel. The panel collects sunlight and converts it into electricity. The electricity can only be produced during the daytime, when there is sunlight. In order to use solar electricity, the solar panel is connected to energy storage systems such as batteries. Figure 2 shows the panel on the rooftop of a house.



**Figure 2:** *The solar panel on a rooftop of a house*

### **Generating electricity using wind**

This type of electricity is generated when strong wind blows on a set of blades forcing them to rotate. The blades are connected to wind turbines which are connected to an electric generator. Electricity is generated when strong wind blows on the blades which rotates turbines connected to electric generators. A place where wind electricity is generated by many wind turbines is called a wind farm.

These locations are called wind farms because the wind turbines are scattered on a large area. Some potential areas for constructing large wind farms capable of producing considerable electricity in Tanzania are Singida and Makambako. A wind turbine used to generate electricity is shown in Figure 3.

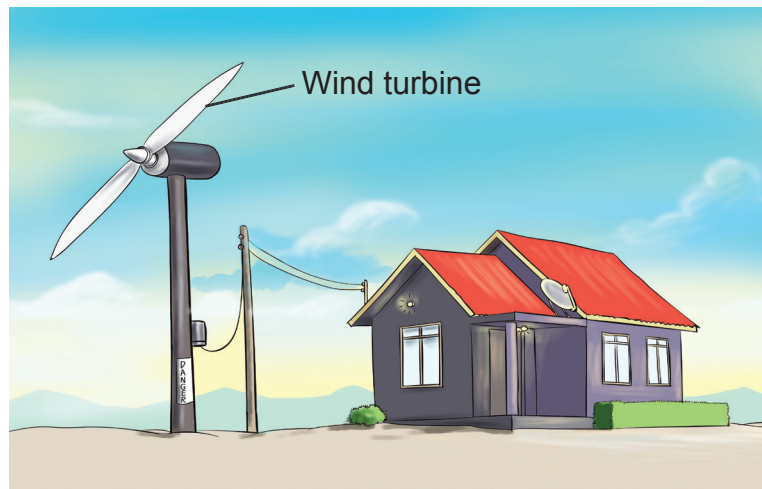


Figure 3: A wind turbine used to generate electricity

### Generating electricity using fossil fuels

Electricity can also be generated using fossil fuels. Fossil fuels include coal, natural gas, petroleum and diesel. When the fossil fuel is burned, it produces heat energy. The heat energy is then converted into electricity using electric generators. The generators can be small or large depending on the needs. Currently, they are being replaced by generators which use cheap natural gas that is abundant in Tanzania.

Examples of generators which use natural gas are found in Mtwara and at Kinyerezi in Dar es Salaam. Small electric generators such as shown in Figure 4 use petrol to generate small scale electricity. The generated small scale electricity is used in schools, homes, dispensaries, conference halls, mosques and churches.

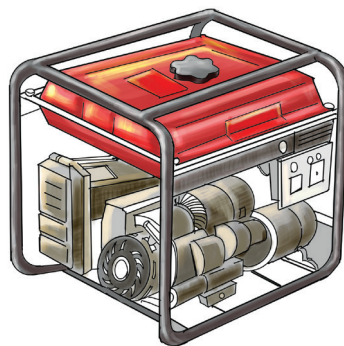


Figure 4: Small scale fuel electric generator

## Transmission and distribution of electricity

The electricity generated from different sources needs to be distributed to different places. These places include homes, industries, workshops, schools, hospitals and many others. The transmission of electricity requires special pathways. A large national scale pathway is called the power grid.

The pathways at small scale found in homes and science laboratories are called electric circuits. An electric circuit is a path through which electric current flows. It consists of the source of electricity, connecting wires or cables, switches and electrical appliances or devices. Electricity flows only if the circuit is properly connected and a switch is turned on.

**Experiment:** To investigate if dry cells can produce electricity

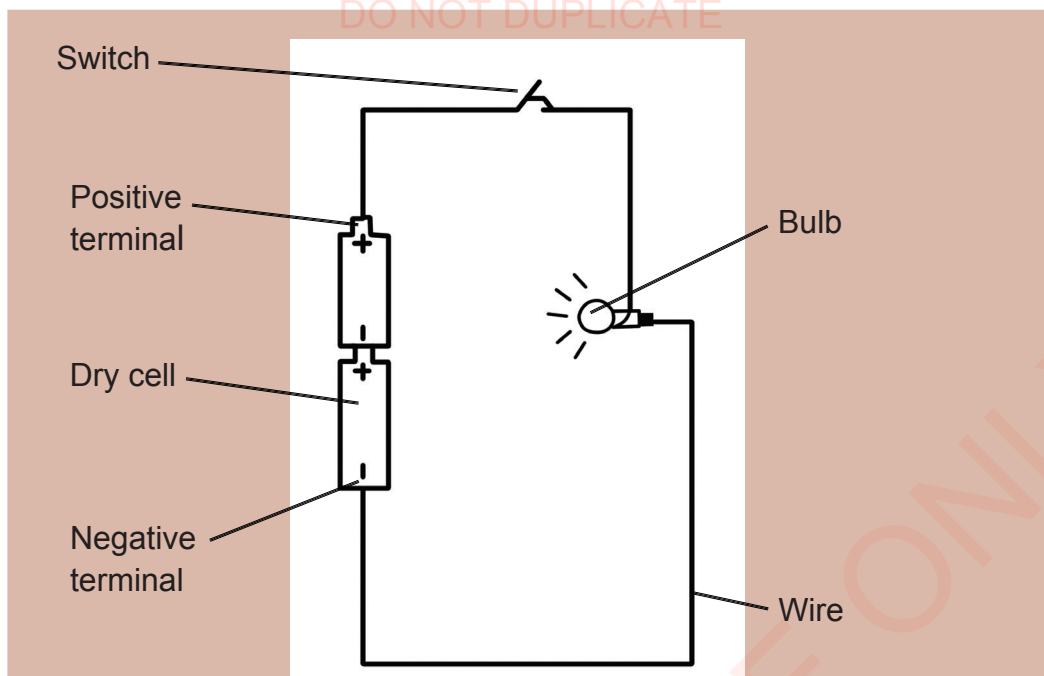
**Aim:** To show that dry cells produce electricity

**Materials:** Two dry cells, three pieces of connecting wire, switch, tape, light bulb

### Procedure

Use the following steps to complete the circuit.

1. Connect the dry cells as shown in Figure 5.
2. Using a tape connect one end of the wire to the terminal with a plus (+) sign (positive terminal) of the dry cell. Connect the other end of the wire to the switch.
3. Connect one end of another piece of wire to the second end of the switch and the other end to the middle metallic part of the bulb.
4. Connect one end of the third wire to the bottom of the bulb and the other end of that same wire to the terminal with a minus (–) sign (negative terminal) of the dry cell.
5. Turn ON the switch and then turn it off.
6. Remove all the dry cells and connect the wires without the dry cells.
7. Turn ON the switch and then off.



**Figure 5:** An electric circuit

8. Write a report of the experiment based on the following questions:
- What did you observe when you turned ON the switch?
  - What did you observe when you turned off the switch?
  - Did the bulb light when you connected the wires without the dry cells?
  - What was the source of electricity in your electric circuit?

### **Conversion of electricity into other forms of energy**

Electrical energy can be converted into other forms of energy using different devices. For example, a torch can convert electrical energy of a dry cell into light energy and heat energy. An electric heater can produce heat energy when connected to an electric socket. An electric bell converts electric energy into sound energy.



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Use Figures 6(a), 6(b) and 6(c) to answer the questions in Activity 1.



Figure 6(a)

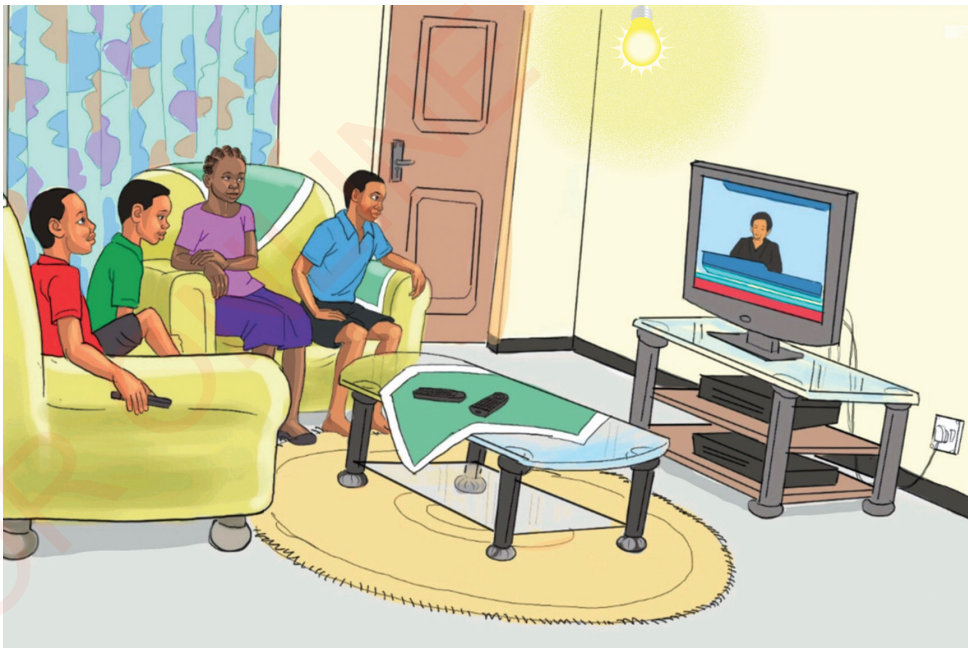


Figure 6(b)





Figure 6(c)

### Activity 1: Investigating the uses of electricity in daily life

1. Name the electric appliances shown in Figures 6(a), 6(b) and 6(c).
2. Mention the forms of energy generated by the electric appliances shown in Figures 6(a), 6(b) and 6(c).

### Uses of electricity

Read the following passage carefully, then answer questions in Exercise 1.

One day, Rehema and her friends were walking from school. On the way, they saw a big truck outside the Ward Executive Office. They also saw a group of excited youths outside the office cheering loudly. Two of the youths went and opened the door of the truck and saw many large and small boxes.

They unloaded the boxes from the truck and carried them to the office. Rehema and her friends went to the office to find out what was in the boxes. Rehema asked the officer, “What do the boxes contain?”. The officer told them that the boxes contained solar panels and associated electrical components such as batteries, electrical cables and sockets.

“The components in the boxes will be used to install a solar system in the village. Very soon, our village will start using electricity that is produced directly from sunlight”, the Ward Executive Officer told Rehema and her friends.

One week later, many people in the village had installed the solar panels on the rooftops of their houses. The people in Rehema’s village started using solar electricity for different home applications. Rehema was also very happy as she started using electricity for different applications at her home. Rehema used electricity to light her room for reading and doing her school homework at night as shown in Figure 7. She was also able to watch television and listen to the news on the radio both powered by solar electricity.



**Figure 7:** Rehema in her room reading

In addition, as shown in Figure 8, Rehema was able to iron her clothes quickly using an electric iron and report to school on time.



**Figure 8:** Rehema ironing clothes using an electric iron

One day Rehema requested her teacher if she could be given an opportunity to explain to the class how the village had benefited from solar electricity. The teacher permitted Rehema to explain the benefits of solar electricity. She said that, electric cookers use electricity for cooking. Refrigerators which are used for preserving foods and blenders for making juice also use electricity. In addition, water pumps and hair clipper machines use electricity.

The teacher further explained that electricity is also used in welding and running machines in industries, hospitals, factories, workshops and laboratories. Therefore, many people can be employed in those areas with activities that depend on electricity.

The teacher added that electricity is useful only when used with care. When used carelessly, electricity can cause damage. Electrical faults including inappropriate connections can cause

fires, explosions and even death. The pupils thanked Rehema and the teacher for the information on the uses, benefits and dangers of electricity.

### Exercise 1

Answer the following questions in your exercise book.

1. Mention the benefits of electricity as described by Rehema.
2. What are the uses of electricity as described by the teacher?
3. What was the source of electricity that was installed in Rehema's village?
4. What are the other benefits of electricity in our environment and lives?

### Exercise 2

Answer the following questions in your exercise book.

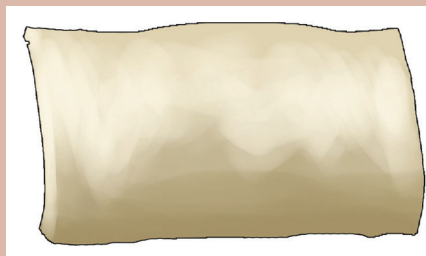
1. Mention any four sources of electricity.
2. What makes an electric bulb light when connected to dry cells?
3. Mention any four domestic appliances that use electricity.
4. Mention any three areas where electricity is used.
5. What are the possible harmful effects that can be caused by electric faults?
6. What are the benefits of using electricity in our daily life?

### Activity 2: *How to make an electric torch*

**Materials:** hard paper, two dry cells, 30 cm piece of wire, torch bulb, adhesive paper tape and a pair of scissors

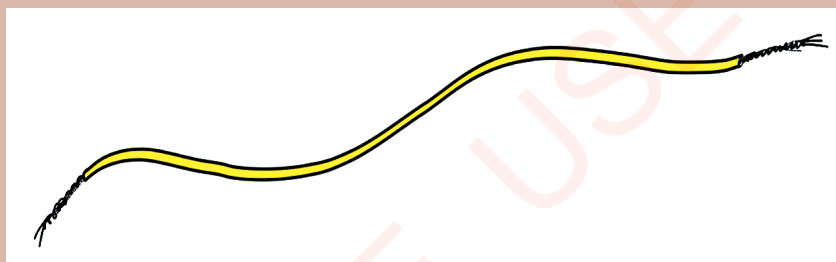
### Procedure

1. Cut a piece of hard paper (Figure 9 (a)) long enough to cover the length of two dry cells.



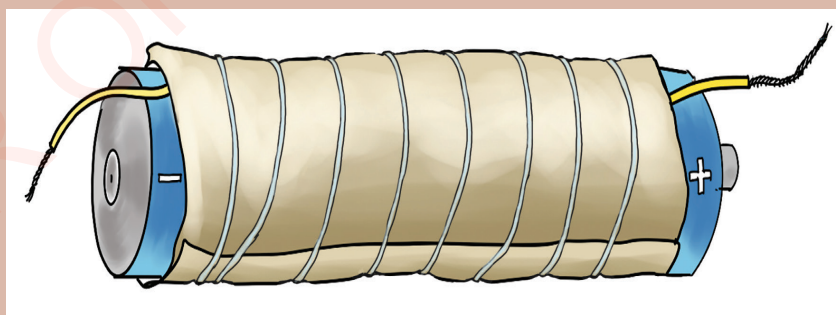
**Figure 9 (a):** Piece of hard paper

2. Cut a piece of wire (Figure 9 (b)) long enough to connect the positive and negative terminals of the two connected dry cells.



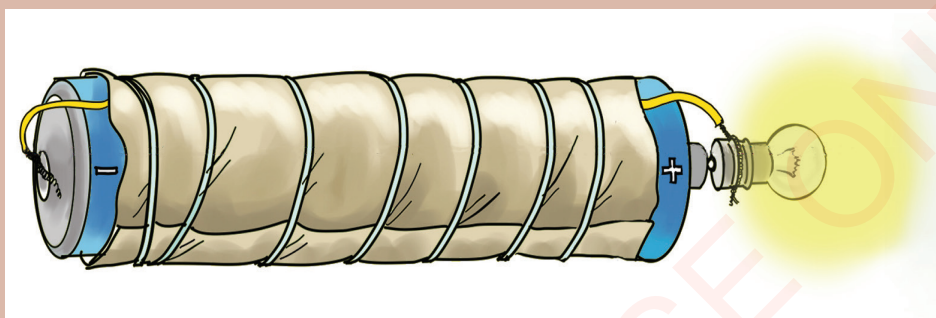
**Figure 9 (b):** Piece of wire

3. Place the piece of wire along the connected dry cells. Wrap the connected dry cells and wire with the hard paper. Secure the hard paper wrapping using an adhesive tape as shown in Figure 9 (c).



**Figure 9 (c):** Dry cells and wire wrapped with hard paper

4. Use the tape to connect the wire to the negative terminal of the connected dry cells.
5. Connect the other end of the wire to the metallic part of a bulb.
6. Connect the positive terminal of the bulb to the positive terminal of the dry cells as shown in Figure 9(d). What do you observe?



**Figure 9 (d):** *An example of an electric torch*

7. Detach the bulb from the positive part of the battery. What do you observe?

In this experiment, you have observed that the bulb gives light only when the dry cells, the wire and the bulb are properly connected. This connection causes electric charges from the dry cells to flow in the circuit. The flow of charges in the circuit is called electric current. When this current flows through the bulb, the bulb gives out light and heat energy.

### **Light energy**

Light is a form of energy which can be produced by natural sources like the sun. Light can also be produced by converting some other forms of energy. For example a torch bulb converts electrical energy into light energy. Light behaves differently when it falls on different objects. Light can be blocked or can pass through some objects.

### Transparent and opaque objects

Objects that allow light to pass through them are called transparent objects. An example of a transparent object is a piece of glass. Glass is transparent because it allows us to see objects behind it. Objects that do not allow light to pass through them are called opaque objects. Examples of opaque objects are wood, books and brick walls.

#### Exercise 3

Using Figure 10, name the objects that allow and those which do not allow light to pass through them.



Figure 10: Transparent and opaque objects

**Activity 3:** To determine the ability of different objects to block or allow light rays to pass through

**Materials:** Torch, dry cells, an empty glass, a black colored plastic cup, a white piece of cloth, eye glasses, a piece of a plane glass, table, a piece of wood, a glass full of water and a book

### Procedure

1. Insert the dry cells into the torch compartment and switch it on. Make sure it gives out light.
2. Enter a dark room with the torch switched on and arrange all the available materials on top of the table.
3. Illuminate the book with the light and observe if the book blocks or allows light to pass through.
4. Repeat step number 3 for all the objects on the table.
5. Use the following questions to write down the results of the experiment.
  - (a) Which objects allowed light rays to pass through?
  - (b) Which objects did not allow light rays to pass through?
  - (c) What did you observe when the light rays fell on the surface of each object?

### Properties of light

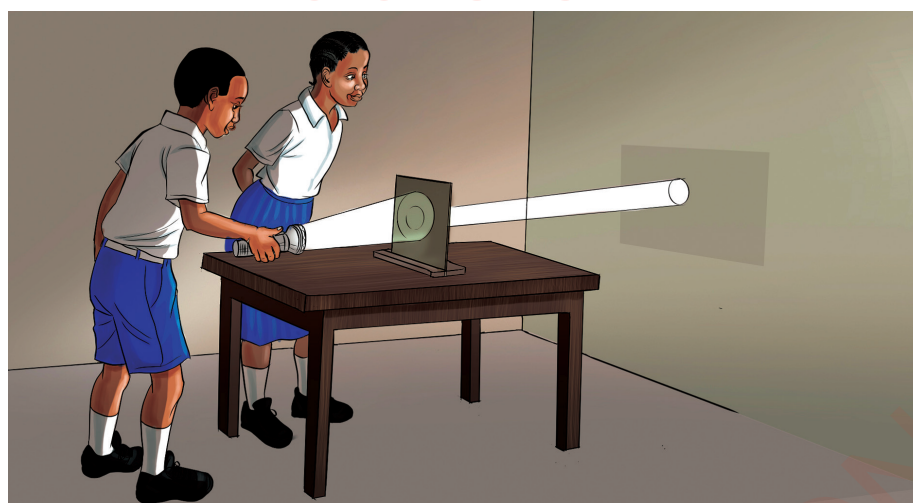
Light travels in a straight line.

#### Activity 4: To observe how light travel

**Materials:** torch, dry cells, table and hard paper

#### Procedure

1. Make a small hole on hard paper and place the hard paper on the table at a distance from a wall.  
Note: Ensure the hole is small.
2. Stand in such a way that the hard paper with a hole is between you and the wall as shown in Figure 11.
3. Illuminate the hard paper containing the hole using the torch light.



**Figure 11:** Observation on how light travels in a straight line

In Figure 11, the hard paper blocked light rays and produced a shadow on the wall. The part with the hole did not block light rays. The hole allowed the light rays to pass through straight to the wall. This shows that light travels in a straight line. When light meets different media, it shows different properties such as formation of shadows, reflection and bending.

### **Formation of shadows**

A shadow is produced when an object blocks the path of light rays. The shapes of shadows resemble the shapes of objects blocking the light rays.

*Read the following passage carefully, then answer questions in Exercise 4.*

Mwajuma and her friends are in standard four at Shaurimoyo Primary School. One day the teacher taught them about the properties of light. He told them that one of the properties of light is that it travels in a straight line. When light falls on opaque objects, it is blocked and produces a shadow.

The teacher instructed the pupils to carry out an activity to help them observe what happens when light is blocked. He said, “tomorrow morning, stand in an open place with the sun shining on your back

and observe what happens in front of you. Again, with the sun shining on your back, take a ball and stretch sideways the hand with the ball and observe what you see on the ground.”

The next morning when there was sunshine, Mwajuma and her friends went to the school playground in order to carry out the experiment. The pupils stood as instructed by the teacher and saw dark shapes as shown in Figure 12. They noted down what they saw and returned to the classroom.



**Figure 12:** *Observing shadows during the day*

The teacher came into the classroom and asked them to explain their observations. Kalunde said, “In front of me, I saw a dark shape on the ground.” Mwajuma added, “I saw a shape which resembles my own body.” Another pupil said, “I saw my own shape along with the shape of the ball I was holding in my right hand.”

Then, the teacher said, “What you saw on the ground are called shadows.” Shadows are formed when light is blocked with opaque objects. They are produced when light is blocked from travelling in a straight line. The teacher explained further, “Shadows change direction and size depending on the location of the light source.” Mwajuma and other pupils enjoyed the lesson because they understood how shadows are produced.

### Exercise 4

Answer the following questions in your exercise book.

1. What did the teacher ask the pupils to investigate?
2. What results did Kalunde and Mwajuma report after the observation?
3. Explain how a shadow is produced?
4. Can a shadow appear in a dark room? Explain.

### Activity 5: *To observe how shadows are produced*

**Materials:** A cup, a book, a chair and a table

#### Procedures

1. Take a cup and a book and expose them to sunlight.  
What do you observe?
2. Place the table and the chair outside in the sunlight.
3. Look under the table and the chair. What do you observe?

### Reflection of light rays

Reflection of light refers to an act of light rays bouncing back off shiny surfaces or substances. The reflection of light rays results into the formation of an image. An example of an object with a shiny surface is a mirror, such as shown in Figure 13.



Figure 13: Formation of an image on a plane mirror

### Exercise 5

Explain how an image is formed on a plane mirror.

### Activity 6: Investigation on the reflection of light rays

**Materials:** A plane mirror, a table and a pen

#### Procedure

1. Place a plane mirror upright on a table.
2. Place a pen in front of the plane mirror and look at the mirror.
3. Write down what you observe in steps 1 and 2.
4. Explain the results of the experiment.

When light rays fall on smooth surfaces, they are reflected. Reflection of light produces images on shiny smooth surfaces.

## Bending of light rays

Light rays bend when they pass from one transparent medium into another transparent medium. For example, light rays bend when moving from air to water. In reality, we do not observe bending of light rays but we observe its outcome.

### Activity 7: Investigation of bending of light rays

**Materials:** A beaker or transparent bowl, clear water and a pencil

#### Procedure

1. Hold a pencil with part of it inside an empty transparent bowl as shown in Figure 14.
2. Observe how the pencil appears.
3. Pour clean water into the bowl until it is full as shown in Figure 14.
4. Again, observe the appearance of the pencil immersed inside the bowl containing water.

What is the difference between the appearances of the pencil before and after pouring water into the bowl or beaker?



**Figure 14:** A pencil immersed in water to show the effect of bending of light rays

When a light ray passes from air into water, it bends. This bending is caused by the different properties of air and water. The effects of bending of light rays were demonstrated by the bending of a part of the pencil which was inside the transparent bowl with water.

### Exercise 6

Answer the following questions in your exercise book.

1. What happens when light rays pass from one medium to another medium of different properties?
2. Why are images formed by plane mirrors?
3. What are the differences between surfaces that reflect light and surfaces that do not reflect light?
4. Explain how shadows are formed

### Exercise 7

Match the items in column A with phrases from column B to make a meaningful sentence.

Column A	Column B
1. Shadow	(a) Bouncing back of light rays on a shiny surface or substance.
2. Bending	(b) The moon and the star.
3. Straight line	(c) Dark shape that occurs when light hits an opaque object.
4. Two different transparent media	(d) Enable light to travel easily.
5. The sun	(e) One of the properties of light.
6. Reflection	(f) The way in which light rays travel.
7. Image	(g) Results of light reflection or refraction.
	(h) Causes light to bend.
	(i) Natural source of light.



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## Vocabulary

- Reflection** - bouncing or change of direction of light by a smooth shining surface
- Transparent** - object or substance that permits light rays to pass through it
- Electron** - a negatively charged particle
- Fault** - wrong, incorrect or damaged, not working properly or not made correctly
- Media** - solid, liquid or gas substances or materials through which light travels
- Solar panel** - device for converting sunlight energy to electricity
- Image** - picture or shape that appears in smooth shining surfaces such as mirrors.



## Chapter Three

### Energy and its use

#### **Introduction**

*In chapter two, you learnt about electrical and light energy, and you did various experiments related to these. In this chapter, you will learn different electrical and non-electrical equipment that are used for cooking and storage of food. The devices which you will learn about are refrigerators and cooking stoves.*

#### **Refrigerators**

A refrigerator is an appliance which preserves different stuffs like food by cooling. A refrigerator uses electricity to operate.

#### **Importance of a refrigerator**

Food is kept in a refrigerator to keep it fresh for a long period of time while preserving its taste and nutritional values. It also saves time as there is no need for shopping for food stuffs every day. In hospitals and pharmacies, refrigerators are used to store medicines for similar reasons. Medicines are kept at low temperatures to retain their effectiveness. Refrigerators are more important in areas with hot climate than those with cold climate. In days with high temperatures, people sell soft drinks preserved in refrigerators to earn money.

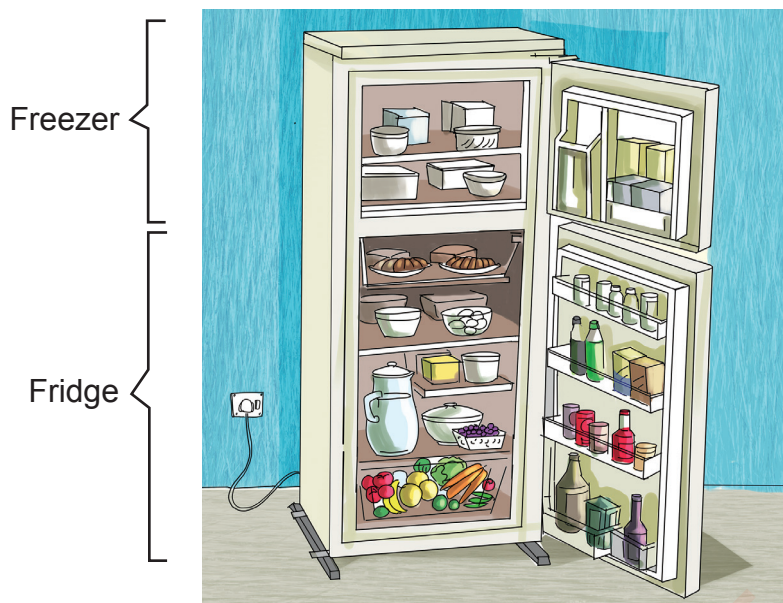


Figure 1: A refrigerator showing different stored foods

## Parts of Refrigerator

Refrigerator for foods preservation has two parts, kept at different temperatures. The first part freezes foods and the second keeps foods cold, see Figure 1. It is important to identify which foods require freezing and which foods need to be kept cold in a refrigerator.

### The freezer

The part of the refrigerator which freezes food items is called the freezer. In some refrigerators, the freezer is the upper compartment while in others it is the bottom compartment. Anything kept in this part will eventually freeze. This part is used to store food that is to be preserved for longer time like meat, fish and milk. Fresh seeds like peas or beans and other types of food stuffs that may spoil when kept under normal temperature should also be stored in the freezer.

### The fridge

The compartment of the refrigerator which does not freeze is called the fridge. This part normally has several partitions. In most refrigerators, the temperature in this compartment is below

5 degrees centigrade. This compartment is therefore used to store foods like cooked rice, fresh or cooked vegetables, fruits and drinks.

As shown in Figure 1, the door of the refrigerator has some partitions used for storing drinks and medicines. Foods that spoils quickly are not kept in the door of the refrigerator because the door does not have a cooling mechanism.

### **How to use a refrigerator**

It is very important to use a refrigerator appropriately so that it lasts long. Every new refrigerator has a manual which instructs users how to use it. Reading and understanding the manual allows proper use of the refrigerator.

The following are some of the important precautions to be taken when using a refrigerator:

1. *Avoid to keep hot foods in refrigerators.*

Putting hot food in a refrigerator will result into an increase of its temperature to more than the desired 5 degrees centigrade. Increased temperature favours the production of microorganisms like bacteria which may spoil foods stored in the refrigerator.

2. *Do not switch ON and off the refrigerator frequently.*

This is because doing so slows down the ability of the appliance to perform its functions.

3. *Clean the refrigerator.*

Before cleaning the refrigerator, make sure that it is switched off. Clean the compartments using water and soap. Do not use any scratching material to clean the refrigerator. Once cleaned, dry it using a piece of soft cloth. You are also advised to clean any food that falls from its storage part before it sticks to the walls of the refrigerator.

4. *Place similar types of food in the same compartment.*

You are advised to pack vegetables and fruits in appropriate bags before storing them in the refrigerator. Do not use glass containers to store food in the freezer because glass can easily break and contaminate food. Not every food should be stored in a refrigerator. Food such as flour, uncooked rice and onions should be stored in a clean and dry safe place and not in a refrigerator.

5. *Close the door of a refrigerator properly.*

Ensure the door of the refrigerator is properly closed to prevent exchange of air between the refrigerator and the outside.

**Activity 1: Switching ON and using a refrigerator**

**Materials:** water, refrigerator, thermometer and power supply

**Procedure**

1. Connect the refrigerator to the power supply and switch it ON.
2. Pour water in a bottle and measure its temperature using a thermometer.
3. Put the bottle of water in the proper part of the refrigerator and then close the door.
4. After 30 minutes take out the bottle of water and measure the temperature of the water.
5. Compare the temperature readings at step 2 and step 4. What do you observe?

### Activity 2: Constructing and using a refrigerator model

**Materials:** Boxes, paper glue, wood glue, pair of scissors, knife, pieces of wood, rope, plastic bags, model of bottles of drinks, fruits, groundnuts, food models like fish, beef, ugali, vegetables and fruits



Figure 2: A model of a refrigerator

#### Procedure

1. Make a model of a refrigerator as shown in Figure 2.
2. Prepare food models of fish, meat, ugali, vegetables, fruits and a bottle for drinking water.
3. Place the food models properly in the right compartments of the refrigerator.
4. Explain how you placed the food models in their respective sections of a refrigerator.

#### Exercise 1

Answer the following questions in your exercise book.

1. List three advantages of using a refrigerator.
2. List five important precautions that you should take when using a refrigerator.

3. Name three types of food that can be kept in the non-freezing part of the refrigerator.
4. What steps should you follow when cleaning a refrigerator?
5. Match the food types in the table below to the proper parts they can be stored in the refrigerator by putting a tick (✓).

Type of food	Fridge	Freezer
Meat		
Green peas		
Ripe bananas		
Cooked rice		
Milk		
Avocado		
Fresh fish		

### Cooking stoves

Cooking stoves are classified according to the type of energy source used. Energy sources used include firewood, kerosene, charcoal, gas and electricity. Cooking stoves are important because they are used for cooking food and boiling water. For example, when you have flour, water and sugar you cannot get porridge without a cooking stove. Our communities use different types of stoves for cooking depending on the availability and cost of energy sources.

### Types of cooking stoves commonly used in our communities

Most stoves in Tanzanian communities use firewood and charcoal as source of energy. However, excessive use of firewood and charcoal requires cutting trees which results into environmental degradation. The use of charcoal and firewood produces smoke that leads to indoor air pollution. Other stoves use kerosene, gas

or electricity. These stoves reduce environmental pollution but their sources of energy are more expensive.

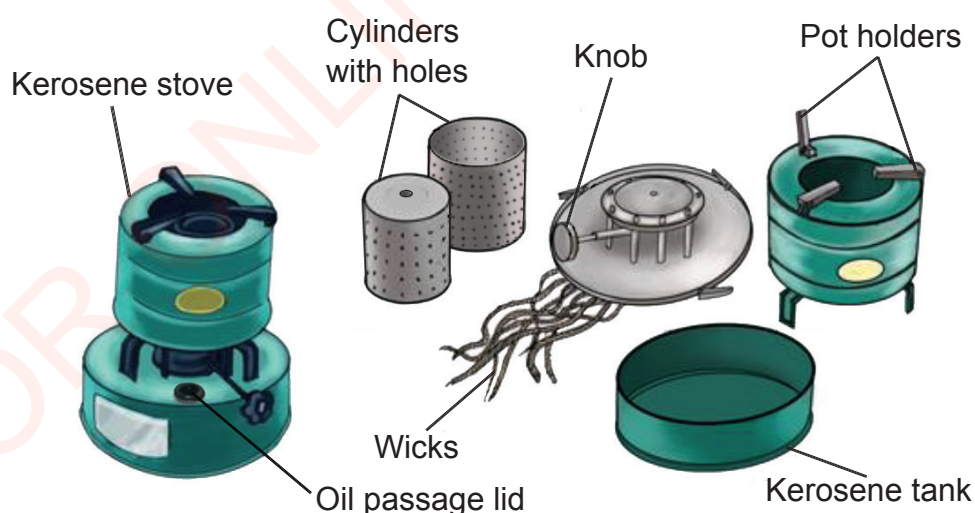
### **Kerosene stove**

A kerosene stove uses kerosene as a source of energy to produce flame. There are two types of kerosene stoves. The first uses a wick and the second uses pressure.

### **Parts of a wick kerosene stove**

The kerosene stove shown in Figure 3 is made of painted metal to prevent rusting and to make it attractive. It has a device with several wicks connected to a round knob. The knob can move the wicks up and down, when rotated clockwise or anticlockwise.

The device is fixed on top of a tank which stores kerosene and forms the base of the stove. The stove has two cylinders both with holes on their sides. The small cylinder has a small hole on its top. The small cylinder is placed inside the circle made by the wicks and the other cylinder is placed outside this circle. The outer cylinder confines the flame to the bottom of the pot on the stove. The holes in the cylinders allow air circulation to produce a clear flame (i.e. without soot). Both cylinders are enclosed in a cover that forms the outer part of the stove with three or more pot holders.



**Figure 3:** Parts of a wick kerosene stove

### How to use a wick kerosene stove

When using wick kerosene stove, make sure it has enough kerosene. It is very dangerous to add kerosene when the stove is on, because the stove may explode. In addition, do not put off the stove by blowing on it or by using water. Putting off the stove by blowing or using water produces smoke which is harmful to human health. To put off the stove, lower the wicks by rotating the knob anticlockwise slowly until the flame is off.

Wick stoves produce a flame with smoke when the wicks are dirty or too few. Smoke may also be produced when the parts of the stove are not assembled correctly. Smoke often produces soot on the cooking pan or pots. Wick stoves can also produce high levels of pollutants which can significantly contribute to indoor air pollution and are harmful to human health. Therefore, it is important to use the kerosene stove correctly to prevent possible effects that can result from improper use. When correctly assembled, the wick stove produces a blue flame.

#### Activity 3: Using a wick kerosene stove

**Materials:** kerosene stove with wick, kerosene, match box and cooking pan with water

#### Procedure

1. Take a kerosene stove and fill the tank with kerosene.
2. Close the oil passage lid of the tank.
3. Remove the cover and the cylinders.
4. Rotate the knob clockwise for the wicks to go up, then light the wicks one by one.
5. Return the cylinders and the cover.
6. Allow the wicks to burn for some time until they produce a blue flame.
7. Place a cooking pan with water on the stove.
8. Leave the water to boil then put off the stove by rotating the knob anti clockwise to lower the wicks.

### **Taking care of a kerosene stove**

After using the stove, wipe the burnt part of the wick with paper tissue. Use a piece of cloth to clean the outer and inner parts of the stove. A stove must be cleaned immediately after use. Keep the stove in a safe and dry place to avoid contact with water. Water may cause rust which can damage your stove.

### **A pressurized kerosene stove**

A pressurized stove is shown in Figure 4. The stove has a kerosene tank, pump, vapour burner, nozzle and a pot holder. Vaporized kerosene from the tank passes under pressure through a nozzle where it mixes with air. When this mixture is lit, it forms flames used for cooking food or boiling water. The vapour flow is controlled by adjusting a valve. This type of stove has a special tool for unblocking the fuel nozzle. The stove can explode if used without proper kerosene. Pressurized kerosene stoves are no longer in the market because they are not that safe.



**Figure 4:** *A pressurized kerosene stove*

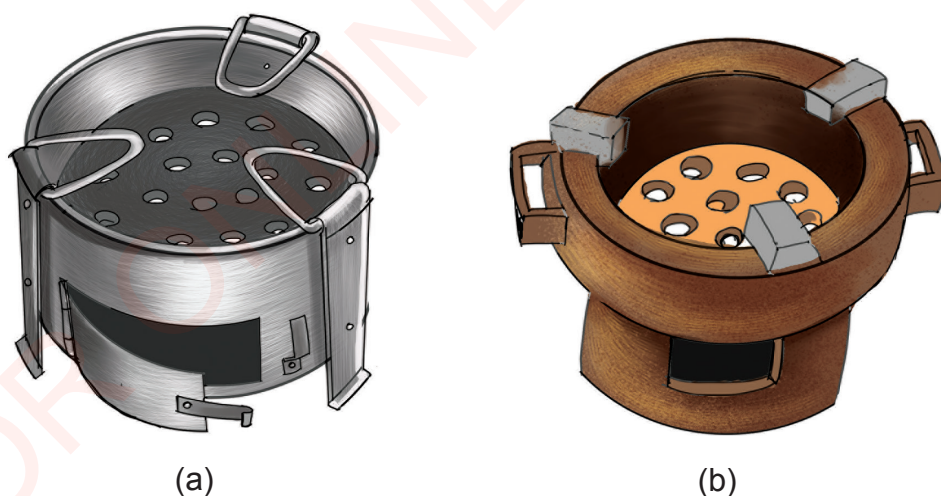
## Charcoal stove

There are two types of stoves that use charcoal as a source of energy. These are metal and clay stoves (see Figure 5). The stoves made from clay use less charcoal than those made from metal. This is so because stoves made of clay preserve more heat compared to those made of metal, which have more heat losses. Therefore, stoves made of clay have more heat available for cooking food than metal stoves.

### Parts of a charcoal stove

Charcoal stoves have two main parts. First, there is the upper part where charcoal is allowed to burn. Second, there is the lower part where ash collects. The base of the upper part has several holes. The holes allow ash to drop to the ash-storage chamber. The lower part has a small door used to take out ash (see Figure 5).

The door and the holes are also used to pass oxygen needed for charcoal burning. When ash is left to accumulate it may block air passage, thereby slowing down the charcoal burning process. The top part of the stove has three or four pot holders.



**Figure 5:** Types of charcoal (a) metal stove and (b) clay stove

### Using a charcoal stove

When using a charcoal stove, fill the charcoal to the level of the pot holder. Put the stove in an open space where there is adequate air circulation. Avoid using a charcoal stove inside the house when the doors and windows are closed. Burning charcoal in limited oxygen supply produces carbon monoxide gas. This gas, when inhaled, reduces the ability of blood to transport oxygen and therefore can cause death. The door of the charcoal stove should be kept open when cooking. The door should be closed in case you need to cook with low heat.

### Taking care of a charcoal stove

#### Activity 4: *Cleaning a metal charcoal stove*

**Materials:** Metal charcoal stove, soap, two pieces of cloth, warm water

#### Procedure

1. Remove ash from the charcoal stove as shown in Figure 6.
2. Take a piece of cloth, dip it in warm water, apply soap and squeeze.
3. Use the piece of cloth to clean the outer part of the stove.
4. Rinse the piece of cloth, squeeze to drain out water and clean the stove again.
5. Take a dry clean piece of cloth and dry the stove.
6. Keep the stove in a dry and safe place.



**Figure 6:** A child removing ash from a charcoal stove

It is recommended to clean the stove frequently to prolong its life. To avoid being burnt, make sure the stove is sufficiently cold before cleaning. After cleaning, make sure the stove is dry before you put it in storage.

### **Gas stove**

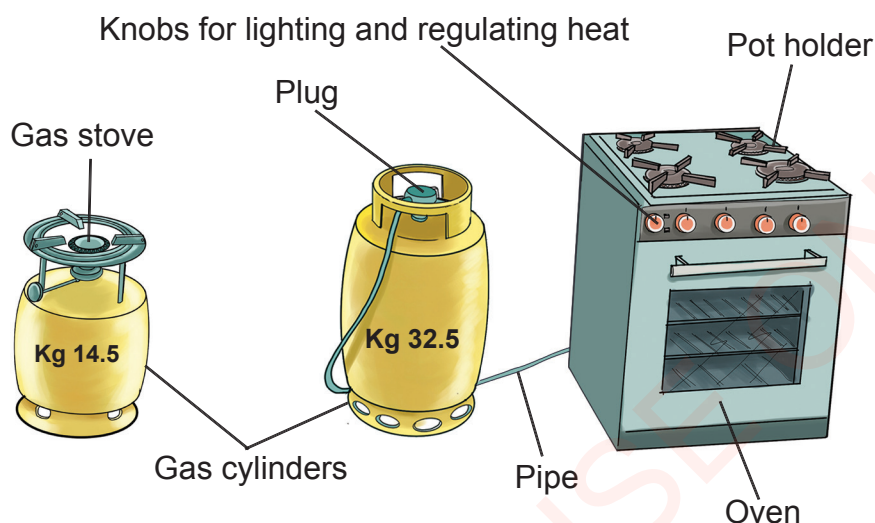
A gas stove uses gas as a source of energy. Some of the gas stoves have an oven which is used for baking and grilling. The gas that is used in a gas stove is stored in a gas storage tank known as a gas cylinder. When a stove is lit, gas burns and produces flames used for cooking.

### **Parts of a gas stove**

A gas stove is made of painted metal to prevent it from rusting. As shown in Figure 7, a gas stove is either directly connected to the gas cylinder (a) or separated from the gas cylinder (b). When the gas cylinder is separated from the stove, the gas is

supplied to the stove through a pipe. The pipe has a plug valve that allows or prevents gas flow.

The gas stove also has a pot support or holder on top and knobs for lighting and regulating the amount of heat.



(a) Gas stove attached to the gas cylinder

(b) Gas stove with oven Connected to the gas cylinder

**Figure 7: Types of gas stoves**

### Using a gas stove

When using a small gas stove without an oven and which has a separate gas cylinder, put the stove on the table and the gas cylinder beside the table as shown in Figure 8. Do not put the gas cylinder under the table on which the stove is placed while cooking. Keep the kitchen windows open to allow free flow of air. Do not keep cans containing insecticides, body sprays, perfumes or spirit close to cooking stoves, since they may explode. Make sure you have prepared all that you need for cooking before you light the stove.

Gas stoves differ in the way they are lit. Some use a normal match stick while others use an ignition switch connected to the stove.

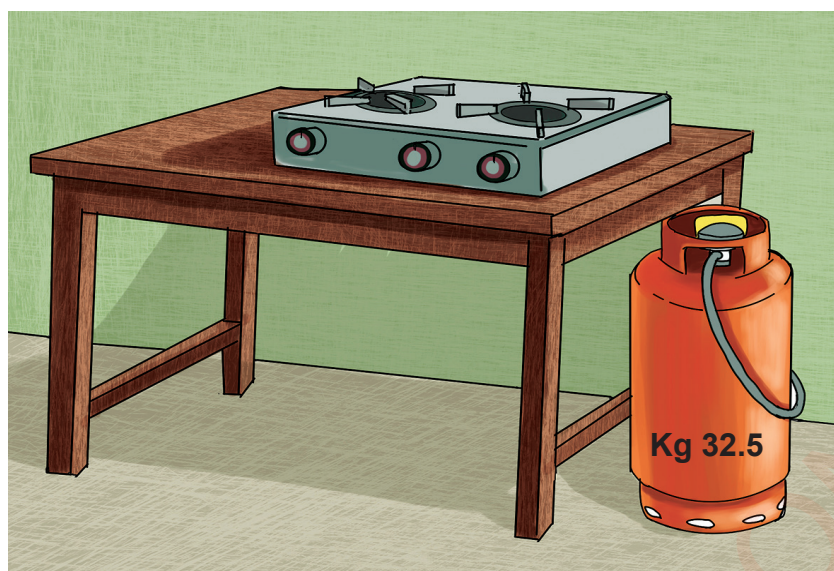


Figure 8: A gas stove without an oven

### Steps to follow when using a gas stove connected to a gas cylinder

1. Open the plug valve of a gas cylinder to allow passage of gas to the stove.
2. Light a match and then turn ON the stove by pressing and turning the knob clockwise.
3. Put off the stove after use.
4. When the stove is off, close the plug valve of the gas cylinder.

### Taking care of a gas stove

#### Activity 5: *Cleaning a gas stove*

**Materials:** water, soap and two soft pieces of cloth

#### Procedure

1. Clean the stove using a wet piece of cloth. Before cleaning make sure the stove is not hot.
2. Remove all food droppings from the cooker or stove using a wet piece of cloth soaked in a soap solution.

3. Dry the stove using a clean and dry piece of cloth.

### Electric stove

An electric stove is a heating device which uses electricity to produce heat for cooking. Electric stoves are of different types; some stoves have ovens and others do not. A stove with an oven is shown in Figure 9.

### Parts of an electric stove

The top part of an electric stove has a plate or coil used for placing the cooking pot. The plate or coil gets electricity using a cable connected to a power source or socket. It also has knobs for switching the power on and off.

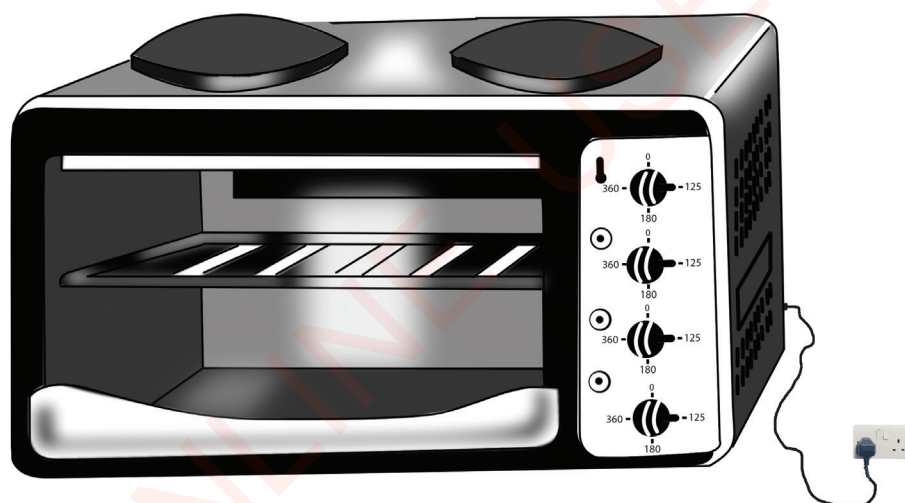


Figure 9: An electric stove

### Use and care of an electric stove

When using an electric stove, ensure that no electrical wire is damaged. This will prevent electric shock if you accidentally come into contact with the wire. Your hands should be dry when inserting the plug into the socket of power supply to avoid electric shock in case the plug and socket are not properly connected. This is because water is a good conductor of electricity. Make sure you wear sandals or shoes with plastic soles when cooking

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using an electric stove. The plastic soles reduce electric effects on people in case of electric shock. The soles act as insulators. Connect your electric stove in a socket with a capacity which matches your stove. Switch ON the socket switch and rotate the knob on the stove to turn ON the stove. Put a cooking pan on the stove.

Do not leave the stove switched ON without a cooking pot on it. Leaving a hot plate unattended leads to loss of electrical energy. After you have finished cooking, turn cooker off before removing the cooking pot.

Disconnect the stove from the socket. Take care that the stove has sufficiently cooled before you start cleaning it. Clean the stove by wiping with a clean piece of cloth, water and soap. Keep the stove in a safe place. If the stove has a lid, cover the stove with the lid after cleaning. Check that the stove is dry before you start using it again.

If a spill occurs when you are cooking, clean it immediately while it is still wet to prevent difficulties in cleaning the stove later when it has dried. Do not allow spills to remain on the cooking area for a long period of time. Do not use abrasive cleaning powders or scouring pads because they may scratch the cooker top.

### **General safety precautions when cooking**

1. Use pot holders to handle hot pans or pots to prevent burning.
2. Do not let children cook without adult supervision.
3. Avoid loose clothes or leaving kitchen towels near hot areas. They can catch fire.
4. Do not use metal spoons to stir food while cooking. Metal spoons heat up quickly and can burn your hands.
5. Always wear shoes when cooking using an electric stove.
6. Prepare all food ingredients before turning ON the stove.
7. Do not leave food on a turned ON stove when you are not in.

8. Turn off the electric switch after using an electric stove.
9. Turn off the gas supply when you finish using the gas stove.

### Exercise 2

Write '**TRUE**' for a correct statement and '**FALSE**' for a wrong statement.

1. Charcoal stoves may use kerosene instead of charcoal. \_\_\_\_\_
2. An electric stove burns more efficiently when its flame is blue. \_\_\_\_\_
3. Charcoal is in a solid state. \_\_\_\_\_
4. All types of stoves need to be cleaned after cooking. \_\_\_\_\_
5. A cooking pan is placed on a plate when cooking using an electric stove. \_\_\_\_\_
6. When cooking on an electric stove, you should remove the cooking pan before putting off the socket switch. \_\_\_\_\_
7. You can start cleaning an electric stove even before it has cooled down. \_\_\_\_\_
8. It is important to dry the stove after cleaning. \_\_\_\_\_
9. If not used properly, a gas stove may explode. \_\_\_\_\_
10. A charcoal stove has a wire to connect it to a socket. \_\_\_\_\_

### Exercise 3

Answer the following questions in your exercise book.

1. Describe the difference between parts of a gas stove and those of an electric stove.
2. Explain steps to be followed when cleaning a charcoal stove.
3. Explain the importance of taking care of stoves.
4. How does taking care of an electric stove differ from that of a gas stove?
5. Why is it advisable to light a match before turning ON a gas knob?
6. List two precautions to be taken when using a charcoal stove.
7. Mention possible effects of adding kerosene to a kerosene stove when it is on.
8. Explain how to use a kerosene stove for cooking.

### Vocabulary

- Gas cylinder** - a strong metal case used to store gas
- Nozzle** - a narrow piece that is attached to the end of a pipe or tube to direct a stream of liquid, air or gas to pass through
- Sole** - the bottom surface of the shoe
- Oven** - a chamber of a cooker or stove with a door in front, in which food is cooked or heated
- Rust** - a reddish brown substance that is formed on some metals by the action of water and air

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## Chapter Four

### Water

#### Introduction

In Standard Three, you learnt about three states of matter. Those states of matter are solid, liquid, and gas. Water is a good example of matter which can change from one state to another. In this chapter, you will learn about the three states of water, their properties, and uses.

#### The three states of water

Water can exist in three states which are solid, liquid and gas.

#### Activity 1: Observation of occurrence of three states of water

**Materials:** A pot and its metallic lid with a handle, ice, a stove or any other source of heat

#### Procedure

1. Put ice in a clean pot.
2. Turn ON the stove then put the pot with ice on it. Observe carefully what happens.
3. Continue heating the pot for a while until the ice melts. Explain what you have observed.
4. Use the metallic lid to cover the pot with melted ice. Remove the lid when the water boils as seen in Figure 1. What do you observe?



Figure1: Vapour escaping from boiled water as the lid is opened

**Results:** Mention the states of water shown in procedure 1, 3 and 4.

The three states of water are solid, liquid and gas. In a solid state, water exists as ice. When temperature is raised, the ice melts. The resulting state of water is called liquid. When the temperature increases, water boils and gives out steam. This steam, which is water in gaseous state, is called vapour.

### Properties of the three states of water

#### **Activity 2 (a):** *Investigation of the properties of water in the solid state*

**Materials:** Blocks of ice of the same size, a pot, an ice storing device, a jug, a stove or any other source of heat

**Note:** Make sure the ice to be used comes from clean water.

#### **Procedure**

1. Put one block of ice into a pot. Observe the colour of the ice, feel the ice by your fingers. Is the ice soft or hard? Smell the ice. What does it smell like? Taste the ice. How does it taste?
2. Take another block of ice, put it in a pot. Observe its shape. Transfer the ice into a jug and observe its shape. Is there any change in the shape and size of the ice in the jug?
3. Take the ice from the jug, put it in a pot and leave to melt. What do you observe?
4. Take another ice block from the ice storage device and put it in the melted ice in step 3. What do you observe?

#### **Results**

Write down the results of the activities you have performed.

Water in the solid state has neither taste nor smell. It can also be held by hands, and can take the shape of the container used to freeze it. Also, ice is lighter than water therefore it floats on water.

### **Activity 2 (b): Investigating the properties of water in the liquid state**

**Materials:** Jug, pot, clean water, plastic bag and cup

#### **Procedure**

1. Take water that has been boiled and cooled in a pot, and pour it in a jug.
2. Pour the water from the jug into a clean cup, then smell and taste it. What is the smell and taste of the water?
3. Observe the color of water. What is its colour?
4. Pour some water from the jug into a pot. Also pour some water into a plastic bag and tie the open end of the bag.
5. Observe the shape of water in the jug, pot and in the plastic bag.

#### **Results**

Write down results of the activities performed.

Water in the liquid state has neither colour, taste nor smell. In addition, water in the liquid state takes the shape of the container into which. Thus, water in the liquid state has no specific shape.

### **Activity 2 (c): Investigating the properties of water in the gaseous state**

**Materials:** Water, pot, stove or any other source of heat

#### **Procedure**

1. Pour some water into the pot.
2. Turn on the stove and put the pot with water on the stove. Wait until water starts to boil.
3. Observe what you see when the water begins to boil.
4. Wait for the water to boil for about 10 minutes. What do you observe?

#### **Results**

Write down the results of the experiment you have done.

### **Activity 3: Changing from a gaseous state into a liquid state**

**Materials:** Clean glass

#### **Procedure**

1. Take a clean glass and place it close to your mouth.
2. Open your mouth and breathe out heavily in the glass.
3. Write down the observation.

#### **Results**

Water in the gaseous state has no color, smell, specific shape and it is not tangible. It can also change from the gaseous state to the liquid state. For example, the air from the mouth is warm and contains water in the gaseous state. When that warm air containing water vapour comes into contact with a cool glass, the water vapour is cooled and looks like fog on the glass surface. If this fog is cooled further, it turns into the liquid state. This shows that when a gas is cooled, it changes into liquid.

## Uses of water in its three states

*Read the following passage carefully, then answer questions in Exercise 1.*

One day Mr Masanja who is a teacher taught his pupils about the uses of water in its three states. He brought an ice storage device, two bottles of juice, soda and two fish. Also, he brought bottles of drinking water, glass, plates, a basin with water, soap and a dish washer.

The teacher guided pupils to perform an experiment to show the uses of water in its three states. Mr Masanja asked one pupil to take a fish and place it in the ice storage device containing ice blocks. Another pupil was asked to place a fish on a plate and then place on a table.

Other pupils took juice bottles, water, and soda and placed them in the ice storage device containing ice blocks. Other bottles with drinks were left on the table. In the evening, they discovered that the fish that was placed on the table was spoiled. The fish that was placed in ice storage device containing ice blocks was not spoiled. They also discovered that the juice, water and soda placed in the ice storage device containing ice blocks were cold. Those placed on the table were not cold.

From the results of the experiment, pupils realized that ice is used to cool drinks and preserve food. The teacher told them, "Ice is also used to preserve drugs in hospitals. Some drugs get spoiled when exposed to temperatures above normal room temperature. Ice is also used to reduce swelling from an insect bite or injury.

The pupils then continued to discuss the uses of water in cooking, drinking and making other drinks. They also added that water is used for mopping, laundry, showering, washing dishes and generating electrical energy.

The teacher further explained that steam is one of the states of water. It is used to generate energy that is used to operate various machines in factories. The water in the form of liquid which is derived from cooling steam is also used to dissolve various drugs. Therefore, water plays essential roles in our daily life.

### Exercise 1

Answer the following questions in your exercise book.

1. What is the difference between the drinks placed in the ice storage device containing ice blocks and those on the table?
2. Why did the fish left on the table get spoiled?
3. Why does water in a pot decrease when heated for a long time?
4. What are the uses of water in its gaseous state?
5. List down other uses of water apart from those learnt in this passage.

### The freezing point of water

You have learnt that water becomes solid when frozen. The decrease in temperature causes water to freeze. Water freezes when a specific value of temperature is reached.

#### Activity 4: *Measuring temperature of water before and after freezing*

**Materials:** Refrigerator, table, thermometer, water and plastic cup



Figure 2: *Measuring the temperature of water using a thermometer*

### Procedure

1. Take a plastic cup containing water and place it on the table.
2. Take a thermometer; slowly dip it into the water while holding it at the tip (see Figure 2).
3. Record the temperature of the water in your exercise book.
4. Note: Record the temperature of the water at intervals while the thermometer is inside the water.
5. Remove the thermometer and place the cup containing water in the freezer. Then record the temperature after every 30 minutes. Continue recording the temperature until ice starts to appear.

### Results

Compare the temperature of water in the solid state and in the liquid state. Write the results of the experiment performed.

If water is placed in an environment with low temperature, its temperature decreases. If the temperature of water decreases up to 0 degree Celsius or 32 degrees Fahrenheit, water freezes. This temperature is known as the freezing point of water. The freezing point of water is therefore the temperature at which water begins to change to the solid state.

## The boiling point of water

### Activity 5: *Measuring the temperature of boiling water*

**Materials:** A stove or any source of heat, water, pot and thermometer

### Procedure

1. Place a pot with water on a turned on stove.

2. Slowly dip the thermometer into the water when it starts to boil and record the temperature.
3. Record the temperature of boiling water.

### Results

When the temperature of water reaches 100 degrees Celsius or 212 degrees Fahrenheit, the water boils. This temperature is called the boiling point of water. The boiling point of water is important because boiled water is safe for drinking. Disease causing organisms that might be present in water die when water reaches the boiling point.

### Exercise 2

Write **TRUE** for correct statements and **FALSE** for incorrect statements.

1. Water obtained by cooling water vapour is clean and safe. \_\_\_\_\_
2. Rain water has the same temperature as the freezing point of water. \_\_\_\_\_
3. Water boiled to its boiling point is safe. \_\_\_\_\_
4. Water at its freezing point is safe. \_\_\_\_\_
5. Fish should be stored below the freezing point of water.  
\_\_\_\_\_
6. Water may form vapour even if the temperature is below the boiling point. \_\_\_\_\_

### Exercise 3

Answer the following questions in your exercise book.

1. List the three states of water.
2. Mention uses of water in its solid, liquid and gaseous states.
3. Explain why meat is preserved in ice.
4. Differentiate the properties of water in its solid, liquid and gaseous states.
5. What is the importance of the freezing point of water?
6. What is the importance of the boiling point of water?
7. What do you think would have happened if water existed only in the solid state?

### Vocabulary

- Boiling point** - the temperature at which a liquid begins to boil
- Centigrade** - a temperature scale in which water boils at 100 degrees and freezes at 0 degrees
- Degree temperature scales** - Celsius ( $^{\circ}\text{C}$ ) or Fahrenheit ( $^{\circ}\text{F}$ )
- Fahrenheit** - a temperature scale in which water freezes at  $32^{\circ}$  and boils at  $212^{\circ}$
- Freezing point** - the temperature at which a liquid begins to change to a solid state
- Temperature** - the degree of coldness or hotness of an object
- Unit** - a quantity or measurement accepted to be used for example temperature (Centigrade), volume (Litre)

## Chapter Five

### Communication

#### **Introduction**

*In Standard Three, you learnt about different means of communication such as the use of cellular phones. Human beings can get information from different sources. In this chapter you will learn how to use and take care of a radio and a television.*

*Observe the following pictures in Figure 1, then answer questions in Exercise 1*



**Figure 1:** *Communication tools*

## Exercise 1

Answer the following questions in your exercise book.

1. Name each picture shown in Figure 1.
2. Which traditional tools are used for communication?
3. What means of communication are used in your community?
4. Name other tools that can be used for communication.

## Radio

A radio is an electronic device designed to receive electromagnetic waves transmitted from radio broadcasting stations. The radio converts the electromagnetic waves into sound waves which we can hear. It also amplifies the sound wave signals. The sound waves carry information which is delivered to the listeners.

### How to use a radio

In order to use a radio correctly, it is important to know its parts. As Figure 2 shows, radio parts are: speaker, power button, tuning knob, stations scale, antenna and volume control dial. Other important parts, not shown in Figure 2, include battery compartment, power inlet and a handle.

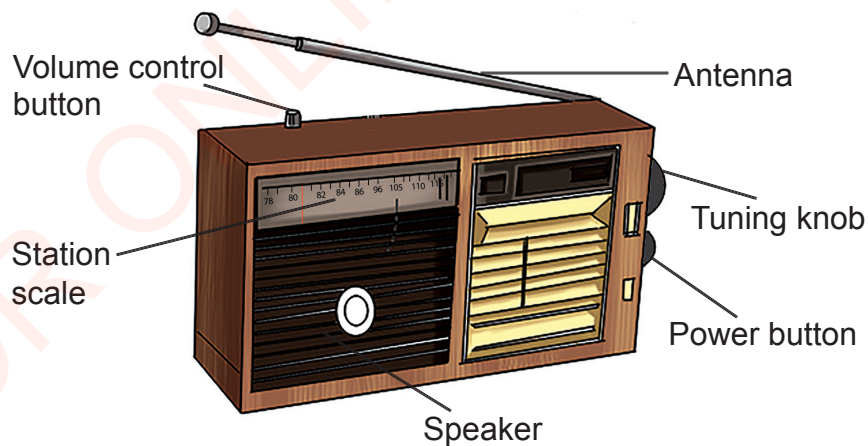


Figure 2: A radio

### Activity 1: Using a Radio

**Materials:** Radio, table, electrical power or batteries

#### Procedure

1. Insert batteries into a radio battery compartment or plug a radio power connection cable into the power source in order to supply power to the radio.
2. Turn ON the radio using the power button.
3. Tune the radio to different radio frequencies using its tuning knob. In case the radio uses remote control to operate, press the tuning button of the remote control device to alter the radio station frequencies.
4. Adjust the volume level to satisfy your need.
5. Listen to the radio.
6. After listening, switch off the radio using the power button on remote control or on the radio.
7. Switch off external power supply if the radio is not using a battery power source.

Observe Figure 3(a) and Figure 3(b), then answer questions in Exercise 2.

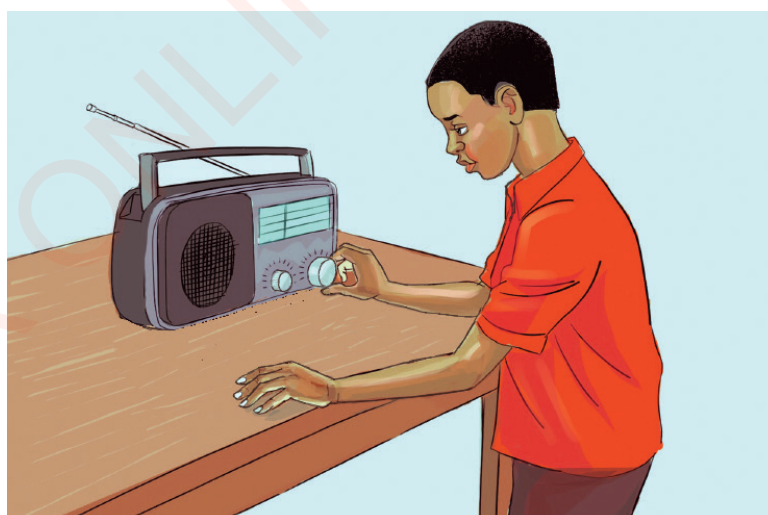


Figure 3(a): Using a radio



Figure 3(b): Using a radio

## Exercise 2

Answer the following questions in your exercise book.

1. What are the differences between the radios shown in Figure 3(a) and 3(b)?
2. Name the device shown in Figure 3(b) that is used to switch on a radio.

## The importance of a radio

A radio is used to receive and disseminate news and information from a radio broadcasting station to people in different areas. The broadcasted information can be in form of news, announcements, advertisements, speeches and dialogues of national leaders. Also, a radio can be used to broadcast entertainment such as music, sports and drama programmes. The information reaches destinations very fast, in all areas within the radio frequency range.

Moreover, a radio can be used for educating the society via a variety of programmes. Such radio programmes could be childrens' educational programmes, health and environmental education and national culture.

## Handling a radio

A radio should be handled with care to last long. It must be kept in a place free from dust, water or moisture. In addition, it is necessary to keep it in a safe place to protect it from falling and breaking down. The following considerations are important in handling a radio:

1. Keep the radio in a clean and dry place. Wipe out dust frequently on the radio using a soft and dry piece of cloth.
2. Switch off both the radio and electrical power outlet when it is not in use.
3. For battery powered radios, remove batteries from the battery compartment. Removal of batteries is necessary if the radio will remain unused for a long time. Unremoved batteries may discharge and also cause rusting on metallic parts of the radio.
4. Always cover the radio using a light cloth to protect it from dust.

### Activity 2: *Removing dust from a radio*

**Materials:** Radio, a clean and dry cloth

#### Procedure

1. Use a clean dry cloth and gently wipe the dust from different external parts of the radio.
2. Keep the radio at a convenient place accessible to all users.
3. Cover the radio with a light piece of cloth when not in use.

## Television

A television is an electronic device that receives television signals from a television transmitter and converts them into sound and images. The images are displayed on a screen and sound reproduced on the speakers. A television has various physical parts including a screen, antenna, speaker and

operating buttons. The design and structure of a television set keeps on changing depending on developments in science and technology. Currently, television sets with curved screens and protruding rear have gradually been phased out. Flat televisions use new technologies and have superior features including low power consumption, clearer visual display and a variety of communication functions. These types of television are shown in Figure 4.

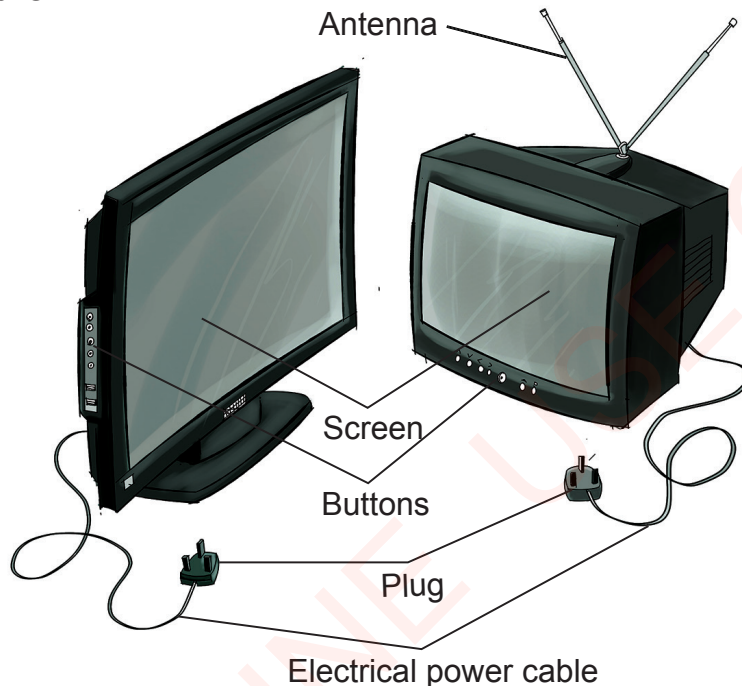


Figure 4: Types of television

### Activity 3: Connecting power and using a television

**Materials:** Television (TV), table, electric power source, TV decoder, remote control, power and TV signal cables, antenna or TV dish and power connection cable

#### Procedure

1. Connect a TV signal cable from an antenna or TV dish to a TV decoder.
2. Connect the TV signal cable from the television to the television decoder.

3. Connect a power cable from the decoder and television into an electric power source and switch on the power.
4. Switch ON the television and wait for a while. What do you observe?
5. Use a remote control device to get pictures and sound from the television.
6. Tune the television channel to select the channel you prefer.
7. Watch and listen to anything from your preferred channel.

What have you learnt from the activity that you have just done?

### **Importance of a television**

A television, like a radio is used by communities to receive news and information from broadcasting stations. In televisions, sound is heard and pictures are seen at the same time. Television programmes may contain entertainment such as music, sports, movies, and drama. Apart from entertainment, television stations broadcast education programmes such as documentaries, health, environmental issues, cultural heritage, and science and technology development. Business advertisements, political speeches and current news are also disseminated through a television.

### **Effects of watching television without parents or guardians' guidance**

A television is good for educating and entertaining people. However, if not used with precaution, it can have negative effects. For example, children who frequently watch television may have the following effects:

1. Acquire unacceptable behaviour in relation to their age.
2. May have poor academic performance due to devoting more time on watching television than on their studies.
3. May copy and imitate inappropriate culture and even learn unacceptable bad behaviour.

## Handling a television

A television can easily deteriorate if it is not handled with care. Some of careless actions which can lead to deterioration of a television include: dust accumulation inside the television and allowing water or moisture to come into contact with television components. Dropping a television can seriously damage it.

The following are some of precautions to take for long-term safe keeping of a television:

1. Keep the television in a dry and clean environment.
2. Wipe out dust regularly using a dry and soft cloth.
3. Keep the television at a secure place to prevent it from falling down.
4. Switch off the television if not in use.
5. Cover the television with a light dry cloth to protect it from dust.
6. Keep the television in a location where air circulation is adequate to protect it from overheating.

### Exercise 3

**Answer the following questions in your exercise book.**

1. Mention five parts of a radio.
2. Which part of a radio is used to receive electromagnetic waves?
3. What are the differences between a radio and a television?
4. Mention things that can destroy a radio and a television.
5. Describe different sources of power that a radio can use.
6. What are the importance of watching television and listening to the radio in your life?
7. What are the negative effects that may be caused by watching television without parental guidance?
8. What educational radio programmes are you aware of ?

## Vocabulary

- Antenna** - a rod or wire connected to a radio or a television for the purpose of receiving broadcast signals transmitted from broadcasting station
- Electrical plug** - a device with two or three pins used to extract electricity from an electrical socket for appliances
- Electrical socket** - a device with two or three holes used to supply electrical power to devices or appliances
- Electromagnetic waves** - waves that travel at the speed of light
- Electronic device** - a device that achieves its function through the use of electrical power
- Television decoder** - a device to convert electromagnetic waves into sound and images so that they can be used and displayed by a television set
- Television Dish** - a bowl-shaped aerial used to receive television signals from a communication satellite
- Transmitter** - an electronic device which produces and sends video and sound waves with the help of an antenna
- Satellite** - a specialized television transmitter or receiver orbiting the earth
- Screen** - a physical surface on which visual information is displayed

## Chapter Six

### Scientific experiments

#### **Introduction**

*In Standard Three, you learnt how to measure things. You used standard and nonstandard measuring instruments in conducting scientific experiments. In this chapter, you will learn about steps which are followed when carrying out scientific investigations. You will also do some scientific experiments to identify the basic needs of living things.*

Have you ever asked yourself questions for which you do not have clear answers? For example, have you ever asked yourself why people fall sick, why it rains, or why fruits fall down from trees? Such questions are sometimes disturbing to the brain but it is good that scientists have explanations for these questions.

Asking questions on issues you see or hear is called curiosity. To get answers to such questions one must conduct scientific investigation. A large part of scientific investigation is conducted by doing experiments and research.

*Carefully read the following passage then answer the questions in Exercise 1.*

Two children of Mr Samanga prepared gardens to grow amaranth. The garden of the first child flourished well and the leaves were green. The garden of the second child did not do so well and her amaranth was yellowish in colour.

One day their father visited the gardens. He asked them; why the amaranth in one garden grew well and became green while in the other garden it did not grow so well and turned yellowish.

The first child said that he had no answer. The second child said that the plants turned yellowish probably due to shortage of water.

Their father responded by saying, “You should always remember that, answers to scientific questions need scientific investigation”. There are eight (8) steps to carry out scientific investigation. These steps are:

- (1) Identification of the problem
- (2) Hypothesis formulation
- (3) Preparation of materials for the experiment
- (4) Conducting the experiment to collect data
- (5) Data analysis
- (6) Interpretation of results
- (7) Conclusion
- (8) Communicating the results by writing a scientific report.

When these steps are followed correctly you will get answers to scientific questions. Therefore, an experiment is conducted in order to get a solution for the identified problem.

### Exercise 1

Answer the following questions in your exercise book.

1. What have you learnt from the passage above?
2. What did Mr Samanga want to teach his children?

### Procedure to follow when conducting scientific investigation

#### 1. Identification of the problem

The first step in conducting a scientific investigation is to identify the problem which needs to be solved or which requires an answer. For example, the case of green and yellowish amaranth could be a problem which could be explained through scientific investigation.

## 2. Hypothesis formulation

A hypothesis is an intelligent guess about the cause of the problem under investigation. At this step you guess the cause of the identified problem or what could be the answer for the problem at hand. For instance, given the amaranth problem one hypothesis could be that “the difference in growth of amaranth is caused by water shortage”. The importance of this step is to be able to set an investigation which will justify or falsify the hypothesis. If the hypothesis does not answer your question then you need to formulate another one.

## 3. Preparation of materials for the experiment

At this step you gather the apparatus or equipment and materials which can be used to collect information in your investigation. You then identify the location where the investigation will be conducted. For example, a hand hoe, a bucket of water and amaranth seeds are materials which can be used in the investigation of the difference in growth of amaranth. The site must have enough sunlight and the soil must be fertile. This step is very important in scientific investigation. If you do not have appropriate equipment and materials, you may end up collecting wrong information (data) and the entire experiment may fail to solve the problem.

## 4. Conducting the experiment and collecting data

At this step, the experiment is conducted by using the prepared equipment and materials. For example, in the current investigation you can plan to plant amaranth seeds in two gardens. After germination of the seeds, irrigate the first garden in the morning and evening but do not irrigate the second. Measure the length of amaranth plants in each garden after every two days. Collect the data and record it in your note book.

## 5. Data analysis

All data which are collected during an investigation must be analysed. This involves organizing, sorting and arranging data

properly. For example, you can compare the length of amaranth plants from the irrigated and non-irrigated gardens in order to identify which sample grew faster. After data analysis, the results may be presented using tables, charts or graphs.

## 6. Interpretation of results

At this stage, the analysed data are interpreted in order to obtain meaningful information. This may enable others who are interested in the study to understand the problem and solutions. Based on the data shown in the table below, the irrigated amaranth grew faster than the non-irrigated amaranth.

Type of garden	Day 1	Day 3	Day 5	Day 7	Day 9	Remarks
Irrigated garden	1.0 cm	2.5 cm	4.0 cm	6.0 cm	8.0 cm	Amaranth grew properly
Non irrigated garden	1.0 cm	1.5 cm	1.5 cm	1.5 cm	1.5 cm	Amaranth did not grow properly

## 7. Conclusion

This is the last stage in scientific investigation. At this stage you can prove the hypothesis. You can also link the results obtained with the cause of the problem and the question you have asked. If the results support the hypothesis, the conclusion will be “there is a direct relationship between the growth of amaranth and water availability”. If the results do not support the hypothesis, the conclusion will be “there is no relationship between the growth of amaranth and water availability”. In this case, a new hypothesis must be formulated and the experiment must be repeated.

## 8. Writing a scientific report

After finishing the scientific investigation, the activity which follows is writing a scientific report. The report is organized in the following order:

- (a) The problem statement
- (b) Aim or objective of the investigation

- (c) Materials or equipment
- (d) Procedure of data collection
- (e) Data analysis and results
- (f) Conclusion

## Exercise 2

Answer the following questions in your exercise book.

1. List the steps to be followed when carrying out a scientific investigation.
2. The report of any scientific investigation is organized in six parts, which are:
  - (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_
  - (d) \_\_\_\_\_ (e) \_\_\_\_\_.
3. State the importance of each of the following stages of scientific investigation:
  - (a) Hypothesis formulation
  - (b) Interpretation of results

## Necessary requirements of living things

Living things require water, heat, air and light for their survival.

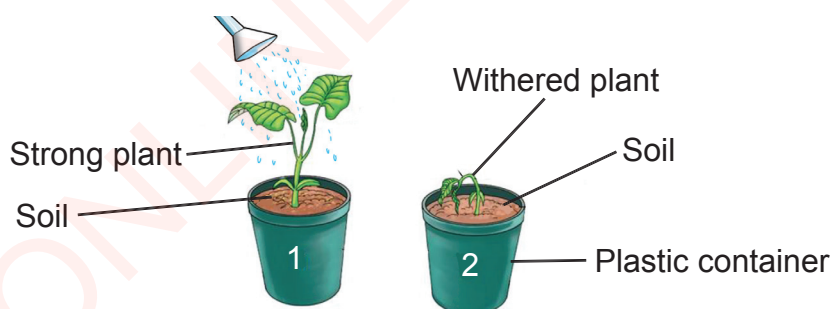
### Experiment 1: *To investigate the importance of water for plant growth*

**Objective:** To investigate the importance of water for plant growth

**Materials:** Two plastic containers, soil, water and bean seeds

#### Procedure

1. Label two plastic containers as number 1 and 2 as shown in Figure 1.
2. Put soil in each container.
3. Pour the required amount of water in each plastic container.
4. Plant one bean seed in each container.
5. Irrigate the seed in each container every day until the seeds germinate and grow to about 5 cm high.
6. Put each container in the sunlight where there is no rain.
7. Continue irrigating the bean seed in container number 1 but do not irrigate the bean seed in container number 2.
8. Repeat step 7 for ten days.
9. Observe the growth of the plants in the two plastic containers.



**Figure 1:** *Bean plants grown in plastic containers*

**Results:** After ten days the plant in container number 1 grew well and the plant in plastic container number 2 withered.

**Conclusion:** This experiment shows that water is necessary for plant growth. Without water plants wither and die.

## Experiment 2: To investigate the importance of heat for seed germination

**Objective:** To demonstrate that heat is essential for seed germination

**Materials:** Two jars or containers, cotton wool, bean seeds, water and ice pellets

### Procedure

1. Mark two jars with letters A and B.
2. Soak two portions of cotton wool in water.
3. Put one bean seed in each wet cotton wool and insert them in each jar.
4. In the first jar labelled A, put ice pellets every day in the morning, afternoon and evening.
5. In the second jar labelled B, irrigate with water that is at room temperature everyday in the morning, afternoon and evening.
6. Repeat steps 4 and 5 for a week or two.

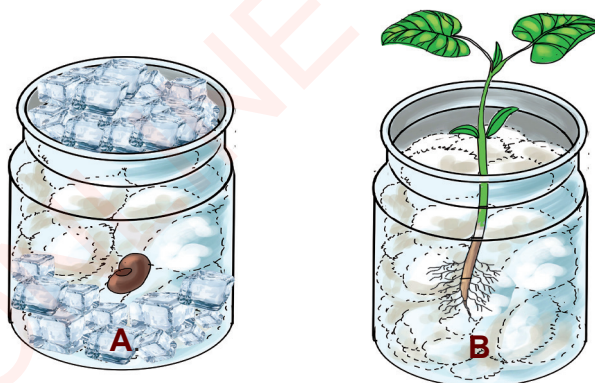


Figure 2: The importance of heat in seed germination

**Result:** In which jar did the seed delay to germinate or did not germinate? (See Figure 2) Why?

**Conclusion:** Write the conclusion of this scientific investigation.

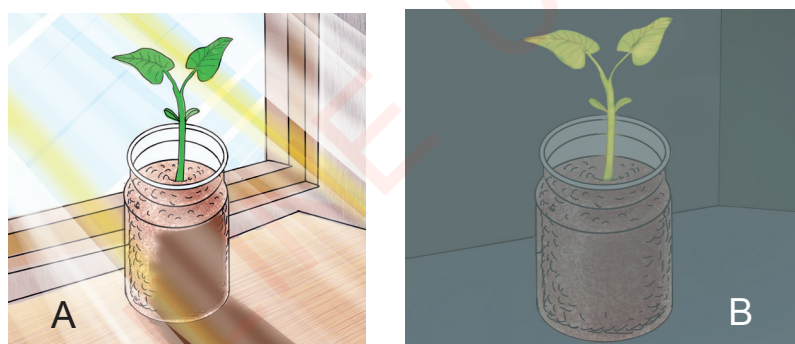
### Experiment 3: To investigate the importance of sunlight for plant growth

**Objective:** To show the importance of sunlight to plant growth

**Materials:** Beans seedlings, two plastic containers, soil, water and a box

#### Procedure

1. Plant the seedlings into two different jars labelled A and B.
2. Expose the jar labelled A to sunlight and put the jar labelled B in a dark box.
3. Irrigate all plants regularly for one week.
4. After a week take out the jar labelled B from the box.
5. Observe the plant that was exposed to sunlight and the one that was kept in a dark box.



**Figure 3:** *The importance of sunlight for plant growth*

**Results:** What is the difference in growth between the plant in jar A and that in jar B? (See Figure 3)

**Conclusion:** Write the conclusion of the investigation you have done.

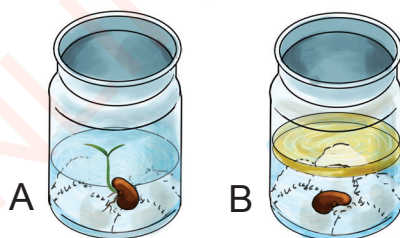
### Experiment 4: To investigate the importance of air for seed germination

**Objective:** To show that air is important for seed germination

**Materials:** Cotton wool, two jars, water, bean seeds and cooking oil

#### Procedure

1. Label the first jar with letter A and the second jar with letter B. Put approximately 150 millilitres of unboiled water into jar A and the same amount of cool boiled water into jar B.  
Note: Make sure the cool boiled water is kept in a tightly sealed container while waiting to cool.
2. Put a seed into a portion of cotton wool and immerse it in jar A.
3. Put the second seed into another portion of cotton wool and immerse it in jar B.
4. Pour a small amount of cooking oil into jar B.
5. Observe the germination of the seed in each jar after a week.
6. Record your observation on both jars A and B.



**Figure 4:** *The importance of air for seed germination*

**Results:** What is the difference between germination of the seeds in jar A and B?

**Conclusion:** Write the conclusion of your investigation and write the report of the scientific investigation you have performed.

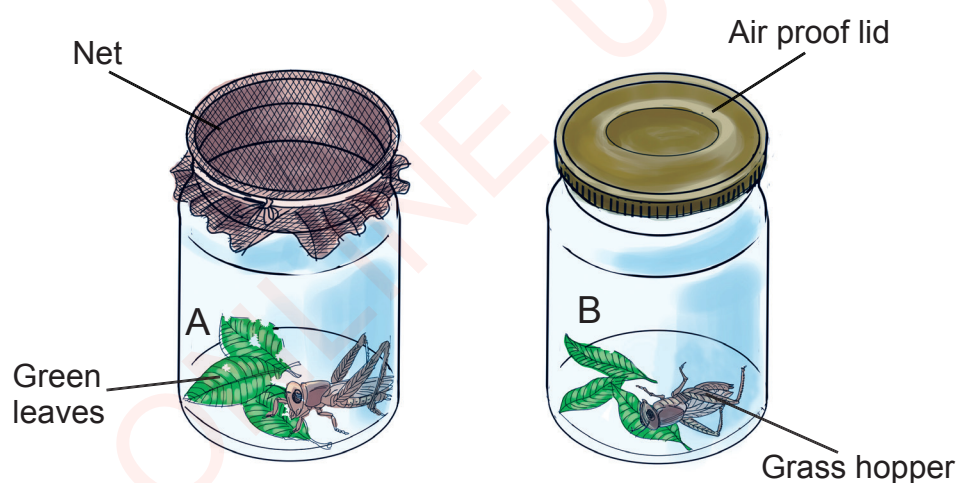
### Experiment 5: To investigate the importance of air to living things

**Objective:** To show that air is essential for life

**Materials:** Two grasshoppers, two jars one with an air-proof lid, green leaves and a gauze

#### Procedure

1. Take two bottles and label the first bottle with letter A and the second with letter B.
2. Put green leaves in each bottle.
3. Put one grasshopper in bottle A, then cover the top with a gauze.
4. Put the second grasshopper in bottle B and close its mouth with an air proof lid.
5. Observe the two grasshoppers in the bottles labelled A and B regularly for one or more days.



**Figure 5:** Importance of air to living things

**Results:** Write the results of your investigation on the grasshoppers in the two bottles (see Figure 5)

**Conclusion:** Write the conclusion of your investigation on the grasshoppers.

### Exercise 3

Write **TRUE** for the correct statement and **FALSE** for the incorrect statement.

1. Not all animals need water in order to survive. \_\_\_\_\_
2. A standard four student can do an experiment and discover new knowledge. \_\_\_\_\_
3. Plants need sunlight to grow but not temperature. \_\_\_\_\_
4. Development of science and technology needs scientific investigation. \_\_\_\_\_
5. The aim of scientific investigation is to avoid guessing of findings. \_\_\_\_\_
6. You can get scientific answers using stories. \_\_\_\_\_
7. Curiosity raises questions that can be answered by conducting scientific investigation. \_\_\_\_\_
8. Plants get water from the soil. \_\_\_\_\_

### Exercise 4

Answer the following questions in your exercise book.

1. Mention the advantages of doing scientific investigation.
2. Explain why seeds in ice blocks do not germinate.
3. In order for a seed to germinate it needs three things. These are (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_
4. Explain why some plants wither during the dry season.
5. List the necessary requirements that living things need for their survival?
6. What is the importance of each of the following steps of scientific procedure:
  - (a) Preparation of materials for the experiment.
  - (b) Data analysis.



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## Vocabulary

- Data** - recorded observation obtained from research, which can be used to explain something
- Hypothesis** - prediction of the cause of the problem
- Research** - detailed scientific investigation on a specific issue with the aim of discovering and getting new knowledge
- Scientific steps** - systematic procedure to be followed when doing investigation



## Chapter Seven

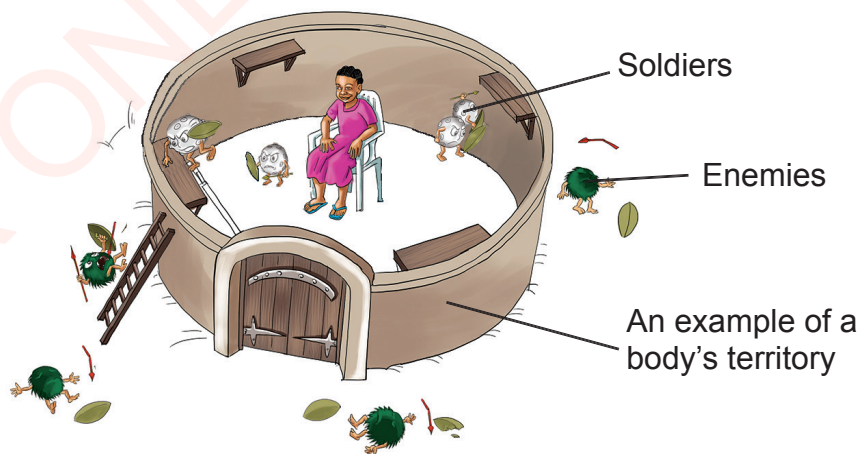
### Body immunity

#### Introduction

*In this chapter, you will learn how the human body protects itself from diseases and the factors that strengthen body immunity. You will also learn how to strengthen your immune system.*

Immunity is the ability of the body to defend itself against infection. Infections are caused by pathogens. These are disease causing organisms that infect the human body and cause diseases. Pathogens that cause diseases include viruses, bacteria, fungi and parasites.

The human body fights against pathogens that cause diseases by using the immune system. The immune system involves physical barriers such as skin and mucus, and white blood cells that work together to protect the body. The white blood cells perform their functions like soldiers fighting against enemies to protect their territory. In this case the territory is the human body, the enemies are the pathogens and the soldiers are the white blood cells as indicated in Figure 1.



**Figure 1:** An example of a strongly protected territory



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Human beings have two main types of immunity. These are natural immunity and acquired immunity. Natural immunity is the first line of body defense against pathogens. Examples of natural immunity include, the skin, which prevents pathogens from entering the body. Mucus in the respiratory system and ear wax that prevents pathogen from entering the body.

The second type of immunity is acquired immunity. An example of acquired immunity is the immunity that an unborn baby receives through her mother via the placenta or which a new born baby receives from her mother through breastfeeding, especially in the first few days after birth.

Another form of acquired immunity is that which a person gets after being infected with a particular disease. This can occur to a person at any age. For example a person living in a malaria prone area will be infected with malaria but with time the person will develop immunity against the disease. Acquired immunity can also be induced through vaccination. Vaccines activate white blood cells to fight against diseases. For example, diseases such as tuberculosis, measles, yellow fever, polio and tetanus can be prevented by vaccines. Vaccines help an individual to develop body immunity against pathogens. It is therefore important for infants to be vaccinated to protect them from infectious diseases.

Low body immunity affects the ability of the body to fight against disease causing pathogens. The body becomes weak so it can easily be attacked by pathogens such as viruses, bacteria, and fungi. Apart from infants, vaccines are also given to adults and children over five years of age to enable their body to develop immunity against certain diseases. For example, vaccines against yellow fever and cervical cancer are available for adults.



### Exercise 1

Answer the following questions in your exercise book.

1. Describe how the body naturally protects itself against pathogens.
2. Name the type of immunity is obtained through vaccination?
3. What is the advantage of breast feeding to a baby?
4. Explain the importance of vaccines to children.

Figure 2 shows that a weak immune system makes the vulnerable to pathogens. When the white blood cells become weak they fail to perform properly their protective functions. This allows pathogens to easily enter the human body and cause diseases.

*Study Figure 2 then answer the questions in Exercise 2.*



**Figure 2:** *Example of a weak immune system leading to body infection*

## Exercise 2

Answer the following questions in your exercise book.

1. In not more than 50 words, briefly explain what you have observed in Figure 2.
2. What happens when your body immunity becomes weak?

### Enhancing body immunity

Body immunity can be strengthened through the following ways:

#### (a) Taking a balanced diet

A balanced diet is a meal containing all the nutrients needed by the body in the correct proportions. The nutrients are vitamins, carbohydrates, proteins, fats and minerals. A balanced diet provides the body with nutrients that keep it healthy and strong. An unbalanced diet weakens the immunity of an individual. Therefore, it is important to take a balanced diet to strengthen immunity.

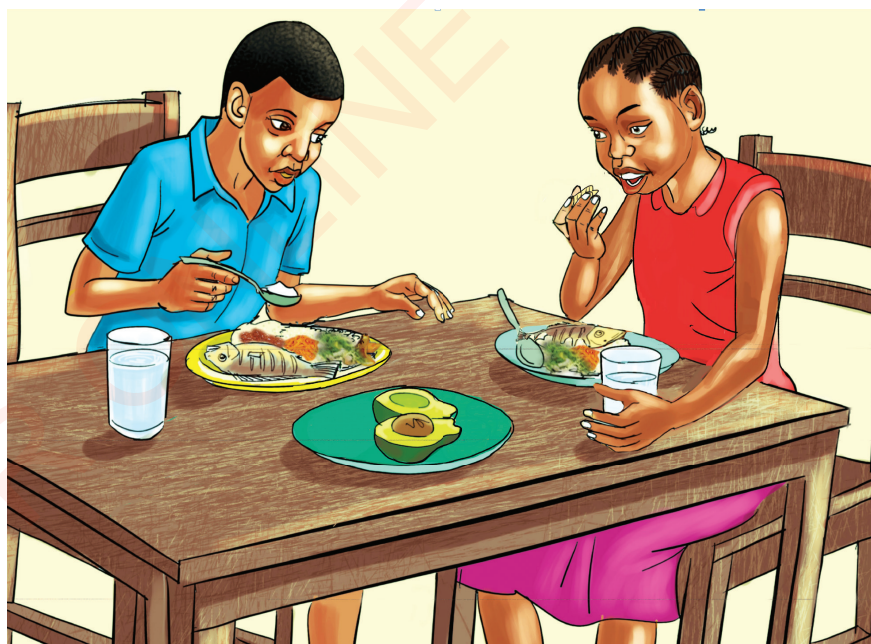


Figure 3: Children having a balanced diet

### **(b) Living in a clean and safe environment**

A dirty environment is a major source of pathogens which affect human health. It can result into contamination of food and water. Contaminated food and water cause diseases such as dysentery, typhoid and cholera. In addition, polluted air can also be a source of pathogens that affect the respiratory system. In this regard living in a contaminated environment can lead into diseases that can weaken our immunity. Therefore, we should clean our environment to protect ourselves from diseases and strengthen our immunity system.

### **(c) Getting enough sleep**

Sleeping is good for your health. Lack of sleep may be due to various reasons such as illness and stress. Lack of sleep weakens the immune system. Therefore, it is important that we get enough sleep in a clean and safe environment for about 8 hours a day.



**Figure 4:** *Sleeping in a clean and safe environment*

#### **(d) Using drugs or medication properly**

Drugs are used to assist killing pathogens. Therefore, drugs support the body immune system to eliminate the pathogens. However, improper use of drugs may cause health problems. Thus, it is not advised to take drugs without prescription from a medical doctor because overuse of certain types of drugs or medication may weaken the body immune system.

#### **(e) Drinking enough water**

About 60% of the human body is made of water. The body needs water in all the cells, organs, and tissues to help it regulate its temperature and for proper body functions. Therefore, drinking enough, clean and safe water is important for proper functioning of the body. Water is also important in removing harmful toxins and waste products from the body hence strengthening the immunity. The body loses water and other waste products through urine and sweat. Therefore, it is important to take enough water to strengthen immunity of an individual.

#### **(f) Doing enough physical exercise**

Physical exercises are important for maintaining a healthy body. The physical exercises help to boost the immune system against diseases. Failure to do physical exercises makes the body weak. A weak body is likely to be attacked by diseases. It is important to do physical exercises everyday as shown in Figure 5.

#### **(g) Avoiding irresponsible behaviours**

Avoid excessive use of tobacco, alcohol, some cosmetics and other dangerous substances. These substances can weaken body immunity when a person has used them for a long time.



**Figure 5:** Pupils doing physical exercise

### Exercise 3

**Answer the following questions in your exercise book.**

1. Mention diseases caused by a weak immune system.
2. Explain the importance of the immune system.
3. Explain how a balanced diet helps to boost the immunity of an individual.
4. Why do some sick persons get better even without medication?
5. What are the factors that can boost immunity?
6. List six factors that can weaken the immunity of an individual.

### Exercise 4

Match the items in **column A** with phrases from **column B** to make a meaningful sentence.

Column A	Column B
1. HIV/AIDS	a. First line of defence in the immune system.
2. Improper use of drugs	b. Dirty environment.
3. White blood cells	c. Deficiency of immunity in the body.
4. Bacteria	d. Second line of immunity in the body.
5. Balanced diet	e. Contains all nutrients required by the body in proper proportions.
6. Vaccination	f. Enables waste products and body toxins to be removed easily.
	g. Artificial acquired immunity.

### Vocabulary

- Immunity** - ability of the body to recognize, neutralize or destroy harmful foreign substances in the body
- Vaccine** - a suspension of live or killed organisms given to induce immunity against specific diseases

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## Chapter Eight

### Diseases

#### Introduction

*In chapter seven, you learnt about human body immunity and how pathogens weaken the immune system. In this chapter, you will learn about communicable and non-communicable diseases. You will also learn how diseases are transmitted, their symptoms and the ways of preventing and controlling them.*

Most human diseases are caused by pathogens that are found in our environment. Pathogens live in the soil, air, water and contaminated food. Pathogens in our environment may enter our bodies through the mouth, nose, skin and genitals. Some human diseases are transmitted through touching or by agents called vectors. Vectors transmit pathogens such as bacteria, viruses, fungi and parasites. For example, female mosquitoes (*Anopheles*) carry malaria parasites called *Plasmodium*. The parasite is introduced into the human body when a mosquito bites an individual.

#### Types of diseases

Diseases can either be communicable or non-communicable. Communicable diseases also known as infectious diseases are diseases caused by pathogens such as bacteria, viruses and fungi. They can be transmitted from one person to another through various ways. For example, some diseases can be transmitted through contact with contaminated blood or other body fluids. Other communicable diseases are spread by ingesting contaminated food or water and breathing in contaminated air. Also, vectors can transmit these diseases

through biting. Children under five years are the most vulnerable to communicable diseases.

Non-communicable diseases are diseases which cannot be transmitted from one person to another through contact or vectors. These diseases are non-infectious and may last long in an individual. They are caused by factors such as the environment, hormones, malnutrition, stress or inheritance.

### **Communicable diseases**

These are diseases that can be transmitted from one person to another through various ways. Some communicable diseases are epidemic. Epidemic diseases spread rapidly and affect many people in a very short time. Examples of communicable diseases are malaria, cholera, schistosomiasis, dysentery, typhoid, leprosy, tuberculosis, measles, flu or cold, chickenpox, tetanus, meningitis, plague and dengue fever.

### **Malaria**

Malaria is one of the most serious diseases in tropical countries including Tanzania.

### **Transmission of malaria**

Malaria is transmitted by a female mosquito called *Anopheles*. The mosquito carries a parasite called *Plasmodium*. Malaria occurs when the mosquito bites a person and thereby injects *Plasmodium* parasites. The mosquito can also transmit the parasites from one person to another after a few days during which a parasite develops inside the mosquito as shown in Figure 1.

### **Symptoms of malaria**

The symptoms of malaria include fever, headache, nausea, stomach upset, vomiting, sweating, feeling cold and shivering. Other symptoms are loss of appetite, joint pains and fatigue.

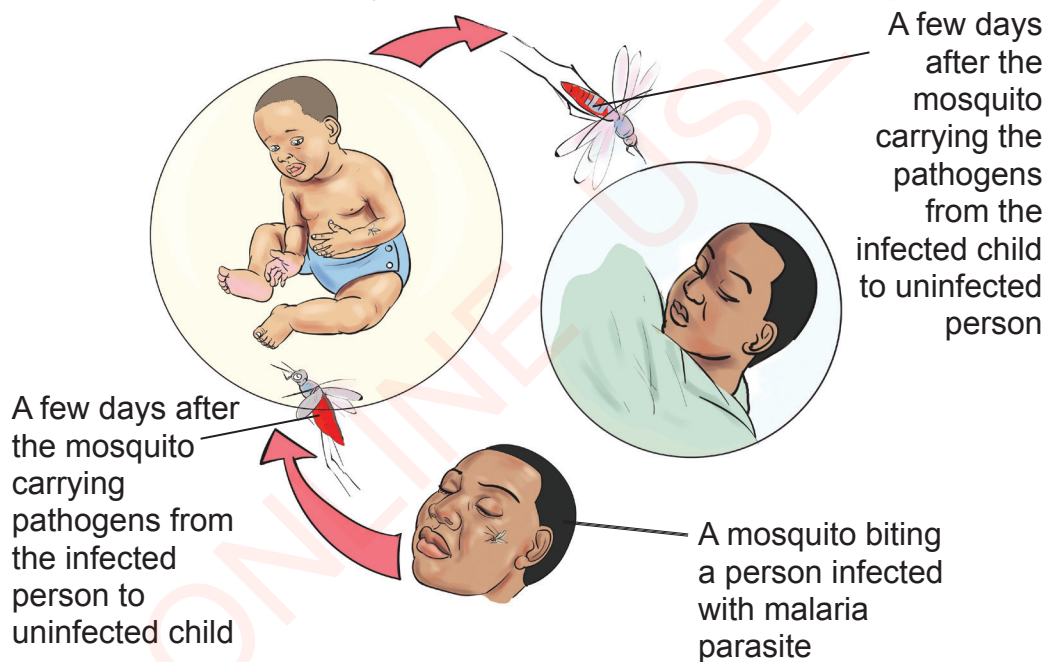
### **Prevention and control of malaria**

Malaria can be controlled by destroying breeding sites of the

*Anopheles* mosquitoes. The mosquito breeding sites include flower pots, ponds, grasses, shrubs, and coconut shells. Other mosquito breeding sites are swamps, rice fields, ditches and rain water pools. Sometimes oil is sprayed to breeding sites in order to kill the mosquito larvae.

Malaria can be prevented by using mosquito bed nets and fixing wire or plastic gauze in windows and doors to prevent mosquitoes from entering homes. Other ways to prevent malaria include applying mosquito repellants and spraying insecticides.

Malaria can be treated using drugs. Pregnant women are usually given malaria drugs to protect the unborn baby from the disease. It is advised that persons showing symptoms of malaria should be treated immediately.



**Figure 1:** *Transmission of the malaria parasites*

### Exercise 1

Mention other methods that are used to destroy mosquito breeding sites.

## Cholera

Cholera is an infectious disease that is caused by bacteria. The bacteria cause severe diarrhoea and vomiting leading to serious body dehydration and even death.

### Transmission of cholera

Cholera occurs when a person is infected by cholera bacteria. The bacteria can be ingested with food or water contaminated by faeces or vomit of infected individuals. Cholera can also be transmitted by houseflies when they pick cholera bacteria from waste and contaminated food and water. Contact with an infected or cholera dead individual can also lead to the transmission of the disease.

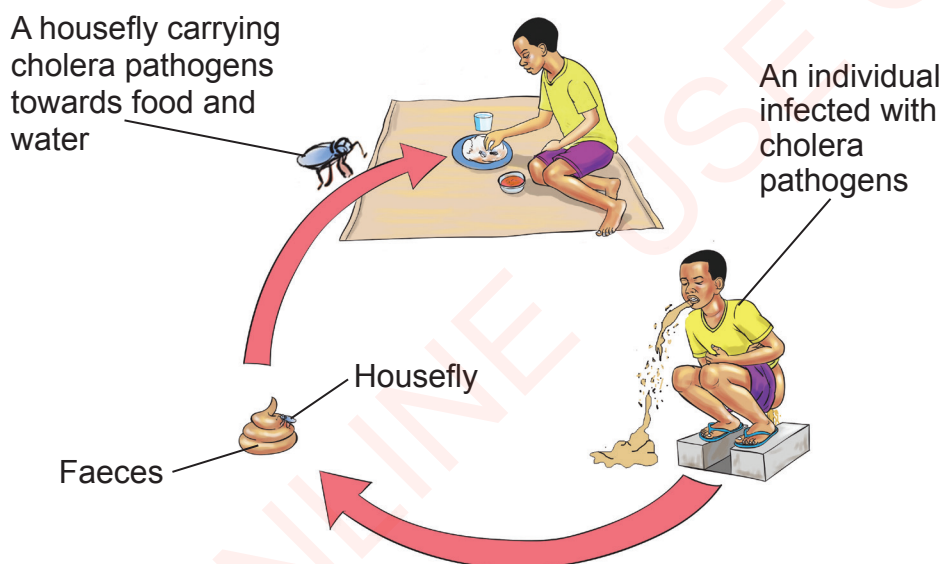


Figure 2: Transmission of cholera

### Symptoms of cholera

A person suffering from cholera discharges or passes white watery diarrhoea which looks like “rice-water”. The victim also has persistent vomiting. The body of a person with cholera becomes very weak because of losing water through vomiting and diarrhoea. Other symptoms are rapid heartbeat, low blood pressure, thirst, loose skin and leg cramps.

### **Prevention and control of cholera**

Cholera can be controlled by practicing good hygiene such as cleaning the environment, drinking clean and safe water, eating fresh and safe food, proper use of toilets, and washing hands with clean water and soap before eating and after using the toilet. A person with cholera should be taken to hospital immediately to avoid further spread. The disease can be prevented by keeping infected individuals away from others to avoid further spreading of the disease.

### **Schistosomiasis**

Schistosomiasis is a disease caused by parasitic worms. The worms affect the intestines and the urinary bladder. The worms live in blood vessels of these organs, but they can affect other parts of the body such as the lungs, liver, spleen, spinal cord and brain.

### **Transmission of Schistosomiasis**

The parasitic worm is transmitted by vectors known as snails. People become infected when they come in contact with water contaminated by the parasites from the snails. The parasites are released by snails and penetrate the skin of a person when he or she is in contact with contaminated water. Fresh water bodies such as lakes, rivers, ponds and ditches may be infested with parasites when people with the disease urinate or defaecate in them. Contact with infested water may occur during swimming, washing or paddling, fishing, fetching water and bathing in water bodies as observed in Figure 3.



**Figure 3:** *Transmission of schistosomiasis*

### **Symptoms of schistosomiasis**

Symptoms of schistosomiasis include presence of blood in urine or faeces, feeling of pain when urinating, abdominal pain, intestinal ulcers, body weakness, fever and anaemia.

### **Treatment and prevention of schistosomiasis**

Avoid urinating and defaecating near water sources or in water bodies such as rivers, lakes, ponds, and pools. Also, avoid swimming, washing clothes, bathing and washing dishes using contaminated or untreated water. Schistosomiasis can be treated with drugs. Therefore, an infected person should be taken to hospital for medical treatment.

### **Tuberculosis**

Tuberculosis is an airborne infectious disease caused by bacteria. It usually affects the lungs.

### **Transmission of tuberculosis**

The bacteria that cause tuberculosis are transmitted from one person to another through the air during coughing, sneezing and spitting of saliva. People become infected by inhaling contaminated air or using contaminated dishes.

### **Symptoms of tuberculosis**

The major symptoms include coughing for three or more weeks, fever, weight loss, and chest pain. Other symptoms are coughing up blood, chills, tiredness, sweating at night and loss of appetite.

### **Prevention of tuberculosis**

Tuberculosis can be prevented by vaccination. New born babies are usually vaccinated against tuberculosis. Also the disease can be prevented by treating infected people early to avoid spreading of the disease and by avoiding sharing utensils with infected people.

## Measles

Measles is an infectious disease caused by a virus. It commonly affects children and usually infects the nose and throat. The measles virus can be transmitted through coughing and sneezing. The disease spreads quickly in crowded areas.

### Symptoms of measles

An individual infected with measles has a high fever and running nose. Other symptoms include sneezing and a dry hacking cough, red-watery eyes, swollen eye lids, white spots inside the mouth and body pain. Also, a person infected with measles develops red rashes on the forehead which can spread down to other parts of the body. Other symptoms are vomiting and diarrhoea.



Figure 4: A child suffering from measles

### Treatment and prevention of measles

There is no treatment for measles. However prevention can be achieved by giving vaccines to children.

## Chickenpox

Chickenpox is an airborne disease that is caused by viruses. The disease is transmitted through the air which is contaminated with the virus. The virus spreads through inhaling contaminated air when an infected person has sneezed or coughed. Also, the virus can spread through direct contact with the sores or wounds of an infected person. It can also be spread by touching contaminated items such as clothing of an infected person.

### Symptoms of chickenpox

A person with chickenpox develops high fever and headache. Also the person becomes tired with loss of appetite. Other symptoms are development of itching, skin rashes and fluid filled blisters. The rashes show up on the cheek, the back and sometimes the entire body. The rashes finally leave scars after the person is healed as observed in Figure 5.

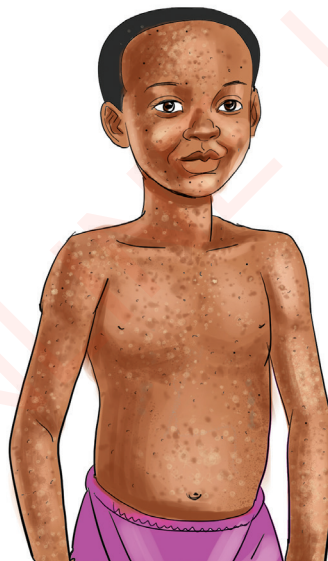


Figure 5: A person infected with chicken pox

### Prevention and control measures for chickenpox

There is no treatment for chickenpox. However, symptoms of chickenpox can be alleviated. Vaccines are also available

to prevent chickenpox. Chickenpox can also be controlled by avoiding sharing clothes, towels and bed sheets with an infected person. Use a household cleaner to wash any items that are contaminated with chickenpox blisters. An infected person should be kept away from others to prevent the spreading of the disease.

## Tetanus

Tetanus is a disease caused by bacteria. The tetanus bacteria can be found in soil, dust, dirt and animal faeces. Bacteria may also be found on surfaces of rusty tools like nails, needles and barbed wire. A person becomes infected with tetanus when bacteria enter the blood stream through a deep wound, cut or bruise.

### Symptoms of tetanus

Tetanus causes high fever, headache and tightening of the jaw muscles which lead to difficult swallowing and breathing. Other symptoms are prolonged muscle contraction, painful and stiff muscles of the neck and abdomen, seizures, high blood pressure and sweating.

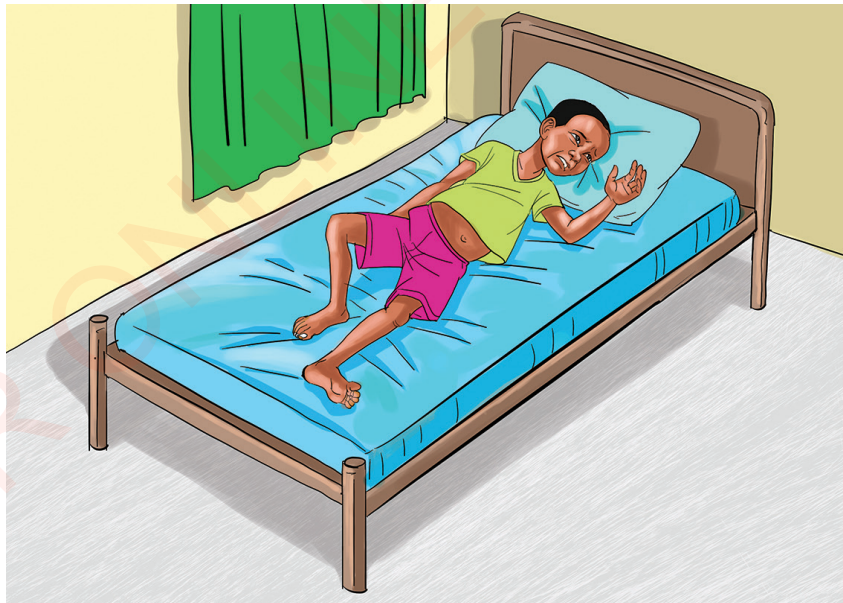


Figure 6: A person with tetanus

### **Prevention of tetanus**

Tetanus vaccines are available for children. Vaccination and proper wound care are important for preventing tetanus infections. Tetanus vaccines can be provided to an injured person within seven days after injury. Drugs are also provided to control muscle contraction.

### **Non-communicable diseases**

An individual can have a non-communicable disease for a long time without showing symptoms. It is difficult for an individual to seek medical care if symptoms are not detected. It is therefore advised that individuals should do regular health checkups in order to detect diseases in their early stages. Examples of these diseases include cancer, anaemia, diabetes, asthma, rickets, scurvy and heart diseases. Treatment of diseases in their early stages reduces chances of developing other complications.

### **Cancer**

Cancer is a disease that affects human cells. Abnormal cells divide to produce new abnormal cells which are not needed by the body. These abnormal growing cells cause swelling, lump or tumour called cancer. The tumour may grow in any part of the body.

Cancer may be caused by various things that can modify human cells. Some of them are chemicals present in foods such as canned food and preservatives of cereal foods, cosmetics, drugs and harmful radiation. Other causes of cancer include smoking, taking too much alcohol and poor nutrition. The symptoms and signs of cancer depend on its type. There are different types of cancer that are named depending on the affected part or organ of the body. For example, cervical cancer is named after the cervix, skin cancer is named after the skin, breast cancer is named after the breasts and liver cancer is named after the liver.

### **Prevention of cancer**

Cancer can be prevented by avoiding lifestyles that increase chances of developing the disease. These lifestyles include smoking, excessive drinking of alcohol and use of some drugs. Early stages of cancer can be cured. Treatment can be done by surgery which removes the affected tissue or organ. Another way of treating cancer is through the use of chemotherapy and radiotherapy.

### **Diabetes**

Diabetes occurs when normal blood sugar levels are not maintained in the body. Diabetes occurs when blood sugar levels are either too high or too low. The major cause of diabetes is the failure of the pancreas to produce enough insulin. This is an organ that is involved in the digestion of food and balancing blood sugar levels.

The pancreas produces insulin, a hormone which controls blood sugar levels in the body. People with diabetes either produce insufficient insulin or produce too much insulin to be used by the body. Diabetes can be inherited from parents or can be acquired in the adult age. Diabetes can affect people of any age or race.

### **Symptoms of diabetes**

Some of the symptoms of diabetes are increased thirst, frequent urination, tiredness, low vision and weight loss or gain without any known reason. Others are increased hunger, bad temper, numbness or reduced feeling in the hands or feet and poor healing of wounds.

### **Prevention of diabetes**

Diabetes can be prevented by following health principles. These include eating healthy foods and balanced diet in order to maintain healthy body weight. Diabetes can also be prevented by avoiding smoking and excessive use of alcohol. Doing physical exercise regularly helps to manage diabetes.

## Asthma

Asthma is a disease that affects the respiratory airways. Asthma can be caused by various substances called allergens. The allergens such as mould, animal fur and feathers can trigger asthma. Other allergens which trigger asthma are dust, strong smell or smoke and pollen from plants. These allergens cause swelling of the airways. Swelling of airways and increased production of mucus make airways narrower than normal making it difficult for an individual to breathe.

### Symptoms of asthma

Symptoms of asthma include difficulty to breathe, coughing, wheezing, chest tightness and pain. A person with asthma may produce a whistling or wheezing sound when breathing. Other symptoms include difficulty to sleep due to shortness of breath.

### Prevention of asthma

Asthma can be prevented by avoiding exposure to asthma triggers or allergens. An individual having asthma is advised to identify and avoid asthma triggers that cause allergy. Asthma patients are advised to take medication as prescribed by medical specialists.

### Exercise 2

Match the items in column **A** with phrases from column **B** to make a meaningful sentence.

List A	List B
1. Measles	(a) Painful urination and presence of blood in urine.
2. Malaria	(b) Causes coughing that persists for two weeks or more.
3. Chickenpox	(c) Can be cured through surgery procedures.
4. Tetanus	(d) Causes rashes on the forehead and the entire body.

5. Schistosomiasis	(e) Tightens muscles and causes stiff neck.
6. Asthma	(f) Causes rashes which then develop into fluid filled blisters.
7. Tuberculosis	(g) Abnormal cell division that causes swelling, tumour or lump.
8. Diabetes	(h) Frequent urination.
9. Cancer	(i) Persistent vomiting and diarrhoea.
10. Cholera	(j) A sick person gives a wheezing sound.
	(k) High fever accompanied with joint pains.
	(l) Lowers body immunity.

### Exercise 3

Answer the following questions in your exercise book.

1. What is the difference between communicable and non-communicable diseases?
2. List five symptoms of malaria.
3. How are communicable diseases transmitted?
4. Mention a disease that affects the respiratory tract.
5. Which disease is caused by improper functioning of the pancreas?
6. List three symptoms of measles.
7. What causes tetanus?
8. Explain the transmission of schistosomiasis.
9. How can cholera be prevented?

## Vocabulary

- Allergen** - a usually harmless substance capable of triggering a response that starts in the immune system and results in an allergic reaction
- Blister** - a small sore or swelling on the skin filled with body fluid caused by friction or forceful rubbing, burning or other damages. It is also a sign of some diseases such as chickenpox
- Chemotherapy** - treatment of diseases by the use of chemical substances like drugs
- Pathogens** - diseases causing organisms
- Pollen** - a fine powdery substance that comes from the male part of flowers and often causes people to suffer an allergic reaction
- Radiotherapy** - the treatment of diseases by the use of radiation to kill harmful cells such as in treatment of cancer
- Tumour** - a swelling of part of the body caused by an abnormal division of body cells
- Vector** - an organism, usually an insect, which carries pathogens from one individual to another

## Chapter Nine

# Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS)

### Introduction

*In Standard Three, you learnt about HIV infection. You also learnt about prevention of HIV infection. In this chapter, you will learn about the effects of HIV and AIDS as well as care and support for people living with HIV and AIDS.*

### Effects of HIV infection

*Read the following passage, then answer the questions in Exercise 1.*

Some people living with HIV do not know that they are infected. A person living with HIV infection can appear healthy. Therefore, people living with HIV infection may not be aware of their HIV status, unless they take an HIV test. HIV attacks the white blood cells and causes the body to lose its ability to fight against pathogens. This weakens the body immunity.

HIV destroys the immune system causing the body to be attacked by different types of diseases. These are called opportunistic diseases. They may cause death to infected persons. Examples of opportunistic diseases associated with HIV include tuberculosis, cancer, dysentery, chronic malaria, pneumonia, meningitis, skin diseases and prolonged cough. A person living with HIV should take correct treatment of all opportunistic diseases. When these diseases are not treated on time, the HIV weakens the immune system resulting into AIDS.

There are several symptoms of HIV and AIDS. During the early stage of HIV, a person may experience headaches, fever, tiredness, chills, aches of muscles and joints, sore throat, swollen lymph nodes and mouth sores. The late stage of HIV

infection is accompanied by rapid loss of body weight, night sweat, skin rashes with purplish spots, recurring fever and prolonged swelling of lymph nodes in the armpit, groin or neck. Other symptoms include diarrhoea that lasts for more than a week, general body weakness and memory loss. Most of these symptoms are related to other illness. People living with HIV and AIDS are advised to take medicine in order to suppress HIV and prolong life.

### Exercise 1

Answer the following questions in your exercise book.

1. How can a person know if he or she is infected with HIV?
2. Describe how HIV affects the body's immune system.
3. List three opportunistic diseases that can affect persons with HIV.

### Caring for people living with HIV

Read the following passage, then answer the questions in Exercise 2.

One day a health officer visited pupils of Mwangaza Primary School in order to explain the importance of caring for people living with HIV. The officer told the pupils that people who are infected with HIV and AIDS need care and support from their families, friends and community.

One pupil asked, "How do we take care of people living with HIV and AIDS?" The health officer replied, "We should love, respect and support them. Also we should care for the HIV infected persons by providing them with a balanced diet. The HIV and AIDS victims should eat a balanced diet to strengthen their immunity".

A balanced diet contains foods rich in proteins, carbohydrates, fats, vitamins and minerals. Such foods include meat, eggs, nuts and vegetables. Others are stiff porridge, rice, potatoes, cassava, fruits and fish. The infected people are supposed to eat a balanced diet and drink clean and safe water".

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The health officer continued to explain that, people with HIV and AIDS have been stigmatized in many communities due to their health condition. For example, people with HIV and AIDS are given embarrassing names and are being denied their basic human rights.

Some infected people are not included in family and social activities. Some people think that helping people with HIV is wastage of time and money. This is because these people are thought to have a short time to live. They are also considered to be no longer useful in their families and society. The health officer asked pupils why they thought the community stigmatized people with HIV and AIDS.

One pupil responded, “It is because many people don’t have the right information about HIV and AIDS and are afraid of getting infected. He added that, “today you gave us a very important lesson. It will help us to live with our friends who are living with HIV without stigmatizing them”. The health officer appreciated the good response of the pupil and insisted that everyone should care for people living with HIV and AIDS.

“It is very important to involve them in various activities at home, in our communities and at school”, the health officer said. She then concluded that, HIV is not transmitted by shaking hands, touching or playing together with a person living with HIV and AIDS.

Lastly, the health officer explained that people living with HIV have the right to good education, good treatment, food and clothing. She also explained that people living with HIV should be loved, taken care of and be appreciated in their family and society.

## Exercise 2

Answer the following questions in your exercise book.

1. What topic did the health officer talk about?
2. Which actions indicate that a particular community stigmatizes people living with HIV?
3. Why are people living with HIV advised to eat a balance diet?
4. List actions that can show that you care for people living with HIV.
5. What did you learn from the passage?

Observe Figure 1(a) and 1(b), then answer the questions in Exercise 3.



(a)



**Figure 1:** Healthy and HIV infected pupils (a) shaking hands and (b) playing together

### Exercise 3

Answer the following questions in your exercise book.

1. What does Figure 1 tell you about interacting with people living with HIV?
2. Mention any other ways uninfected persons can interact with persons living with HIV.
3. Can you identify HIV infected and uninfected persons with your naked eyes?

### Exercise 4

Answer the following questions in your exercise book.

1. List foods that are recommended for people living with HIV and AIDS.
2. Mention at least three symptoms shown by people infected with HIV and AIDS.

3. What important care should be provided to HIV and AIDS victims?
4. What should be done to minimize stigmatization of people living with HIV and AIDS?

### **Vocabulary**

- Balanced diet** - a diet that contains proper amounts of carbohydrates, proteins, vitamins, minerals and water necessary for good health and body growth
- Opportunistic diseases** - diseases that occur more frequently and are more severe in people with weakened immune systems, including people with HIV
- Stigmatization** - the act of treating people in a way that makes them feel that they are not important
- White blood cells** - the cells that protect the body against disease causing organisms or pathogens

## Chapter Ten

### First aid

#### **Introduction**

*First Aid is an immediate help given to a person suffering from a sudden illness or injury before being taken to a health centre or hospital. If the victim does not get this help his or her condition may become worse and the victim can die. Therefore, first aid helps to save lives, promote recovery and avoid further illness or injury. In Standard Three, you learnt how to provide first aid to a person bitten or stung by insects. In this chapter, you are going to learn about first aid given to a person who has fainted.*

*Read the following passage, then answer the questions in Exercise 1.*

Amani, Johari and Jumanne are friends. They all live in Maendeleo Village. One day Amani and his friends were playing outside their house. While playing, Amani's mother called him. She told him to fetch water. Amani took a bucket and went to fetch water together with his friends.

On their way, they saw a big snake crossing the road. Amani was very scared. He fell down suddenly and fainted. His friends were shocked, so, they started calling him: "Amani! Amani!" Amani did not wake up and was unable to respond.

Johari and Jumanne lifted Amani and placed him in a safe place. They laid him on his back under a tree where it was cool. This helped Amani to get fresh air and recover. Johari told Jumanne to raise Amani's legs with his face facing upward. This helped the heart to easily pump blood to the brain.



**Figure 1:** *First aid given to a fainted person*

Johari and Jumanne fanned Amani using a piece of cloth in order to supply more air to him. Amani was sweating and was breathing with difficulty. Johari quickly rushed home to inform Amani's mother of what had happened. Amani's friends and his mother rushed Amani to hospital. The doctor told Amani's mother that her son was recovering from the shock he got and he would be fine.

"A person may faint because of a heart attack or after getting bad or good news. Excessive bleeding caused by injury of blood vessels may also lead to fainting" he said mentioning other factors such as insufficient fresh air, fatigue, hunger and electric shock.

The doctor advised that when first aid is being given to a person who has fainted, the following procedure should be observed:

- (a) Place the victim flat on his or her back in a cool and well ventilated area.
- (b) Loosen any tight clothing at the neck, chest and belt to give the victim some relief.
- (c) If the victim is in a room that is not well-ventilated, open the doors and windows to let in more fresh air. Also, you can fan the victim using a piece of cloth in order to increase air circulation. Thereafter, take the victim to a health centre or hospital.

After the good advice from the doctor, Amani's friends and mother thanked him.

### Exercise 1

Answer the following questions in your exercise book.

1. List three causes of fainting.
2. Mention the type of first aid given to Amani before he was taken to hospital.
3. What was the condition of Amani when his mother came to see him?
4. Why did Amani faint?
5. Explain how you can help a person who has fainted.

### Activity 1: *Providing first aid to a person who has fainted*

Organize a role play on providing first aid to a person who has fainted. Note that all steps should be followed.

## Exercise 2

Write **TRUE** for the correct statement and **FALSE** for the incorrect statement.

1. We should not cause shock to people because they may faint. \_\_\_\_\_
2. Excessive bleeding may cause a person to faint. \_\_\_\_\_
3. A person who has fainted may have breathing difficulties. \_\_\_\_\_
4. A person who has fainted should be covered with a blanket to prevent him or her from cold. \_\_\_\_\_
5. Opening doors and windows of the room may supply fresh air to a fainted victim. \_\_\_\_\_
6. A person who is not fearful cannot faint. \_\_\_\_\_
7. We are advised to surround a person who has fainted in order to supply more fresh air. \_\_\_\_\_
8. Fainting occurs when the brain does not receive enough blood supply. \_\_\_\_\_
9. There is only one reason which can cause fainting. \_\_\_\_\_

## Exercise 3

Answer the following questions in your exercise book.

1. What is first aid?
2. Explain the importance of first aid to a person who has fainted.
3. What are the effects of delaying first aid to a person who has fainted?
4. Mention other reasons that may cause a person to faint.



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5. Why is it advised to loosen the clothes of the victim when providing first aid?

### **Vocabulary**

- Consciousness** - the state of awareness and responsiveness to one's surroundings
- Fainting** - a sudden loss of consciousness due to insufficient supply of oxygen to a person



## Chapter Eleven

### The digestive system

#### **Introduction**

*In Standard Three, you learnt about the digestive system, its functions and importance. In this chapter, you will learn about some disorders in the digestive system. You will also learn how to protect the system by observing proper eating habits.*

*Read the following passage and then answer questions in Exercise 1.*

Mr and Mrs Mahone have two children; a son called Mahenge and a daughter called Sayani. One day Mr Mahone travelled to town and came back home at night. His wife and children had finished taking dinner.

Mr Mahone told his children, “My children, I have brought you delicious fried meat, will you eat now?” Sayani said, “Father, I will eat tomorrow because I’m already full”. Mahenge said, “Daddy, although I’m full, I will eat my portion of meat now”. Mr Mahone gave Mahenge the meat. Mahenge was already full but he ate because he liked eating meat very much. Thereafter, they all went to sleep.

At midnight, Mahenge had severe stomach ache, he started to cry. Also he experienced heartburn and belching. He could not go to school in the morning because the stomachache continued.

## Exercise 1

Answer the following questions in your exercise book.

1. Why did Mahenge suffer from stomach ache?
2. Why did Sayani refuse to eat the fried meat?
3. What have you learnt from this passage?

### Disorders in the digestive system

Digestion of food occurs in the mouth, stomach and small intestine. It starts in the mouth, proceeds in the stomach and ends in the small intestine. Undigested food is temporarily stored in the large intestine before being eliminated as faeces through the anus. Figure 1 shows the human digestive system.

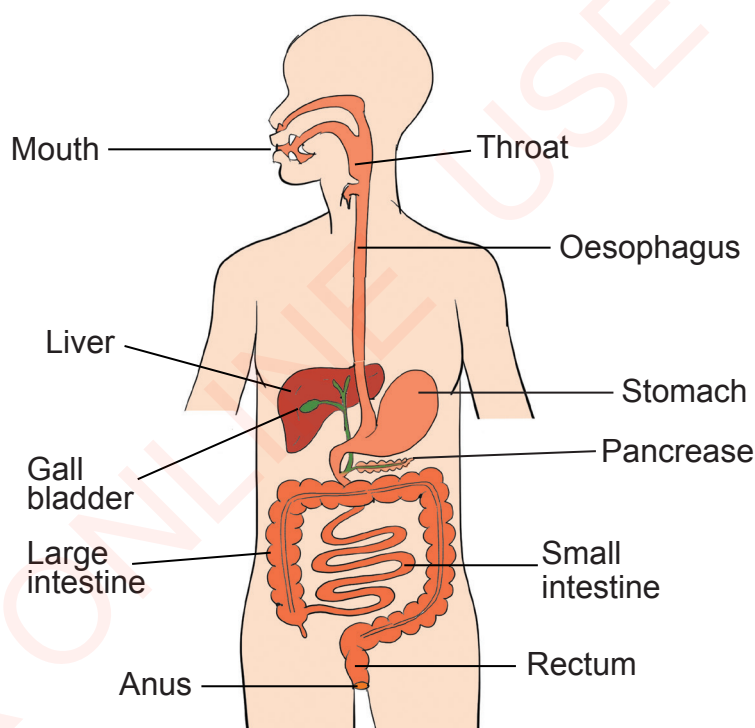


Figure 1: Human digestive system

Each organ in the digestive system performs a specific function. The organs work together to facilitate break down of food into simpler substances which can be absorbed by the

body. However, sometimes the digestive system may become inefficient due to poor eating habits. Disorders in the digestive system may occur at any part of the system during digestion. These include indigestion, heartburn, and stomach ulcers.

### **Indigestion**

Indigestion is a digestive disorder which is normally associated with pain or discomfort. This disorder can be caused by eating habits that may result into partial digestion of food substances in the stomach.

### **Causes**

Indigestion may be caused by smoking cigarettes, consumption of alcohol, and certain medications. It may also be due to stress, overeating and eating or swallowing food quickly without properly chewing it.

### **Symptoms**

The symptoms of indigestion include stomachache, vomiting, abdominal discomfort, nausea, constipation, diarrhoea, bloating and belching. Often belching produces air with bad smell.

### **Prevention and control**

This condition can be prevented by eating a reasonable amount of food, eating slowly and chewing the food properly, and avoiding food with a lot of acid. It can also be prevented by drinking enough water and consumption of food containing roughage to enhance effective digestion. Sources of roughage are fruits, green vegetables, and whole grains. Other prevention methods include avoiding smoking and excessive consumption of alcohol.

### **Heartburn**

Heartburn is a burning sensation which occurs when acid containing food in the stomach is moved back to the oesophagus through a valve called sphincter muscles. The acid in the food causes a severe burning sensation from the lower to the upper part of the chest.

### **Causes of heartburn**

Heartburn can be caused by overfeeding. Also, it may be caused by eating foods containing too much oil or fats such as fried foods. Presence of a large amount of oil or fats in the food delays digestion in the stomach. This results into overproduction of gases in the stomach. The other cause of heartburn is eating foods with high acid content. Such foods include lemon, bitter lemon, bitter tomatoes, sour milk and foods containing too much tomato. In addition, taking drinks rich in caffeine like coffee and tea, and going to bed shortly after meals may also cause heartburn.

### **Symptoms of heartburn**

The symptoms of heartburn include a burning sensation in the chest, belching, and sour taste in the mouth.

### **Prevention and control of heartburn**

Heartburn can be prevented by consuming food at a normal pace instead of eating too fast. This will enhance the digestion process.

It can also be prevented by eating small amount of meals at regular intervals. The other method of preventing heartburn is to avoid food and beverages that cause heartburn. Such foods include beans, tomatoes and cold sweet potatoes which have high acid content. Drinking enough water and avoiding going to bed shortly after eating can also help to reduce the risk of heartburn. It is important to take a rest after eating for about two to three hours before going to bed. Furthermore, doing physical exercise or heavy duty shortly after eating should be avoided. If heartburn persists, it is important to seek for medical advice and further treatment.

### **Stomach ulcers**

This is a condition which occurs as a result of wounds on the mucus lining of the stomach wall. The wounds expose the stomach wall to direct contact with acids and digestive enzymes. The acids and enzymes then burn and digest parts

of the stomach walls and create ulcers. These ulcers are associated with severe stomachache. Usually, acute ulcers are associated with excessive bleeding. Ulcers may also occur in the duodenum.

### Causes of stomach ulcers

Stomach ulcers are caused by several factors including action of stomach acids on bare stomach walls. Other causes include prolonged fasting, stress, eating too little food, and eating foods contaminated with ulcer causing bacteria. Eating foods containing acids and excessive consumption of alcohol increase risk of getting stomach ulcers.

#### Exercise 2

Write **TRUE** for the correct statement and **FALSE** for the incorrect statement

1. Anybody can get problems of the digestive system if he/she does not follow proper eating habits. \_\_\_\_\_
2. Indigestion is caused by eating food containing a lot of oil or fats. \_\_\_\_\_
3. A balanced diet cannot trigger disorders of the digestive system. \_\_\_\_\_
4. Proper eating habits are important in preventing disorders of the digestive system. \_\_\_\_\_
5. Excessive consumption of acidic foods is the only cause of ulcers. \_\_\_\_\_
6. Consumption of vegetables and fruits causes disorders of the digestive system. \_\_\_\_\_
7. The disorders of the digestive system include indigestion, malaria, and stomach ulcers. \_\_\_\_\_

### Exercise 3

Answer the following questions in your exercise book.

1. Mention any three (3) disorders that can occur in the digestive system.
2. What are the causes of indigestion?
3. Briefly explain how to prevent disorders of the digestive system?
4. List the components of a balanced diet.
5. Briefly explain methods of preventing ulcers.
6. How can you prevent heartburn?
7. List down food stuffs which can cause heartburn in the following meals:
  - (a) breakfast
  - (b) lunch
  - (c) supper

### Vocabulary

- Belching** - to let air come up noisily from your stomach and out through your mouth
- Sphincter muscles** - muscles located between the oesophagus and the stomach that prevent food in the stomach from going back to the oesophagus
- Digestion** - the process of breaking down large food substances into small and absorbable forms
- Husk** - the outer shell or coating of a seed



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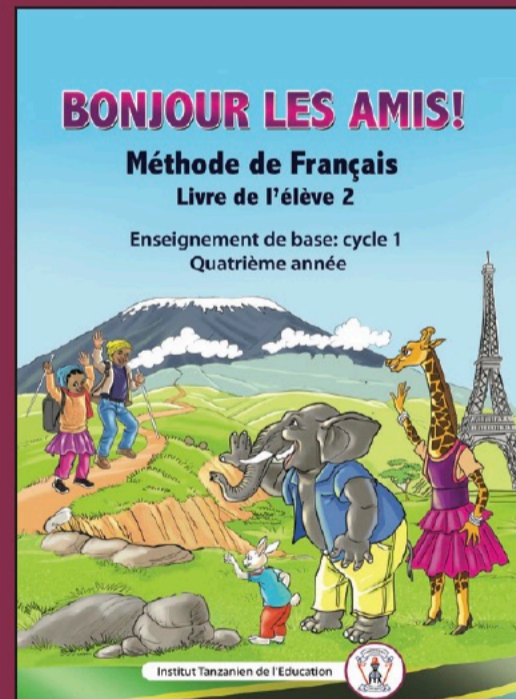
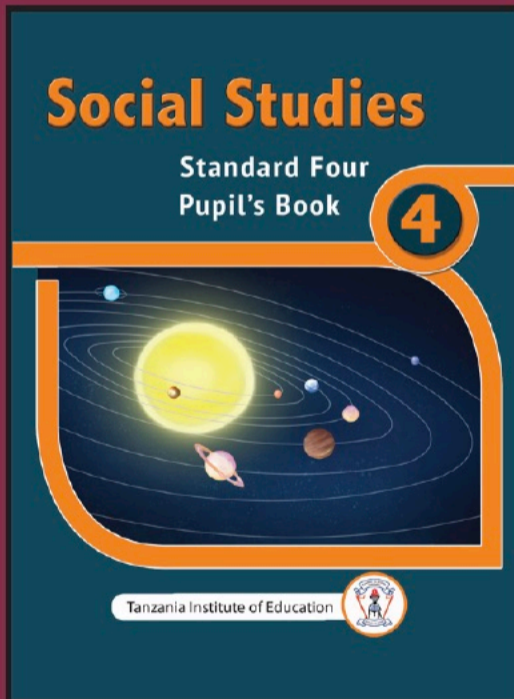
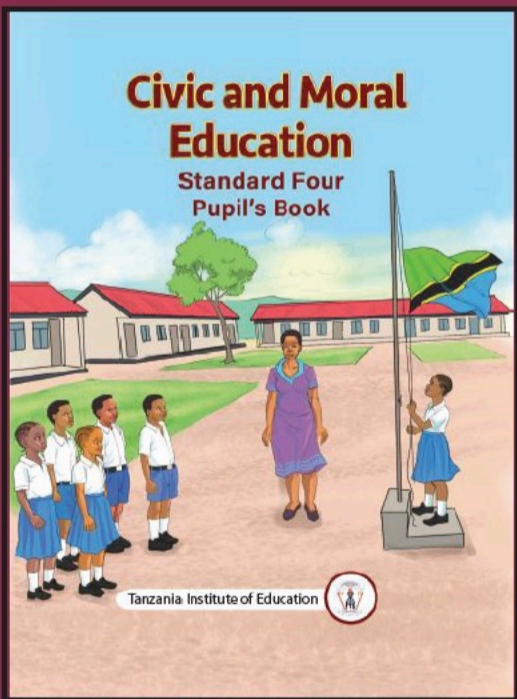
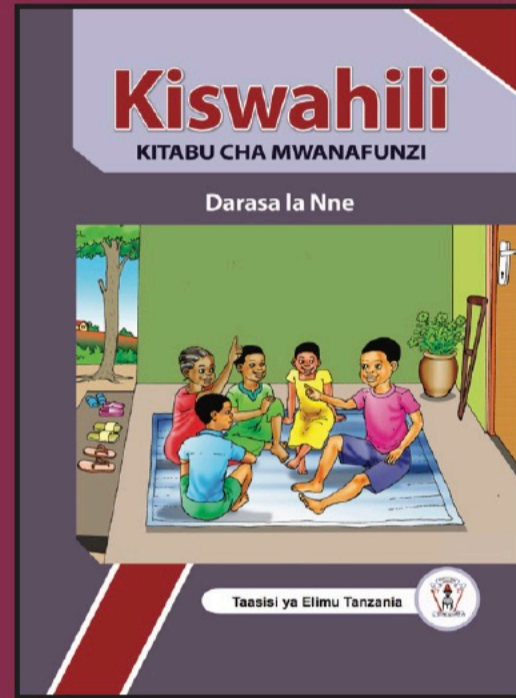
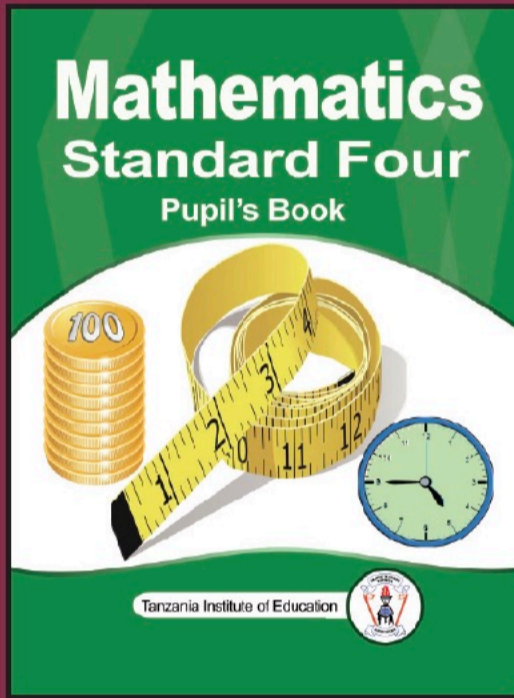
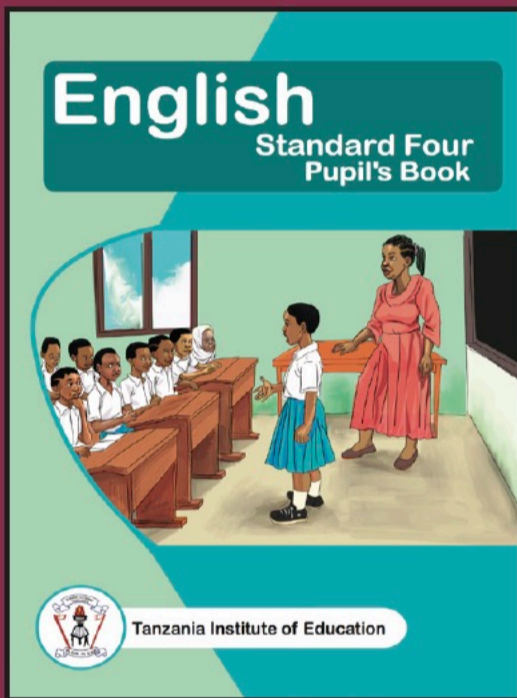
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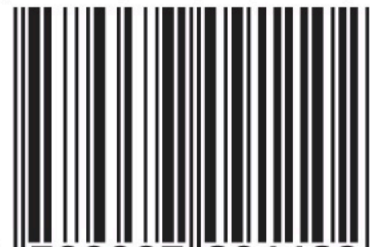


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