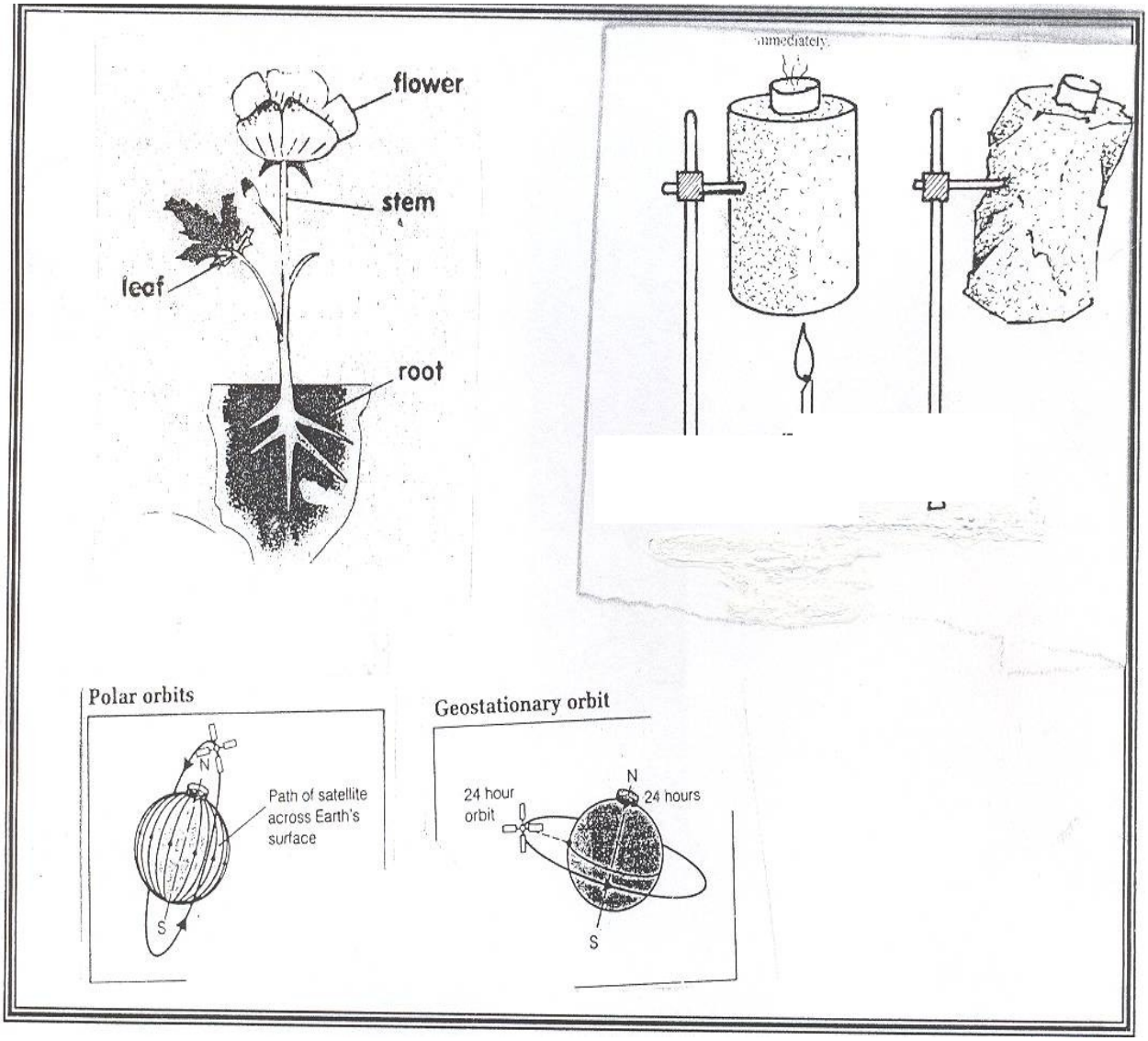
BASIC INTEGRATED SCIENCE

STUDENT'S TEXT



GRADE 5

This book is prepared for grade 5 students of SNNPRG in accordance with the syllabus prescribed under the new revised curriculum. The book covers six units. These are Air, Water, Plants, Animals, Our body and the Earth.

In each unit, topics and sub topics brainstorming, practical activities, exercise and project works are given to facilitate the teaching and learning process of the subject matter. One of the aims of teaching basic integrated science is “to build up scientific habits, attitudes and outlook in the learners.” We believe that this aim is best achieved by instilling into the students the spirit of inquiry which has all along been the motivating force behind all the inventions and discoveries.

Finally, the SNNPRS Education Bureau department of curriculum and educational materials supply core process is sincerely grateful to give comments and suggestion that help to improve the book.

Any suggestion to enhance the usefulness of the book will be gratefully acknowledge.

Writers

Unit 1
Air

Contents	
Section	**Learning competencies**
1.1 Air as substance	• Define a substance as a solid, liquid or gas that may contain is one or a mixture of components, • List nitrogen, oxygen argon and carbon dioxide as components of air. • Give example of common elements • Explain physical properties of metals and non-metals • Classify common elements into metals and non-metals
1.2 properties of air	• Explain the properties of air • Define pressure as a force exerting over an area • Demonstrate some of the properties of air.
1.3 Importance of air	• Explain the importance of air • Identify some products of technology that use air.
1.4 The human breathing	• Define breathing as the taking in oxygen and giving out carbon dioxide • State organs of breathing • Identify composition of inhaled and exhaled air.
1.5 The effects of smoking on health	• Explain the effects of cigarette smoking on health
1.6 Harmful rational practices	• Mention inhaling ‘ gaya’ and ‘ suret’ and Uvular mutilation of babies as harmful traditional practices. • Describe the harmful effects of ‘ gaya’, ‘ suret’ and uvular mutilation on health.

Unit - 1

1. Air

Atmosphere: is a thick blanket of air that surrounds the earth.

Activity 1.1

* What is air?

* From where do you get air?

Introduction

This unit deals about air, properties of air, importance of air and also about the general structure of the human breathing system.

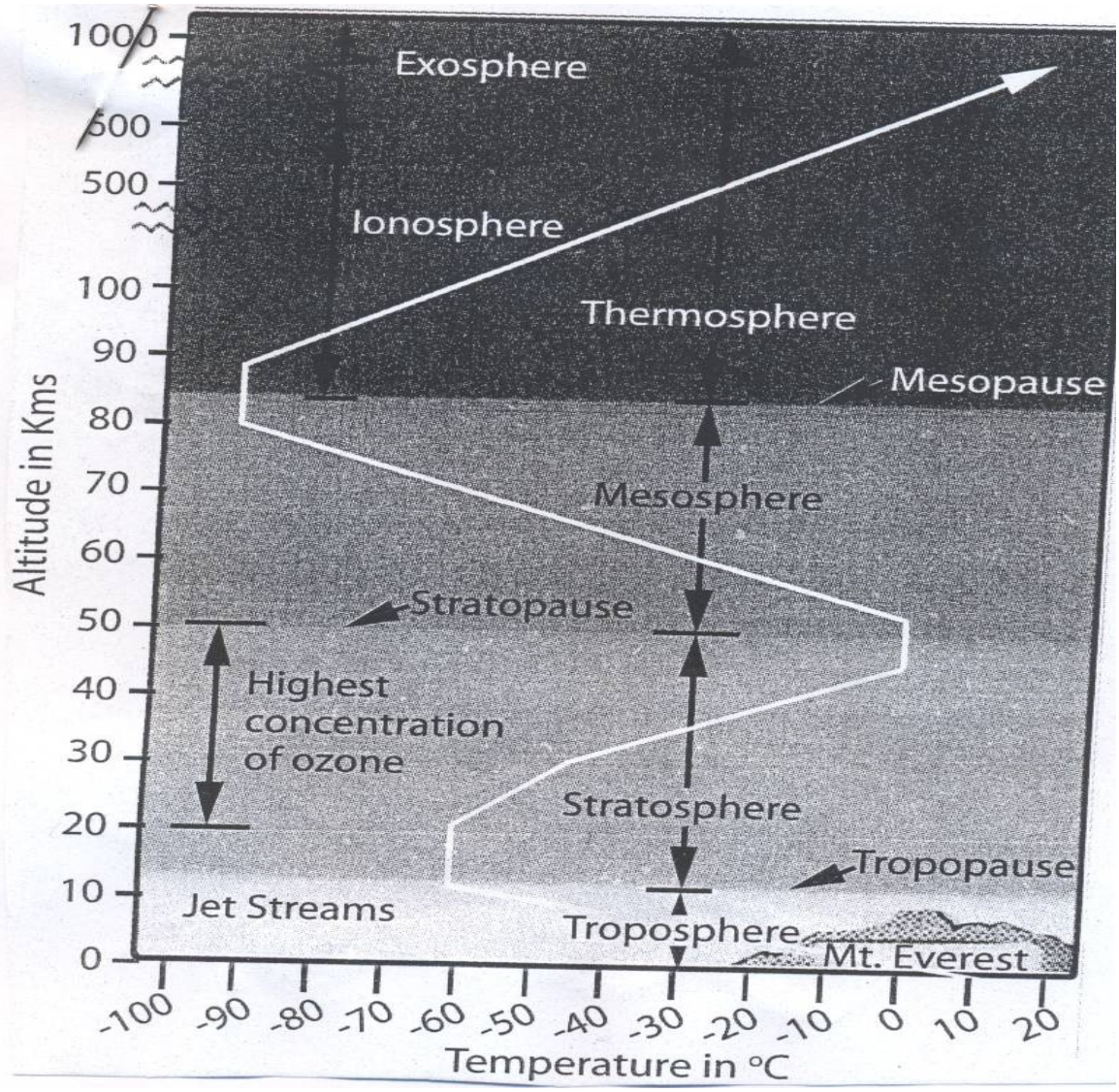


Fig. 1.1 Vertical structure of the atmosphere

The earth's atmosphere can be divided in to different layers. The atmosphere is made of different gases (air). The layer at the bottom is the place where we are living.

It is necessary for life on earth.

1.1. Air as a substance

Composition of air

Activity 1.2

* Is air a mixture?

* How do we know air is there?

Discuss with in a group.

Substance – matter that has a definite or fixed physical property

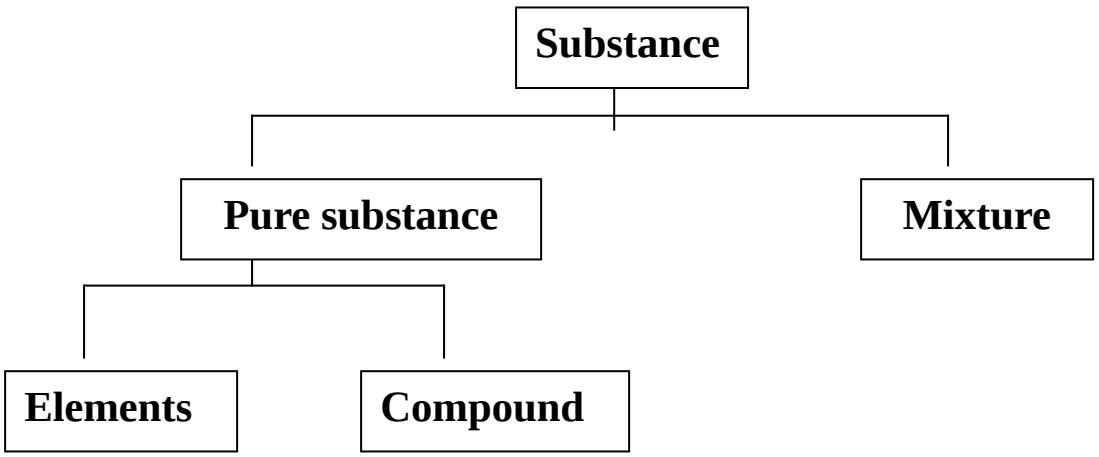
Example: coin, water, gold, cloth, etc.

Volume: is the space occupied by substance.

Mixture – the substance made up of two or more pure substances.

Example: mixture of salt and water, air, etc

Air is not a pure substance. It is a mixture of different gases. These gases have no equal composition by volume. Among these gases, oxygen is necessary for animals to exist on earth. In general life can not be possible without air. The main compositions of air are nitrogen, oxygen, argon and carbon dioxide.



Elements: a substance that cannot be decomposed into simpler substance by chemical reactions.

Example: nitrogen, oxygen, argon, etc.

Compounds: a substance composed of two or more chemically combined elements.

Example: carbon dioxide, water, etc.

Mixtures: the combining of two or more elements or compounds which have not chemically combined.

Example: air, mixture of water and salt, etc

Composition of air

Components of air	Percentage by volume in air
Nitrogen	78%
Oxygen	20.96 %
Carbon dioxide	0.04%
Argon	1%

Table 1.1 composition of air

Activity 1.3

* Draw a diagram (pie chart) to show the composition of air using the data given in the above table.
* Which constituent of air is found in lowest amounts?

Other Common Substances

* Which components of air are elements?

All substances are either a mixture, compound or an element. Ninety two (92) of the elements are naturally occurring. Compounds and mixtures are formed from these naturally occurring elements.

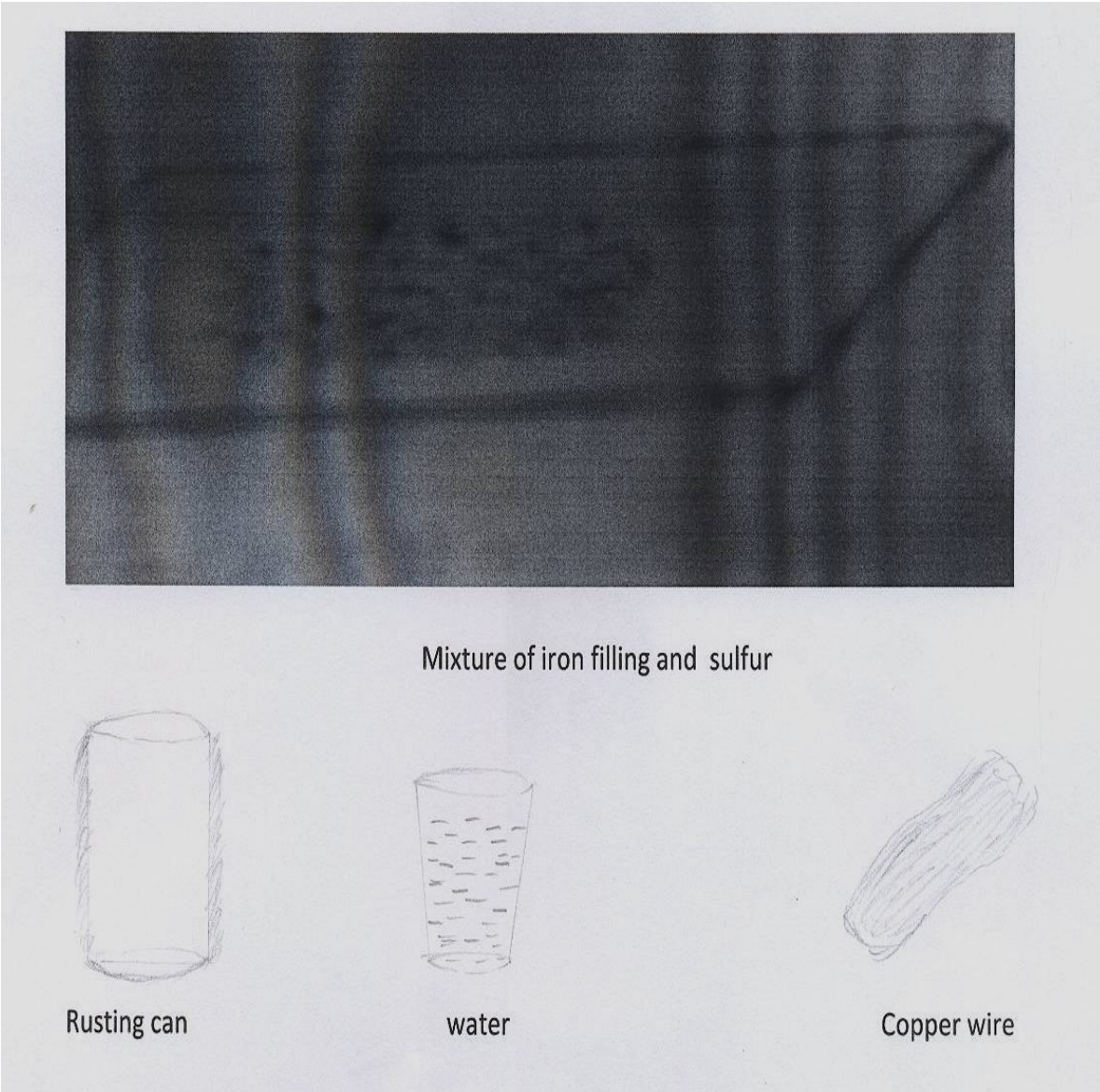


Fig 1.2 Common substances

Activity 1.4

* Categorize the common substances in the above figure into elements, mixtures or compound.
* How elements classifies into groups?

Bases on their common properties generally elements are divided into two groups. These are:

1. **metals**
2. **non-metals**

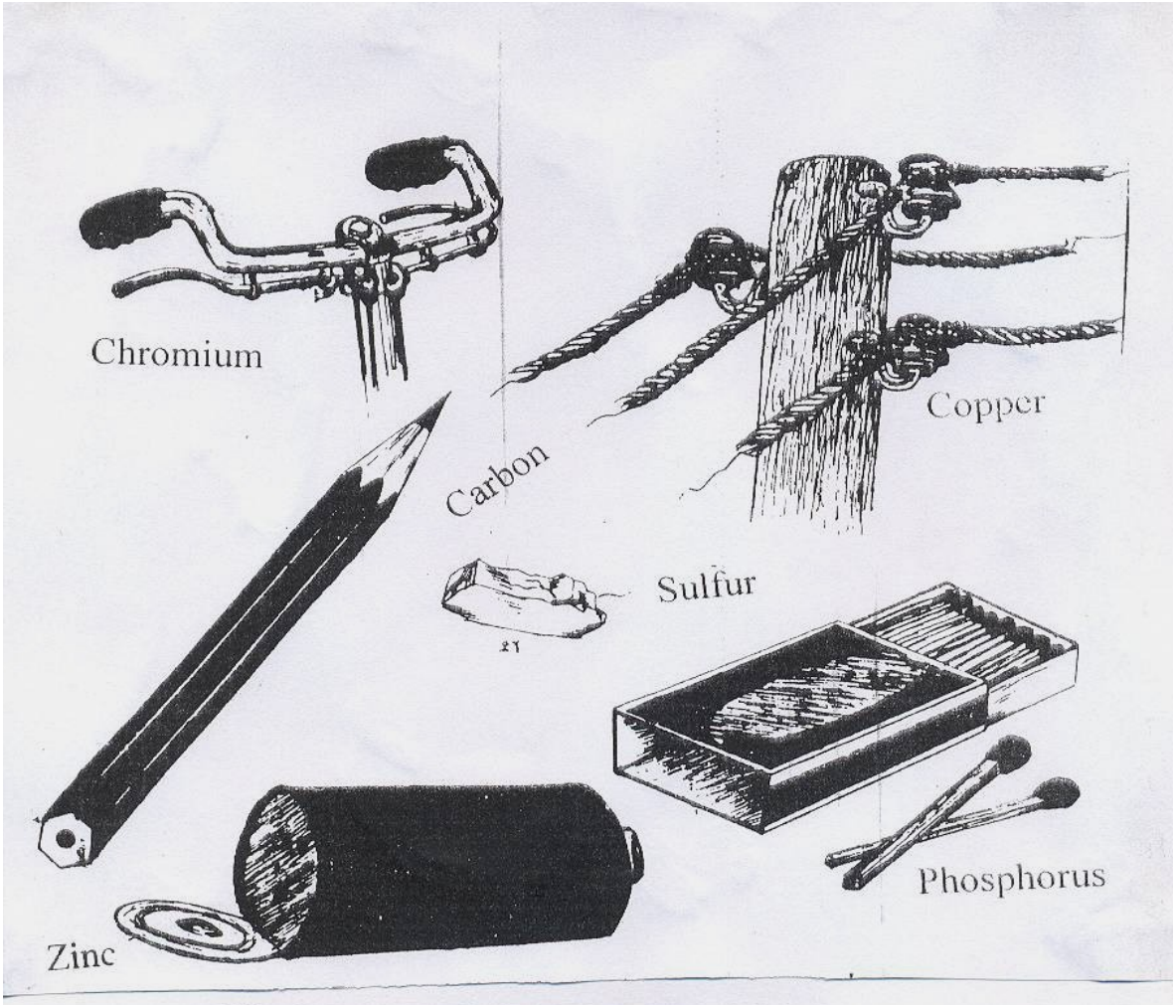


Fig. 1.3 metals and non metals

Activity 1.5. Classify the elements in fig 1.3 as metals and non-metals

Metals

Most of the elements are categorized as metals. They have common properties. Some of the properties of metals are:

Common metals	**Physical properties**

Iron, gold, copper, silver, aluminum, nickel, tin, lead, etc.	Solid Hard Flexible Metallic appearance (polished)

Table 1.2 Common metals with their similar properties

Alloys are not elements. They are a mixture of different elements. People make alloys for making different materials.

Alloy: is a mixture of two or more elements.

Examples: spoon (steel), medals, air plane body, cents, etc.

Air plane body.

Fig.1.4. Different alloys

Non-metals

A non-metal is a group of elements that do not show the properties of metal. Most of the non-metals are gases. For example: oxygen, hydrogen, etc. Bromine is the only liquid non-metal at normal conditions.

Common non-metals	**General physical properties**
Carbon, sulfur, iodine,etc.	Solid, rigid, can be crushed into powder and dull appearance.

Table 1.3 Non-metals with their similar physical properties

Activity 1.6

* Name the materials that you and your family use.
* Are they made from metals or non-metals? Present your findings to the class.

Exercise 1.1

I – Choose the correct answer.

1. Air is _____

   A) compounds B) elements

   C) mixture D) pure substance

2. The most abundant element in the air by volume is _____.

   A) argon B) carbon dioxide

   C) nitrogen D) oxygen

3. Which parts or a constituent of air is used to stop fire (as fire extinguisher)?

   A) Argon B) Carbon dioxide

   C) Nitrogen D) Oxygen

Match column "A' with column " B"

A	B
1. Compound	A. a solid non-metal
2. 5 cents	B. iron rust
3. Sulfur "*dign*"	C. alloy
4. Mercury	D. liquid metal
	E. liquid non metal.

1. 2 Properties of Air

Activity 1.7

* The air which is found around us has no color and not seen with our naked eyes.

So how can you describe the presence of air to your friends?

* What do you feel if you ride a bicycle or horse very fast?

Discuss with your group members.

All substances have their own properties. The property of one substance is used to differentiate them from others. It is also used to explain its presence. Similarly, air has also properties. The main properties of air include:

Air: occupies space

: is very compressible

: is diffused

: exerts pressure

: expands when heated

Diffusion: is the spontaneous movement of a gas to fill up all the available space.

Practical Activities 1.1. Air occupies space

Objectives /aim: To show that air occupies space.

Materials: Jar, glass, water

Procedure: 1. Fill a jar about two-third of its volume with water.

2. Then push down the glass as is shown on the figure below

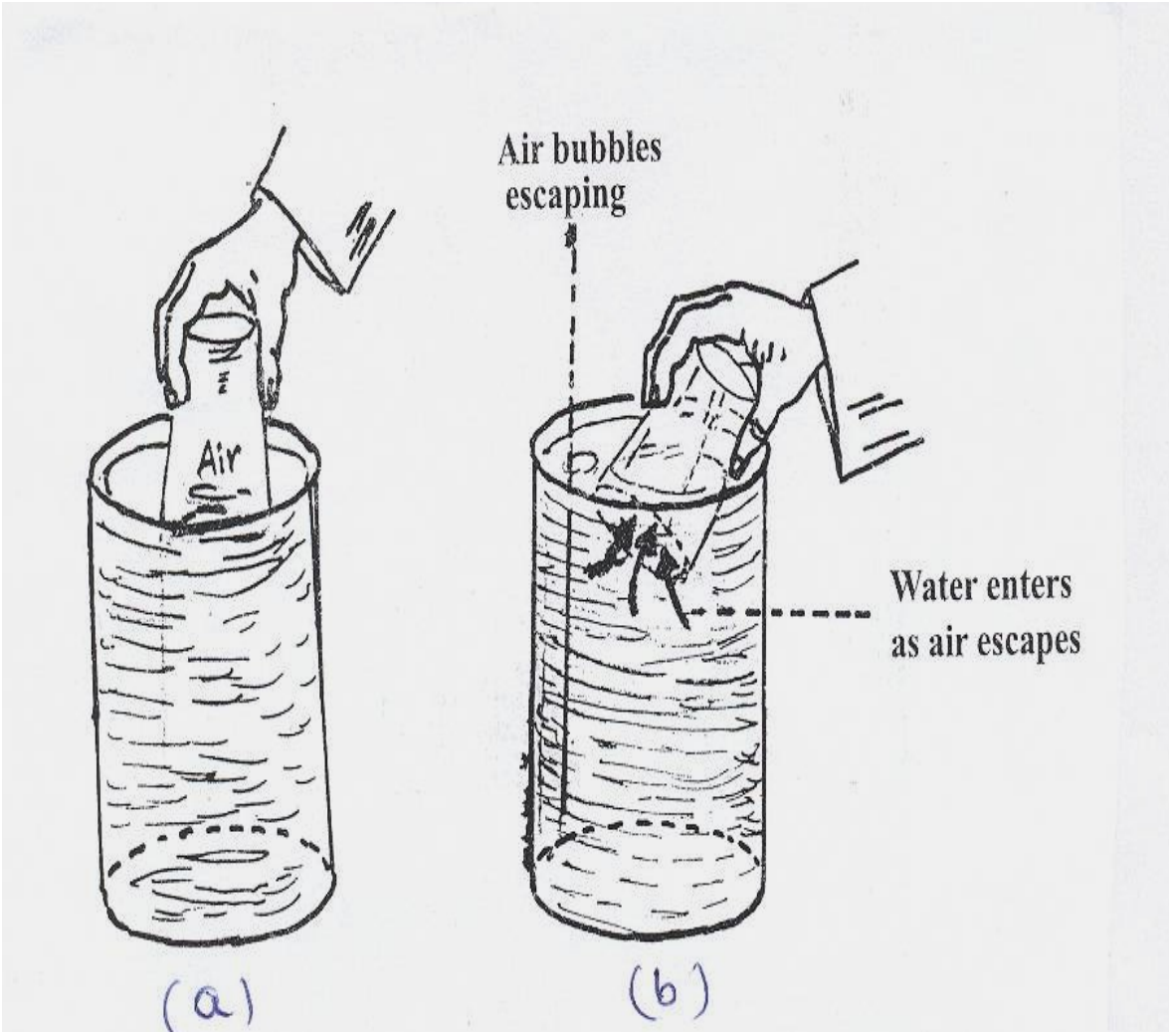


Fig.1.5 Air occupies space

Questions: What do you observe?

In which glass does water enter easily? Why?

Practical Activity 1.2. Air is very compressible

Objective /aim: To show that air is compressible

Materials: syringe

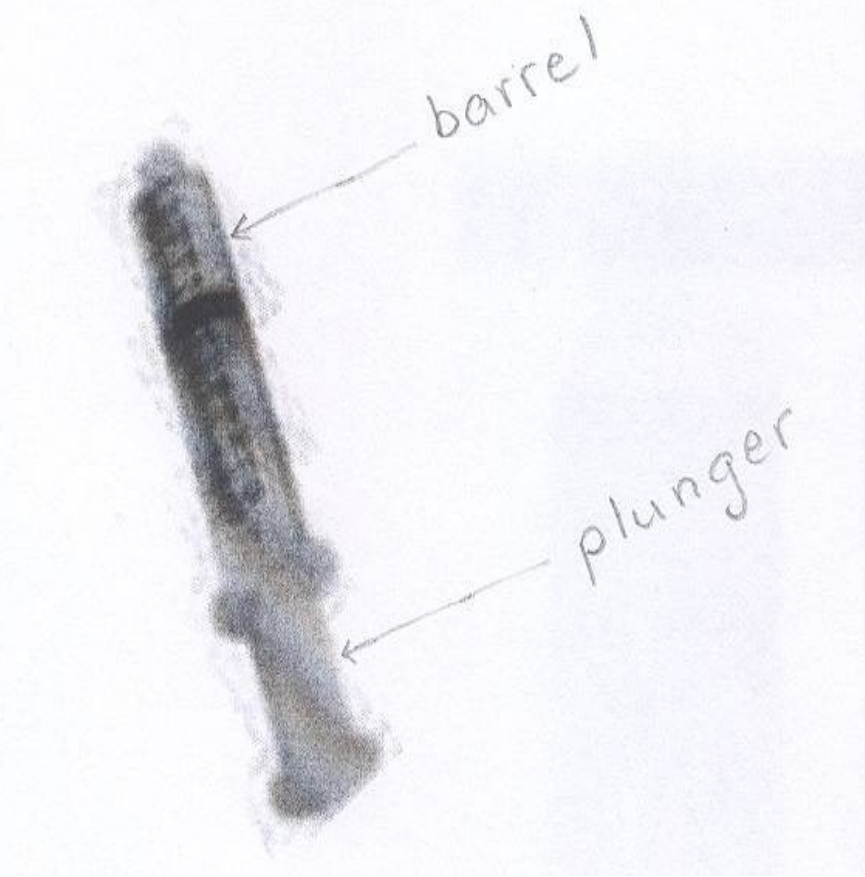


Fig. 1.6 Syringe

Procedures: 1. Pull the plunger out as the figure shown below.
2. Place your finger over the outlet of the syringe.
3. Push the plunger back in barrel as far as it will go.

Questions: Did you push the plunger downward successfully?
What do you conclude from your observation from the practical activity?
Discuss with your partner.

Practical Activity 1.3. Air is diffused

Objective/ aim: to demonstrate how gases expands and fill the space

Materials: perfume, cotton wool

Procedure: 1. go outside the class and soak the cotton wool with the perfume.

2. let the students return to the class.

3. observe whether there is any pleasant odor in the class

Fig. 1.7. Air is diffused

Questions: Is the odor the same as that observed first in the class?

Can the pleasant smell be detected in all parts of the class immediately or a few minute later?

By what process did the perfume travel in the class?

Practical Activity 1.4. Air exerts pressure

Objective / aim: to demonstrate air exerts pressure.

Materials: bottles, water, and straw "*kessem*"

Procedure: fill each bottle with water and cork it securely and insert the straw and suck

slowly.

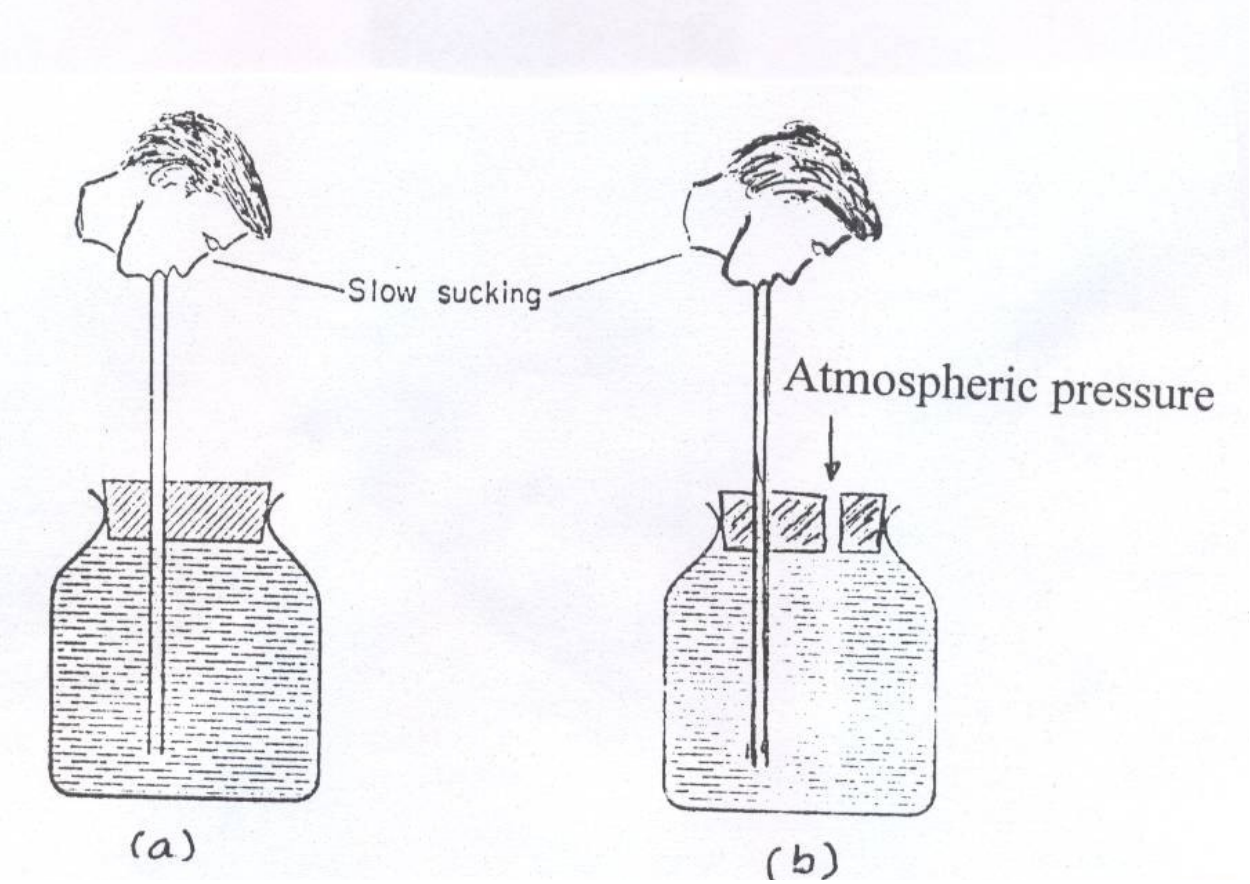


Fig. 1.8. Air exerts pressure

Questions What do you observe?

Is it possible to suck the water in both cases easily?

What is your conclusion from the practical activity?

Practical Activity 1.5. Air expands when heated.

(Collapsing can experiment)

Objectives /aim: to show that the air pressure inside a container is equal to the air pressure outside.

Materials: metal can, water, Bunsen burner (stove)

Procedures: 1. put small amount of water into a metal can as it is shown on the figure below.

2. boil the water for several minutes to drive out the air.
3. stop heating and cover (seal) the can with a well fitting rubber or cork immediately.

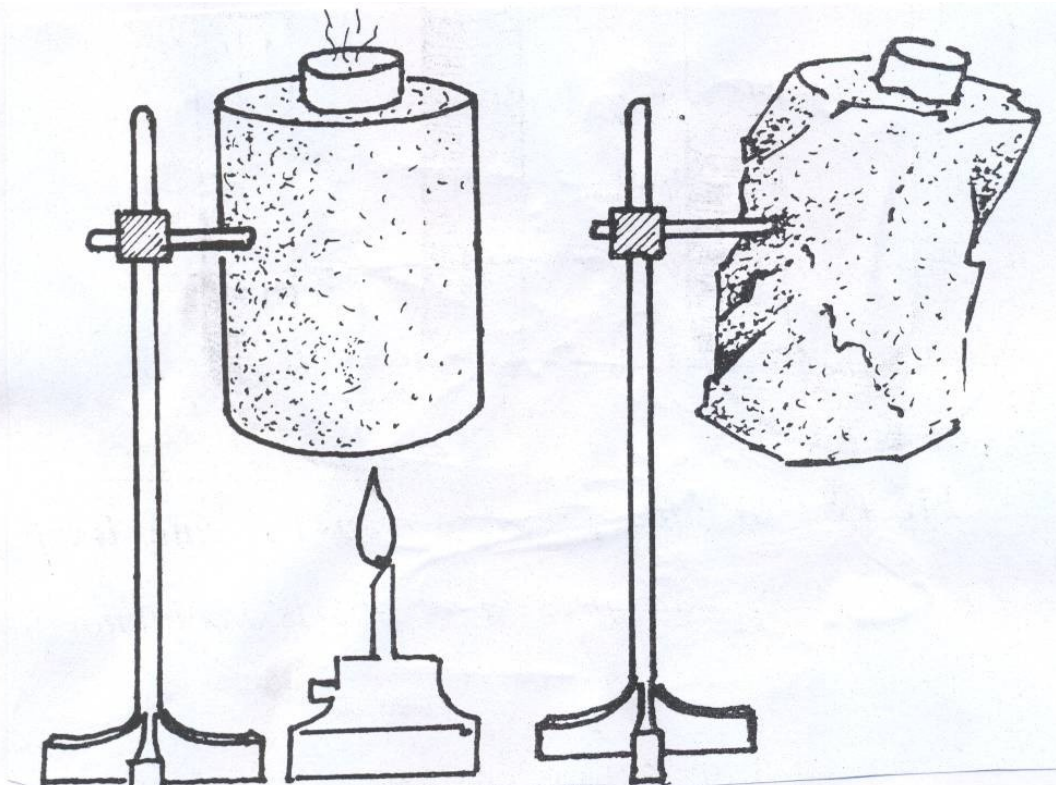


Fig. 1.9. Collapsing can experiment

Questions: What happen to the can?

Why this does occurs?

Explain your answers.

1.3 The importance of Air.

Activity 1.8

***** Is it possible to stop the air entering your mouth and nose using your hands or small clothes for three or five minutes? Why?

* Which parts of the air is very important for plants and animals to exist on earth?

Photosynthesis: is a process by which plants make food.

The gases that make up air are very important to plants and animals. For example, carbondioxide is found in small proportion in the air, but all plants and animals depend on this gas directly or indirectly. Plants use this gas to make their own food in the process of photosynthesis. And, the sources of most of the foods of animals are plants. Nitrogen in the air is a necessary gas for living organisms. Both plants and animals need it to make protein.

$$\text{Carbon dioxide + water} \xrightarrow{\text{Sun light}} \text{glucose + oxygen}$$

Practical activity 1.6 Air supports combustion

Materials: Candle, gas jars, match

Procedures: 1. light the candle.

2. put the light candle on the table.

3. cover the two light candles with separate jars.

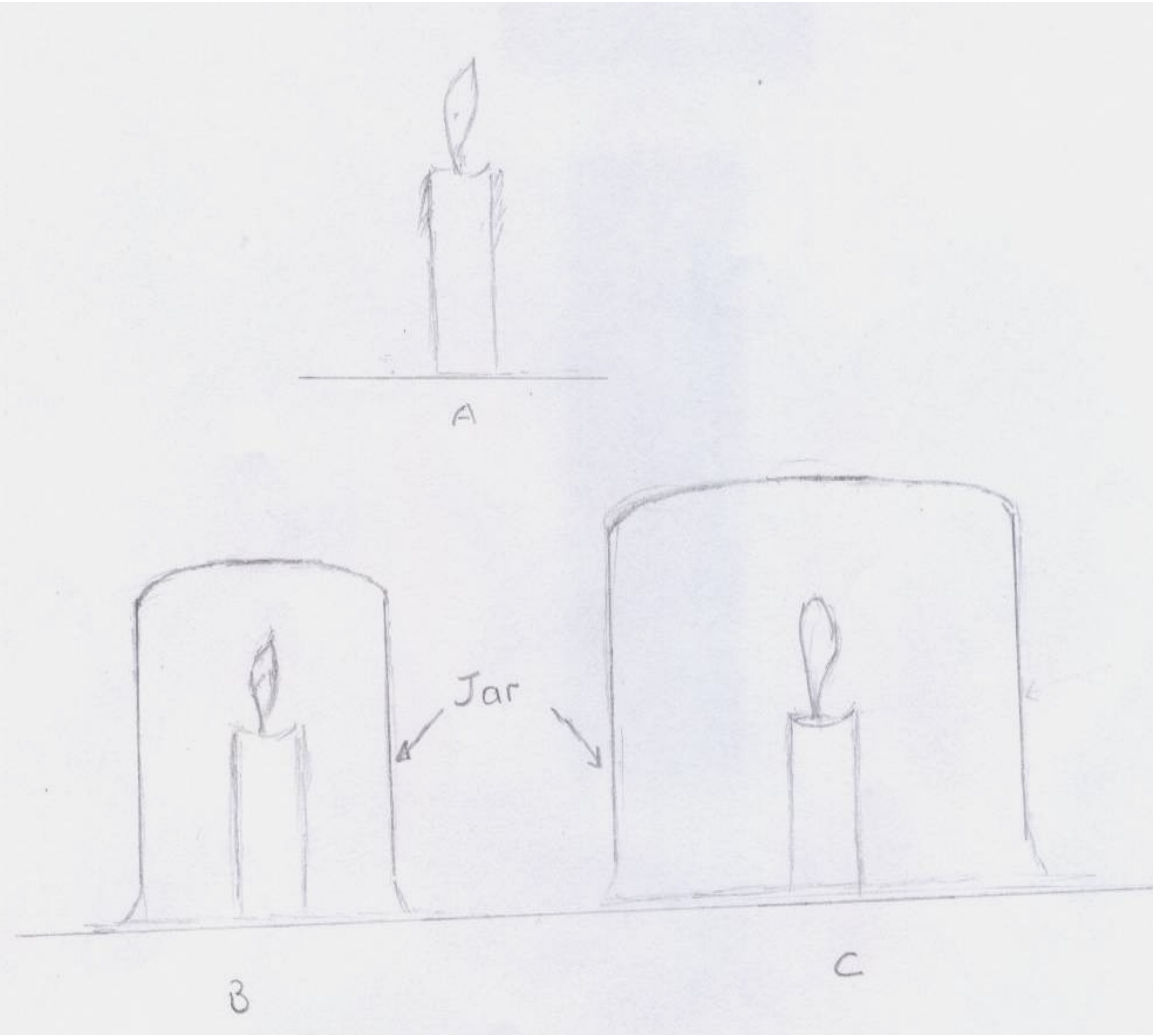


Fig. 1.10 Air supports combustion

Questions: Which candle does not loss its light? Why?

What happens to the candle under the jar?

Which candle losses its light with in a short period of time?

Is there air in the jars?

Discuss your findings with in a group.

Practical Activity 1.7 Extinguishing fires by eliminating air

Materials: wood, sand, sacks and match

Procedures: 1. prepare wood for burning

2. burn the wood

3. put the sand on the burning wood,

4. repeat procedure 1 and 2 and then cover the fire by blanket.

Fig. 1.11 Eliminating fire by using sand or sacks

Questions: What do you observe?

Is sand the extinguisher of fire?

Are sacks facilitating burning?

Explain the reason to your group.

1.4 The Human Breathing System

Activity 1.9

- Hold a small mirror in front of your mouth. Now breathe out on the mirror. What formed on the mirror? Where does it come from?

Every time when we breathe, we take air in to our body. Air contains oxygen. In our body, oxygen combines with digested food. In this way energy is released. Our body needs this energy to live and grow.

When oxygen combines with food, water and carbon dioxide gas come out as wastes. These wastes must be removed from the body. When we breathe out, carbon dioxide and water leave the body.

Food + Oxygen ⟶ Carbon dioxide + Energy + Water

* How does our body takes in oxygen?
* What is the source of air we breathe?

Breathing: is an action of taking in and out air from the body.

Organs of Breathing

* What are our breathing organs?
* What happens to the chest when you breathe in and out?

Trachea: the tube that leads from the throat to wards the lungs.

Alveoli: tiny air sacs in lungs where gas exchange takes place.

Bronchial: tube one of the pair of tubes that branch off from the trachea and go in to the lungs.

Bronchioles: narrow tubules in the lungs.

All living things need air (oxygen) to stay alive.

Air enters the body through the breathing organs. Most animals have breathing organs. But their breathing organs and the way they obtain air differ from animal to animal.

The human breathing system includes the nose, nostrils (nasal cavity), trachea and lungs.

When we breathe in, air moves through our nose, nostrils (nasal cavity) and trachea. The trachea divides in to two bronchial tubes; each of them goes in to a lung.

In side the lungs, the bronchial tubes divided into smaller and smaller tubes called bronchioles.

The bronchioles lead to cluster of ting air sacs known as alveoli. A net work of tiny blood vessels surrounds each alveolus.

Each part of the breathing system has function. For example, the air which enters to the body may contain mixture of gases, dust particles, bacteria and other germs. So the nostrils filter the air from germs and dust particles by their tiny hairs and mucus. In addition the air become warm and moist as it is pass nostrils.

Mucus: sticky liquid in the nose which trap dust and germs from the air.

Epiglottis: small tissue on the top of trachea

The upper opening of tracheas is covered with a thin flap of tissue called epiglottis. Epiglottis prevents and drinks from entering the trachea.

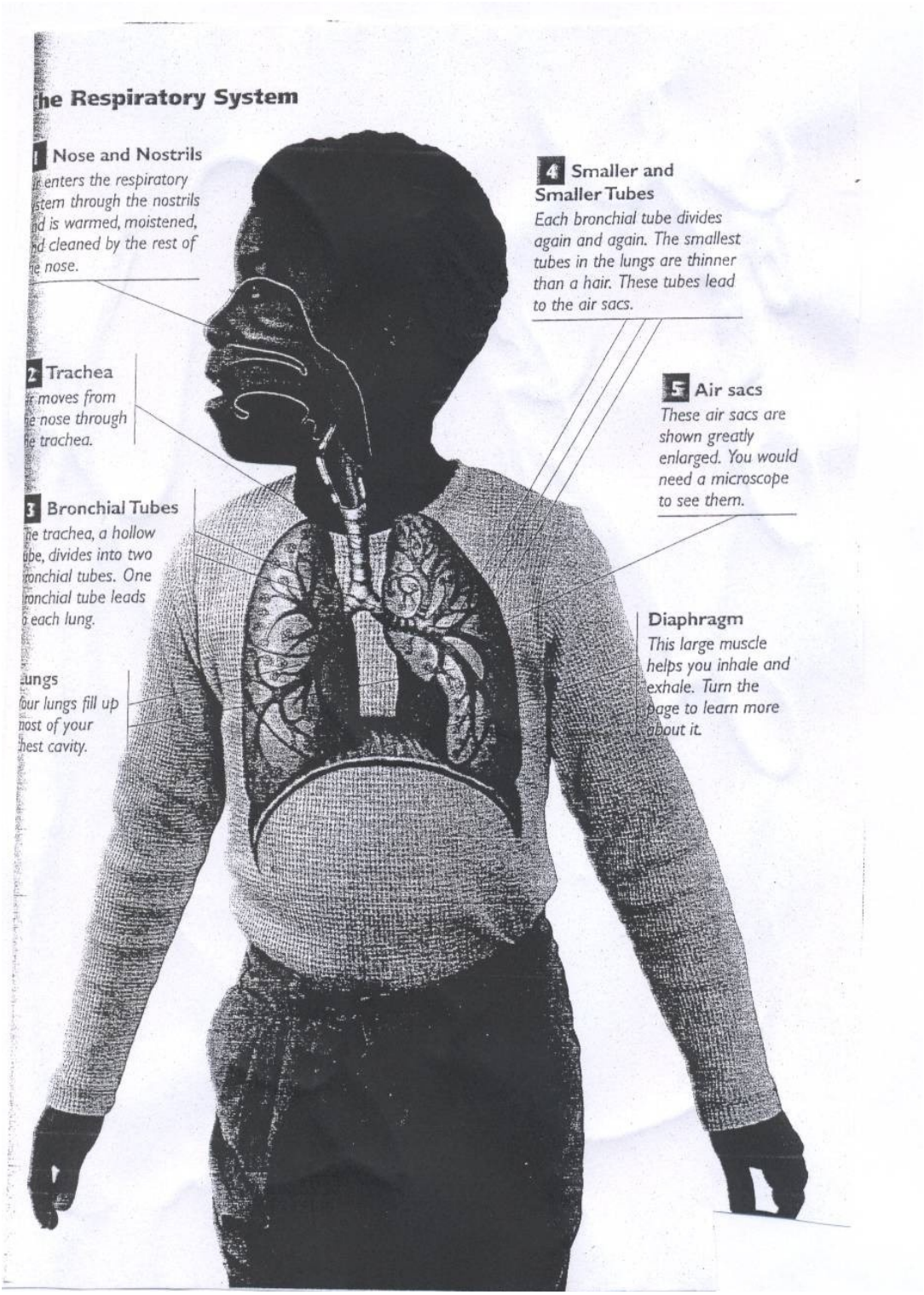


Fig. 1.12 The human breathing system

Alveoli and Gas exchange

When air enters the lung, it fills the alveoli. Alveoli are tiny sacs in the lungs in which the exchange of oxygen and carbon dioxide takes place. Oxygen passes from the alveoli into the blood vessels and at the same time carbon dioxide passes from the blood vessels in to the alveoli. An exchange of gases takes place quickly.

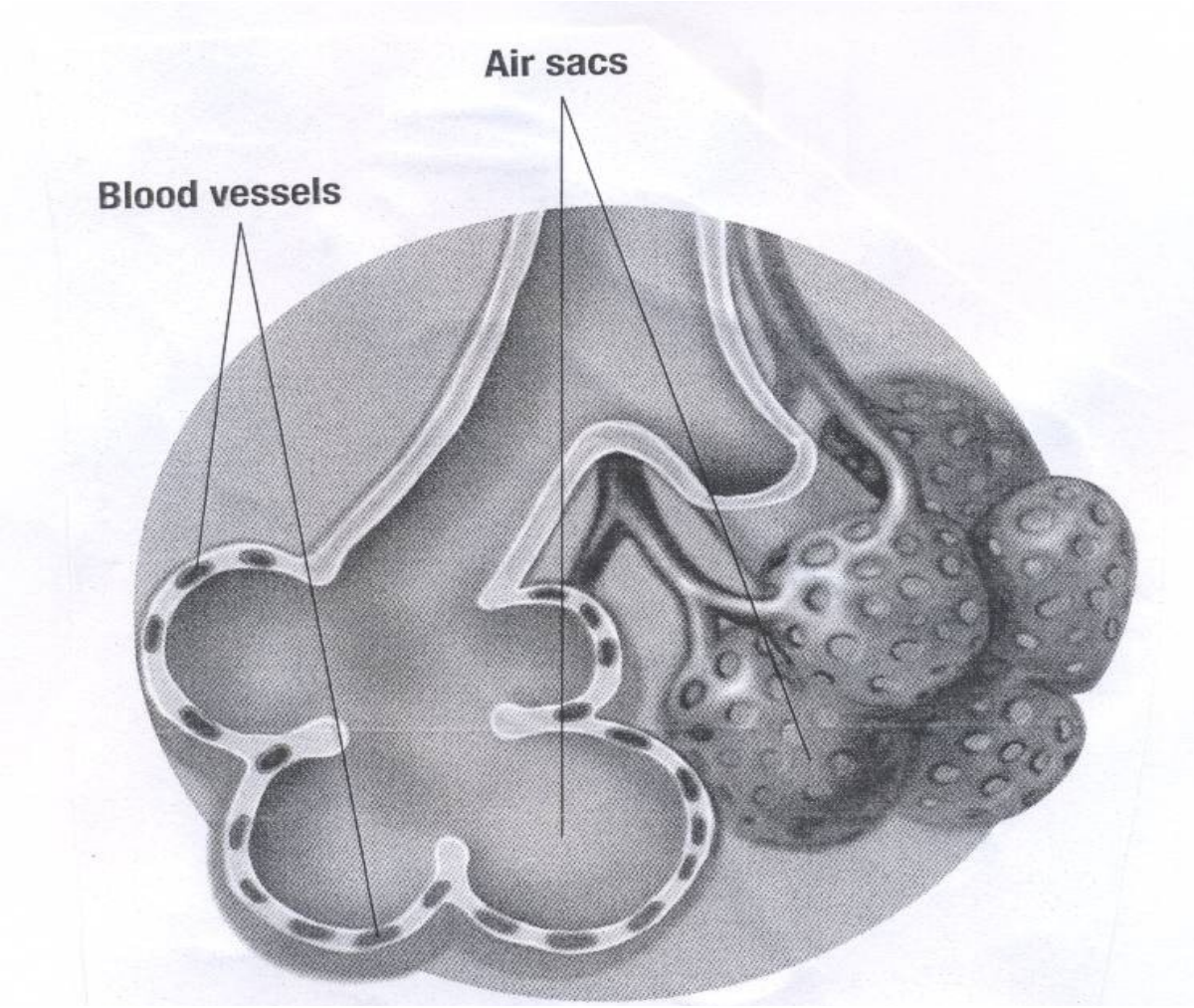


Fig.1. 13 Alveoli and gas exchange

Inhale: to breathe in
Exhale: to breathe out.
Water vapor: water in the form of gas.

Inhaled and Exhaled Air

A. Inhaled Air

The inhaled air is rich in oxygen. This oxygen helps to burn food particles in our body to provide energy. Our body uses the energy for various activities. For example, to grow, repair damage, to move. What other substances are produced in this process? The inhaled air can be taken by the nose or mouth. But the inhaled air is better to be taken through nose rather than mouth. Why? Explain it.

B. Exhaled Air

The exhaled air contains more carbon dioxide than the inhaled air. It also contains water vapor.

No	Gases	Amount in inhaled air	Amount in exhaled air
1	Nitrogen	78 – 79%	78 – 79%
2	Oxygen	20.5 – 21%	16%
3	Carbon dioxide	0.03 – 0.05%	4%
4	Water vapor	Not constant	Not constant
5	Other gases	0.05%	0.05%

Table 1.4 The percentage composition of each gas in the inhaled and exhaled air

Practical Activities 1.8

Objective: to show the exhaled air contains relatively large amount of carbon dioxide.

Materials: 20 m/liters of clear lime water, two beakers or glasses, two glass tubes "*kessem*", filter paper and water.

Procedure: 1. pour equal amount of lime water in two beakers.

2. Add equal amounts of water to the lime water (not more than 15 ml each) and shake the mixtures.
3. Filter out the lime water using filter paper.
4. Take the filtrate in two separate beakers and label them breaker "A" and "B"
5. Put the ends of glass tube " *kesem*" at the same time in your mouth and breath in and out for 15 seconds. (Do not forget that one of the glass tube does not touch the lime water.)

Notice: When the lime water reacts with excess carbon dioxide the lime water turns milky or cloudy

6. After 15 seconds if there is no difference in the appearance of the lime water in the two tubes, continue breathing for another 15 seconds.

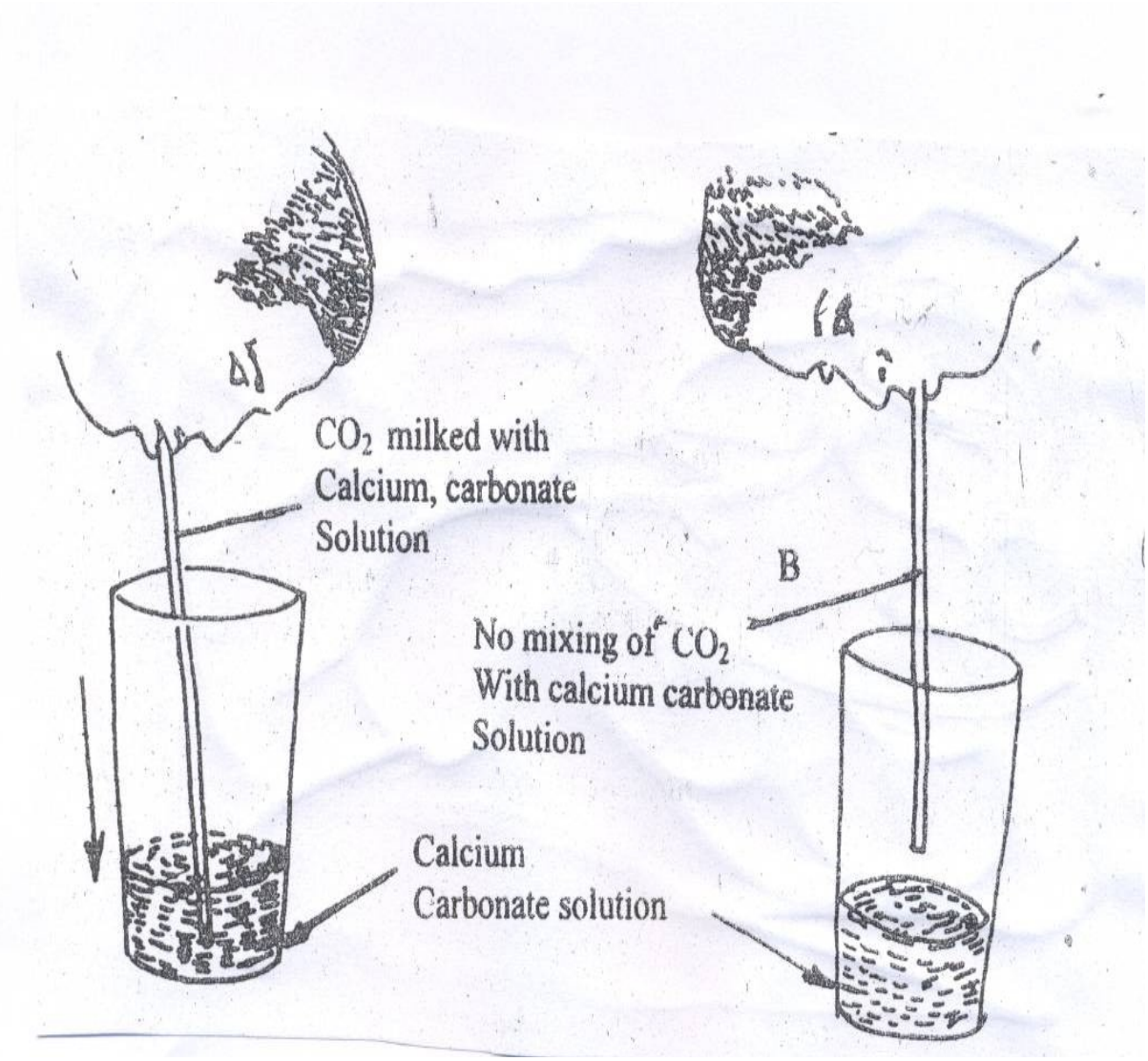


Fig. 1.14 Comparing the carbon dioxide content of inhaled and exhaled air

Questions: In which backer do you observe color change?

Why does the change take place?

What is your conclusion?

Discuss in group.

Exercise: 1.2

1. A _____ is a tube that branches off from the trachea and goes in to a

lung.

2. A tiny sacs in the lungs where gas exchange take place is _____

3. The wall of the nose makes a sticky liquid called _____

4. The tube that carries air to the bronchial tube is called _____

5. What happens to oxygen inside our body?

Mechanism of Breathing

Activity 1.10

* Place your hands on your chest and notice how your chest and ribs move when you inhale and exhale.

* Mention other body parts that help your lungs work?

Our lings have no muscles, they are spongy in nature. The muscles that allow to breath are outside of the lungs. These are diaphragm ribs and inter coastal muscles. They are considered as organs of breathing. The work of breathing is done mainly by these muscles and bone.

Diaphragm: large muscle below the lungs that helps breathing.

Inter costal muscles: muscles between rib bones.

A. During Inhalation

- The muscles between ribs contract, pulling ribs up and out.
- The diaphragm contracts (moves down)
- These movements make the space inside the chest larger.

- Air pressure inside the chest decreases.
- All these cause the air to rushes in to the lung to take up extra space.

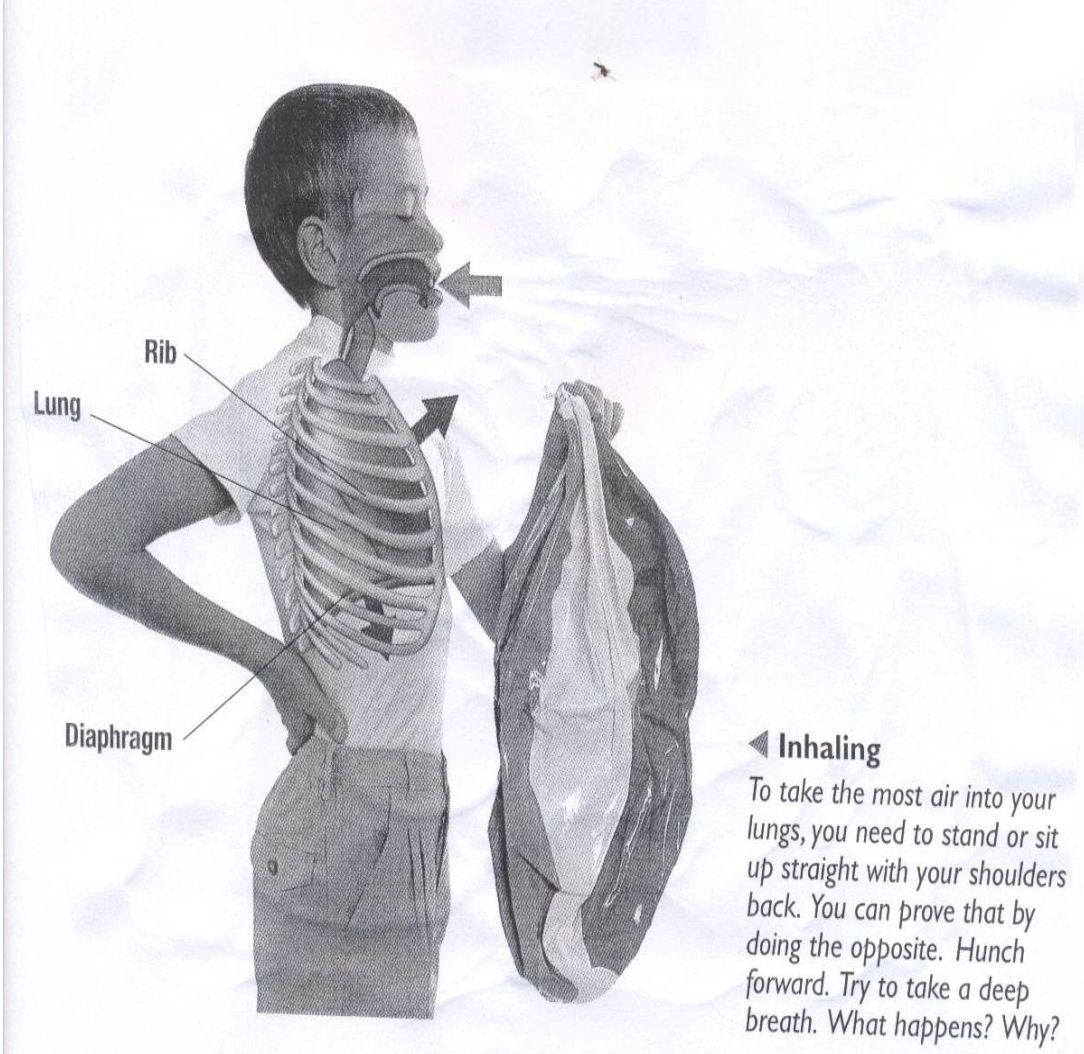


Fig. 1.15 The structure of the breathing organs during inhalation.

B- During Exhaling

- The muscles between ribs relax and ribs move down and in.
- The diaphragm relaxes (moves up).
- With these movements, the space inside the chest becomes smaller.
- Air pressure in the chest increases.

- All these cause air to force out of the lungs.

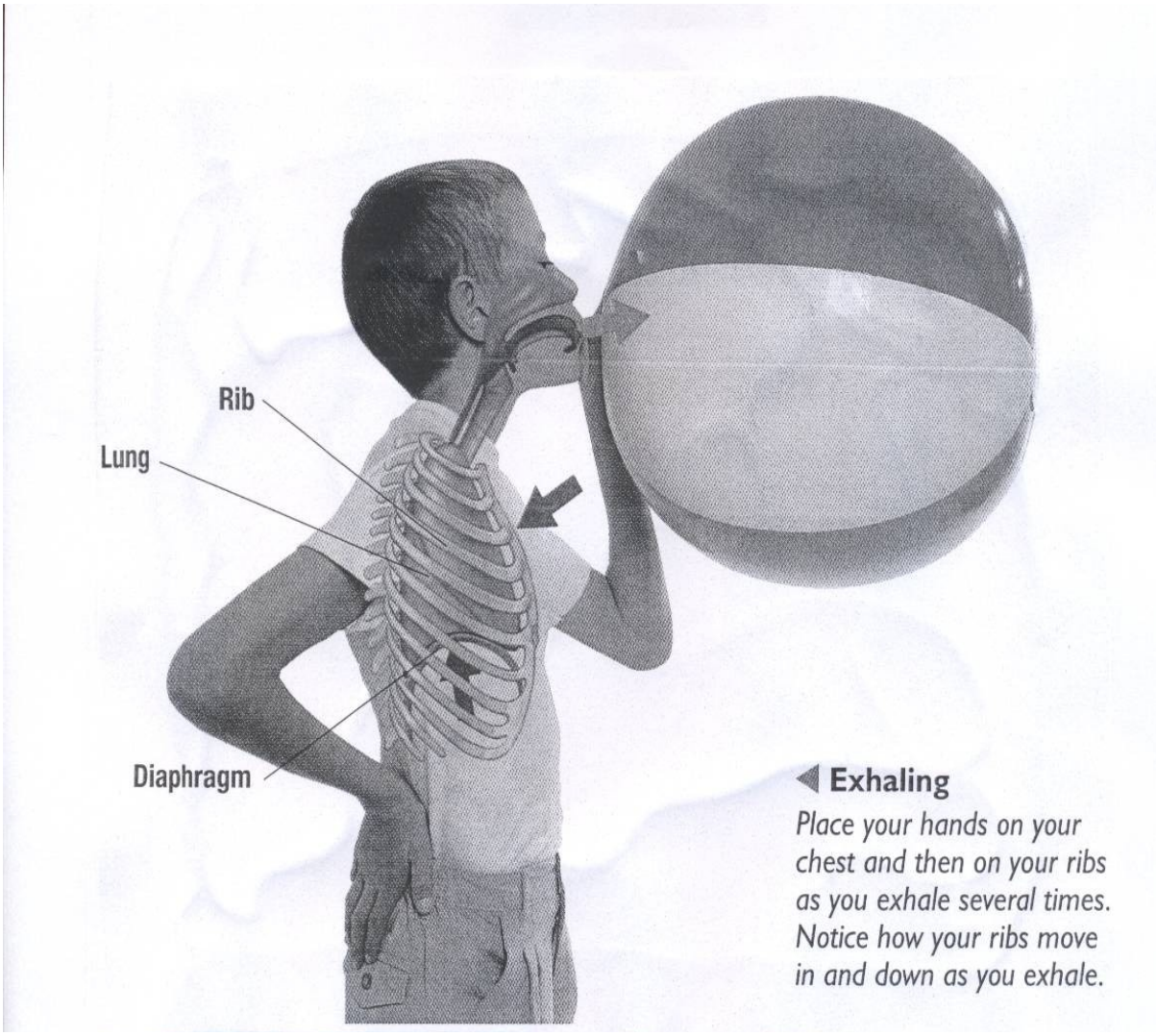


Fig. 1.16 The structure of the breathing organs during exhalation.

Practical Activity: 1.9 Making a breathing model.

Objective: to show mechanism of breathing.

Materials: Y- tube, two equal sized balloons, stopper (cork with one hole), bell jar, rubber and fiber

Procedure: 1. Invert y – tube and fix it with the balloons.

2. Fix the y – tube with one hole cork.

3. Put rubber plastic at the bottom of the bell jar and tie it with fiber.

4. Pull down the rubber plastic gently and observe the changes on the balloons and again release the rubber plastic.

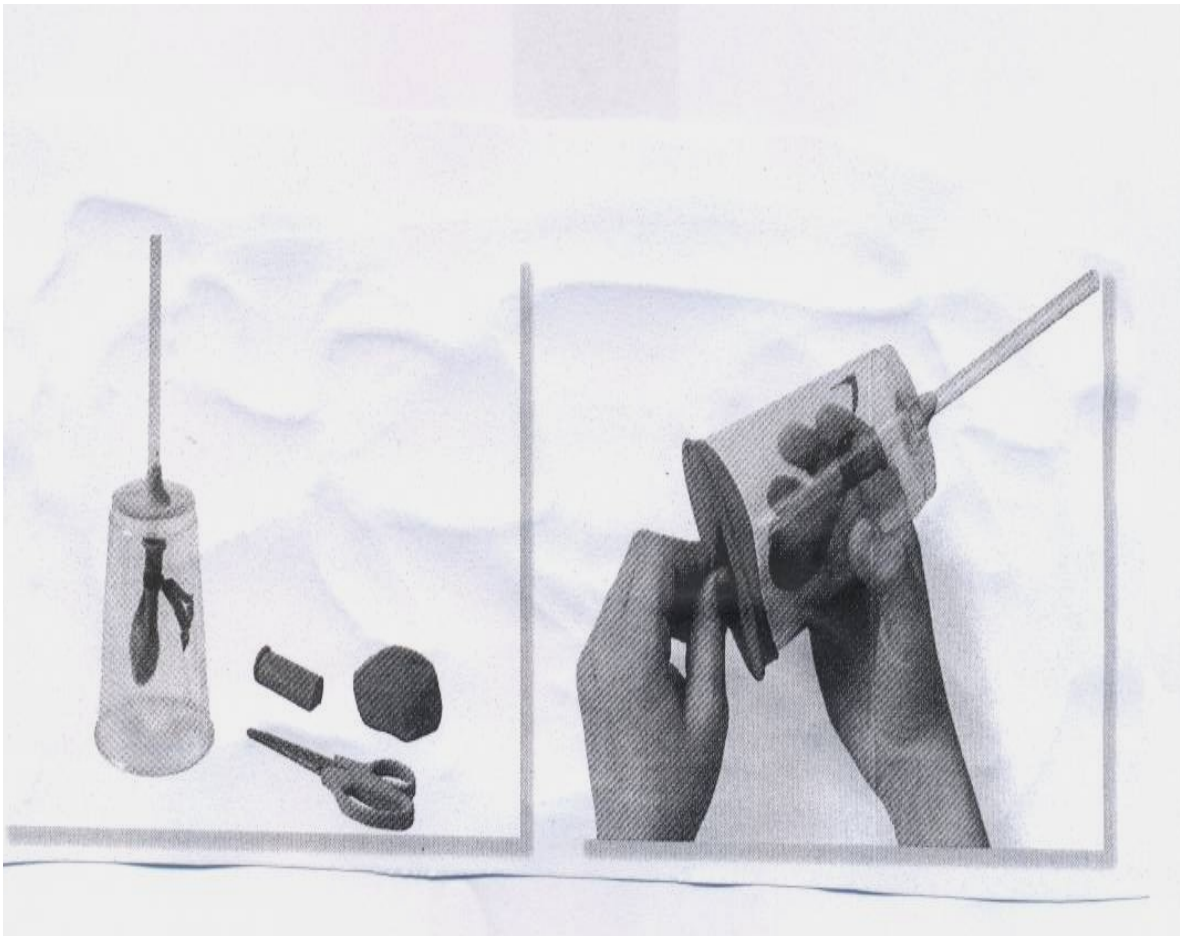


Fig. 1.17 Lung model

Questions: What are the changes as you pull the rubber plastic down wards?

What changes will be observed on the balloons when you leave the rubber plastic?

Compare and contrast the working of your model with the actual process of breathing? What similarities and differences do you note?

Which part of your breathing organ represented by the stretched rubber?

Exercise 1.3

1. What are the gases taken in during inhalation?
2. Which gases show a quantitative change comparing inhaled and exhaled air?
3. In which breathing organ does air filtered from dust and other impurities?
4. Show the correct sequence of breathing organs through which air passes during inhalation?
5. Which body parts contract and relax to allow a person to inhale and exhale air?

1.5 The Effects of smoking on Health

Nicotine: is the addictive substance of tobacco smoke
Carbon monoxide: colorless and poisonous gas.
Tar: black and harmful chemical in cigarette smoke.
Lung cancer: the most serious disease of the lungs.
Bronchitis: is an inflammation of the lung and bronchial tubes

Activity 1. 11

* Why do you think people start smoking?
* From what does cigarette made up of?

Smoking is very harmful to the lungs and other breathing organs. The tobacco cigarette smoke contains several harmful chemical substances, such as nicotine, carbon monoxide and tar
When smokers inhale they take in these chemicals which affect the health and the normal functions of the breasting organs.
Some of the effects of cigarettes smoking are:-

A. Lung cancer

Lung cancer is the most serious and common disease of lungs. It can be caused by different causes, but 90% of lung cancer is caused by smoking. The tar in cigarette smoke increases the risk of lung cancer.

Number of cigarettes per day	Increased risk of lung cancer

1 – 4	X 8
15 – 24	X 13
25 +	X 25

Table 1 .5 Shows the relationship between smoking cigarette and the risk of developing lung cancer.

Nicotine, the addictive component of tobacco smoke causes other problems such as heart failure and rise in blood pressure. Carbon monoxide also prevents the red blood cells from carrying oxygen. Therefore, smoking cigarette brings physical, social and economical disturbance on the smoker.

Exercise 1.4

1. A part from lung cancer, what other diseases are caused by smoking?
2. Someone who smokes 20 cigarettes per a day, by how much his chances of getting lung cancer disease?
3. What are the effects of tobacco smoke on the trachea, bronchi and lungs?
4. Can you mention other plants which are inhaled in the form of smoke in your locality?

Practical Activity 1.10 The smoke from cigarette affects lung.

Objective: To show how smoking affects the breathing organs.

Materials: Cotton, cigarette and matches.

Procedure: 1. light the cigarette.

2. pass the smoke through certain part of the cotton using a transparent plastic tube.

3. compare the part of the cotton where the smoke passes through and the part that has no contact with the smoke.

Questions: What changes do you observe on the cotton that has contact with the smoke? How a smoke of cigarette does affect the lung?

B. Other risks.

- Bronchitis.
- Heart diseases, cancer of mouth, throat, bladder, etc.
- Bad smell.

* How do you think smoking cigarette can be a cause for economical crisis of the smoker?

1.6 Harmful Traditional Practices in relation to the Breathing organs.

Uvular Mutilation

Activity 1.12

* At which part do you find your uvular?
* What do you advice if your friend has a pain on uvular?
* Do you know someone in your village that practices as traditional medical practitioner?
* What materials does he/she use during uvular mutilation?

Discuss and present to the class.

Uvular mutilation or any other cultural removal of a part of breathing organs can bring a serious health problem. These are excessive flow of blood, tetanus and the materials (blade or scissor) used in the process may contaminated with disease causing bacteria, virus (even HIV/AIDS).

Therefore, it is better to consult a physician (doctor) rather than going to traditional practitioner.

Air Born Diseases

* What kinds of diseases are easily spread from person to person?
* How do these diseases pass from a sick person to a healthy person?

When an infected person coughs, sneezes or spits without covering his/her nose and mouth, droplets containing germs are sprayed in to the surrounding air. Other healthy person, who inhales the germs, will be infected by the same disease. Those diseases which spread through polluted air are called air borne diseases. Air borne diseases mainly attack the breathing organs.

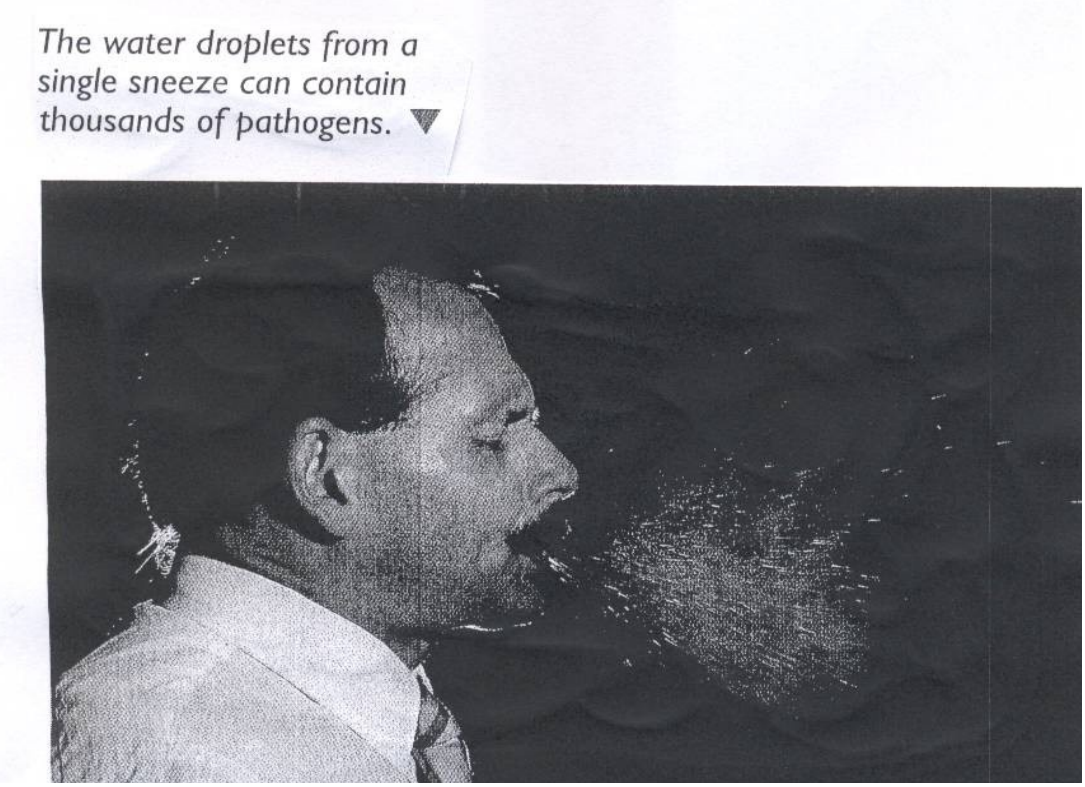


Fig. 1.18 A coughing person

Exercise 1.5

1. Is there a breathing organ which can not be affected by smoking cigarettes?
2. List out some diseases that can be transmitted by air?
3. What other harmful practices do you observe in your village? Which are practiced by the traditional medical practitioners?
4. Why do we breathe fast when we run?
5. Describe one way that air borne diseases can spread from one person to another.

Unit summary

- Air is a mixture of gases including nitrogen, oxygen, carbon dioxide and argon.
- Substance is a matter that has a definite or fixed physical property.
- The most abundant element in the air by volume is nitrogen.

- Elements based on the properties divided in to two groups.
- Metals are group of elements which are flexible and have a metallic appearance.
- Mercury is the only liquid metal at room temperature.
- A metal like gold and tantalum is found in the southern region of Ethiopia.
- Non metals are a member of elements that do not show the properties of metals
- Bromine is the only liquid metal.
- Sulphur is one of the non metal that is found in the Afar region, *Dallol*.
- Air is very important to plants and animals
- Life do not exist without air
- One of the components of air, oxygen is the most essential gas to all animals.
- When we breathe in we take oxygen to burn the food. Oxygen combines with food to produce energy and carbon dioxide. This process is called respiration.
- Organ of breathing are nose, nostrils, trachea, lungs, diaphragm, etc.
- The ribs, rib muscles and diaphragm make the lungs expand and contract. This cause inhaling and exhaling.
- Alveoli are tiny sacs in the lungs in which the exchange of oxygen and carbon dioxide takes place.
- The inhaled air is rich in oxygen and the exhaled air is rich in carbon dioxide.
- Tobacco smoke cause lung cancer, bronchitis, heart diseases, cancer of mouth, throat, bladder, bad smell, etc.
- Any cultural removal of part of breathing organs can bring a serious health problem.
- Air born diseases are diseases that transmit through contaminated air. Air born diseases mainly attack the breathing organs.

Review Questions

I True or False item

1. Oxygen is one of the abundant gas in the atmosphere.
2. Hydrogen is a non-metallic gas.
3. Smoking cigarettes brings social disturbance.
4. When a person coughs, sneezes or spits he or she should take a special case in public areas.
5. It is advisable to breath with mouth than nose.
6. The exhaled air has more oxygen than inhaled air.

II Matching

Column **“A”**	Column **“B”**

1. Tiny sacs where gas exchanges takes place in the lung	A. tar
2. Causes lung cancer	B. nose
3. Prevent food from entering the trachea	C. alveoli
4. Block supply of oxygen to our body	D. Carbon monoxide.
5. Harmful traditional practices	E. epiglottis.
	F. Uvular mutilation

III Choose the correct answer

1. Which one of the following is the property of air?

   A. Occupies space C. Exerts pressure

   B Very compressible D. all

2. The gas produced when the food taken into our body cell burned with oxygen is:

   A. hydrogen C. carbon dioxide

   B. nitrogen D. all

3. One of the following is the effect of smoking cigarette.

   A. bronchitis C. lung cancer

   B. bad smell D. all of the above

4. The amount of oxygen in exhaled air is about _____

   A. 0.03% C. 16%

   B. 4% D. 21%

5. Which one is **NOT** true about air?

   A. Air support combustion

   B. It is a pure substance.

   C. It is a mixture of different gases

   D. It is life determining substance.

IV Give short answers

1. The two groups of pure substance are _____and _____
2. _____ and _____ metals are commonly used in making hand ring and neck lass ornaments.

3. Diseases that are transmitted from a patient to a healthy person by air called _____
4. Write the name of three metallic and three non metallic elements.

Metallic elements	Non metallic elements
1 _____	1 _____
2 _____	2 _____
3 _____	3 _____

5. Mention harmful chemical substance that is found in tobacco smoke.

Unit 2

Water

Contents	
Section	**Learning competencies**
2.1 Water in nature	• List types of natural waters • Identify types of natural waters • Tell the differences between types of natural waters
2.2 Water as a compound	• Define compound as two or more elements chemically combined together. • Identify water as a compound. • Give example of compound. • Define oxides • Give common examples of oxides • Demonstrate oxides with simple practical activities
2.3 Importance of Water	• Explain the important of water.
2.4 Wastage of water	• Mention the causes of water pollution
2.5 Pollution of water	• Explain the effects of water pollution
2.6 Methods of water	• Describe method of water conservation • Demonstrate method of water conservation.

UNIT TWO

2. Water

2.1 Introduction

Fig 2.1 World map with the water surface.

* Is the largest part of the earth covered by water?

* How many percent is the earth covered by land?

Water is the most essential and common substances on earth. It covers over 70% of the earth's surface. It is a very impotent resource for people and all other living things.

Fig 2.2 Water from well dug.

* From where do you get water for drinking and house hold activities?

The different sources of water includes: underground water, river, lakes, seas, oceans. Ethiopia has twelve river basins, about fourteen major lakes and some manmade reservoirs. We are also known for ground water resources.

2.2 Water in nature

Water dissolves many substances. This is one of the reasons for water to become the essential part for all living things. It contains many minerals in it especially the sea water. Some of the minerals are dissolved salts or mixed with water.

For example, sea water contains a mineral salt. It can be detected by its salty taste.

Practical activity 2.1: Water contains dissolved substances (salt) in it

Materials: sample of cup of tap water, cup of lake water or cup of stream or underground water, a tube of distilled water and three dishes.

Procedure: 1. put the sample of water as shown in the figure

2. place it near a window to evaporate

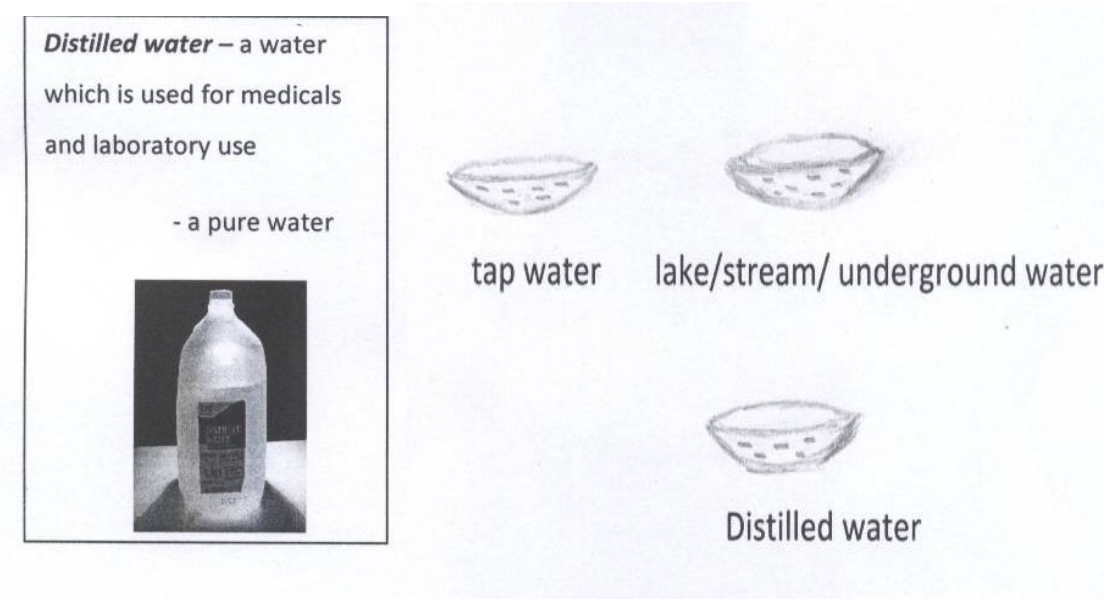


Fig. 2.3 Sample of water

Questions. Is residue (solid) left on the dish?

What is left on the dish?

Discuss in groups.

2.3. Water as a compound

Activity 1.1

* Do you remember the two groups of substance?

* List some substances which are found in your community?

* Classify them in three groups as mixture, elements and compounds.

There are many compounds in our surroundings. Water is a compound that is found in large amount on the earth's crust. Even our body contains large amounts of water used as solvent to many substances in our body.

Water is composed of two elements, hydrogen and oxygen. It is formed chemically from two atoms of hydrogen and one atom of oxygen. Thus water is a compound.

Compound: two or more elements chemically combined together.
***Example*:** water is formed chemically from the elements of hydrogen and oxygen
Solvent is a substance that dissolves another substance to form solution

Compounds and mixtures

* Students do you remember what does a mixture mean?

Compounds and mixture are classes of substances .But they have differences among them

For example: in compounds the constituents are not separated by any physical means.

But the constituents of a mixture are easily separated by physical means.

Every substance in your locality or community which contains more than one element is either a mixture or a compound. In a mixture the elements are able to show the same properties as they are alone. A compound has its own properties which is usually different from those of the component elements.

Mixture : two or more elements not chemically compound together.

Example1: mixture of iron filling and powdered sulfur.

2. The mixture of water and oil.

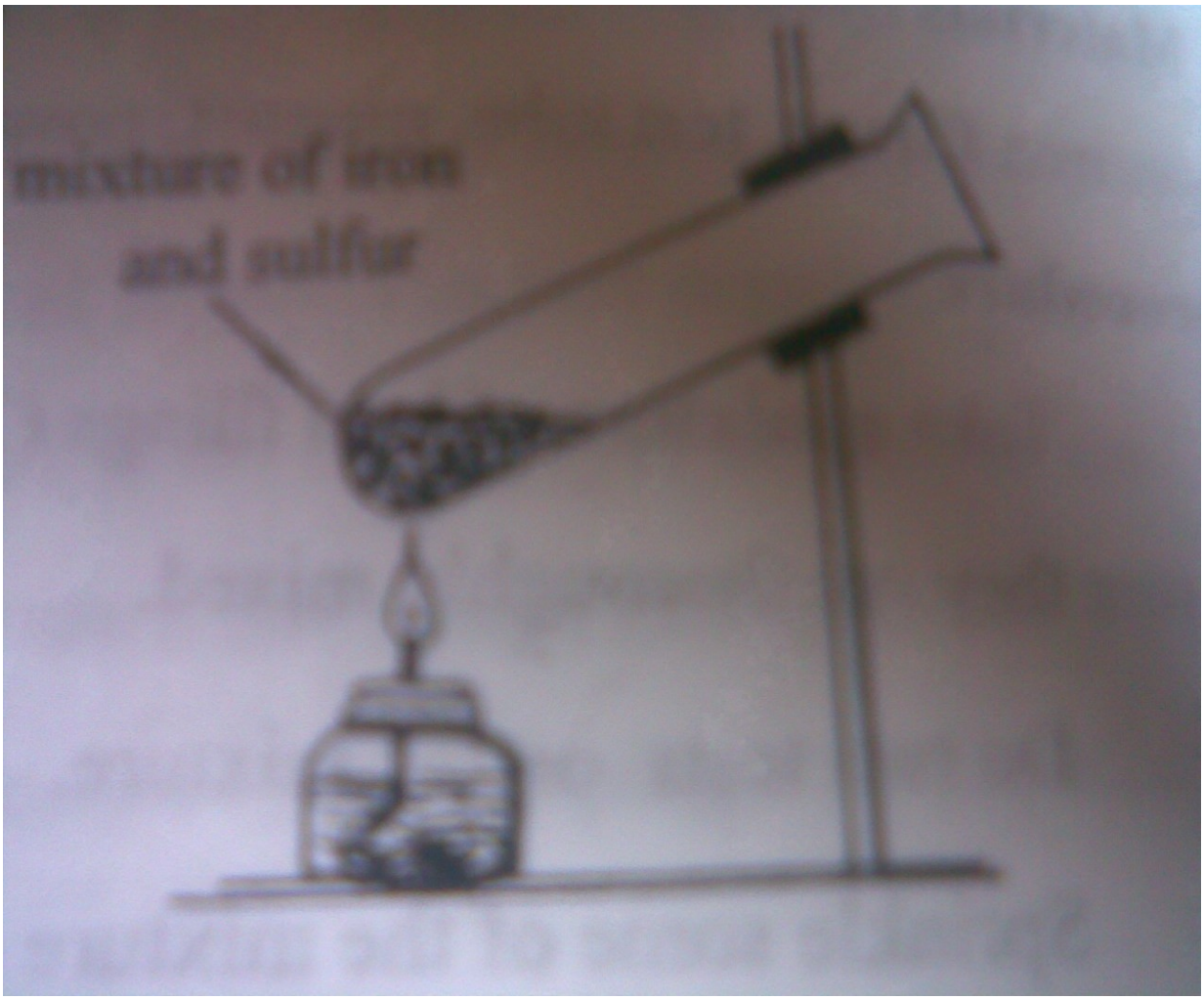
Fig. 2.4 Mixtures

Practical Activity 2.2 Heating the mixture of iron and sulfur

Materials: powdered sulfur, iron filling, flask, Bunsen burner

***Procedure*:** 1**.** heat the mixture of iron filling and sulfur

2. after a glowing red hot, it remove from the source of heat.



Questions: Do you observe any difference between the mixture and the black substance formed after heating?

Try to separate the iron from the black substance by a magnet. What is your result? Discuss with a group and present your findings to the class.

Practical Activity 2.3 To show the differences using dilute acids.

Materials:

Mixture of iron and sulfur
(Sample – 1)

Dilute acids

Iron sulfide
(Sample – 2)

Procedure: put 5 to 8 drops of dilute acids into sample-1 and sample-2

Questions What do you observe? Have you seen a gas which comes out of the test tube?

Name the gases formed in each test tube

Have you smelt a rotten egg smell?

Which sample gave a bad smell?

Oxides

* What is an oxide?

There are different types of compounds. Oxides are one of them. They are formed by burning or combination of elements with oxygen.

Element + Oxygen $\rightarrow$ Oxides

Oxide: compounds of oxygen with other Elements

Example: water, carbon dioxide

Oxides can be divided into two. These are:

Metallic oxides; formed when metals burn with air.

Example:-1. Magnesium ribbon burn in air and forms a white ash. It is called oxide of Magnesium (magnesium oxide)

2. Heating iron fill gives an oxide called iron oxide

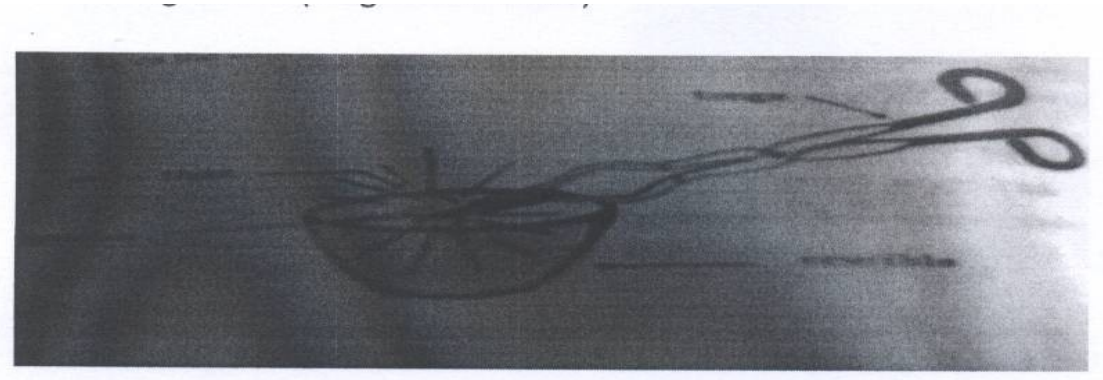


Fig. 2.5 Magnesium oxide similar to ash

Non-metallic oxides: formed by burning or heating of non metals with oxygen

Example: 1.Heating of powdered carbon produces a non metallic oxide. This non-metallic oxide exists in the form of gas and called carbon dioxide.

2. Heating of non-metal sulfur gives an oxide. The name of the oxide is sulfur oxide. It is a gas.

Practical Activity 2.4 The formation of an oxide

Materials: sheet of copper, Bunsen burner or stove

Procedure: 1. fold a sheet of copper into an envelope

2. heat the fold sheet of copper in strong flame

3. leave to cool.

4. open the envelope.

Question. What kind of color do you observe after heating the envelope?

Is there any difference in the inside of the copper sheet after you open the envelope?

Discuss in groups and present your findings to the class.

Practical Activity 2.5 To show oxygen is about 20.9% air by volume

Materials: pan, water, iron filling, jar and marker.

Procedure 1. Wet the inside of a gar and coat it with iron filling

2. Place the jar upside down in a pan of water

3. Mark the level of water inside the jar with a marker.

4. Let the experiment for several days.

5. Observe the iron filling (many of them turned into rust)

6. Mark the level of the water inside the jar

Questions Is the level of water increases or rises?

By what height the level of water rises?

Relate this with the percentage composition of oxygen in air

Discuss with your groups and present your finding to the class.

Do you remember the composition of air?

Which constituents of air are responsible for the formation of iron rust?

Iron rust: an oxide of iron

Exercise 2.1.

Write true or false

1. Most of the earth's surface is covered by water
2. water is an oxide that contains hydrogen and oxygen
3. Metallic oxides can be formed by mixing metals with other metals
4. It is not possible to separate oil from the mixed water.

2.4 The Importance of water

Water is the most important compound for all living things. A person can survive weeks without any food, but no one can survive for three days without water.

We use a large amount of water at home. However, the amount of water we use differ from person to person, one community to other community and from country to country. Because it depends on the availability of water and the state of economic development.

In addition to domestic supply like drinking, cooking and washing water also used for the following purposes.

A. Agriculture

Plants cannot grow without water. Plants need water to grow and make food. They take water through their roots. Therefore, agriculture with out water is impossible like life without air.

Practical activity 2.6 Plants needs water

Materials: four tin plant/ pot plant, maize

Procedure- 1) place the maize on the four samples which contain the same soil type

2) Watering the two sample regularly and leave the other without water.

3) Record your observation for every 24 hours to 3 or 4 days.

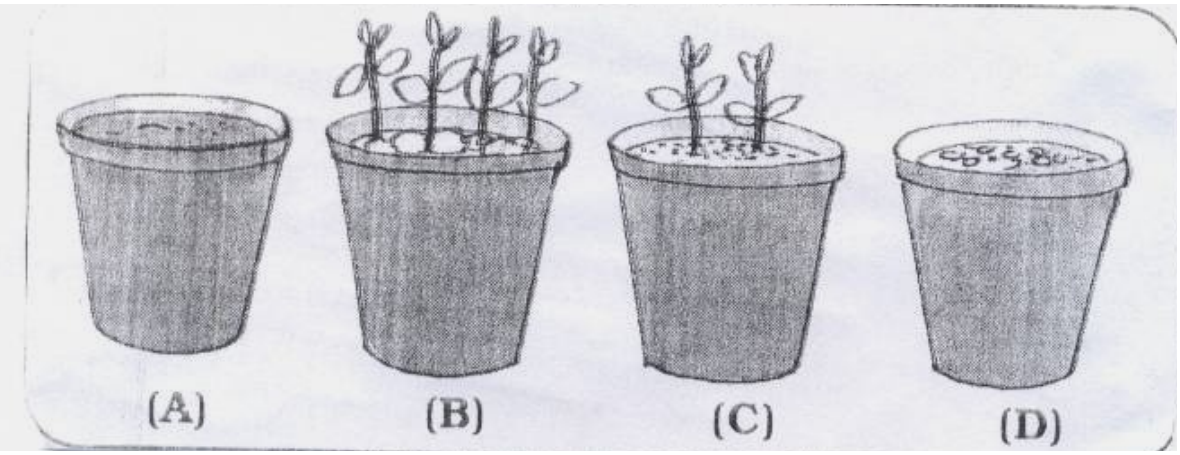


Fig. 2.7 Potted plants

Questions 1. What differences do you observe among the four samples.

2. What is the reason for the changes?

3. Why plants cannot grow in dry season?

B. Industrial uses

Probably every manufactured product uses water some parts of the production process. The use of water to all factories is not the same.

For example: water is used as raw materials in alcohol (ethanol) industry

- Soap factory uses water in steam form to melt the raw materials.
- In addition, water is also used for heating, cooling, cleaning, to remove impurities from factory and as a solvent.

Group work

Identify industries in your area and find out which factories rely most heavily on water.

How is water important to industry?

Write as many examples as possible.

C. Transportation

Transportation is the movement of people and goods from one location to another. There are different of means transport. The main modes of transport are air, rail, road and water. The importance of water transportation varies from country to country depending on the availability of large water surfaces. However, now days most of the large commodities are transported by large ships from one continent to other or from one country to another. In Ethiopia this way of transportation is used in lakes like, Abaya, Hawassa, Zeway, Baro, Tana, etc.

Fig 2.8 Boat in Hawassa Lake

Activity 1.2

1- Compare water transportation with other means of transportation in terms of cost, time and impact on the environment

2- Discuss in groups

D. Hydroelectric power

Electric power can be obtained from water. Almost all the electric power of Ethiopia comes from water resources. About 123 billion cubic meter of water runs off annually from Ethiopian rivers. But we are on the way of using these water resources by building dams. Even at the end of 2003 E.C Ethiopian launches the biggest hydroelectric power project in Africa.

Activity 1.3

* Do you remember the name and location of this biggest hydroelectric project?

*What is the financial source of this dam?

*Have you contributed in building of this dam? How much?

Discuss in group and present your ideas to class

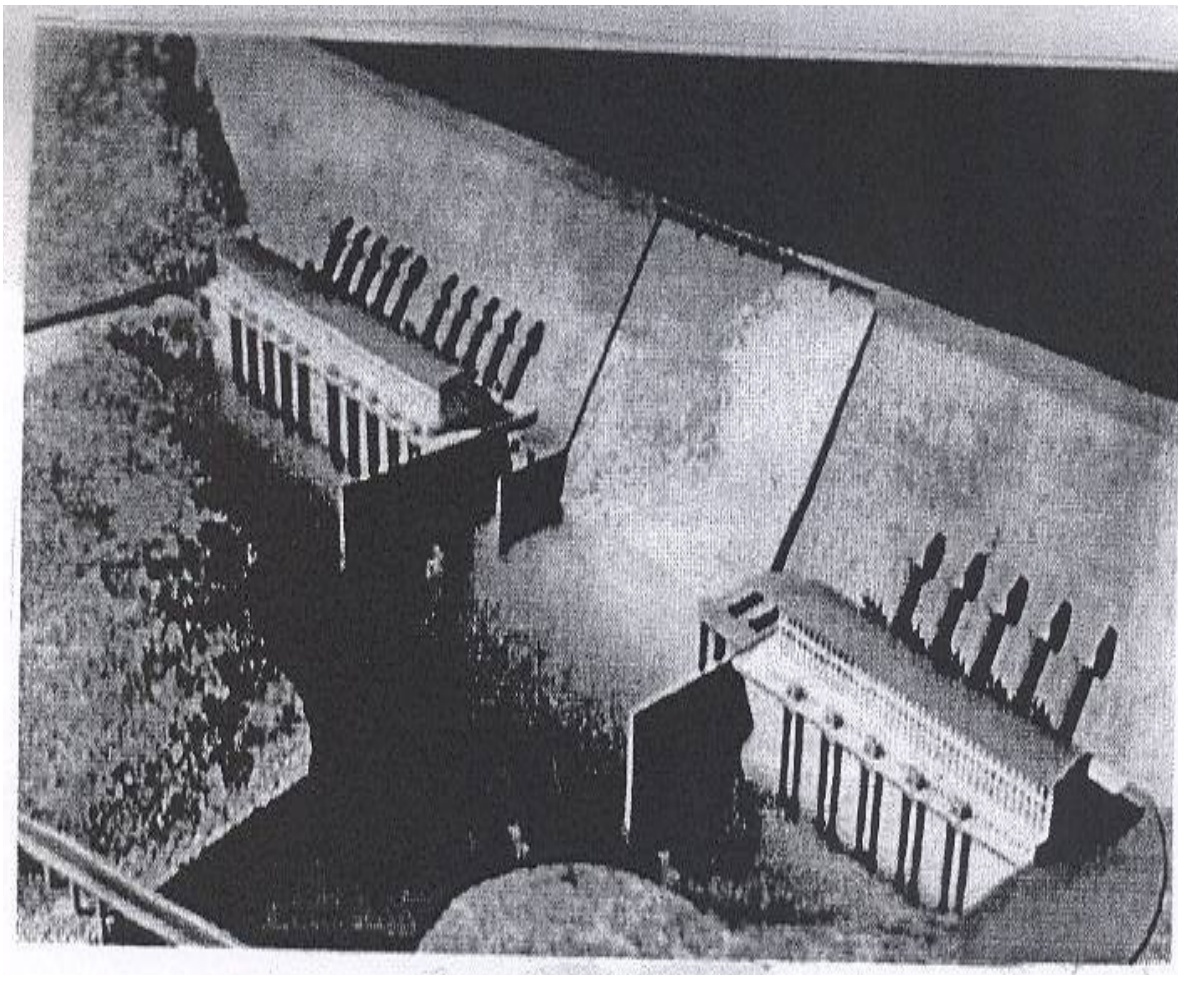


Fig. 2.9 The Grand Renaissance Dam of the Abay River

E. Universal solvent

Water is called universal solvent because it dissolves more substance than any other liquids. For example: in preparing food, in factories, to produce goods and decreases the poisons of wastes, etc.

Exercise 2.2

Choose the best answer

1. For what purposes people use water in their home?

A. for cooking wet and plant trees

B. to remove wastes and for drinking

C. to drinking and irrigation

D. all of the above

2. Which one of the following is **not** the use of water in industries?

A. as solvent

B. to remove impurities

C. as source of raw materials

D. to pollute

3. Which one of the following is the use of water?

A. for electric power

B. for transportation

C. for agriculture

D. all

2.5 Wastage of water

*What does wastage of water mean?

*List the use of water to you and your family?

Discuss with a group

Water is the most abundant substance on the earth's surface. All the activities of human are directly or indirectly related to the uses of water. But, some countries are in shortage of water.

*What do you feel about our rivers, Abay, which flow to abroad without giving a considerable uses to us?

*Discuss with group and present your groups discussion to class.

Water flow or pour without giving any use to people. This is called wastage of water.

This wastage of water includes:

A. **The rain water falls and passes down rivers into lakes or the sea.**

*How much rain water can you collect?

*How can you restore this water for use?

Rain water is one source of water. It is seasonal. Farmers are mostly depending on the rain water. Rain water has many advantages when we use it.

*What are the advantages of collecting and using rain water by the farmers?

*Are you ready to minimize the shortage of water?

Discuss with a group

B. **Water is stored and goes down through pipes to the users.**

* How can we waste water during storing and sent down through pipes?

* What methods do you use in minimizing wastage of water

The water which is collected for use can be sent to other places through pipes . During this process some of the water is lost by miss use of it, the breaking down of the pipes and even by breaking down of tankers.

*What should be done to avoid this loss of water?

C. The water is wasted by individuals in their houses

* How water is wasted in our homes?

* How much water do you use per a day?

* Do you use water economically in your home?

Discuss in your group

Water can be lost by:

- damaged washers
- washing under running water rather in a bowl
- when the taps left on unnecessarily

* What do you suggest to reduce the wastage of water?

Discuss in groups and present your findings to the class.

2.6 Pollution of water

* What are the causes of water pollution?

Water pollution: the presence of harmful substances in water

The unwanted substances that can be thrown from our homes and other places enter the surfaces of water. This can be done by humans or other animals . Sometimes it can also occurred by natural events like storms and floods.

*Which are the causes of water pollution in your community?

Discuss in groups.

The causes of water pollution might be occurred by domestic wastes or industrial wastes.

Domestic wastes

*List the causes of waste water in your home.

There is an opportunity that the wastes of your home or community enter to the rivers, streams or lakes. These are the causes for the water to be polluted.

Some of the domestic wastes are the following:

- the liquid which comes from toilet
- throwing dirt into the rivers
- the liquids after washing different house hold material, clothes and others.
- fertilizers and others chemicals that are not absorbed by the farms and washed by floods or rain water

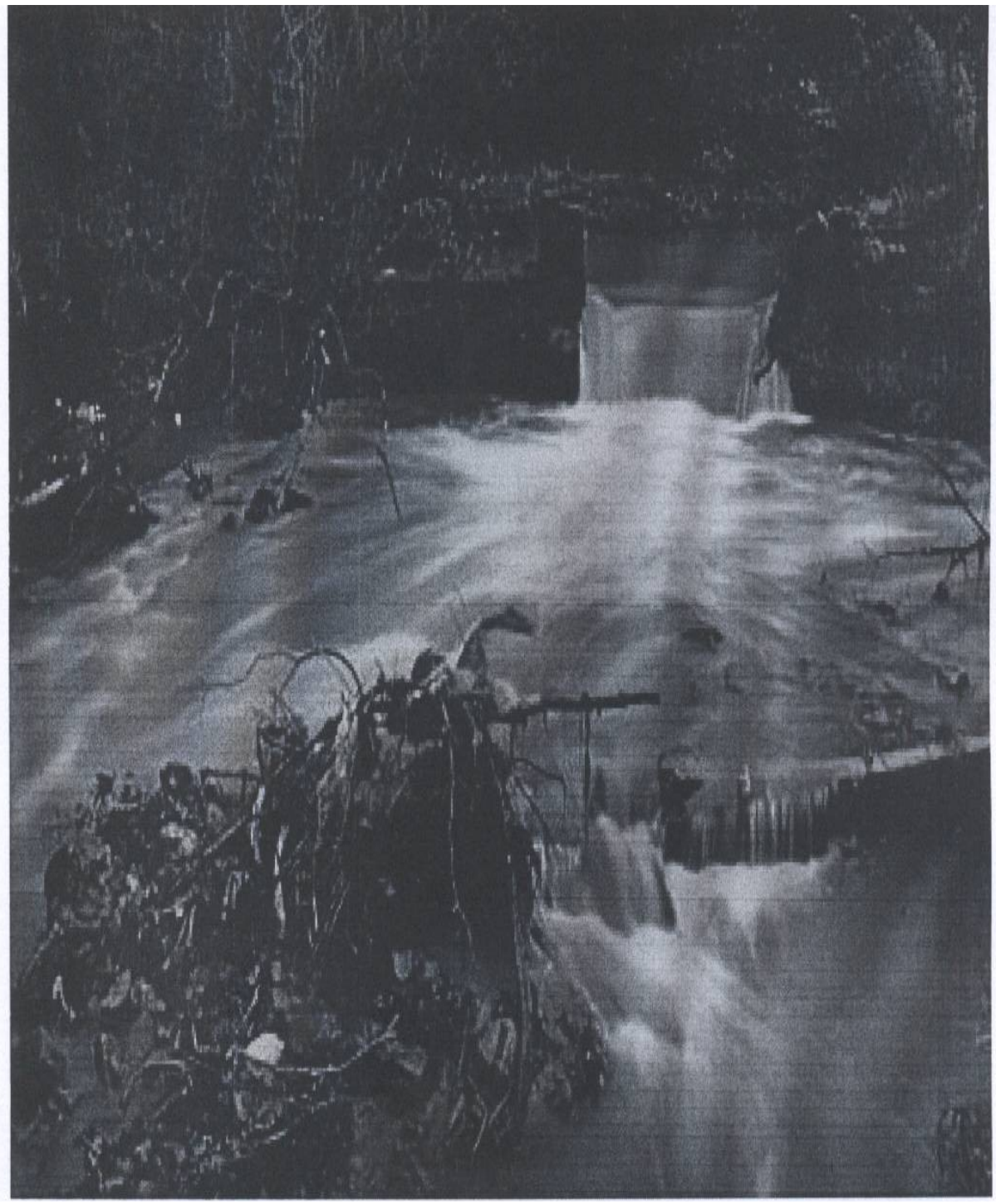


Fig.2.10. The throwing of wastes in to river

Industrial wastes

When liquid and solid wastes from factories released to water bodies cause water pollution.

Fig 2.11 Industrial wastes

Effects of Water Pollution

*What are the effects of water pollution?

*Who is affected by polluting water?

Lakes, rivers, streams and ponds can be polluted by wastes from homes, farms and industries.

- The wastes from homes are mostly detergents that are washed down and drains
- The farm wastes are fertilizers, insecticide and other chemicals. They are washed away by running water (floods) which are not absorbed

- The industrial wastes are in solid, liquid or gas forms. They contain different chemicals. The gas which comes out of industries form an acid rain. It enters to rivers, lakes and to streams.
- All the wastes which come out from homes, farms and industries have an impact on humans and on other living things.

For example:

- the aquatic animal fish will die
- the health of humans and the growth of plants will be affected.

Fertilizers: chemicals added to increase soil fertility

Insecticide: chemicals used to kill insects.

***** What solution do you suggest to decrease the health problem of children due to polluted water in your community?

Discuss in groups.

Methods of controlling water pollution.

Almost all of the water pollution is due to human activities. So it is possible to stop or decrease polluting water. Some of the methods of controlling water pollution are:

- to have knowledge of the effects of water pollution
- do not throw wastes into water surfaces
- do not build a toilet near the water drainage system.
- do not remove the wastes of factory before they are treated
- care be taken in using different chemical in farm area.

Project work 2.1

Visit a near by river, lakes, stream or pond and prepare a note including the:

- location of the water surface
- types of water
- color of water
- smell of water
- wastes(types of wastes found in water, outside or near the water)

Questions

1. Do the water polluted?
2. What are the cause and the effect of water pollution from your observation?
3. What is your suggestion in protecting the water of your community from pollution?
4. What are your classmates, teacher and even your contribution to protect water from pollution?

Group work

*Choose one of water pollutions below and write a report out lining the causes, effects and how it can be controlled or prevented.

A- sewage

B- eutrofication

C- effluent

D- acid rain

E- agricultural pollution

F- detergents pollution

2.7 Methods of water conservation

During the rainy season some areas receive a large amount of water (rainfall). But they still have a problem of getting water.

*What is your suggestion to solve this problem?

Discuss with your friends and present your solution (findings) to the class.

Water is an important substance or compound. All the living things existence is depend on it. Therefore, we have to protect it from destruction and the miss use of it.

*Have you follow some of the methods of water conservation in your community?

List some of them.

1. **Constructing dams**

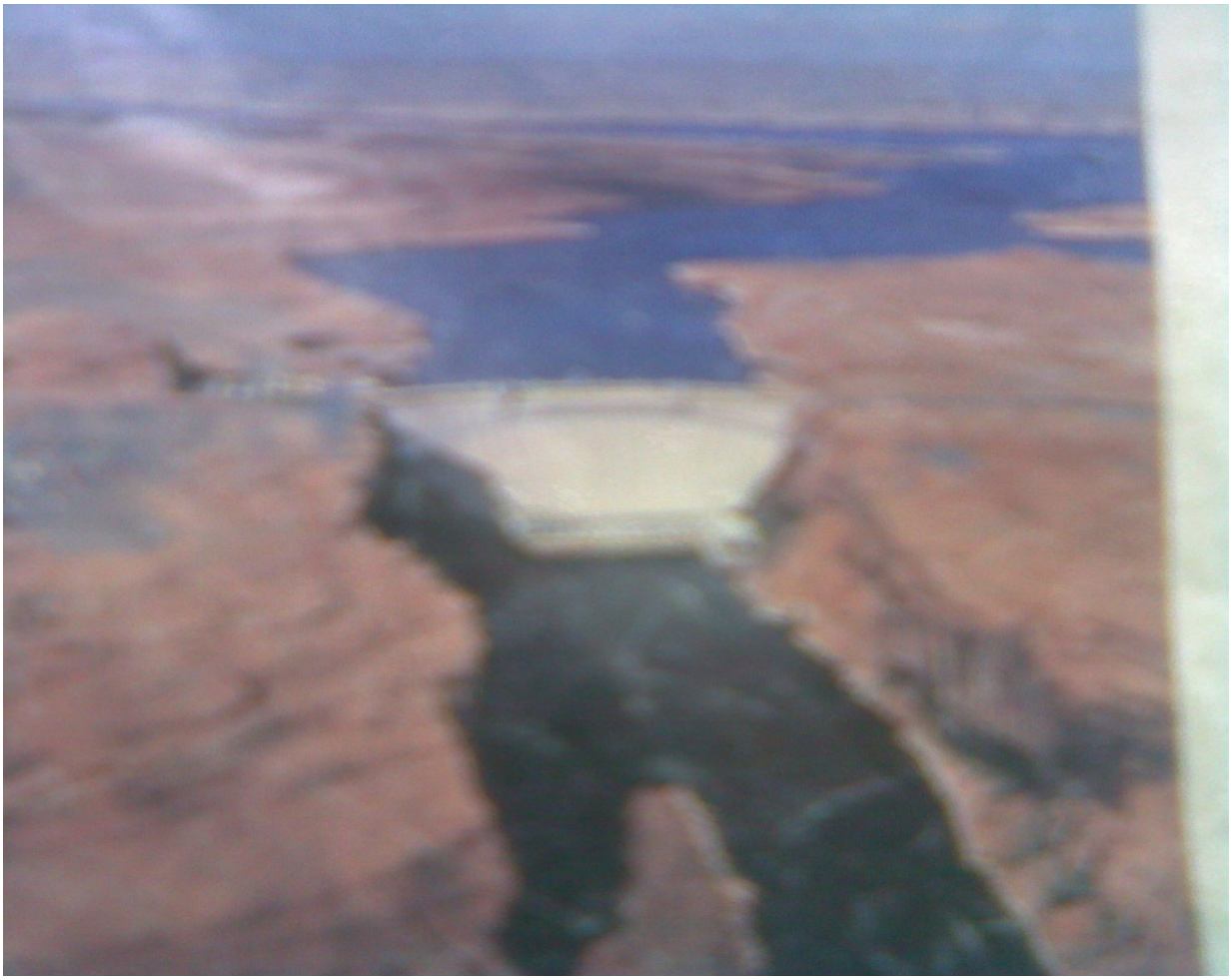


Fig 2.12 Dams can be constructed to store water as reservoir

Dams block the movement of water and store water for farming and to accomplish other activities. Ethiopia has been constructing different dams in different regions of Ethiopia. These dams are also used for farming activities and most of the farmers' lives have been changed.

2. **Water harvesting ponds**

Water harvesting ponds hold rain water that would otherwise is lost. This water can solve the problems of mankind the shortage of water. Water is used for different purpose like: drinking, washing clothes and watering gardens for irrigations in large farms

Project work 2.2

Are there local water storage facilities in your locality?

Name of the water storage	Location		The level of the water	
	Name of Woreda	Name of Keble	Rainy season	In dry season

Write report conserving to the advantage of water reservoir and the problems you observe.

3. **Planting Trees**

***** What is your hobby? Do you plant trees in your spare time?

*Why don't you plant trees to conserve water?

Planting trees make the atmosphere comfortable to humans. They protect the wastage or rain water by flood. Even they stop soil erosion. The plants absorb water and contribute to make the land fertile.

Erosion:-the washing away of soil by the action of water and wind

Practical activity 2.7 To relate the temperature of the soil with the amount of water lost from the surface by evaporation.

Materials: thermometer, samples of soil

***Procedure*:** 1. Take sample of soil from two places such as soil exposed to the sunlight and covered with foliage(leaves of plant)

2. Measure their temperature using thermometer

3. Record and compare their temperatures

Questions: Which samples of soil has a high temperature

From which soil less water is lost by evaporation? Why?

4. **Good farming practices**

People raise most of their crops in the areas when the rainfall is sufficient. But there are regions which do not have much amount of rainfall in dry areas. On these places, people must use irrigation. They provide water for crops and get large amount of crops and becomes an income generating and leads to wealth. The water for irrigation mostly comes from blocking the rivers.

Activity 1.4

*Have you ever seen irrigation in your community?

*List out the name of Ethiopian rivers which are used for irrigation?

*Discuss with in your group about the rivers which cross your community /town without giving uses the community

*Write a paper about the use of irrigations which can generate income and fulfill the needs of the people.

Fig 2.13 Irrigation

Irrigation: manmade application of water to the land

Terracing

The runoff water mostly take the top part of the soil. The top soil is rich in minerals and essential for plants growth. In order to protect the top soil from erosion and to conserve water by plough the land horizontally. This is called terracing. Terraces hold rain water and prevent it from erosion or washing down of top soil.

Terrace :- level stepped field which is dug into hillsides for growing Crops

Fig 2.9 Terracing

Practical activity 2.7 To show how particles of soil carried down

Materials: soil, sticks, water, a container which is used to pour water

***Procedure*:** 1**.** Make mound of soil (to model a hillside)**.** Scratch lines in mound of soil from the top to the bottom using sticks.

2. Gently pour a container of water from the top to simulate rain observe how quickly the water run off

3. Repeat this experiment by only changing the procedure 2 into fashioning the mound into a series of terraces.

Questions: 1. What differences do you observe in the two experiments?

2. What changes do you observe concerning the speed of water and particles of soil in the two experiment?

3. Prepare a report and present to the class.

Unit Summary

- Water covers over 70% of the earth's surface and essential to all living things
- The source of water is rivers, lakes, oceans, seas, rainfall and underground water.
- Water is the only common substance which is found naturally in all three state of matter.
- Water is formed chemically from two atoms of hydrogen and one atom of oxygen.
- Compounds and mixtures are formed from elements
- Compounds are the chemical combination of two or more elements.
- Elements can be classified into two. These are metals and none metals.
- Oxides are the binary compound of oxygen and other elements. Example: water, carbon dioxide, etc.
- Water is important for the plants growth, industries transportation and for hydroelectric powers.
- Most of the water pollution is due to human activities.
- Water is wasted when people do not use in appropriate way or use unsafely. The rain water is also wasted when it is not collected for further use in dry seasons.

- The causes of water pollutions are the throwing of homes, factories solid and liquid wastes in the water surfaces
- Water pollution can damage the health of humans and the growth of plants or the existence of other animals.

Review questions.

I. Write True or False

1. Water covers the smallest part of the earth's surface.
2. River Baro and lake Hawassa are used as means of transportation
3. Tap water is wasted unknowingly by human activities.
4. Polluted water has use to humans and other living things.
5. Water can be conserved by building dams and water harvesting ponds.

II. Match column " B " with " A "

Column A	Column B
1. Building dam	A. acid rain
2. Water	B. means of water conservation
3. Water pollution	C. not built water pond or reservoir
4. Wastage or rain water	D. a means of transportation
	E. good farming practices

III. Choose the correct answer

1. Which one of the following pair of substances does not form a mixture?
   A) Water and salt C) Carbon and oxygen
   B) Teff and maize D) Oil and water
2. Which one of the following is a compound?
   A) Oxygen C) Iron sulfide
   B) Air D) Mixture of iron filling and powdered sulfur
3. Which one is a metallic oxide?
   A) Iron oxide C) carbon monoxide

B) Nitrogen oxide D) sulfur dioxide

4. Iron rust is

   A) a mixture C) an element

   B) a metallic oxide D) not compound

5. wastage of water is reduced by:

   A) Damaging a water pipe washers

   B) Washing under running water

   C) Not left the taps off after use

   D) Choice “A “and “B” are correct

6. Which of the following is the causes of water pollution?

   A) Acid rain C) The wastes of industries

   B) The toilet which is built near water drainage. D) All

7. Agriculture wastes are:

   A) fertilizers

   B) chemical for killing insects

   C) chemicals which is not absorbed by the soil.

   D) rain water.

8. Which one of the following is the use of planting trees?

   A) To protect soil from erosion

   B) To conserve water

   C) To make a good living condition

   D) All

IV Give short answer

1. List at least three hydroelectric powers of Ethiopia?
2. What are the methods of water conservation?

Unit 3
Plants

	Contents	
	Sections	**Learning Competencies**
3.1	Parts of plants and their functions	• Explain the functions of root, stem and leaves
3.2	Importance of plants	• Explain the importance of plants to human
3.3	Soils and plants	• Explain the important of soil to plants • Describe the soil profile in relation to its significance to plants • Define soil depletion as the wearing out of minerals from the soil • State causes of soil depletion • Explain the methods of prevention of soil depletion
3.4	Soil improvement practices	• Define fertilizers • Explain the importance of fertilizers • Classify fertilizers as natural and artificial • Organic manure and used in the school garden
3.5	Our forests: The threats on forests and conservation	• Compare Ethiopia's forest cover past and present • Mention the cause of deforestation • Describe the consequences of deforestation • Describe the methods of conservation of forests • Plant tree seedlings in and around the school compound • Describe the biogas technology as an alternative source of energy • Demonstrate the biogas technology using a simple model
3.6	Raising vegetable seedlings and crop growing	• Raise seedlings of vegetables in pots or in the school garden. • Grow crops in the school garden • Demonstrate crop protection methods
3.7	Weeds and Weed control	• Give common examples of weeds • Explain the harmful effects of weeds • Describe weed control methods
3.8	Harmful practices	• Mention setting forest fires and clearing forest as harmful practices • Discuss the harmful effects of setting forests fires and clearing forests.

Unit Three
3. Plants

Activity 3.1

* What do you know about plants?
* Think of their importance, and discuss in pairs?
* Could human beings survive without plants?

Producer: is a living thing that can make its own food

Plants are living things that can prepare their own food. Since plants prepare food, they are called producers. The prepared food is used by themselves and animals. Plants need air, water and sunlight to make their own food. The process by which plant prepare food is called photosynthesis. After photosynthesis plants give out food and oxygen. So the survival of animals including humans depend on plants. Besides plants have many other importances. Plants can be found in water and on land.

Carbon dioxide + water $\xrightarrow{\textbf{sun light}}$ **food +oxygen**

* What types of plants are found in water?

3.1 Parts of Plants and Their Functions

* Can you mention the main parts of a plant?

Plants have many parts. Each part carried out various functions. The main parts of a plant are: root, stem, leaf, flower, fruit and seeds.

(I) Root

Root is the underground part of a plant

It anchors (attaches) the plant with the soil

It also absorbs water and minerals from the soil. Plants use water and minerals to grow and to make food.

(II) Stem

Stem is the part of a plant that supports the branches, leaves and flowers. The stem also carries food, water and minerals to all parts of the plant.

(III) Leaf

Leaf is the part of the plant where most of food making process takes place.

On the underside of a leaf there are small openings called stomata. Air moves in and out of the plant through the stomata.

(IV) Flower

It is the bright and colorful part of a plant.

Are site for seed and fruit formation.

Stomata: is a small opening on the under side of a leaf of plants.

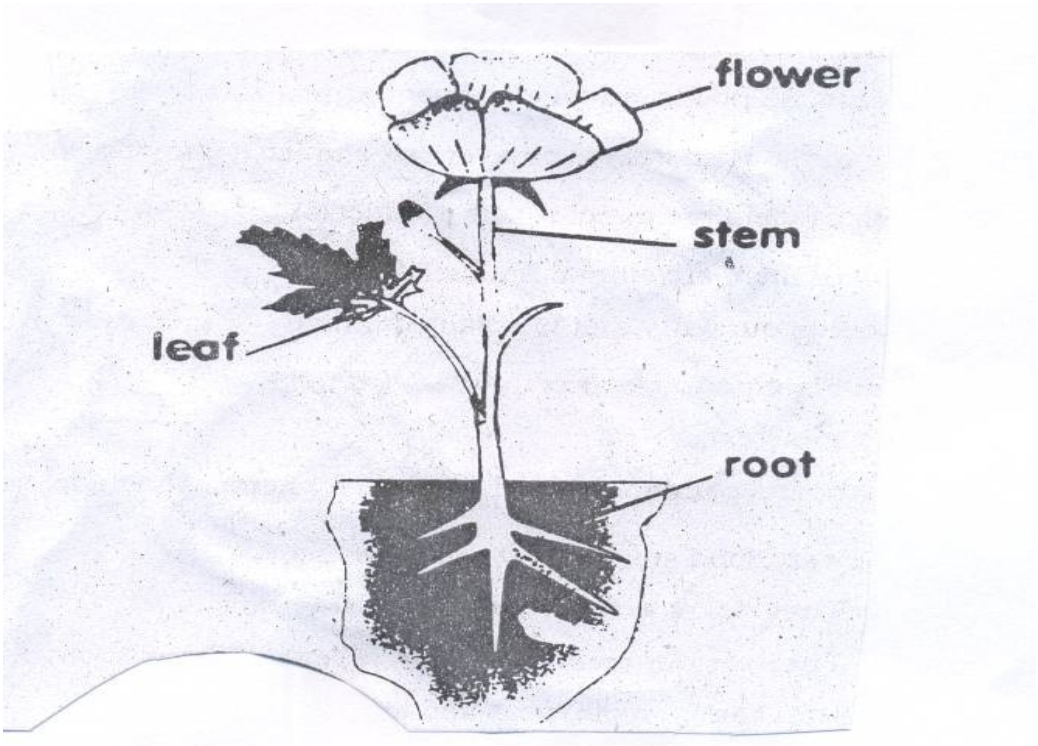


Fig 3.1 A Typical flowering plant with the main parts.

Exercise 3.1

1. Describe two things stem do for plants?
2. Name the part of a plant that grows underground?
3. What are the things that a plant need to make food?
4. Where does a plant make its food?

3.2 The Importance of plants

* Think of the last time you ate the part of a plant. Did you eat a stem, root, leaf, seed or flower?
* Observe a carrot, beat or radish. What part of a plant is each of these?

Plants are useful to us in many ways. They provide us with things that we need in our day to day life.

I. Plants give us oxygen

During photosynthesis, plants make food and oxygen. The oxygen gas is given out from the plants through stomata. All animals breathe in the oxygen and it helps them to stay alive. Thus, it is good to grow plants near our homes because plants are sources of pure and fresh air

II. Plants give us food

Plants are the main source of our food. We human beings and other animals depend on plants. We also get food from animals which eat plants. So, plants are the direct or indirect source of our food.

* Think of the food items you ever eat, and list some of them.
* Which of them are direct plant products?
* Which of them are animal products?

The plant parts commonly use for food by human includes: seeds, fruits, leaves, and stems.

A. Food From seeds

Seeds are food storing structures of plants.

Seeds are formed in a flower of the plant

Seeds are the main source of carbohydrates, proteins and fats and oils.

Example: wheat, barley, peas, “teff”, coffee, etc.

Carbohydrate: is energy giving food items.
Proteins: body building foods
Ovary: is the part of a flower that changes to fruit
Vitamins: are chemicals that keep the body health

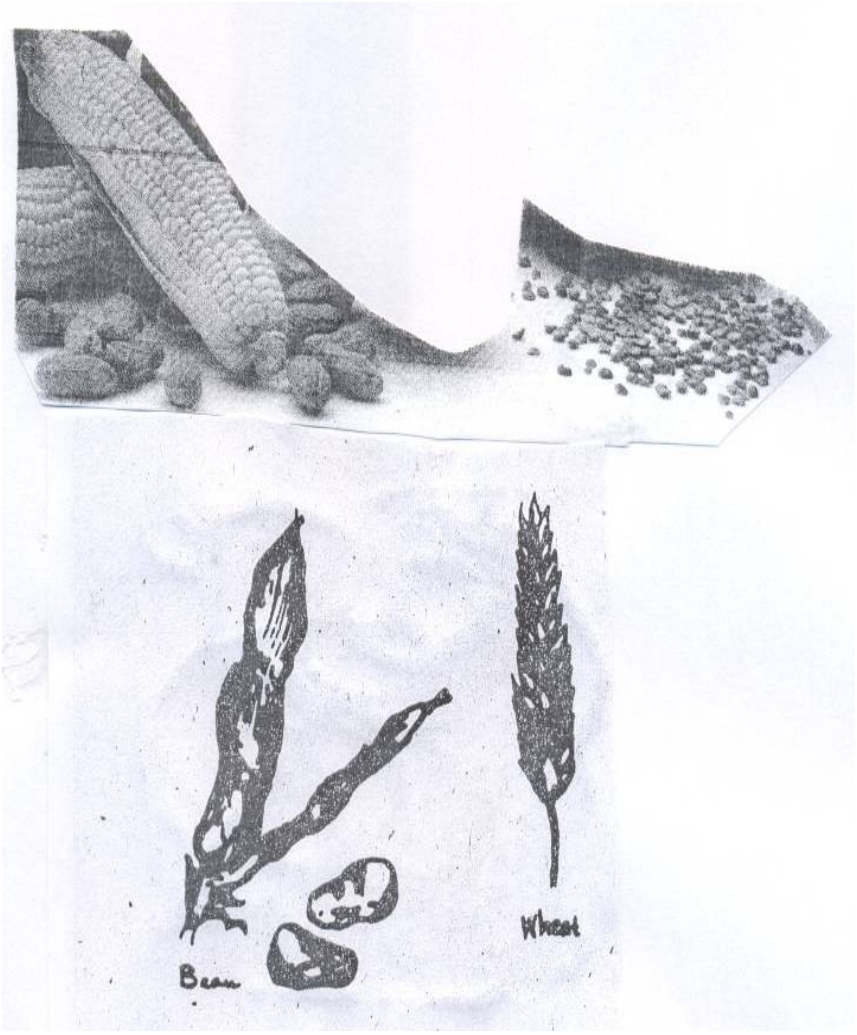


Fig. 3.2 Eatable seeds

* List at least five other seeds which are used as food

B. Food from Fruits

They are developed from flower part called ovary

They can be eaten raw or cooked.

They are good sourer of vitamins

Example: avocado, mango, tomato, etc.

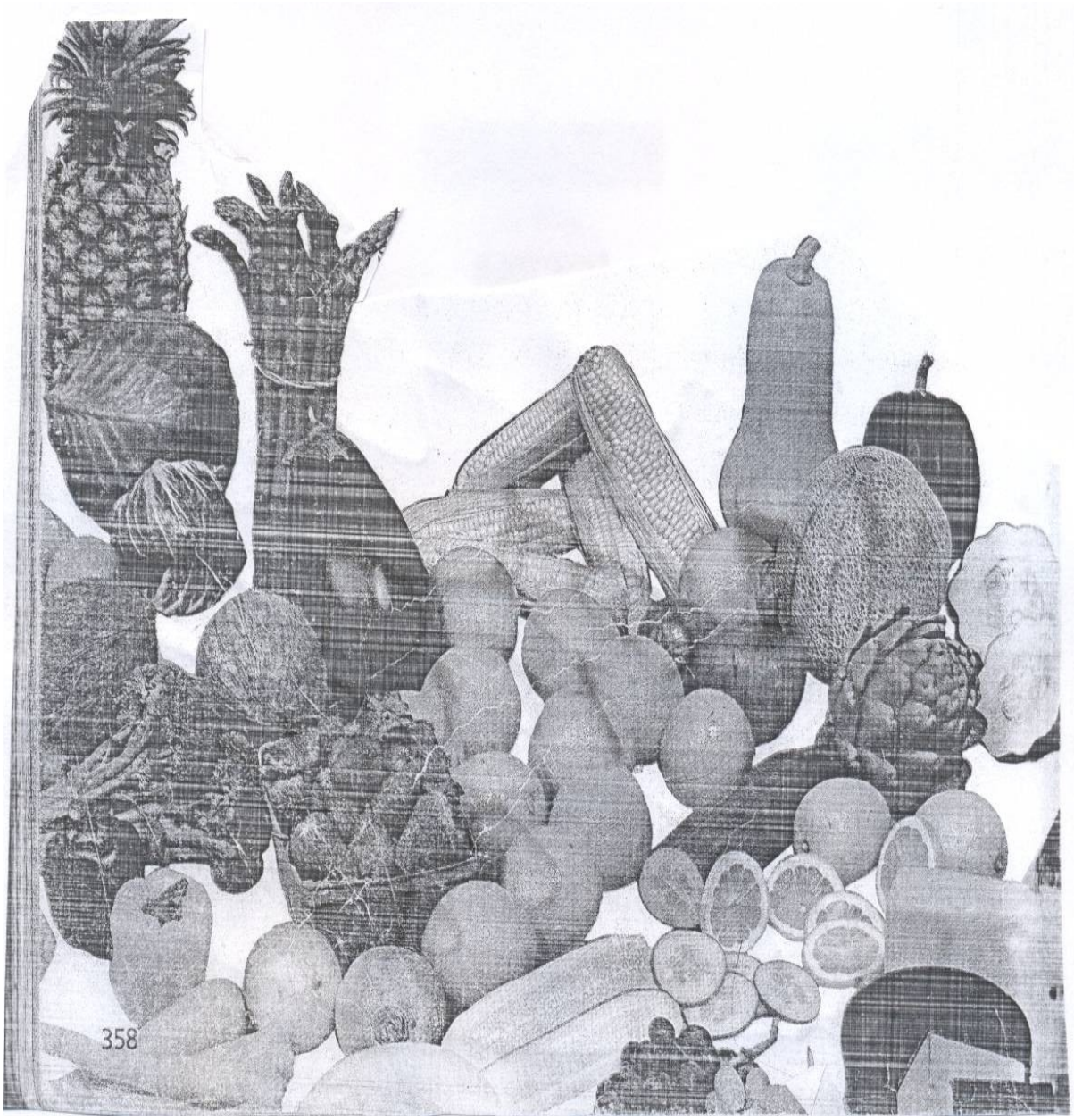


Fig. 3.3 Some eatable fruits.

* List at least five other fruit types which are found in your locality.

C. Food from leaves.

Some plants leaves are edible.

Leaves are the main source of vitamins

Example: onion, salad, lettuce, tea leaf, etc.

* Which leaves can be eaten row or cooked?

D. Food from stems

Stems of some plants are eatable

They can be cooked or eaten row.

Their main content is carbohydrate.

Example: sugar cane, "*inset*", potato tubers, etc.

* Can you mention some other eatable stems in your locality?

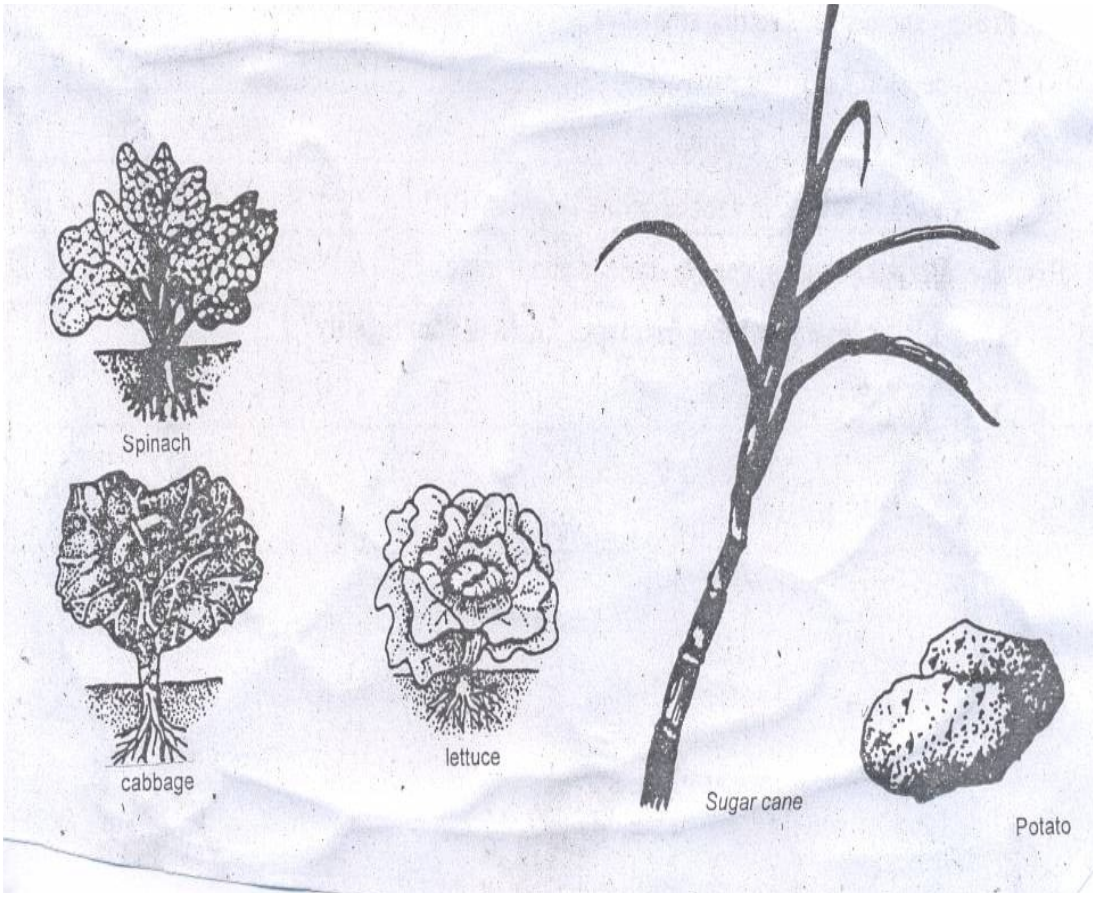


Fig.3.4. Some Eatable Leaves and Stems

D. Food from roots.

In some plants root are used to store food.

Roots are the best source of carbohydrates.

Example: sweet potato, carrot, reddish, etc.

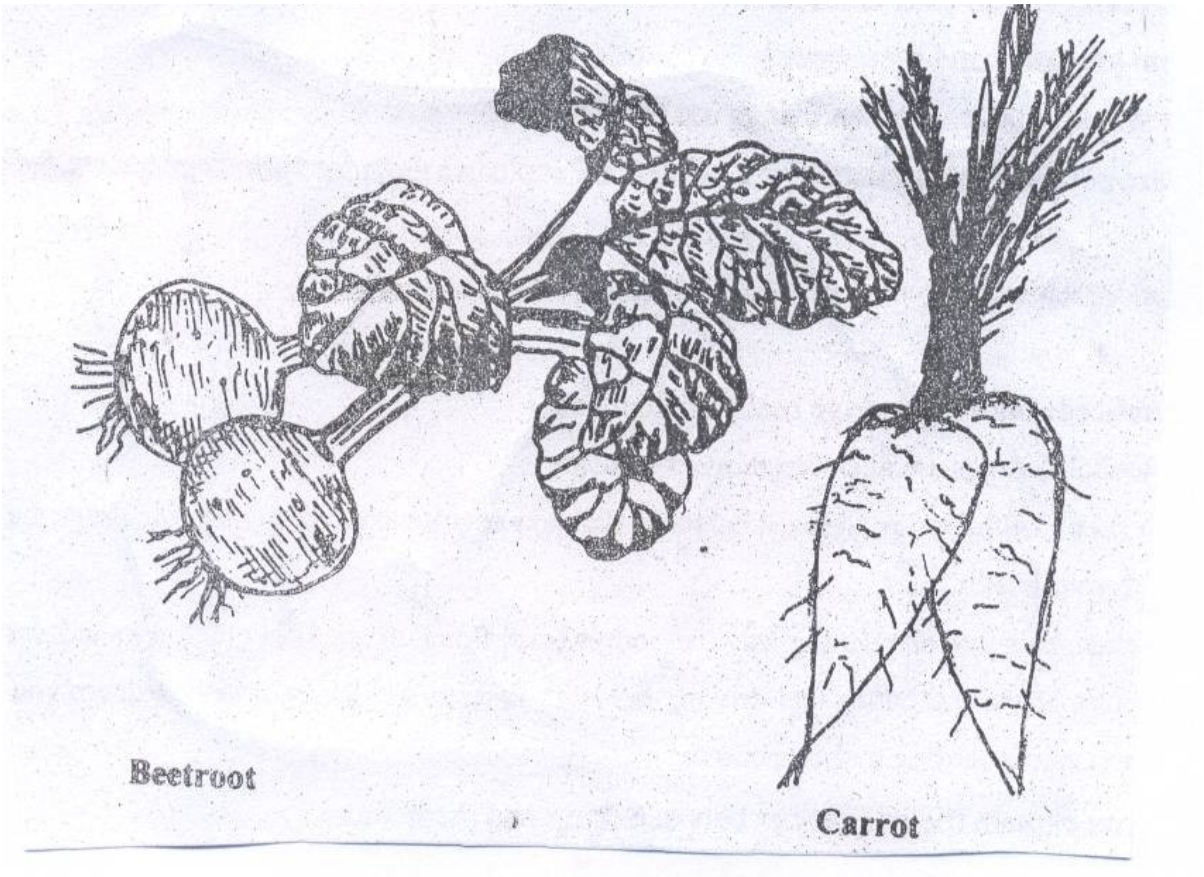


Fig.3.5. Some Eatable Roots.

3. Fiber from Plants.

* What are plant fibers?
* Think of your clothes, from where do the row materials comes from?

Fibers are elongated, fine thread like structures. They are produced from different parts of plants. After being extracted and processed in factories, they can be used as for making different materials. For example, sacks, rope, clothes, fishing nets, etc.

* For what other purposes plant fibers are used in your locality?
* Which plant parts are used as source of plant fibers?

4. Plants Maintain Normal Climate.

* How do you think plants keep normal climate?
* What maintain the composition of oxygen and carbon dioxide in the air?

Large amount of carbon dioxide is added to the atmosphere by the burning of fuels like wood, charcoal, benzene, etc. But the composition of carbon dioxide in the air remains more or less constant. This is because that the plants take in carbon dioxide to manufacture their own food. The process is known as photosynthesis.

If this carbon dioxide does not removed from the air it increases the temperature of the atmosphere what we call it global warning.

* Mention some of the results of global warning?

5. Plants Prevent Soil Erosion.

* How do you think plants prevent soil erosion?

* Which parts of a plant involving, in the prevention of soil erosion?

Soil erosion: washing away of the top soil by rain or wind.

As plants grow on a soil, they bind the soil particles by ` their roots, us prevent the washing away of the soil by flood or wind.

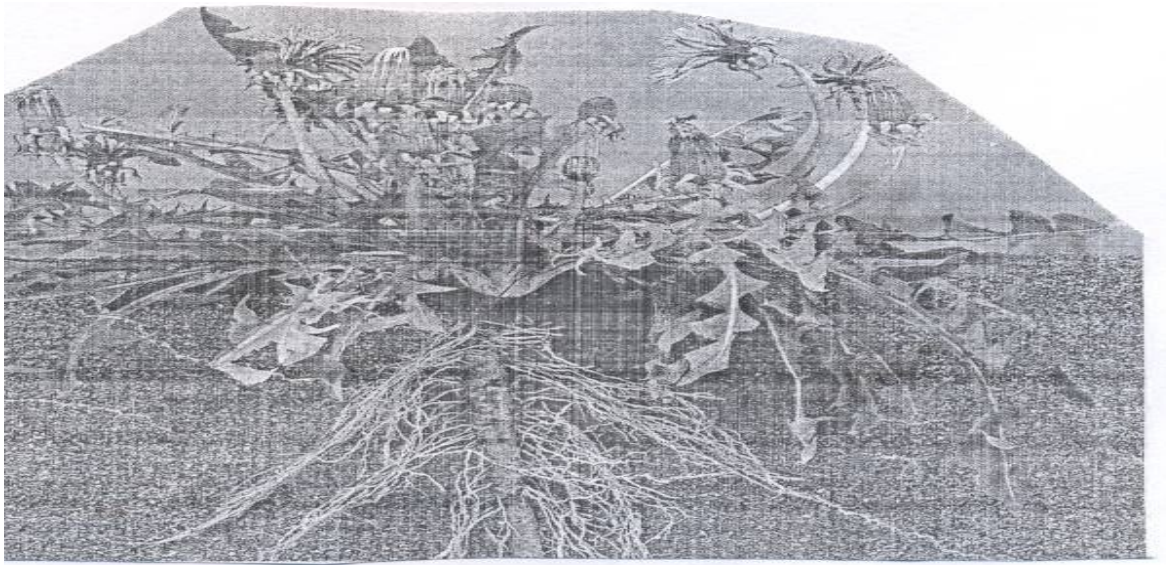


Fig. 3.6. Plants Hold Soli Particles

6. Plants Have Aesthetic Value.

* Why people grow decorative plants around their house? What pleasure do they get?

* Which plants do people grow for their attractiveness?

Discuss in groups

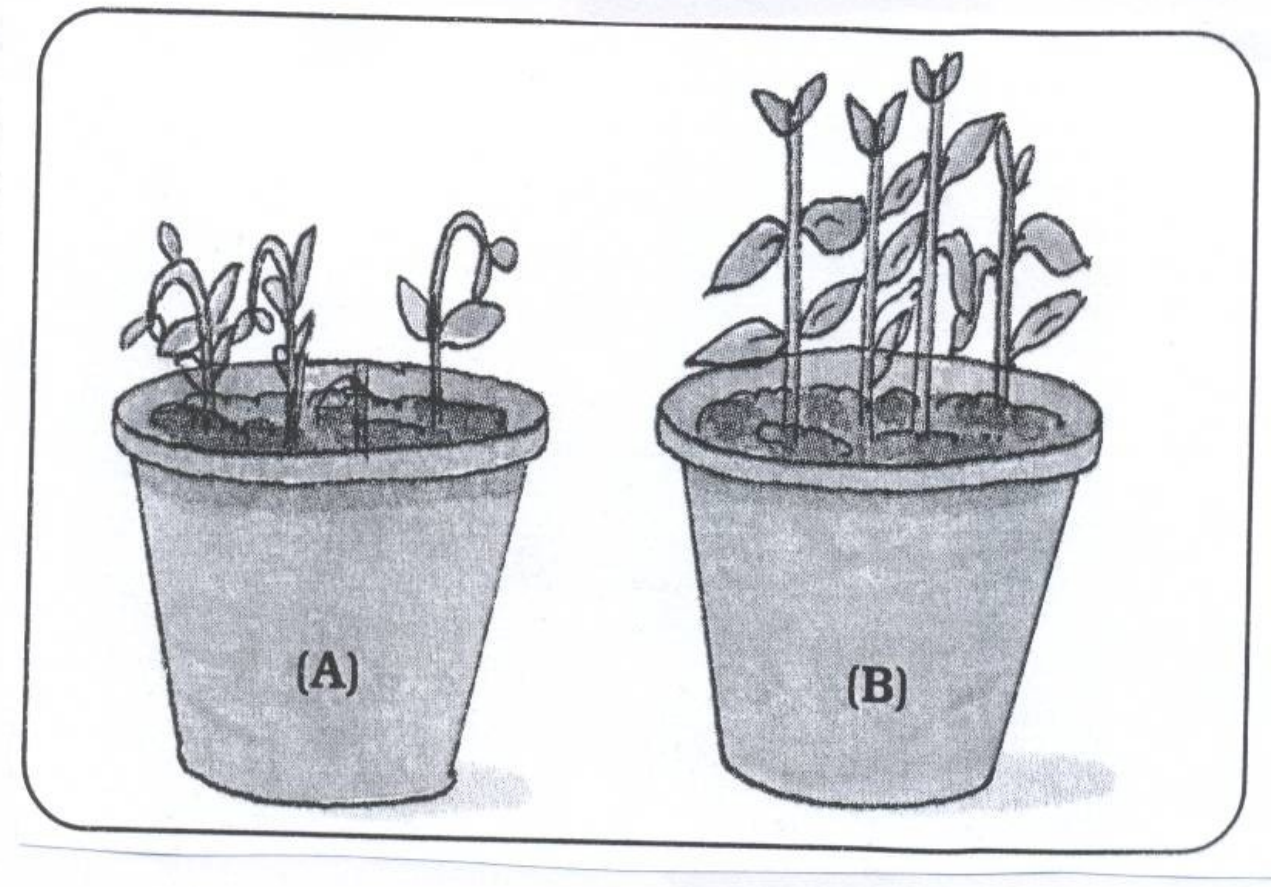


Fig. 3.7 Potted Plants

7. Drugs and Medicines from Plants

* What are drugs and medicines?
* For what purposes human beings use them?
* Which plants are used as drugs or medicines?

Drug: natural or artificial chemical substance which can affect the body for good or bad.

Most drugs and medicines are extracted from various parts of plants. People use them for good or bad.

Drug is any chemical substance which can affect the brain. and This intern affects the whole activities of our body.

Some drugs are stimulant, which increase the activities of the body and others are depressant that slow down the work of our body.

* Are drugs useful or harmful?

According to the purposes of using drugs, they can be classified in different ways:

For example:

I. **Medicine drugs**: are used to treat sick people and cure them. Medicine drugs are only used when they are prescribe by the doctors.

II. **Mood altering drugs**: they can change the behavior of the user by increasing or decreasing the activities of the body (the brain). If they are used repeatedly they can exposed to drug dependency (addiction).

- What is the difference between mood altering and medicines drugs?

Commonly used mood altering drugs

* Which plants are commonly used as drug source in your locality?

* In what forms are they used?

A. Chat

- It is grown for its soft leaves and buds.

-The leaves and buds contain stimulant chemical which leads to addiction.

-It can be chewed in fresh or dried forms.

* What are the negative effects of chat?

* Why do you think that a chat chewing person usually has no healthy teeth?

* What are the physical, economical and social disadvantages of being addicted to certain drugs?

B. Hashish

It is mood altering drug which is extracted from a plant called cannabis. It is concentrated form of crushed leaves, flowers and twigs of the plant. When it is smoked, it creates relaxation, increases heart beat and sensation. It also causes people to see or hear things that do not exist (real).

C. Tobacco

* What is tobacco? What are the effects of smoking cigarettes?

Tobacco contains various harmful chemicals. These are:

I **Nicotine**: is the addictive drug which is found in tobacco smoke.

II. **Carbon monoxide**: is very poisonous gas which is found in cigarette smoke. This can cause shortage of oxygen for the smoker.

III. **Tar:** is a sticky black chemical in tobacco. Tar makes smokers more likely to develop lung cancer, bronchitis, and infections of bronchi. This chemical also affects the heart and blood vessels.

Activity 3.2

* What do you suggest about the use of such drugs?
* People say that, smoking has a big effect on the whole family. Do you agree with this idea? If so, Why?
* What happens if a mother or a father smokes and becomes ill in a given family?
* In many countries smoking in public areas such as cafes, restaurants, bars, in public transport or in any other places are absolutely for bidden. Would you appreciate this measure? How would people react to it?

Discuss in groups

Drug free behavior of individuals

* What do we mean by drug free behavior?

If drugs are used wisely under medical supervision, they can be helpful. Repeated use of drugs lead to addiction. This is the term used to describe the condition in which the user can not do anything with out the drug.

Drug addiction: is the repeated use of a drug, which the user find difficult to stop.

In our country there are many addicted individuals. Most of them are teenagers. To get these drugs, teenagers are involved in illegal activities such as in drug-trafficking and in other crimes.

* Why people use drugs?
* Have you ever seen such drug addicted individuals?
* What are the most important things to avoid drug addiction?

Drug addiction is directly related to stress, depression or some discomfort in life. In addition to this, teenagers may tend to use drugs by either of the following cases:

- ❖ social and peer group influence.
- ❖ unknowingly just for the sake of fun and excitement.

- ❖ to produce a feeling of independence.
- ❖ lack of regular physical exercise.
- ❖ to avoid stress and tension.
- ❖ as an escape from reality

If one is being addicted to a drug, it is very difficult and takes long process to return back to normal life. The best solution to avoid drug addiction is, condemn even tasting the drug. This is what drug free behavior means.

* Is there **“ Anti drug club”** in your school? If no, discuss with your class friends and with your teacher and establish the club which helps you to develop drug free behavior. Do not take much time, do it now! To save yourself and others.

Exercise 3.2

1. Name the main parts of plants?
2. Which plant parts are used as food?
3. In what way plants considered as a source of pure and fresh air?
4. What do you mean by drug addiction?
5. List plants that used as source of drugs?

Project work 3.1

Consult a farmer or agricultural expert in your locality. Ask him/her for a list of crop plants that are cultivated in the area. Then classify them according to their importance and the parts used as follows:

List of crop plants	Importance	Parts used
Example; 1 chat	As drug	Leaf
2		
3		
4		
5		
6		
7		
8		
9		
10		

III.3 Soil and Plants

Activity 3.3.

* What is soil?
* How soil is formed?
* What is the composition of soil?

Soil is a medium which provides all necessary things for the plants' growth. Plants need air, water and minerals to grow, to make their own food and reproduce. Soil consists of mineral salts, humus, water, air and living organisms such as bacteria, fungi, worms, etc. In addition, soil provides attachment for roots, which support the plant not to be washed (blown) away. But the soil of an area may not contain all types of materials needed by every kind of plants. Why?

* Do you think that different plants require different substances from the soil? Why? Discuss in your groups.

Soil Profile

There are different vertical layers of soil on the earth. The soil profiles are: top soil, sub soil and parent rock.

Practical Activity 3.1 Demonstration of soil profile.

Materials: soil, beaker, water

Procedure: 1. collect some garden soil in a beaker

2. observe the settled soil profiles. At the base, lie the largest particles over it. Lay the smaller soil particles. Above this lies the fine layer of particles.

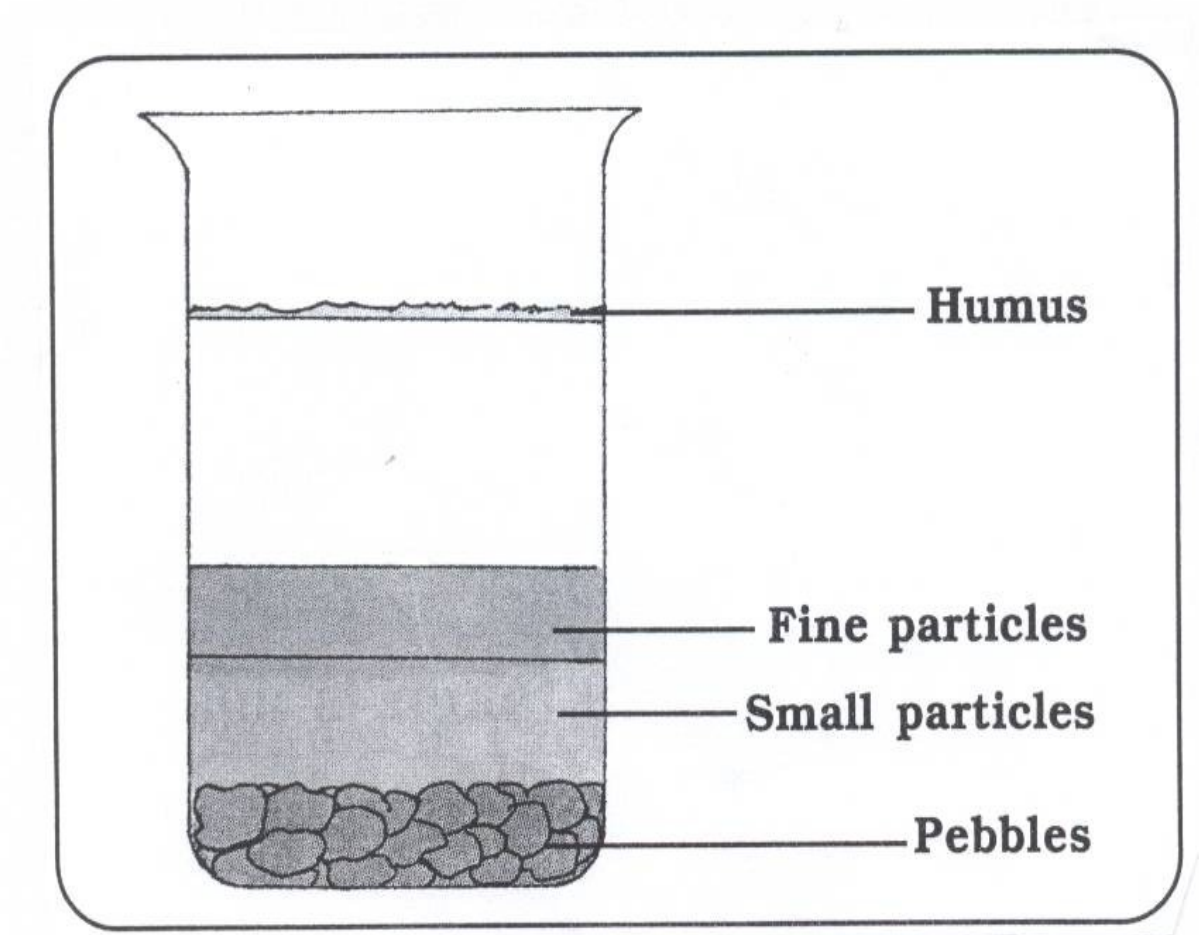


Fig. 3.8. Soil Profile.

Questions: What can you see floating over almost in clear water?

A. **Top Soil**

- Top soil is the upper most layer of the soil.
- Darker in color and is only a few inches thick.
- Roots of most plants are found in this layer.
- Top soil is rich in soil nutrients and humus.

* Why do you think top soil is rich in nutrients and humus?

Nutrients: are necessary Substance for the growth of plants

Humus: are decomposed substances in a soil.

B. Sub Soil

- Sub soil is found just below top soil, is also light in color.
- This layer consists of sand and small stones. Since the layer has very few nutrients, few plants` root reaches this layer.

C. Bed Rock

- This layer is mainly rocky.
- The top layer of the rocks is soft and porous.
- As one goes deeper the rocks get bigger and harder.

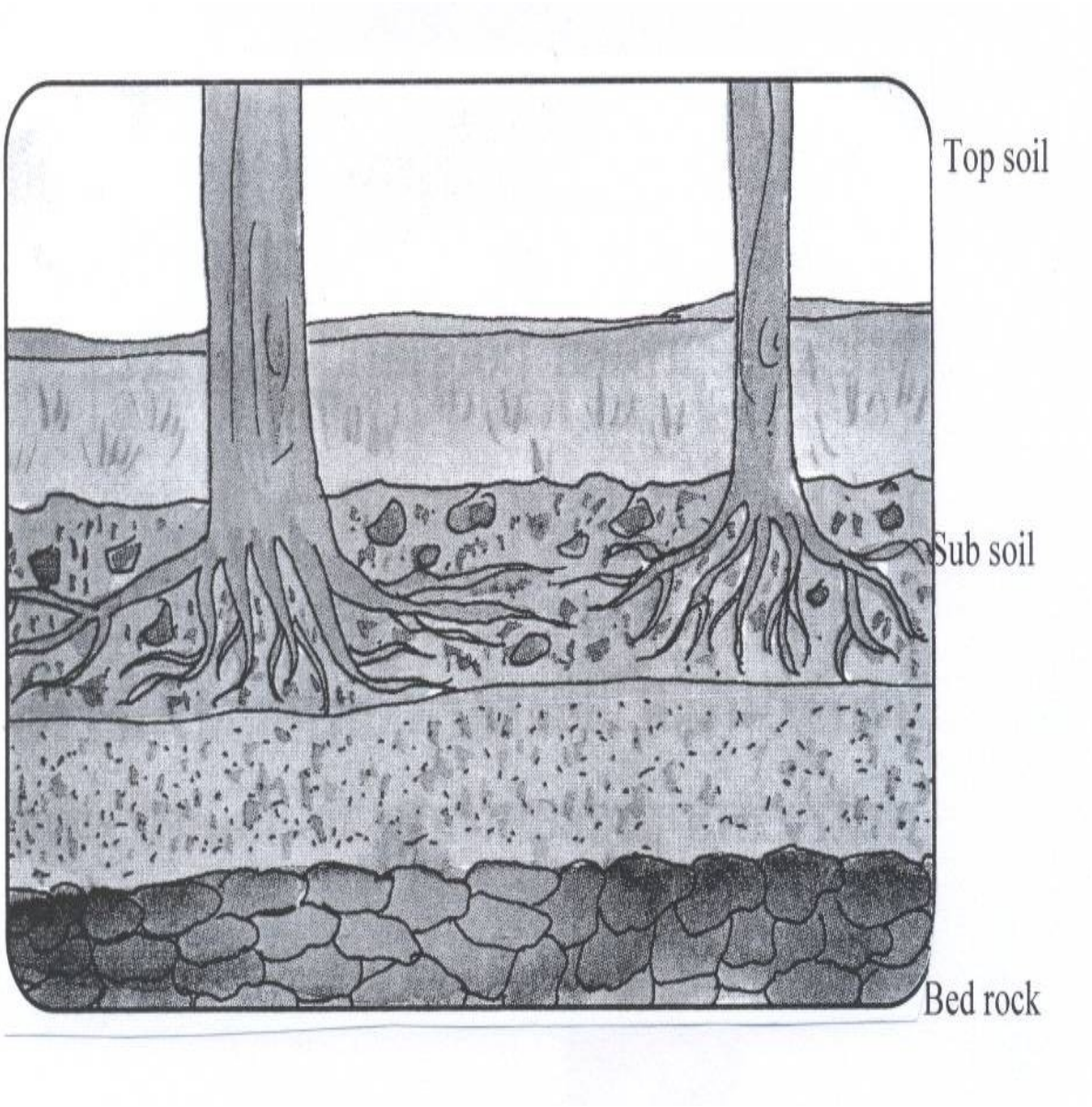


Fig. 3.9. Layers of the soil.

Types of Soil

There are many different types of soils and are found in different places.

A. Clay Soil.

- Is very fine soil.
- Is sticky and feel smooth.
- The particles of this soil closely and tightly packed.
- Can hold too much water but very little air. It also has humus and minerals salts.

B. Sandy Soil

- The sand particles are irregular in shape.
- Made up of fine hard rocks.
- Cannot hold water and has no nutrients. It also holds too much air.

C. Loam soil

- Loam soil is a mixture of sand and clay soils.
- Found mainly in the top layer.
- Has plenty of humus and can hold enough water and air.
- Loam soil is the best soil for the growth of plants.

* What features of loam soil makes suitable for the plant's growth?

Practical Activity 3.2

Objective: To show the water holding capacity of soil types

Materials: clay, sandy and loam soil types, three pots, three beakers and water.

Procedure: 1. Take three identical pots with holes at their base.

2. Fill pot-A with sandy soil, pot-B with loam and pot -C with clay soil.
3. Place the three pots on separate stands.
4. Put empty beakers under each pot.
5. Pour equal amount of water in each pot. What do you observe?

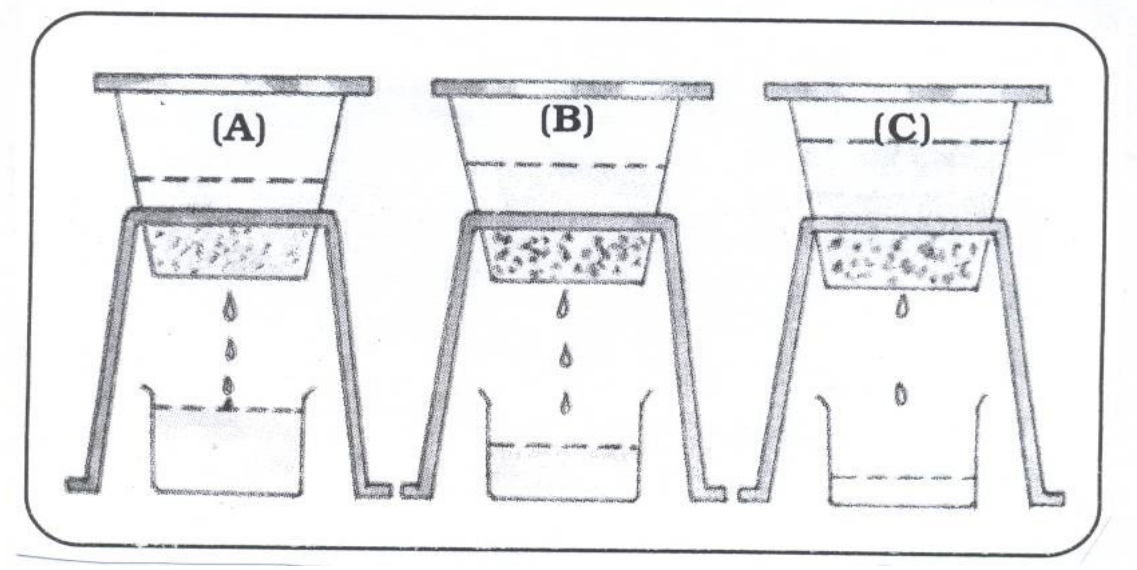


Fig. 3. 10 Water holding capacity of soil types.

Questions: 1. From which pot most water drains out?

2. From which pot less water and very little water drains out?

3. What are your conclusions?

Soil Damage

Soil may be damaged in two ways. These are by; soil depletion and soil erosion.

A. Soil Depletion

* What happens to the productivity of farm lands if the same kind of crop is grown for many years continuously?

Depleted soil: a soil with out or little amount of mineral nutrients
Crop rotation: planting different crops year to year in a field
Soil erosion: is the washing a way of the top soil by water or wind.

A depleted soil is a soil without or with little minerals in it.

How a soil can be depleted?

Continues planting of the same crop on the same farm land draw the same minerals from the soil may result in serious depletion of the particular mineral. The best solution to avoid soil depletion is crop rotation.

Crop rotation maintains the minerals content of the soil because different plants have different minerals requirements.

* Can you explain the role of crop rotation to avoid soil depletion?

B. Soil Erosion

* What is soil erosion?

***** What are the causes of soil erosion?

Soil erosion is the washing away of the top soil by the action of water and wind. It is a natural process but it can be increased or fasted by the activity of animals or people.

Causes of Soil Erosion

The main causes of soil erosion are:

A. **Excessive use of fertilizers**: improper utilization of fertilizers may change the nature of the soil which accelerate soil erosion.

> ***Fertilizers:*** are substances added to soil to increase soil fertility.
>
> ***Deforestation:*** cutting trees from the forests.
>
> ***Overgrazing:*** herd of cattle are grazed for long periods on one area of land.

B. Deforestation: the cutting of trees from the forest.

* Why people cut trees?

C. Overgrazing: if cattle graze on one area of grass land for long time the vegetations are cleared away. During heavy rains and strong wind that blows over the bare lands the top soil is taken away.

D. Cultivation of grass land: land with a cover of natural vegetation such as grass or forest is well protected against erosion.

E. Heavy rain fall.

F. Poor farming method

G. Wind

H. Road Construction

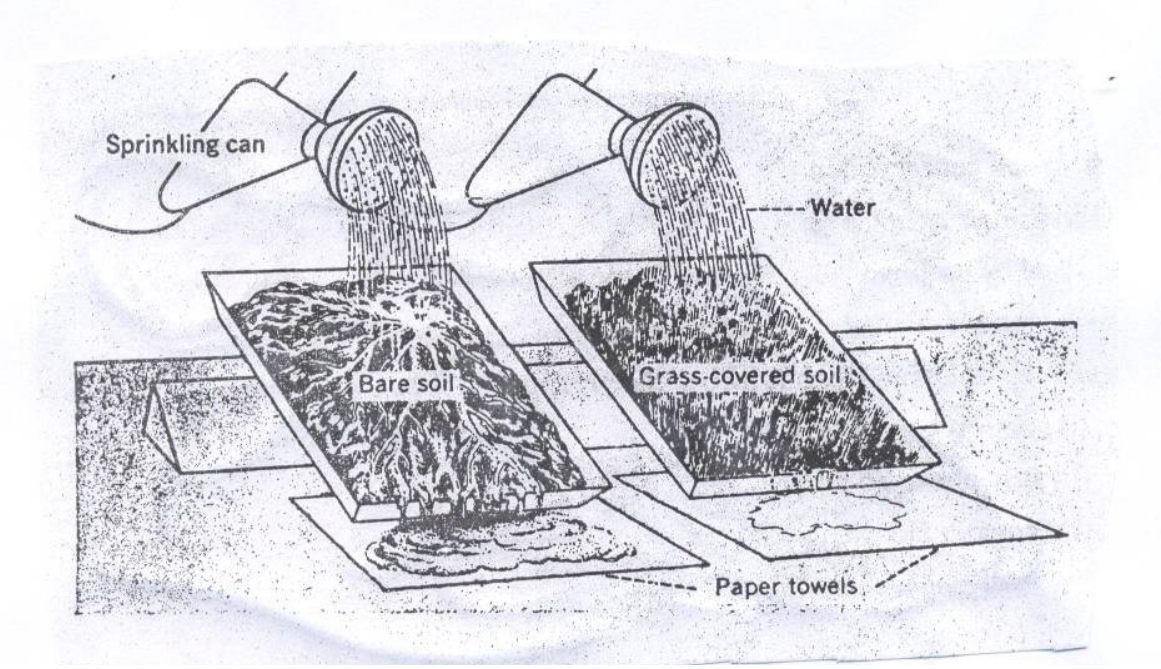


Fig. 3. 11. To show the degree of erosion.

Conservation of Soil

Conservation: means the wise use of natural resources.

Top soil is normally support plant life. Roots of most plants are found in this layer. Top soil is also a home for many animals and other living things such as bacteria and fungi. These living things breakdown substances into humus. If this layer is taken by erosion, it is very difficult for agriculture. Therefore, measures should be taken to avoid soil erosion.

Some of the methods of soil conservation are:

A. **Protection of forests**

B. **Wind breaks and shelter**: trees should be planted around farm lands to reduce the eroding action of the wind.

C. Cover vegetation: planting trees on hilly slopes and mountainous areas

D. **Contour ploughing:** fields should be ploughed along the contour of sloping land, instead of up and down the slopes

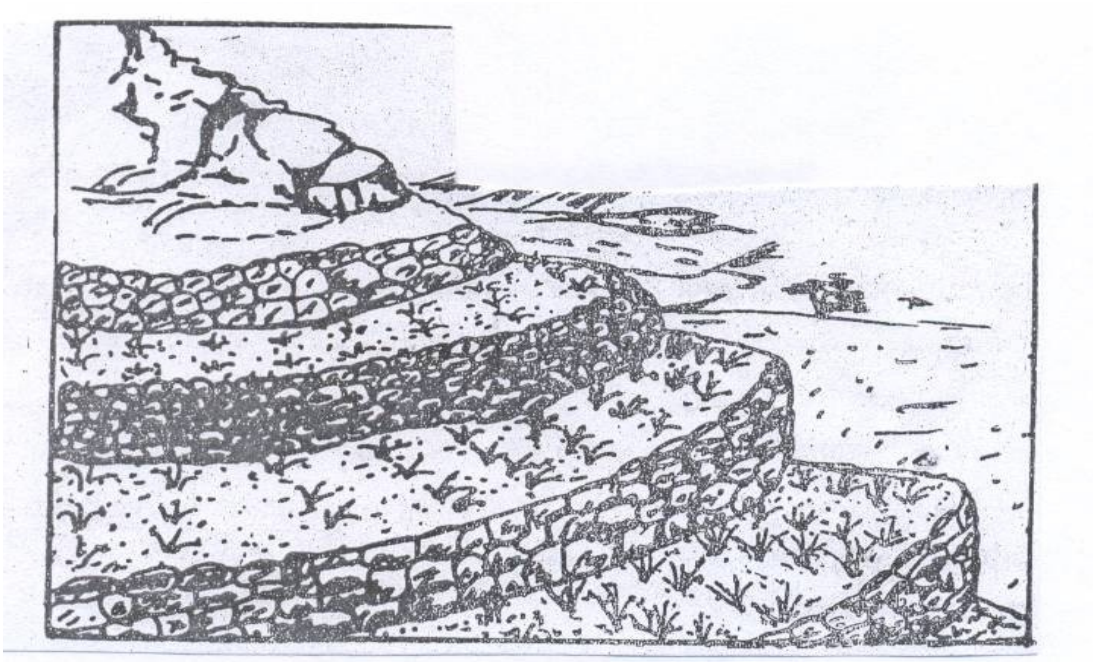


Fig. 3.12 Contour strip planting.

E. Terracing: on steep slopes, step of soil and rocks should be built across the hill and plant trees with soil binding plants.

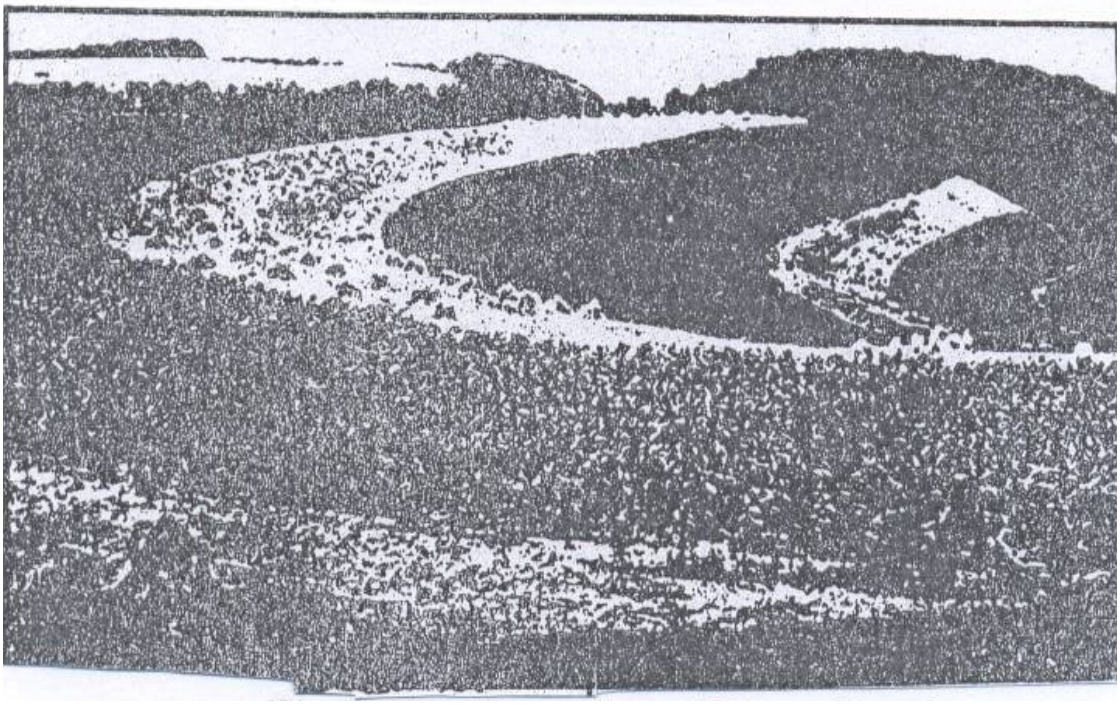


Fig. 3.13. Terracing of Konso People

* Which people are known by their work of terracing in Ethiopia?

F. Constructing dams: build small dams across the gullies to reduce rapid flow of running water along slopes.

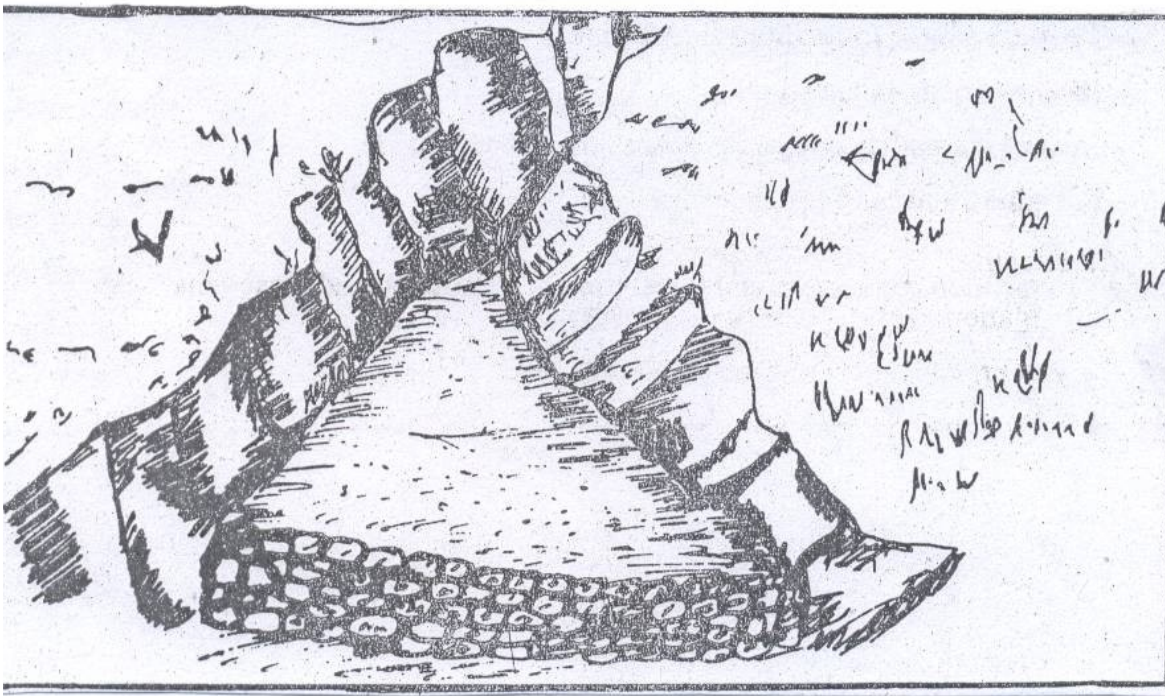


Fig. 3.14 Dams to Protect Soil Erosion.

G. **Mulching**: covering the soil with materials such as leaves, grass cuttings, etc to protect the soil and reduce erosion.

H. Educating farmers about good land management

Exercise: 3.3

1. The outer most layer of the soil is called _____
2. Which type of soil holds much water?
3. Define soil depletion.
4. What is the difference between soil erosion and depletion?
5. How do you think plants prevent soil erosion?
6. Write the importance of soil for plants?

3.4. Soil Improvement Practices

* How can you improve the fertility of depleted soil?

* How do farmers increase the soil fertility in your locality?

Different plants grow in different ways and they need different nutrients. From where do plants get what they need? To grow and be health plants need water, minerals salts and air. Plants get water and minerals from the soil on which they grow. So, keeping soil fertility is very essential for the normal growth of plants.

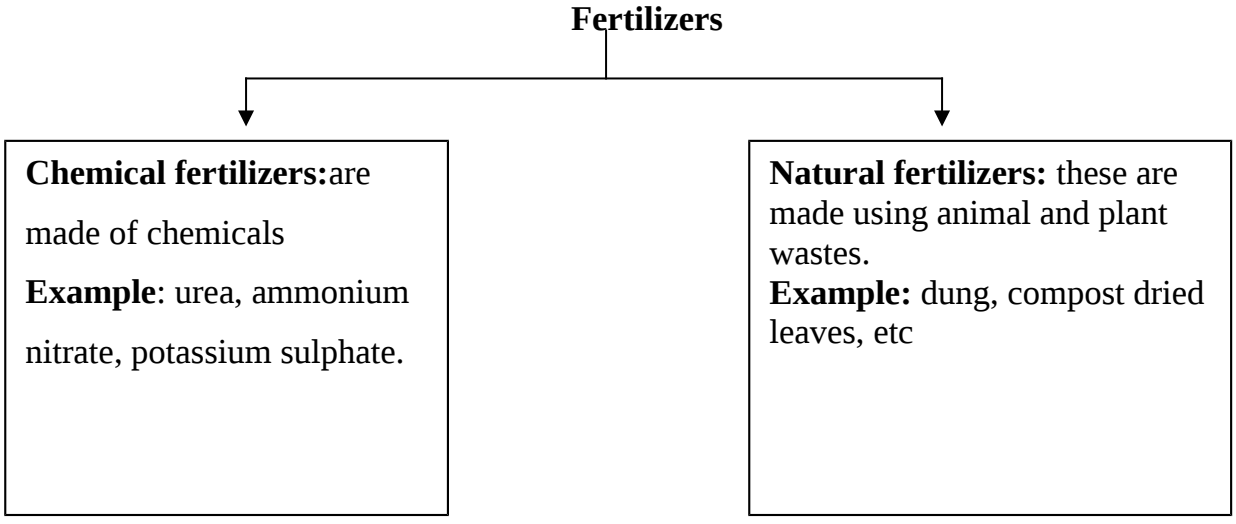
Fertilizers and Their uses

* What are fertilizers?

Fertilizers are substances added to the soil to make it more fertile. The components of soil can vary from one place to another or from time to time. A fertile soil for one type of crop for one year may not be effective for the next year. The minerals used up should be replaced by adding fertilizers.

Types of fertilizers

Fertilizers are of two kinds.



I. Chemical fertilizers

Chemical fertilizers contain important compounds of nitrogen, phosphorous, magnesium and potassium which are very essential for the proper growth of plants. These fertilizers are important to increase the soil fertility which can then increase the productivity of crops. How ever chemical fertilizers have side effect on the soil. They may increase the acidity of the soil. So for the coming harvest time the soil may not be good for the growth of plants and needs certain modification to avoid the chemical effects of the fertilizers.

* What kinds of fertilizers do farmers use in your locality?
* What are the disadvantages of using chemical fertilizers?

II. Natural fertilizers

Natural fertilizers are made from plant materials, animal excrete and any other organics rubbish. One of the most important natural fertilizers is compost.

In the formation of compost animals dung of urine can be used as a raw material. The raw materials contain very small micro organisms (bacteria and fungi) which break down the dung into useful nutrients.

* What type of materials will compost?
* What are the advantages of using compost?
* Explain the function of bacteria in compost making?

Difference Between Natural Fertilizers

Farm – yard	**Green manures**	**Plant residue**
-Contains the mixture of crop residue and animal dung	- Crop plants are used as they are green.	- Made from plant remains after harvest on the soil
-Mainly supply nitrogen, phosphorus and potassium (NPK) to the soil	- Supply, carbon, oxygen and hydrogen mainly.	- Contains leaves, roots stalk of corn, husk, etc
- Decompose at a slower rate but faster than plants residues	- Decompose at a faster rate but with lesser amount	- Comprises different essential elements - Decomposes relatively at a slower rate.

Exercise 3.4

1. The chemical substance that used to increase the soil fertility is called _____
2. Why do need rotating crops on a farmland?
3. What are the two main types of fertilizers?

3.5 Our Forest

* What type of an area to be called a forest?

* Can you list down some of the importance of forests?

Forest is an area where these are tall trees and other lower plants which are arranged in layers. A forest is homes for many animals such as birds, monkey, elephant, buffalo, antelope, leopards, insects, frogs, snakes, etc.

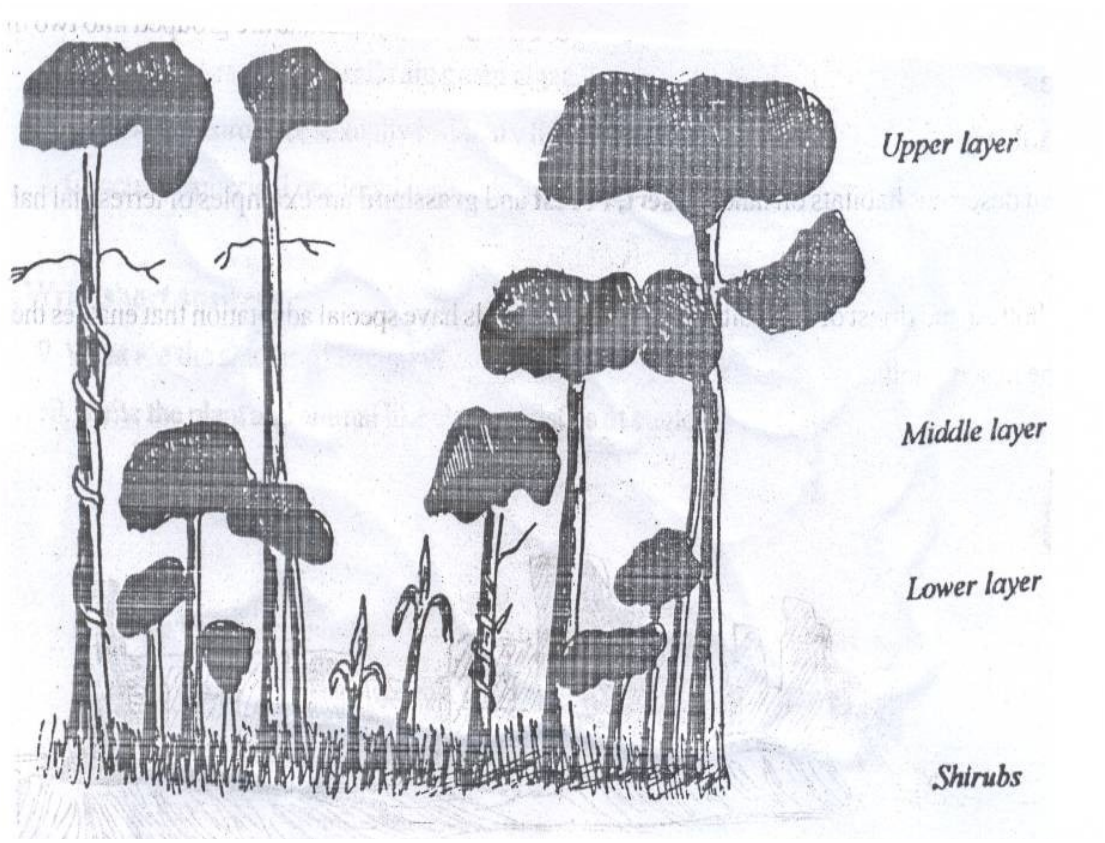


Fig. 3. 15 Profiles of Forest

Importance of Forests

Some of the essential values of forests are:

A. Prevent soil erosion and flood.

B. Act as water shed to retain water.

C. Provide homes for wild animals

Fig. 3.16 Forests are the home for many wild animals.

D. Are good source of traditional medicines

E. Help to regulate the climate.

F. Reduce air pollution by taking in carbon dioxide from the air

G. As a source of energy (fuel wood).

H. Used as a raw material for products such as lumber, paper, chair, table, box, etc

I. Serve as educational and aesthetic value

Activity 3.4.

* What are other importance of forests?

* Can you mention substances which derived from forests? Do you know varnish?

* Where does it come from? What is its use?

* Do you know rubber tree? For what purpose do we use it?

History of the Ethiopian Forests.

Before many years ago, 34% of the total area of our country was covered by dense forests. However, deforestation has been practiced to the forests and now a days, it is believed that not more than 3% of the country as a whole covered by forests.

Name of forests	**Location**
Harena forest	In Oromiya, Bale zone
Menagesha Forest	In Oromiya, Western shoa.
Wendogenet Forest	In Oromiya and SNNPR
Guda Forest	In SNNPR , Semen Omo
Wacha Forest	In SNNPR, Kafecho
Belete Foreste	In Oromiya, Jimma.
Gesha Forest	In SNNPR , Kafecho.
Mocha Forest	In SNNPR, Shekacho

Table3.1 Examples of some Ethiopian forests.

Cause of Forest Destruction

* What are the main activities that affect the existence of forests?

People destroy forests for different purpose knowingly or unknowgly. Cutting down of trees for human activities is called deforestation. Man is by far the worst enemy of forests. He destroys forests by using them unwisely. The following are usually considered as to be the main contributors for deforestation.

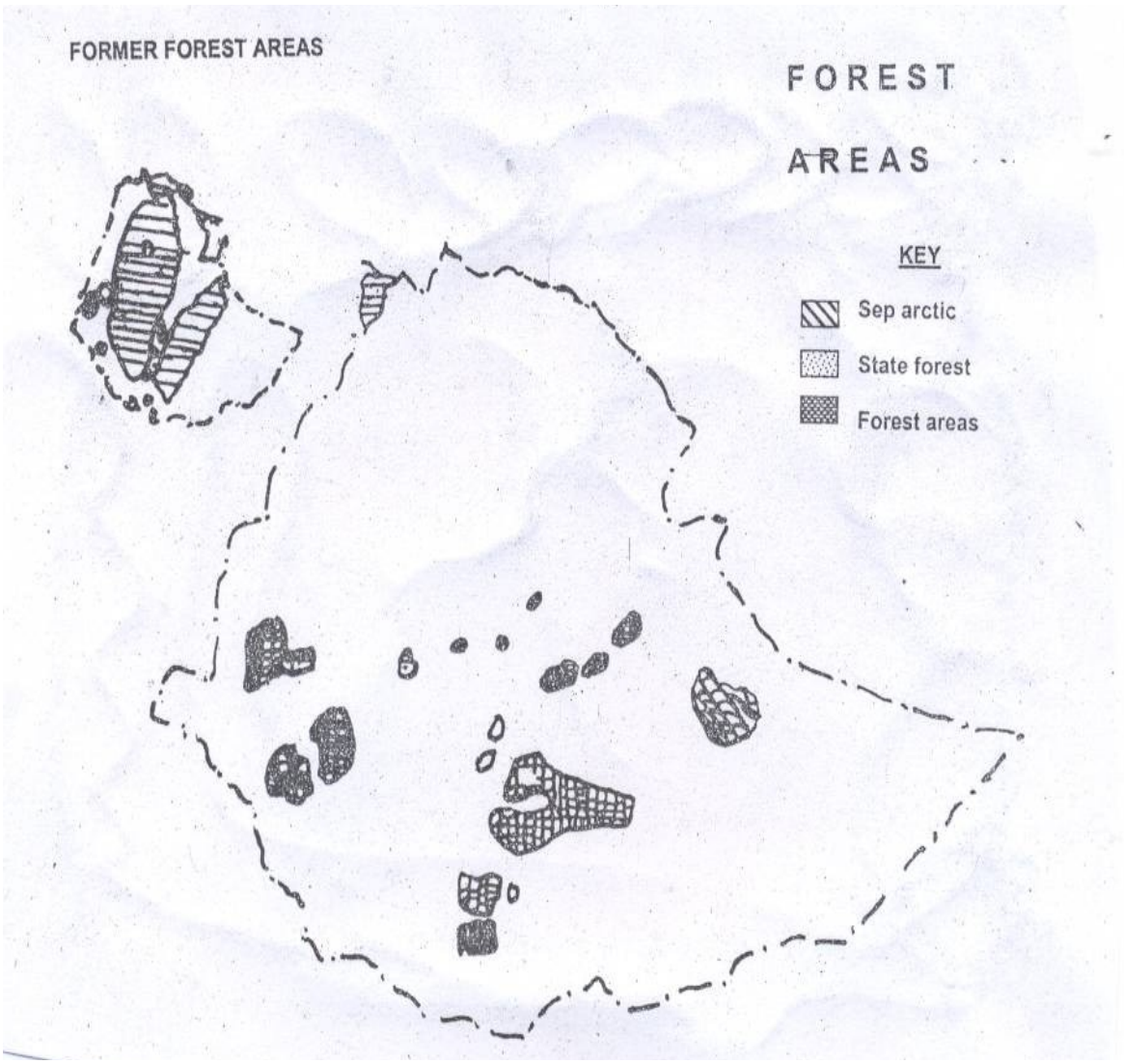


Fig. 3.17 Forested area now and in the past.

1. **Cutting trees for firewood**

In Ethiopia, the main energy source for cooking and heating are firewood and charcoal. People cut trees for these purpose, even some areas, peoples use fire wood and charcoal for commercial purpose. How is charcoal formed from wood?

Fig. 3 18. Forests has been cleared for fuel.

Migration: is the movement of people from one area to another
Population expansion refers to the increasing number of human population

Drought : shortage of Rain
Famine: shortage of food

2. Clearing forest for settlements.

People migrate due to some environment problems such as drought, famine, population expansion, etc. They may move to an area where there are forests. They build houses by cutting tress and start cultivation by clearing forests.

3. Clearing forests for farming

Activity 3.5.

* Do you think the human population growth affect the environment (forests)? If your answer is yes, how?
* What are the effects of human population growth?
* What should be done?

Discuss the above questions in group.

Farmers cannot live without cultivating land. High population expansion results in new demands for large farmlands. Hence farmers clear bushes and trees for cultivation.

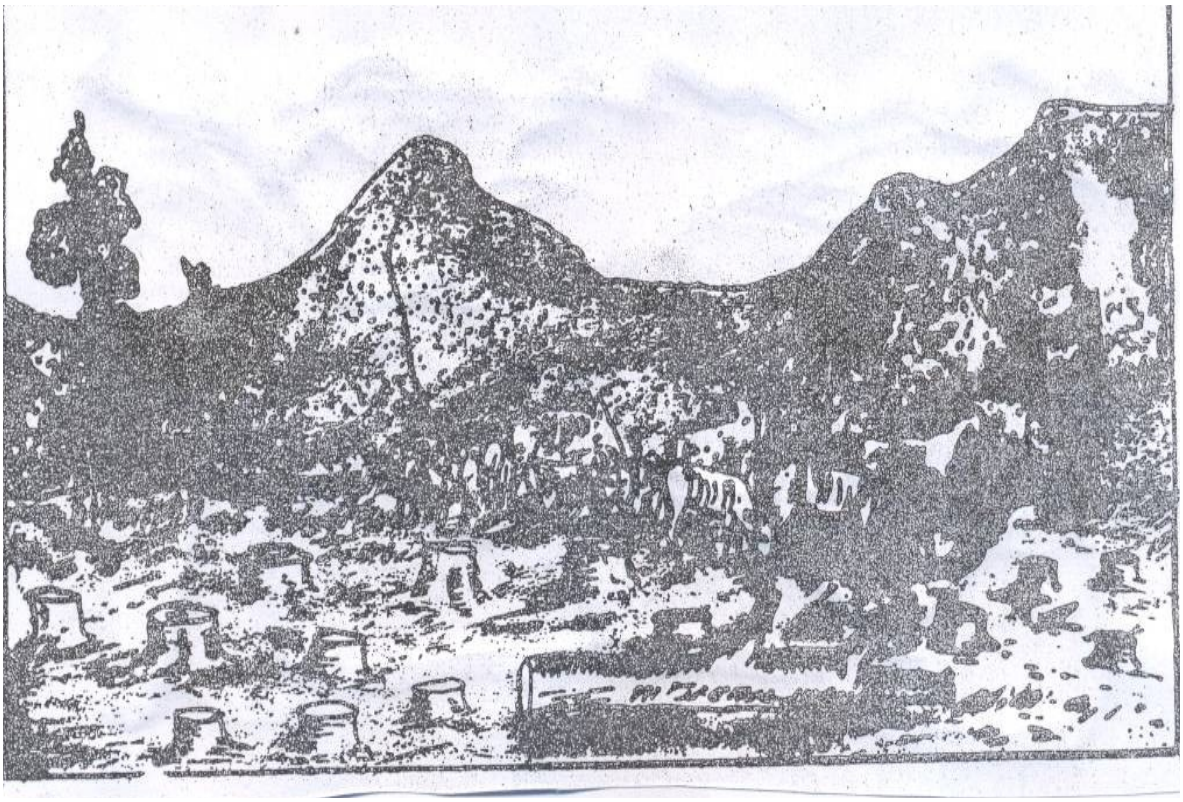


Fig.3. 19 High population growth leads to deforestation.

3. Wood Work

A part from its uses as fuel in Ethiopia, wood is widely used for the construction of houses and manufacturing furniture, pulp and paper, for electric and telephone poles, etc.

4. Overgrazing forests

* Do you remember what does overgrazing mean?

It is also a serious problem particularly where domestic animals are greater in number. If domestic animals are too large in number, they consume much bushes, grasses and trees that grow. After some time, vegetation of an area becomes poor. Thus, overgrazing leads to desertification.

Desert: an area with out vegetation and little or no water.

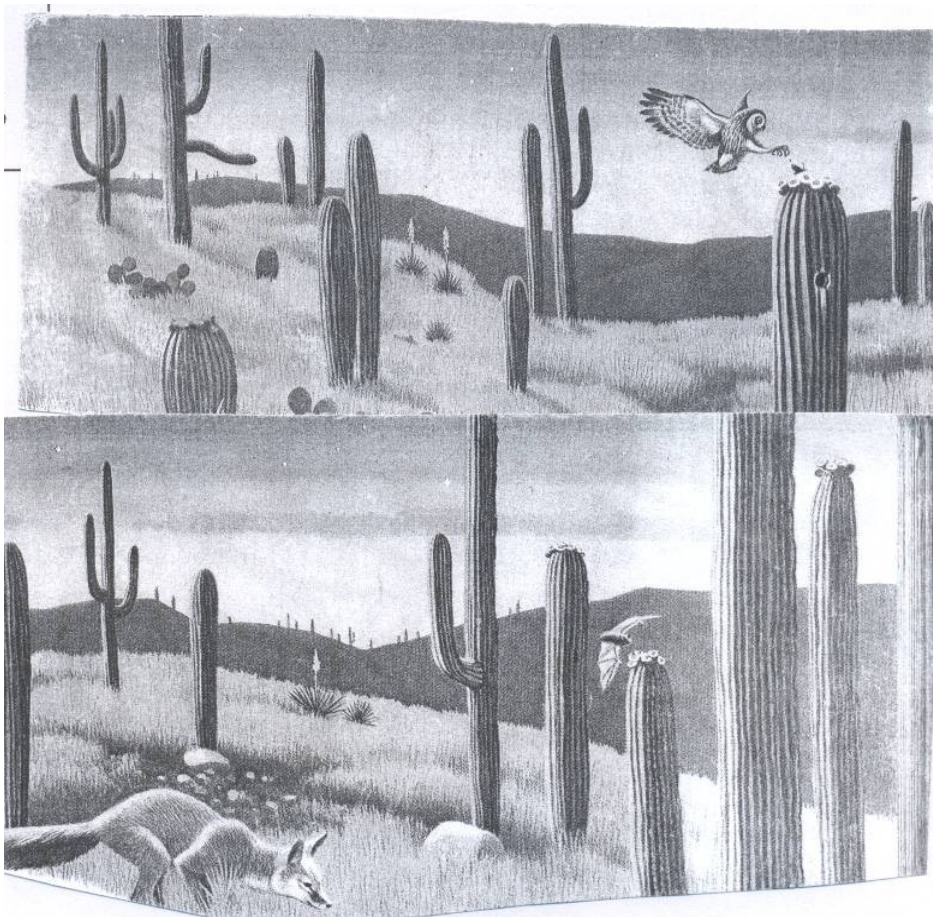


Fig. 3.20 Deforestation and desertification.

Conservation of Forests.

* What are the activities to be taken to control the destruction of forests?

* What happen if we do not conserve forests?

A. Reforestation: is planting of trees in places where forests are cleared.

B- Avoid overgrazing of forests.

C. Using fire control mechanisms.

D. Train people for fire prevention campaign.

E. Remove dead or diseased trees

F. Use other alternative sources of energy for example electricity, biogas, etc.

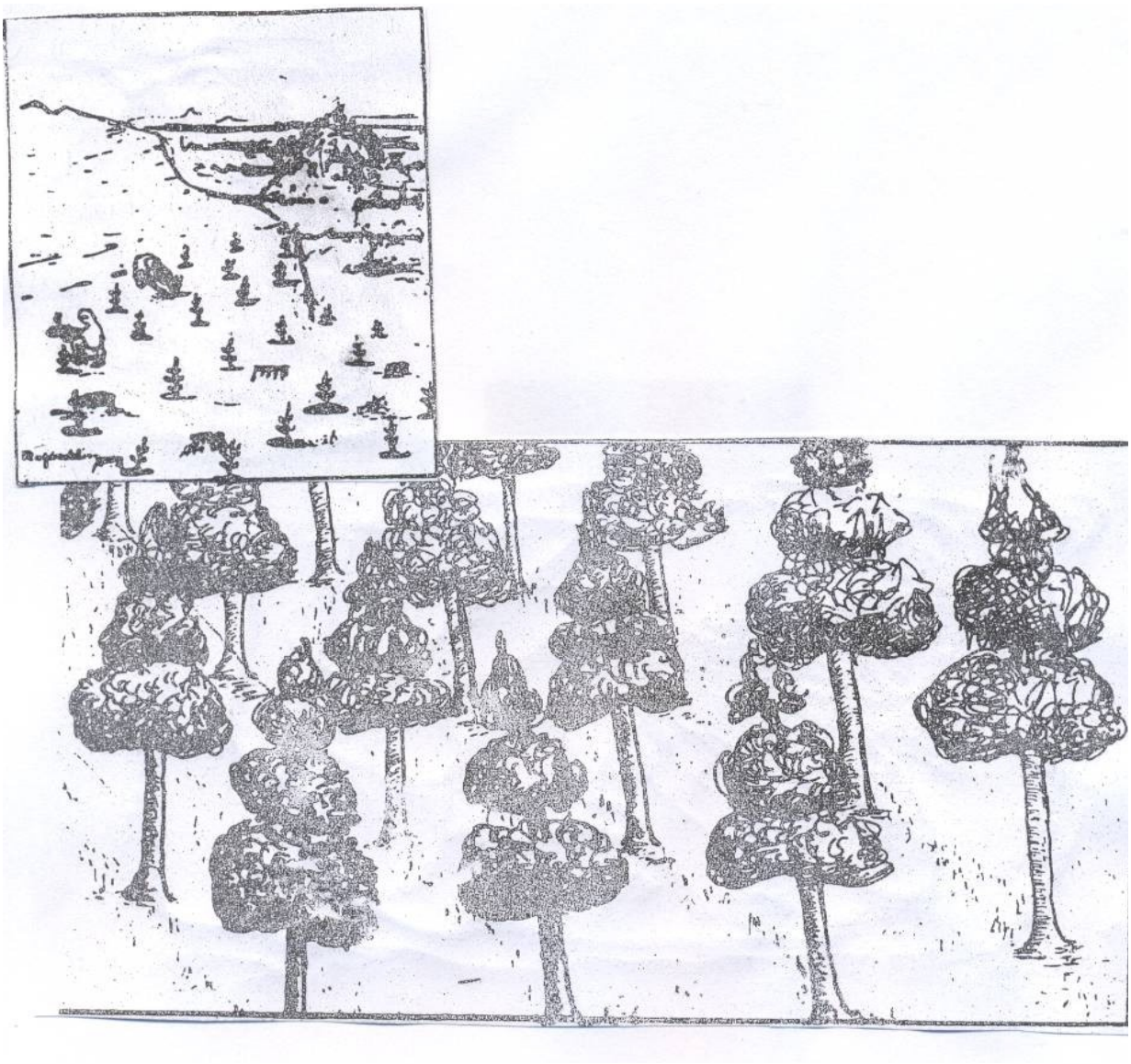


Fig. 3.21. Reforestation.

- Is there “environmental protection” club in your school? If no, discuss with your teacher and establish the club to take tree planting initiative around your school or class.

Exercise 3.5

1. Write at least four uses of forests?
2. Write at least three forest conservation measurement.
3. How many percent of the Land is covered with forests in Ethiopia at present?

A. Tree planting project

Practical Activity 3.3

Objective: to organize a tree planting initiative around your school so that the students in their future academic years will benefit from the shade they provide.

Materials: Equipments and materials needed for nurseries and planting trees that is available in the locality . Such as tin, polythene, bags, mulch, seeds.

Procedure: 1. collect tree seeds or seedlings from your locality (agricultural Berau)

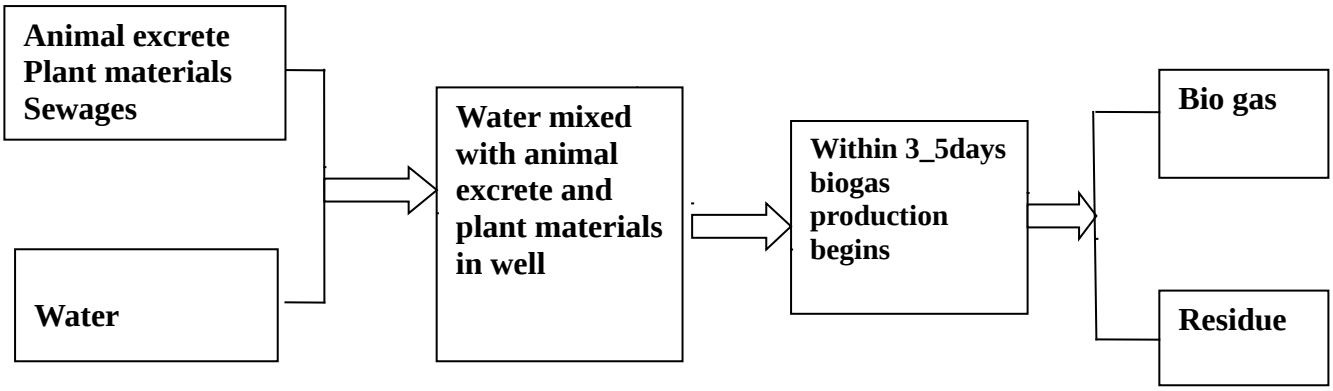
2. prepare the school garden "*Medeb*" or seed boxes.
3. transfer seedlings to tin or polythene bags
4. plant the seedlings.
5. shade the garden and water the seedlings.
6. mulch the planted seedlings.
7. care and protect daily as it grows
8. take out the planted tree seedling in a chosen area of reforestation or in the school garden or in your village.
9. give protection and care to tree seedlings as they grow up to mature trees.
10. observe how the whole work is done and write a report for the school club.

Fig. 3.22 School garden.

Biogas

Biogas: generates energy from wastes.

Biogas is an alternative source of energy. It is made from domestic sewage, animal excrete and plant materials. The biogas (methane) is important for the use of cooking, lightening or heating. This replaces petroleum " *Nedaj*". Biogas technology is also important to prevent pollution. The residue (the waste products) is used as fertilizer.



Reaction involved in the production of biogas (methane).

3.6 Raising vegetable seedling and crop growing

* What is seed?

Seed is a part of a plant from which new plant (seedling) can grow. A seed consists of three main parts. These are:

A. **Seed coat**: is a protective outer covering part

B. **Ting young plant (embryo**): small living plant.

C. **Stored food:** serve as a source of energy for the young plant.

In order to grow (change to seedling) a seed requires, water, air, light and space. If these conditions are fulfilled, a seed develops to seedlings. In the absence of one of these conditions, seed can not grow.

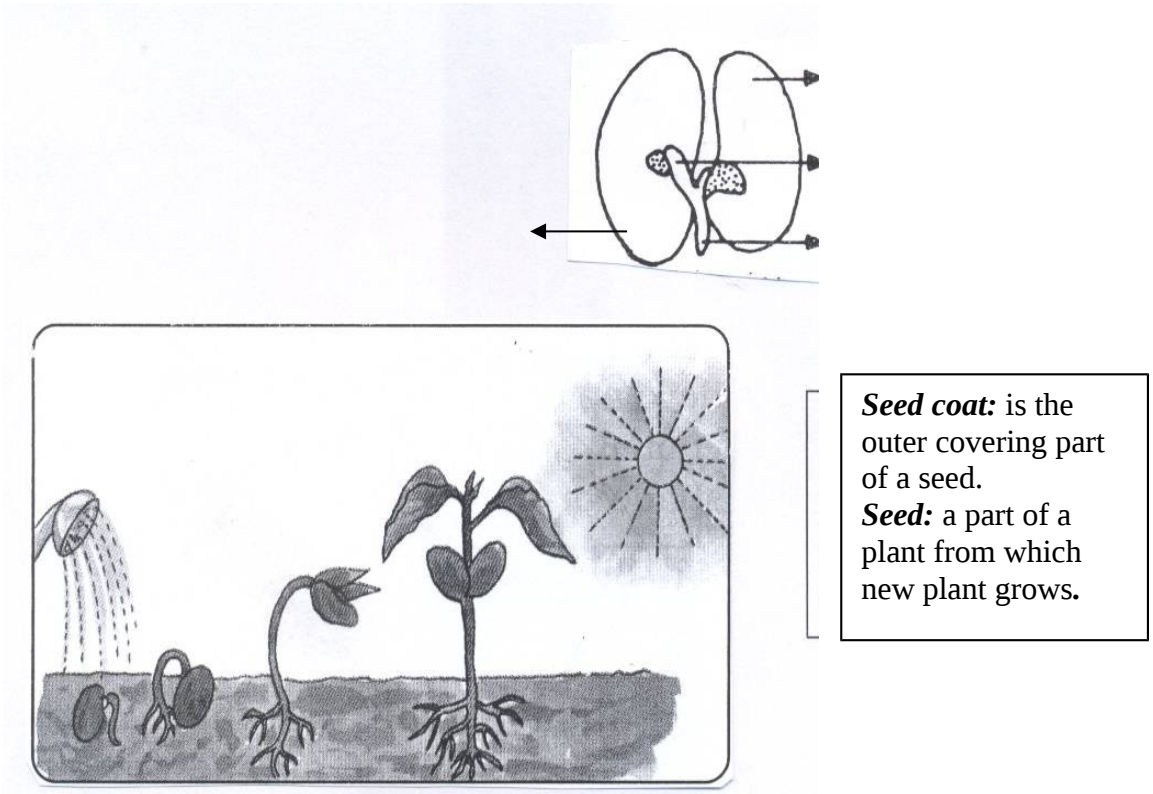


Fig. 3.23 Parts of a Seed.

Practical activity 3.4

Objective: to demonstrate the parts of a seed and how seed germinate.

Materials: beaker (dish) bean seed, water

Procedure: 1. take some water and pour in the dish

2. put the bean seed in the dish and cover it with plastics.
3. place the dish at place where there is light.
4. observe after two or three days.

Questions: What happens to the seed?

You observe the three parts of the seed?

What happens to the seed coat?

How is the size of the seed?

Crop Protection

There are many enemies for crops. They are pests, birds, herbs (weed), etc. In order to get enough agricultural products we must care and protect our garden. Some of crop protection methods are:

-build a fence to keep out animals.

-use nets to keep out birds.

- applying chemical pesticides – either traditional or commercial

- grow plants that will deter some pests.

3.7 Weed and Weed control

* What are weeds?

Weeds are unwanted (undesired) growing plants on farmlands or gardens. These weeds hinder the successful growing of our crops by:

- competing for sun light.
- competing for water.
- competing for nutrients from the soil.

Some weeds produce poisonous chemicals that can be harmful to animals and humans. If they are eaten they can cause death. The basic successful characteristics of weeds are:

- grow rapidly and invade the whole farm land with in short periods of time.
- flourishes in a range of different types of soil.
- produce lots of seeds.

Unless we control the weeds, they decrease our agricultural products.

Weed Control Methods

Weed can be controlled by two main ways:

I. **Physical control method:** involves digging out weeds regularly before they have a chance to flourish or produce seed.

Fig. 3.24 Weeds decrease our agricultural products.

II. **Chemical control method**: involves spraying the weeds with chemical weed killers which are absorbed into the weed and kill it.

Project Work

Consult a farmer or agricultural expert in your locality and ask:

- the most common weeds in your community.
- the advantage and disadvantage of physical and chemical weed control methods.
- some chemical weed killers and which are effective against. Then present your findings to the class.

3.8 Harmful Practices Towards Forest Conservation.

Setting forest fires

This can takes place naturally or it can be done deliberately. In this section we will see the deliberate side. People burn forest trees for the purpose of settlement for additional farm lands or for road construction. All are not good practices because the outcome is more harm than good.

* What are the consequences of setting forest fires?
* Do you see some common wild animals in your locality? Where do they live?

Unit Summary

- Plants are living things that can prepare their own food.
- Plants have many parts. These are root, stem, leaf, flower, fruit, and seeds. Each part has its function.
- Plants are very important. They give us oxygen, food and fiber. They also maintain climate, prevent soil erosion and have aesthetic value. Drugs and medicines are also extracted from plants.
- Drugs are natural or artificial chemical substances which affect the body for good or bad. Drugs can be grouped as medicine drugs and mood altering drugs.
- Repeated use of drugs lead to drug addiction

- Soil consists of materials needed by plants
- Soil has three profiles. These are: top soil, sub soil and parent rock.
- There are three types of soil: clay, sandy and loam soil. Loam soil is the most suitable soil for the plants` growth.
- Soil may be damaged by two ways. These are by soil depletion and soil erosion.
- Some of the causes of soil erosion are excessive use of fertilizers, deforestation, overgrazing, cultivation of grass land, etc.
- Soil can be conserved by protecting forests, cover vegetation making wind breaks and shelter, terracing, constructing dams, etc.
- Fertilizers are substances added to the soil to make it more fertile. Fertilizers are of two types:- chemical fertilizers and natural fertilizers.
- Forest is a place where there are tall trees and other lower plants. Forests are homes for many wild animals.
- Forests are destructed by a number of ways. Some of the reasons for deforestation of forest are cutting trees for fire wood, clearing forests for settlements, for farming, wood work, etc.
- Measures should be taken to conserve forests. The methods of conservation of forests are: reforestation, avoid overgrazing of forests, using fire control mechanisms, train people for fire prevention campaign.
- Biogas is an alternative source of energy. Biogas is made from domestic sewage, animal excretes and plant materials.
- Weeds are unwanted growing plants on farmlands or gardens. Unless weeds are control, they reduce our agricultural products.

I. Write True or False

1. Drug addiction develops gradually.
2. Not only our foods but our clothes are also derived from plants.
3. All plant parts are useful except roots.
4. A soil is a store house of nutrients for plants.
5. Sandy soil contains more that 70% of clay particles.
6. Compost can be formed from decay of plants or parts of plants.
7. Forests help to regulate the climate and to support farming.
8. Clearing forests for settlements are a good practice.
9. Clay soil is the best soil for the plant's growth.
10. Overgrazing facilitates the formation of deserts.

II. Matching

Column A	Column B
11. Chemical that is found in tobacco smoke	A. Deforestation
12. Derived from cannabis	B. Nicotine.
13. Extracted from sisal	C. Reforestation.
14. Cutting trees	D. Fiber.
15. Planting trees	E. Hashish

III. Choose the correct answer from the given alternatives.

16. The most widely cultivated drug plant in Ethiopia is _____

A. Tobacco B. Cannabis C. Wheat D. Chat

17. One of the following plants is grown for its fibers.

A. Maize B. Orange C. Cotton D. Cabbage

18. Minerals salts or foods for plants are called _____

A. vitamins B. nutrients C. rock D. proteins

19. Manure is:

A. an artificial fertilizer
C. natural fertilizer
B. made only from cow dung
D. pollute soil

20. Which one of the following are the uses of forests?

A. Shelter for wild animals
C. Prevent floods.
B. prevent soil erosion
D. All of the above

21. Which one of the following forest is located in SNNPR?

A. Belete forest
C. Harena forest
B. Guda forest
D. Menagesha forest

IV. Give short and precise answer.

22. Why animals depend on plants for their survival?
23. Outline some disadvantage of drug addiction.
24. Write the types of soil.

Unit. 4
Animals

Contents	Learning competencies
4.1 How are animals classified?	• Classify animal as invertebrates and vertebrates. • Describe the general characteristics of invertebrates and vertebrates • give examples of invertebrate and vertebrates
4.2 Insects 4.3 The life history of harmful insects. 4.4 Useful insects	• Describe the common characteristics of insects • Show the external structures of insects. • Tell the functions of external structures of insects • Give examples of insects. • Diagram the life cycles of locust, housefly, silk moth, honey bee and mosquito. • Explain the harmful effects and control methods of locusts, mosquitoes and house flies. • Describe the importance of silk worm.
4.5 Fish	• Mention the general characteristics of fish • Give examples of fish • Show the external body structures of fish • Explain how fish breath in water • Explain how fish reproduce. • Describe the importance of fish farming • Explain methods of fish farming.

Contents	Learning competencies
4.6. Amphibians.	• Mention the general characteristics of amphibians • Give examples of amphibians. • Show the external body structures of amphibians. • Explain how amphibians reproduce. • Explain the difference between fish and amphibians
4.7 Reptiles	• Mention the general characteristics reptiles. • Give example of retiles. • Show the external body structures of reptiles. • Explain how reptiles reproduce. • Explain the difference between reptiles and amphibians.

Unit 4
Animals

Introduction

Activity 4.1

* What are animals?

* Can you mention the common features of animals?

* How do animals differ from plants?

* Are all animals the same?

* Can you name some animals?

* Can you mention some of the main difference among them?

Back bone: is a long connected row of bones in the back of animals.

Invertebrate animals: animals without back bone.

Vertebrate animals: animals with back bone

Animals have certain features in common. These are they:

- do not prepare their own food.
- eat plants or other animals as food
- can move from place to place to place to find food.

Animals differ in size, body organization, complexity, way of life and reproduction mechanism, etc. There are more than two million animas types and we are one of these animal.

4.1 How are Animals classified?

* Can you feel the long row of bones going down your back?

Generally Animals are grouped in to two classes. These are: invertebrate and vertebrate animals.

I. **Invertebrate animals:** are relatively small animals with out backbone. Backbone is a long row of bones on the back of animals.

Example: insects, snails, spiders, worms, etc

From two million existing kinds of animals 1,950,000 are invertebrate animals.

II. **Vertebrate Animals**: are animals with backbones. There are 50,000 kinds of vertebrate animals

Example: fish, amphibians, reptiles, birds and mammals are vertebrae animals.

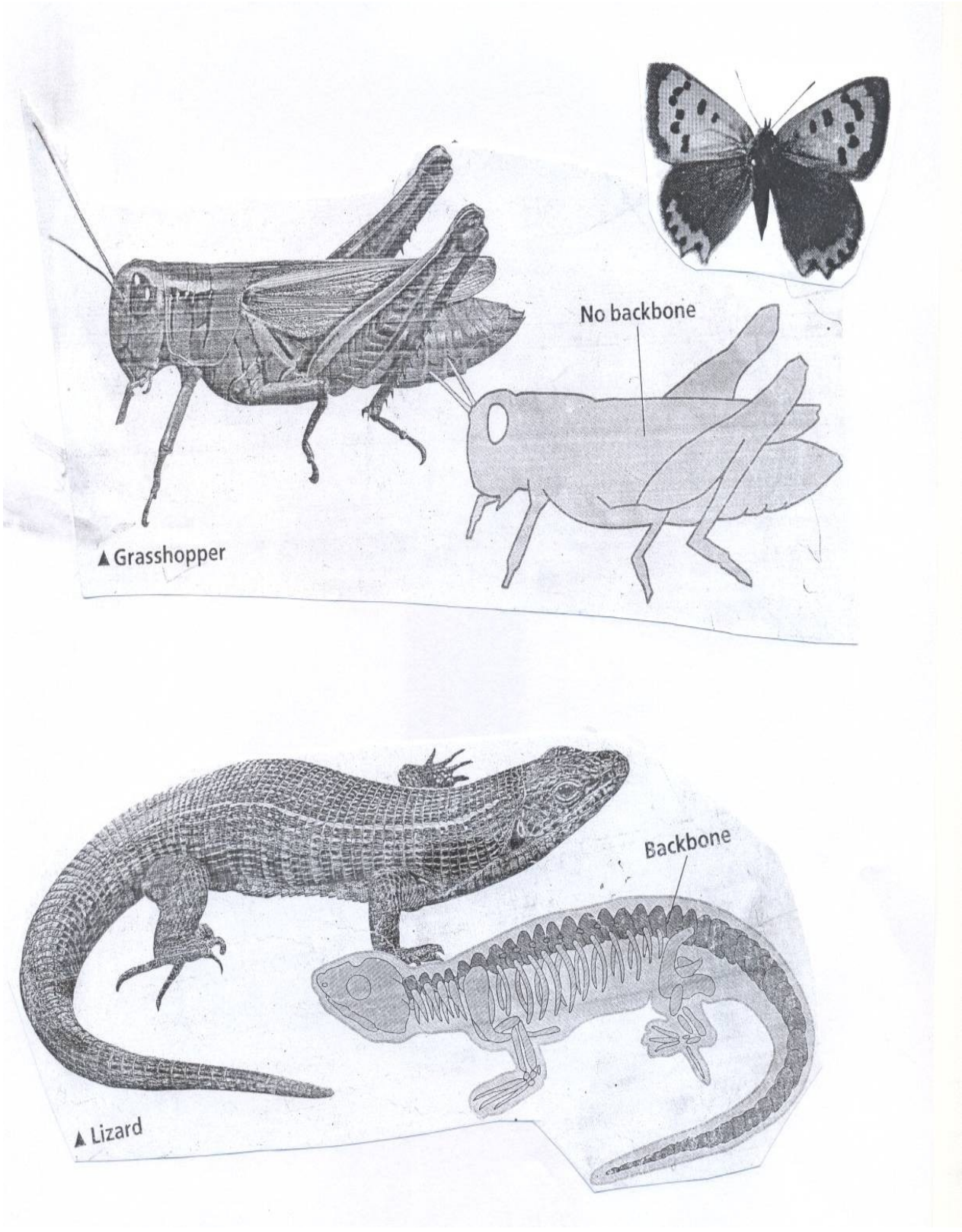


Fig. 4.1 Some invertebrate and vertebrate animals

4.2 Insects

* What do you know about insects?

* How do they differ from other animals?

Insects are the largest group of animals on earth. There are more kinds of insects than all other animals combined. Insects live almost every where. They could be in various shapes and colors. There body is segmented and divided in to three parts. These are head, thorax and abdomen.

A. **The Head**: it consists of two compounds eyes and several smaller simple eyes. One pair of antennae and mouth parts. The mouth parts of different insects are adapted for feeding for different kinds of food.

* What kinds of mouth parts do you expect for grasshoppers and mosquitoes?

For example grasshoppers have jaws to bite pieces of vegetation and mosquitoes have sharp needle like mouth part to suck blood.

B. **The thorax**: it is attached to the three pairs of legs and two pairs of wings in many of them.

C. **The abdomen**: it is usually segmented with reproduction, digestive and excretory structures.

Examples of insects are: locusts, termites, silk moths (silk worms), bees, mosquitoes, cockroaches, house flies, etc.

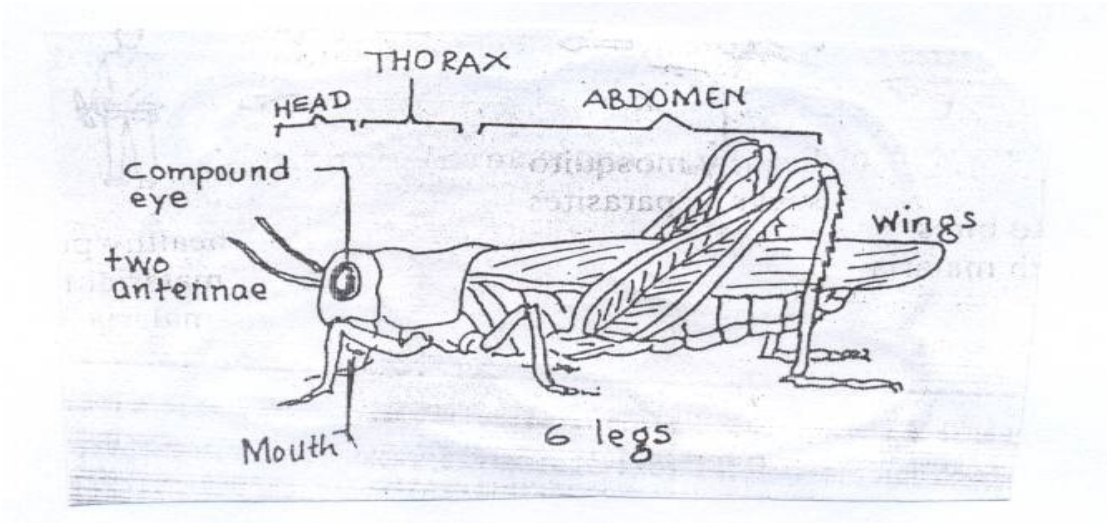


Fig. 4.2 External structures of insects

How Do Insects Reproduce?

Insects reproduced by laying eggs. When they develop from the egg, there are changes in shapes or forms. This process is called metamorphosis. There are two kinds of metamorphosis in insects. They are: incomplete and complete metamorphosis.

Metamorphosis: the changes in form that occur from egg to adult.

Nymph: the second stage in the metamorphosis of some insects.

Larva: the second stage in the life cycle of some insects.

Pupa: the third stage in the metamorphosis of insects.

Molting: shading of a body covering like skin

A. Incomplete Metamorphosis.

Some insects gradually pass through three distinct stages. These are: egg, nymph and adult. This type of developments is called incomplete metamorphosis.

Egg ⟶ Nymph⟶Adult

A nymph is a young insect that looks similar to the adult. It changes its skin four or five times until it reaches adult size and appearance. The process of shading of skin is called molting or ecdysis. The nymph of a winged insect may lack wings.

Examples of insects which have incomplete metamorphosis are: grasshopper, locusts, dragon flies, termites, cockroaches, etc.

* Why do you thin

k, some animals are like insects that shade their skin?

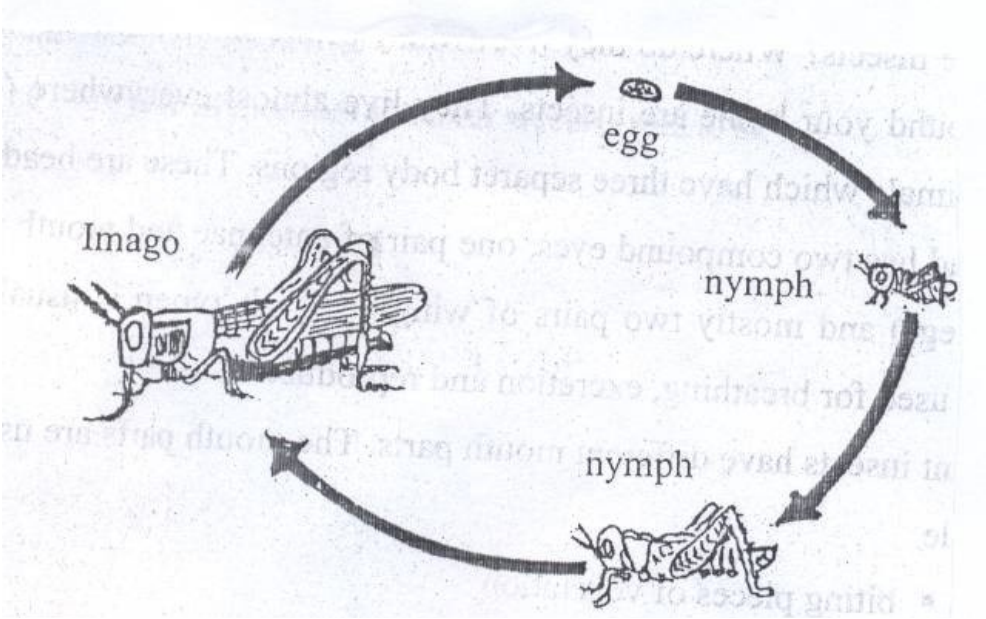


Fig. 4.3 Incomplete metamorphosis.

B. Complete Metamorphosis

It shows four stages of developments. These are egg, larva, pupa and adult. In this life cycle the larvae and pupa don't look like the adult. The larvas of these insects are worm like creatures that look completely different from their parents.

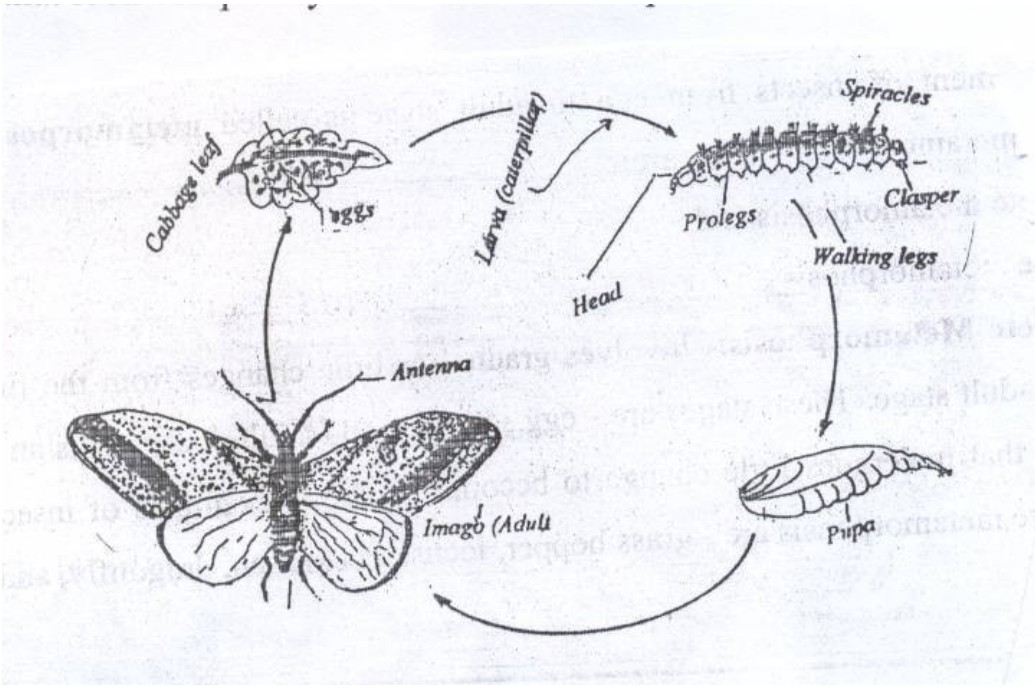


Fig. 4.4 Complete Metamorphosis

Exercise 4.1

1. What are the common characteristics of animals?
2. Write the two groups of animals?
3. Describe the basic features of insects?

4.3 The Life History of Some Harmful Insects.

A. House flies

Activity 4.2

* Are house flies useful or harmful?

* Where do we find house flies?

* Have you ever noticed the way how they feed themselves?

Maggot: the larva of house fly.
Proboscis: the mouth part of housefly.

House flies have mouth parts called proboscis which are used for sucking. Houseflies feed on rotten foods, human feces, cow dung and on decayed organic matters. The flies put out the saliva on the food to dissolve it. Then they suck by their sponge like mouth tip.

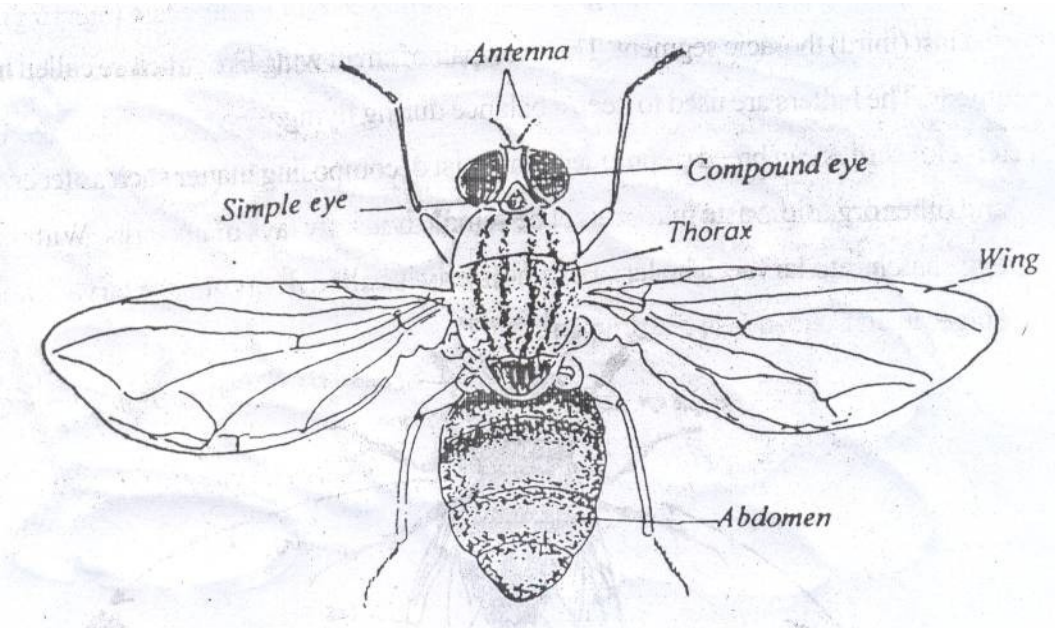


Fig. 4.5 The external parts of house fly.

Life Cycle of a Housefly

House flies undergo complete metamorphosis. The female fly lays 500-600 eggs and the eggs hatch in to legless larvae called maggot. The larvae are quite different from the adult. The larvae feed and grow. After a few days, the larvae changed into pupa. In preparation for this stage larvae form some other protective covering around their bodies. Although the pupa looks lifeless, (does not move, feed). But in side in the protective covering there is great activity. The Larvae structures are broken down largely in to a liquid and reform adult organs. After the change is completed, the pupa coverings crack and opened. Finally the adult insect comes out expanding the wings and there away.

Practical Activity: **4.1 Studying the metamorphosis of a housefly**

Objective: to observe the structures and features of the different developmental stages of a housefly

Materials: glass or beaker, a piece of fresh meat, a piece of covering cloth "*shema*" cloth or wire gauze

Procedure:
1. Put a piece of meat in a glass or beaker
2. Leave the beaker for 20 minute in an area where flies are available.
3. Allow flies to enter the glass and visit the meat.
4. Then take the glass and cover its opening with a piece of cloth.
5. Put the glass in suitable and safe place.
6. Observe the changes that will occur on the meat each day. You can use a hand lens. If it tends to dry, moist the meat with some drops of water.

Questions: Answer the following questions from your observation.

When did you observe white powdery structures on the meat?

Which day did you observe worm like larvae first on the meat?

In which day the Larva in changed into pupae?

In which day adult flies emerge from the pupae?

How many days are needed for the house fly to complete its life cycle?

House Flies as Vectors of Diseases

Vectors: are insects that transmit diseases.

Vectors are organisms that transmit diseases. The houseflies are vectors of various infections. They carry germs which are found on the feces on their body's hairs, wings, legs and proboscis then put on our foods or drinks. Typhoid, diarrhea, cholera, dysentery and polio, are some of the diseases which are spread by house flies.

Methods of Controlling Flies

- Cleaning our surroundings.
- Keeping latrine clean and covered.
- Cleaning dirty places where house flies are breed.
- Food should be kept covered at all times.

Exercise 4.2

Answer the following questions accordingly

1. The feeding structure of a housefly is called _____
2. House flies undergo complete metamorphosis and their larva stage is called
3. Which parts of a housefly can carry bacteria?
4. During which phase of an insect's life cycle does growth take place?
5. The first stage in the metamorphosis of insects is _____

Swarm: the large group of locusts.
Hopper: wingless young grasshopper.
(locus)

B. Locusts

Activity 4.3

* can you mention some harmful insects?

* In what ways could they affect our life?

Both nymphs and adults of a locust feed on vegetation. Mostly they form groups

(swarms) and destroy crops. An overage swarm of locusts contains 1,500,000,000 insects and covers an area of 30 km^2. Relatively small swarm of locusts can eat 3000 tons of food per day. They have enormous a petite and mouth part used for chewing.

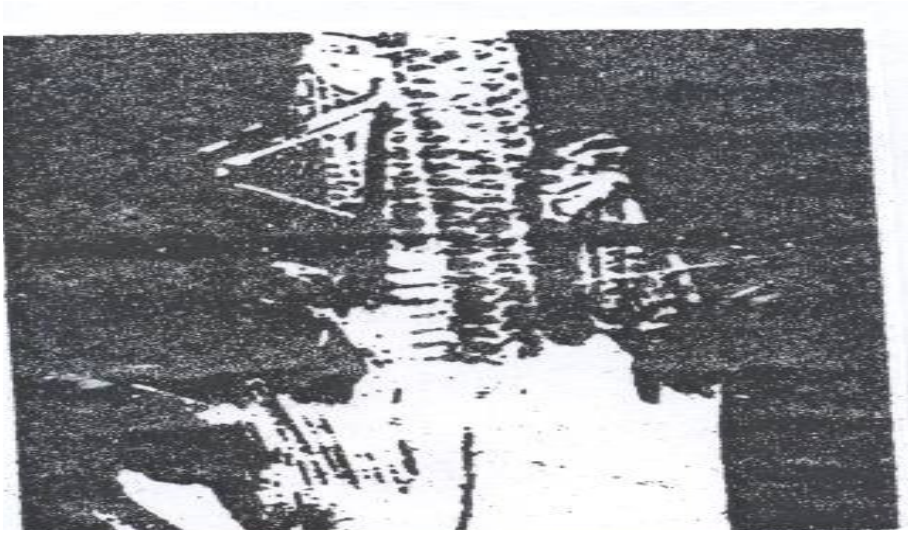


Fig 4.6 Grass hopper feed on crops.

Life cycle of Locust

Development is by incomplete metamorphosis. The female lays 50 to 100 eggs in the sand at once. The nymphs hatch with in 10-20 days. The nymphs have no wings and can not fly. At this stage they are called hoppers. If the space is crowded they may come together in bands of hundreds or thousands of hoppers together. During this stage the bands do not move more than a few kilometers. They shed their skins five times. After about six weeks they undergo their final molt and wings expand and they become fully matured flying adults. The adult locust can fly about 8 km per day.

The controlling methods of locusts

Locusts are controlled by:

- spraying insecticides on the swarm or on vegetations. Spraying is carried out by aircrafts (aero planes).

- breeding other animals which are enemies of locusts like birds, frogs, etc

C. Mosquitoes and Malaria

Activity 4.4

* Think of different infectious diseases in your locality write down at least five of them.

If malaria is the one in your list, it may take the first level. Do you agree or disagree?

* What causes malaria?

* How is malaria transmitted?

Discus with your friends

Insecticides: chemicals that kill insects.
Parasites: living things that cause diseases.
Plasmodium: parasite which cause malaria

Mosquitoes are of different types. Some carry parasites that cause serious diseases such as malaria and yellow fever.

* How do mosquitoes carry such parasites?

Malaria is a disease which is caused by small microscopic living things called plasmodium. The plasmodiums invade the red blood cells and destroy them there by producing fever, headache and shivering.

Malaria is transmitted by the female mosquito from one person to another. Normally the male mosquito feeds on fruit juice but the female feeds on the human blood. If a mosquito sucks up blood from a person suffering from malaria, blood containing malaria parasites are taken in. Later, when this mosquito bites another person, it injects the parasites to the blood stream with its saliva and the person develops malaria. There fore, the transmission of malaria increases as the breeding rate of mosquito increases.

Activity 4.5

* Why do you think only the female mosquito transmits malaria? Why not the male?

* The male mosquito does not feed on blood, why is that?

Give your reasons.

Life Cycle of Mosquitoes.

A Mosquito has complete metamorphosis. The female mosquito lays eggs in stagnant and dirty water. After a few days, larvae hatches from the eggs. The Larva lives in water. After casting its skin four times, the larva becomes pupa. Then after a few days later the skin splits and the adult breaks out.

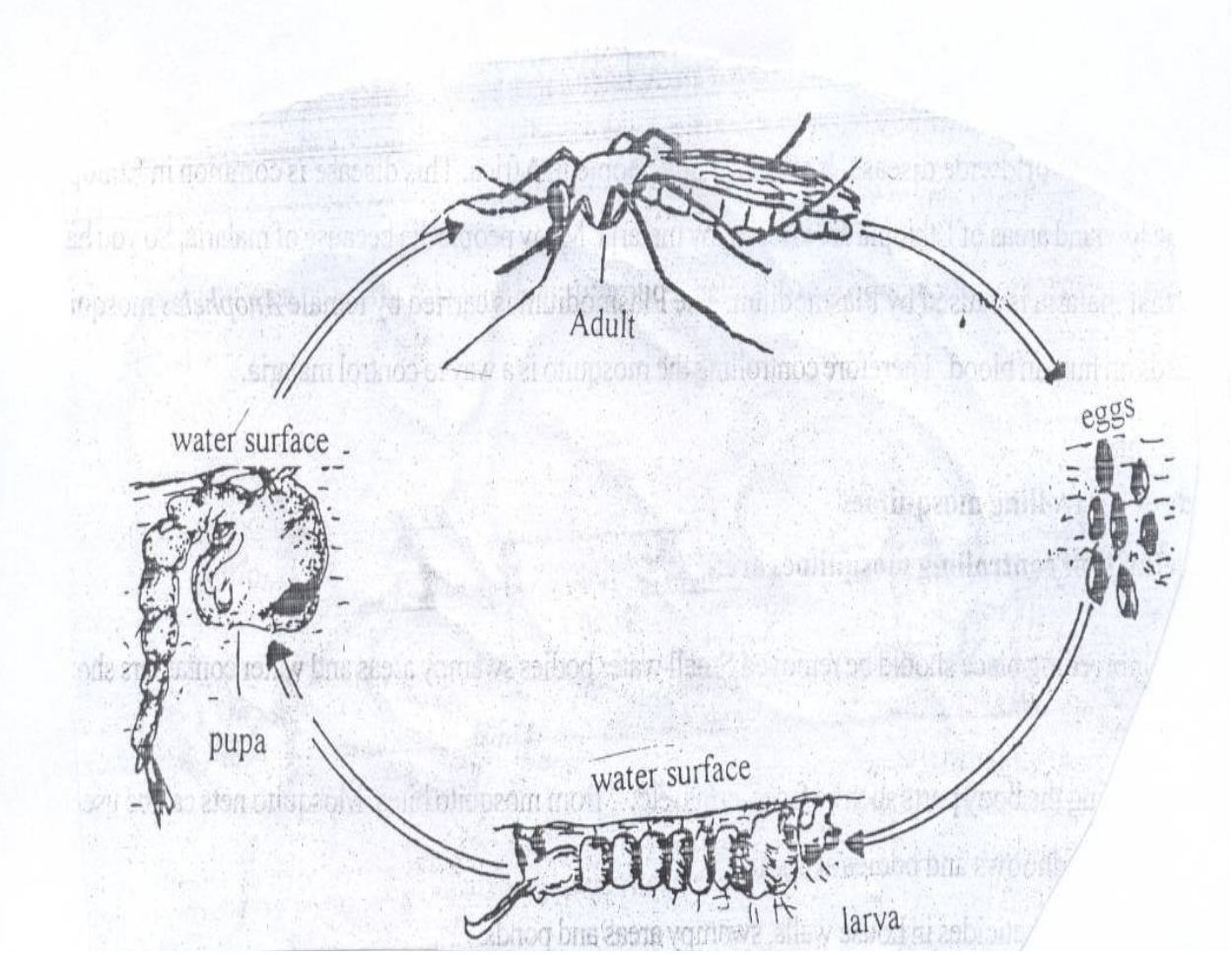


Fig. 4.7 Life cycle of mosquito

Methods of Controlling Mosquitoes

* Controlling mosquito helps us to control malaria. Do you agree with this idea? Justify your answer.

Malaria can be controlled by:

- ❖ Breeding animals that feed on mosquito's larvae and eggs such as fish, etc.
- ❖ Draining mosquitoes breeding places like stagnant water and swamps.
- ❖ Spraying oil on the water to destroy the larvae and pupa.
- ❖ Avoid mosquito bites using mosquito nets "*Agober*"
- ❖ Spraying insecticides such as D.D.T.

N.B: DDT is a very effective insecticide but it is harmful to other forms of wild life because it has poisonous effect on our environment.

4.4 Useful Insects

* Can you list some useful (beneficial) insects in your locality? Discuss about their importance with your friends.

Many insects are useful to humans in different ways.

Example: - Butter flies are very important for the reproduction of flowering plants (are pollination agents)

- Moths used to produce silk thread (fiber) from its larvae.
- Honey bees produce wax and honey and are used as pollinating agents.

A. The Honey Bees

There are different types of bees. The bee than man keeps for honey is the smallest bee. They live in group (colony) in hives. Every hive consists of thousands of bees. The individuals of a bee colony belong to three types of bee. These are: the queen, the drone and the worker bee.

The queen is the head of the colony. Its job is only to lay eggs. Several hundred male bees may be present in the hive. They are called drones. Their job is only to make the queen to fertilize. The remaining several thousands of bees are workers. They do not lay eggs (sterile females). They perform several tasks in the hive.

Some of these are:

- ❖ Cleaning the hive.
- ❖ Protecting (guard) the hive from enemies
- ❖ Feeding and caring the eggs and the larvae.
- ❖ Building wax cells for storing honey and larvae to develop in.
- ❖ Others searching for food and bring back to the hives.

As you can see above there is division of labor among the three groups of the honey bees.

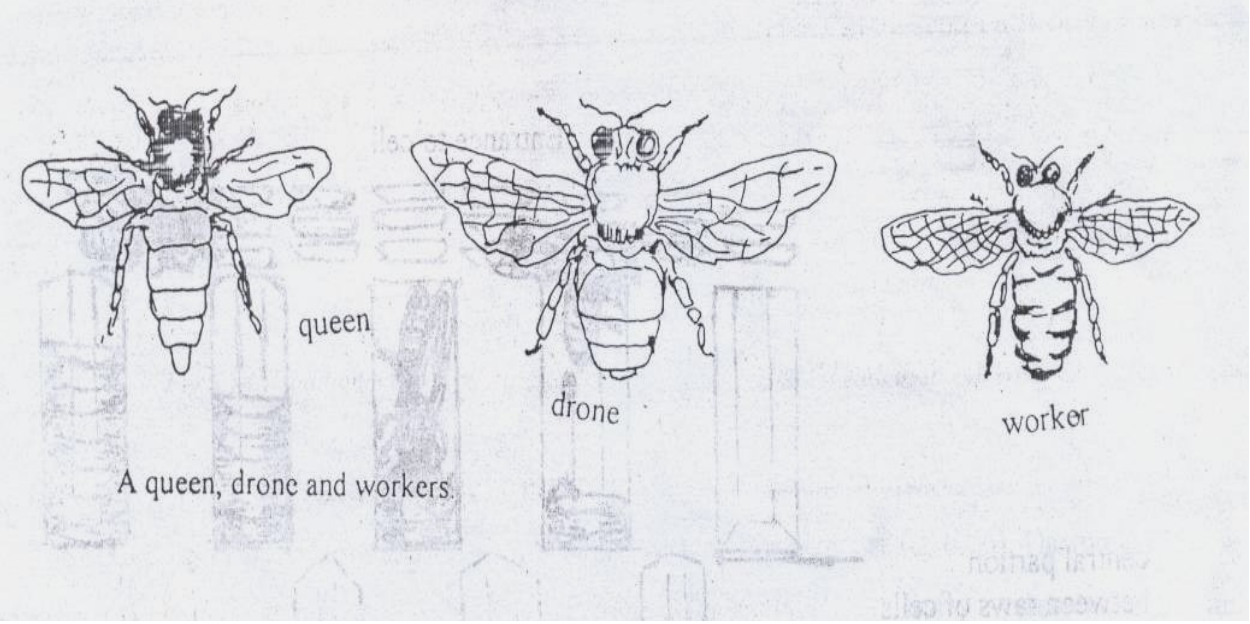


Fig. 4.8 Casts of the honey bee.

Honey is made by the honey bees.

Nectar: is a sweet (sugary) liquid produced by some flowers

Honey is the main food that the bees feed themselves. It is made from nectar of flowers. When the worker bees visit flowers, they suck the nectar from the flowers using their long tongue like proboscis. They

store it in a little pouch in their abdomen “ the honey stomach.” There the nectar is changed into honey. When the bee returns to the hive, it stores the honey in the cells of the comb. Man can take honey from bees because they normally make more than they need.

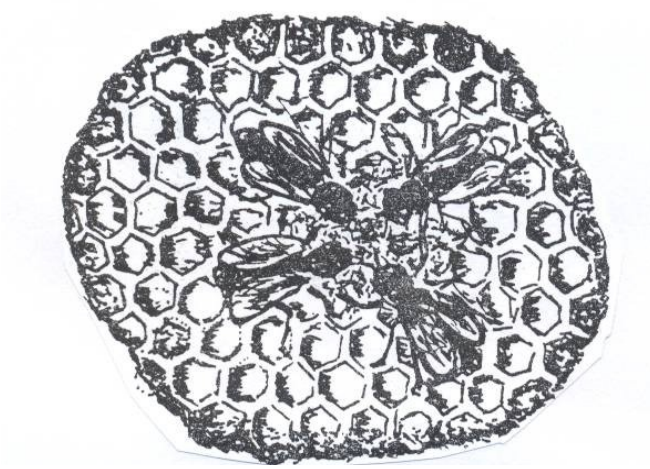


Fig. 4.9 Honey comb

Beekeeping

* What should be done to the bee keepers to increase honey production?

Bee keeping may be carried out by using traditional or modern hives. Traditional bee hives are simple, cylindrical container. Both sides are closed and a small hole is left as an entrance for the bees. The inside of the traditional bee hive is dark and this make difficult to manage the bees. But the modern hives are suitable for rearing bees. They are large and have more than two rooms. They avoid overcrowding. Therefore it is advisable to use modern bee hives than the traditional bee hives. In addition to this sufficient flowers and water supplies must be available in the areas where bees are found.

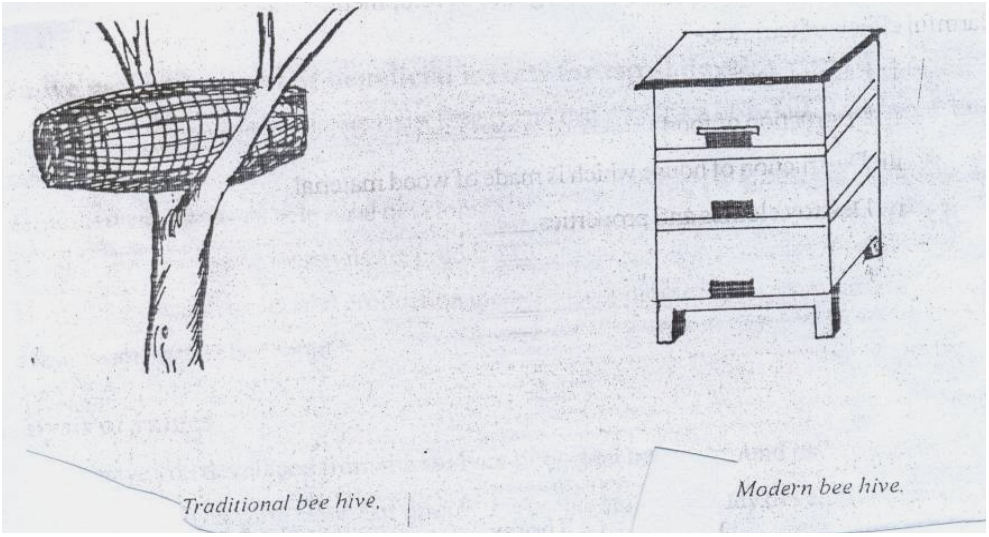


Fig. 4.10 Traditional and modern bee hives

Project work 4.1

* Go to the farmers or agricultural experts in your locality. Ask the advantages and disadvantages of the traditional modern bee hives and present your findings to the class.

	Advantage	Disadvantage
Traditional bee hive.	- - - -	- - - -
Modern bee hive.	- - - -	- - - -

* Which hives are preferable? Modern or traditional hives.
* Lastly prepare the hive which is the most suitable for rearing the bees in the school compound.

Exercise 4.3

The following table has partial information about some common insects. Complete by using the relevant information which are indicated by the letters.

Name of insects.	**Development (metamorphosis)**	**Feeding habit.**	**Impact on human life.**

Mosquitoes	A	Sucking blood.	B
C		Freed on crops	D
House fly	Complete	E	F
	H	I	Provide honey and wax

B. Silk Worms

* What is a silk worm?

A silk worm is a larva of moths that spin silk around it self. Silk is a fine soft thread produced by silk worms. Silk is used for manufacturing smooth clothes. It is commercially produced by rearing silk worms.

Cocoon: the oval shaped hard outer covering structure of silk worm.

The Life Cycle of Silk Worms.

An adult female moth lies about 300-400 eggs at once. The eggs are hatched in to larvae within 8 -12 days. The larva spins silk around itself and constructs an oval shaped outer covering called cocoon. The formation of pupa takes place inside the cocoon. The adult moth comes out from the cocoon after 10 -12 days.

* What kind of developments do silk worms exhibits?

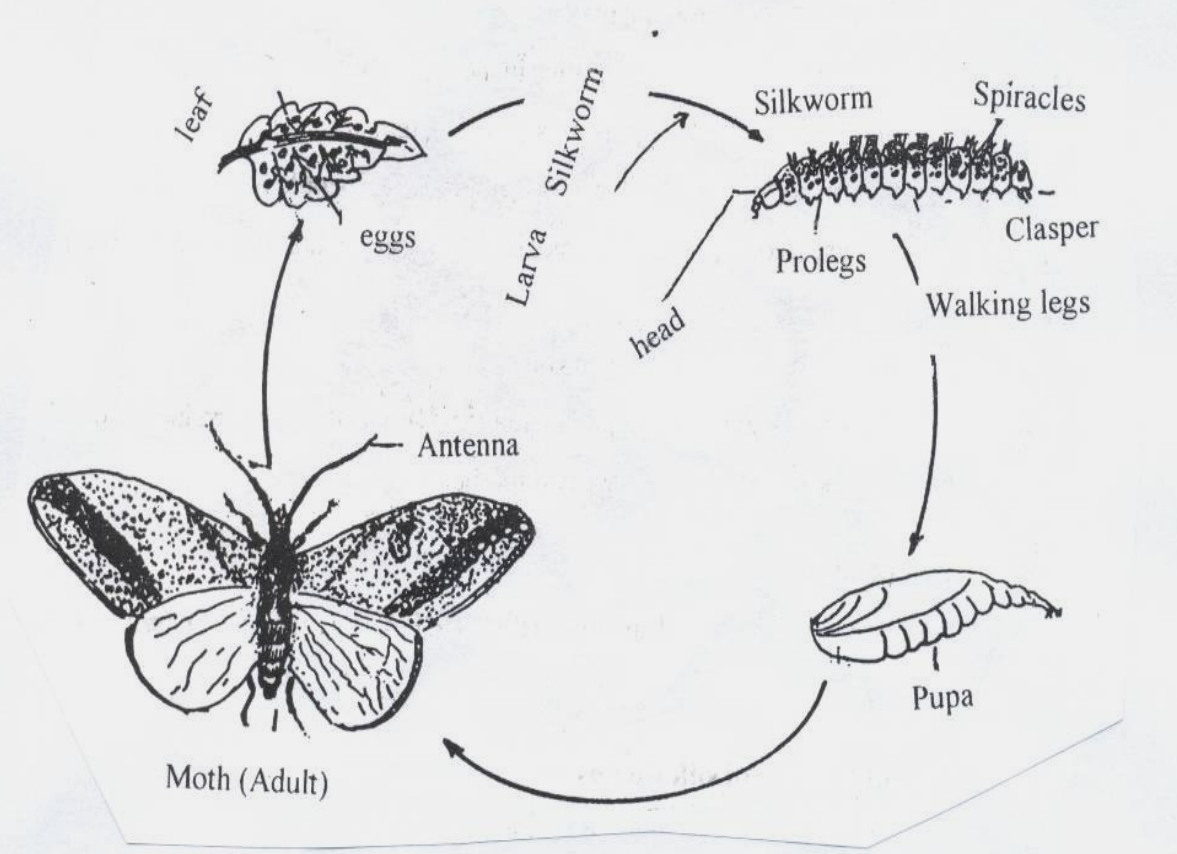


Fig. 4.11 The life cycle of silk worm (moth).

Rearing Silk worms

Silk can be produced by rearing silk worms. The silk worm feed on mulberry leaves and cassava. Simply by providing food and care we can easily spin silk from the silk worms. Silk is commercially produced to make silk garments. It is believed to be an alternative production that can improve the living standards of our community.

* Do you know silk and silk clothes? How do you compare the clothes which are made from cotton? Which one has strength and easy to dry? Discuss with your friends.

Exercise 4.4

1. Organisms that transmit diseases are called _____
2. Malaria is caused by _____
3. The larva of moth is known as _____
4. Name the insect that transmits malaria_____
5. List at least three diseases which are transmitted by houseflies.

6. Define insecticide.

4.5 Fish

Activity 4.6

* What are the general characteristics of fish?

* Have you ever seen fish on land?

* How are fish different from other animals?

Fish are vertebrate animals that live only in water. The body of most fish is covered with scales. A scale is a hard flat plate that protects an animal body. Fish take in oxygen found in the water through their gills. Gills are thin and feathery body parts filled with blood. Most Fish use gills for breathing.

* How do fish take in oxygen from the water?

Scale: hard outer covering of animals' body

Gill: body part of a fish that used for breathing

Fin: Fan like part of a fish used for swimming.

First the fish take water in to its mouth. The water flows over the gills. The oxygen from the water goes in to the blood inside the gills. Then the water flows out of the fish's body. All fish have fins. A fin is a fan like part on fish's body. Fins help the fish to move (swim) and keep balance in the water.

Fish feed on smaller organisms that live in the water such as: worms, insect's larva, crabs, algae and other organic matters. As the food passes through the pharynx, it is prevented from entering the gills by gill rackers.

There are two kinds of fish. These are: cartilaginous and bony fish.

A. **Cartilaginous fish:** are fish which have cartilage skeleton.

Example: shark, rays, skates, etc.

* Do you have a body part made of cartilage?

Cartilage: is bone like flexible body structure of animals.

B. **Bony fish**: are modern fish with bone skeleton. Most fish are found in this group. The bony fish are commonly used for food by humans.

Example: perch, tilapia, lung fish, etc.

* Mention some of the fish found in Ethiopian lakes and rivers?

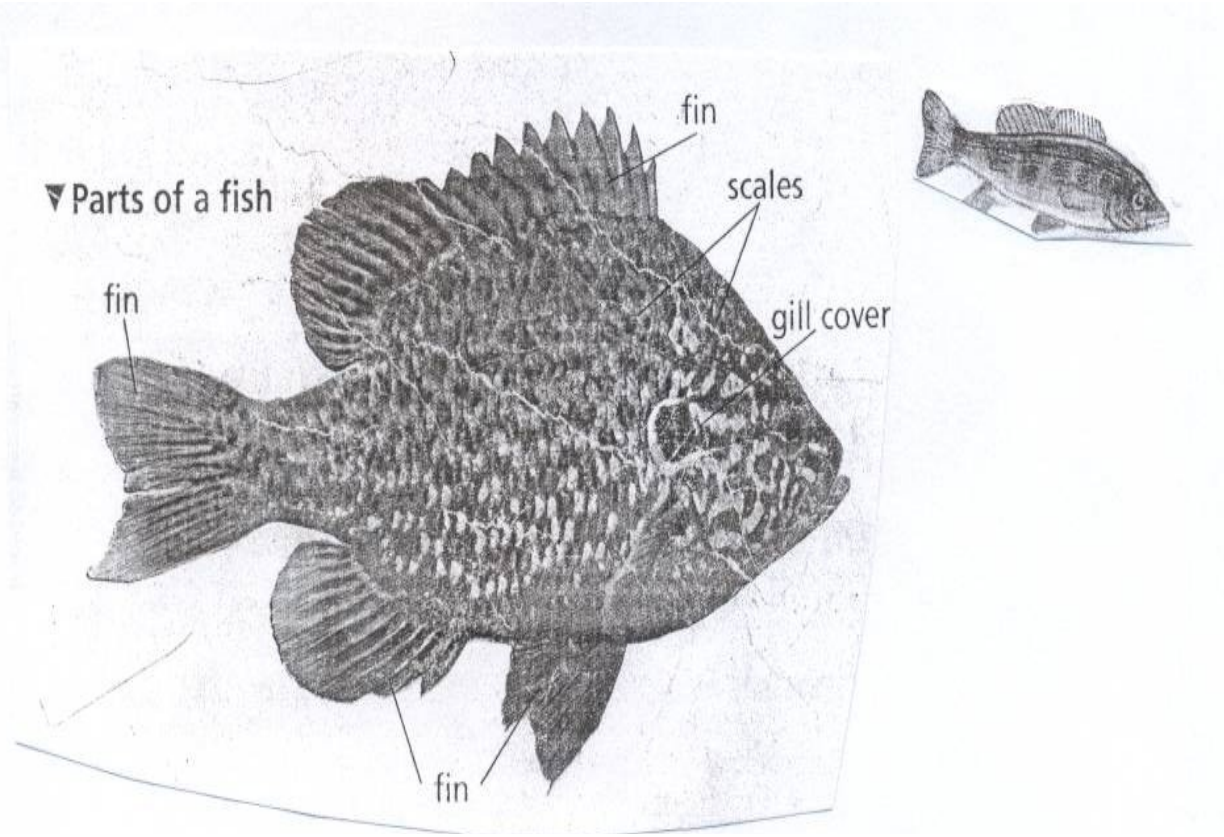


Fig.4. 12 External structures of fish.

Practical Activity: 4. 2 Observe the gills of a fish

Objective: to observe the structures and the arrangement of gills in relation to the mouth.

Materials: fish specimen, scissor, dissecting board, glove, etc.

Procedure: 1. bring a specimen of fish like" *korosso*"

2. remove the hard gill cover called operculum by cutting round with scissors,
3. look at the gills underneath. Observe the structure of one gill and gill rackers in detail.

Questions: How is the gill suited to its function?

How is the water made to pass over the gills?

How do fish produce young?

Fish are egg laying animals. The female fish lays eggs and the male fish releases its sperm cells in water. The Fertilization of the eggs takes place in the water. This type of fertilization is called external fertilization. In a few weeks, a young fish hatches from the fertilized eggs. Fish lay thousands or even millions of eggs at once.

Activity 4.7

* Why this much number of eggs are needed to be produced?

* Do all the eggs hatch? If not, why?

* If so why not the water bodies over crowded by fish?

Discuss with your friends

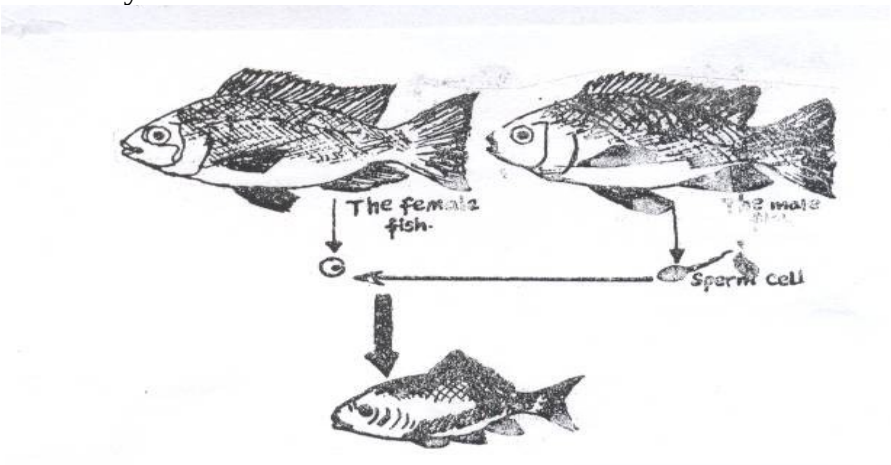


Fig. 4.13 Fertilization of fish.

Fish Farming

* What is the use of fish to human beings?

* Think about fish farming and discuss with your friends.

Fish farming is a technique by which farmers raise fish for sale and consumption (food). The fish farmer removes eggs from the female fish and fertilizes them with the sperm from male fish. The fertilized eggs are placed in to the growing conditions are best. The food, temperature, depth of water and the amount of oxygen should be carefully controlled. After the eggs hatch, the young fish are transferred to man made special ponds. There, they are fed with foods rich in proteins, vitamins and minerals to help them grow. When the fish are large enough, they should be removed from the pond and can be used as food. A fish farmer tries to raise fish that grows fast, resist disease and taste good.

Example: trout, carp, catfish, etc.

* How do you see fish farming in Ethiopia?

* Think of poverty and food shortage problems in Ethiopia and to what extent the expansion of fish farming solves the problem?

Discuss the above questions in pairs.

Fish farming is very much limited in Ethiopia. Currently there are encouraging developments of dams' construction in many parts of the country. In many of the dams fish are used for human consumption. The most commonly used fish are tilapia and carps. Nevertheless much remains to be done in this respect. More ponds and dams need to be prepared by individual farmers or groups of farmers. This practice would enable the farmers to obtain the much needed protein (fish) with less expense.

Exercise 4.5

1. The fish's body is elongated and stream lined. What are the advantages of having such a shape?
2. If fish are taken out of water they will die soon. Why?
3. What qualities of fish should a fish farmer consider?
4. What kind of fertilization does fish exhibit?

Project work 4.2

Prepare an artificial pond or lake in the school compound. Add fish specimens or their eggs. Keep the over all conditions suitable for the growth of fish. Then, study the structures, movements and other ways of living conditions of the fish. Your teacher will help you. Finally, organize a report about your study and observation and submit to your teacher.

4.6 Amphibians

Activity 4.8

* What are Amphibians?

* What are the common characteristics features of amphibians?

* Are they live on lands or in water?

* Why are frogs are abundant during the rainy season?

Frogs, toads, newts and salamander are belonging to a group of animals called amphibians. Amphibians are vertebrate animals that can live both in water and on land. Amphibians have some traits in common with fish. Like fish, they are vertebrate animals. They lay eggs in water. Like fish, young amphibians live in water and breathe with gills.

Amphibians are different from fish in many ways. Amphibians have thin, moist skin. They do not have scales. Most amphibians have two pairs of legs. Unlike fish, adult amphibians have a lung. There fore, they can live on land. The most common amphibian is a frog. It represents most characteristics of amphibians

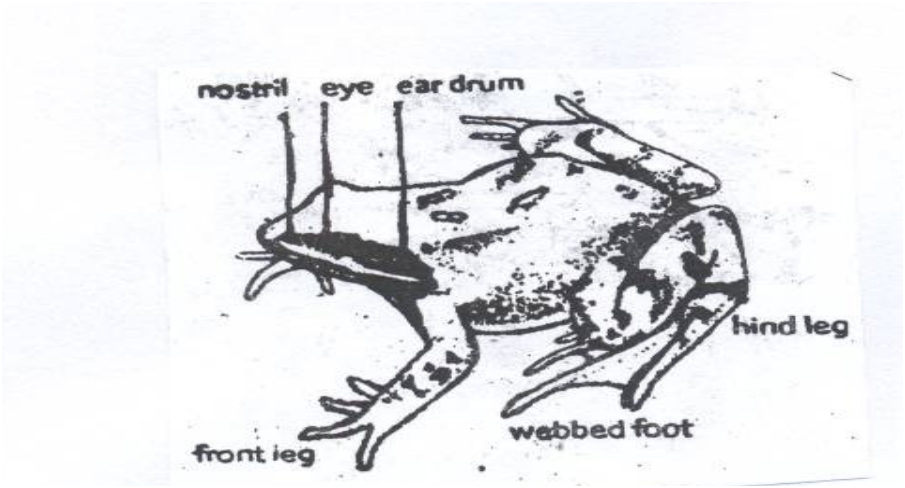


Fig.4.14 External structures of frog

* How do frogs feed?

The frog tongue is special in that it is attached to the front and points back wards. The frog uses its tongue for feeding on insects. When and insect passes the frog flicks out its tongue and catches it. The tongue is sticky so that the insect cannot escape. It is carried to the back of the throat and then it is swallowed quickly.

* How are frogs reproduces?

* What kind of fertilization do they have?

Tadpole: a young (baby) frog.

Amphibians go through many changes during their life cycles. In fact, young amphibians do not look at all like their parents. The change inform that occur from egg to adult are called metamorphosis. The metamorphosis of a frog is summarized as follows:

A female frog lays many jelly- covered eggs in water. The eggs are fertilized by the male frog. Fish like animals called tadpoles hatch from the fertilized eggs. A tadpole has gills, tail and no legs. It lives in water and eats plants. The tadpoles grow and change quickly. Hind legs are formed and the tail disappears. Lung and front legs are formed. Then the full grown frog moves on to land. Adult frogs live near the water bodies. They return to the water when they are ready to lay eggs and then the life cycle begins again.

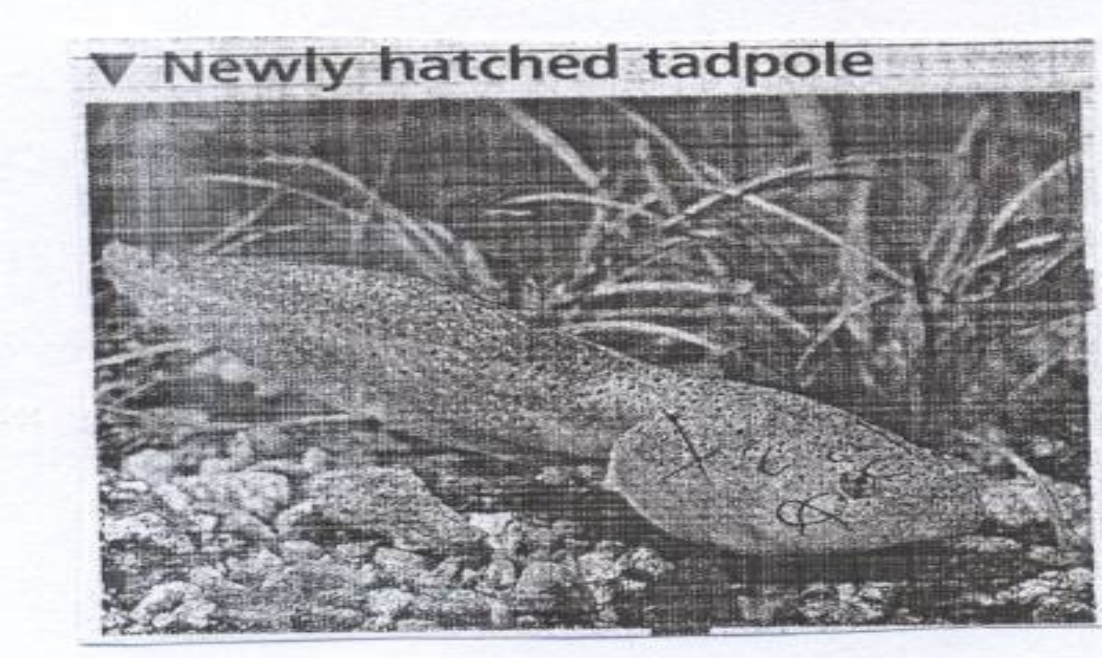


Fig. 4.15 Tadpole

We usually cannot see frogs during the winter season. They spend the winter in a long, deep sleep condition called hibernation. In the spring or the rainy season, they wake up and become ready for reproduction. When they get water bodies, the male starts croaking, producing a characteristics sound. This attracts the female frog. Then the male climbs on to the female back, soon the eggs start to pass out of the female's opening called cloacae. At the same time the male produces sperm to fertilize the eggs. This helps to increase the chance of fertilization.

* Why do you think frogs need water bodies?

* Why do frogs get deep sheep (hibernate) during the winter season?

Exercise 4.6

1. How is a tadpole different from an adult frog?

2. What is the importance of tail in a tadpole?

3. Why are the hind legs of a frog is longer than the front legs?

Cloacae: opening of frogs to release eggs.

Croaking: a characteristic sound produced by frogs.

Hibernation: getting deep sleep for long time during dry season.

How do frogs breathe?

Frogs breathe in three different ways: through the moist skin, the lining of the mouth cavity and by means of lungs. Oxygen and carbon diode diffuse across these three surfaces. The frog's skin contains many glands which secrets watery mucus on to the surface of its body. That is why amphibians are always moist and slimy. This helps to take in and out air through the skin.

4.7 Reptiles

Activity 4.9

***** What are reptiles?

* What make them different from amphibians?

* You may have heard the saying "as slimy as a snake:" What does this tell you? And how some people fell about snake?

Reptiles are vertebrate animals that have well developed lungs and dry skins. Almost all reptiles are covered with scales. The scale prevents internal body parts and water loss. Most reptiles have four legs (two pairs) with claws on the toes except snakes. Reptiles lay eggs that have thick coverings. These spend their whole life on land. They do not have gills at any stage

of their life cycle. Reptiles get oxygen from air through their lungs. Reptiles can feed on various food types. Their foods are usually insects and other animals and plants.

Example of reptiles: snakes, lizards, turtles (tortoise), crocodiles and alligators. They can be very large like crocodiles, snakes and alligators or small like lizards.

Fig. 4.16 Reptiles.

How Reptiles Reproduce?

Reptiles are different from amphibians the way they are reproduced. Unlike amphibians, reptiles lay eggs on land. Reptiles' eggs are protected by a leathery shell and they are fertilized before they are laid. This type of fertilization is called internal fertilization, since the sperms and eggs are united in the female body, not in the water. The newly hatched reptiles look very much like their parents.

* Do you think a female reptile can lay thousands of eggs at once like fish and amphibians?

Exercise 4.7

1. How do reptiles and amphibians differ the way they lay eggs (reproduce)?
2. What conditions enable reptiles to live on land?

3. How does the leathery shell help is protecting reptiles' eggs?

Unit Summary

- Animals have certain features in common. These are they do not prepare their own food, can move from place to place.
- Generally animals are classified as vertebrate and invertebrate.
- Vertebrates are animals with back bone and invertebrates are with out back bone.
- Insects are the largest group animals which have segmented body parts. These are head, thorax and abdomen.
- Insects reproduce by laying eggs. There are two kinds of metamorphosis. These are incomplete and complete metamorphosis.
- In incomplete metamorphosis there are three stages egg, larva (nymph) and adult.
- In complete metamorphosis there are four stages. These are egg, larva, pupa and adult.
- House flies have complete metamorphosis. It carries various diseases such as typhoid, diarrhea, cholera, dysentery and polio.
- Locusts have in complete metamorphose. Usually they live in colony (swarm) and destroy crops with in short period of time.
- Mosquitoes have complete metamorphosis. It carries the parasite that cause malaria called plasmodium. It lays egg in stagnant water.
- Some of the useful insects are honey bees, moth, butter flies, etc.
- The honey bees live in hives. There are three casts of honey bees in the hives. These are the queen, the drone and the worker bees. The queen is the head of the colony. The worker bees perform several tasks in the hives.
- Bee keeping is very important practice to get honey and wax. Bees can be kept in traditional or modern bee hives. But modern bee hives are the most suitable for bees.
- Silk worm is the larva of moth. Commercially silk worm is reared for production of silk garments.

- Fish are vertebrate animals that live only in water. It breathes with gills, moves by fins and has external fertilization. There are two kinds of fish. These are: cartilaginous fish and bony fish.
- Amphibians are animals that can live both on land and in water. The most common amphibian is frog. Amphibians have external fertilization. They have certain common features with fishes. Amphibians have thin, moist and scale less skin. Tad pole is the young frog.
- Reptiles are vertebrate animals that have well developed lungs and dry skins. Their body is covered with scale. Most reptiles have four legs with claws. Reptiles are different from amphibians the way they are reproduced. They have internal fertilization.

Review Questions

I. Write true or false.

1. Insects and fish have external fertilization.
2. The bodies of fish and reptile are covered with scales.
3. Frogs and fish breathe by using their gills.
4. All insects feed on plants and plant products.
5. Reptiles can use their skin for breathing.
6. Tadpoles and adult frogs have different feeding habits.

II. Use the following appropriate terms to fill in the blank spaces.

Hind legs	Fins
Tail	gills
Lung	nymph
Tongue	maggot
Front legs	croaking

7. ----------are organs of breathing in reptiles
8. A tadpole swims using its----------
9. ---------- of a male frog attracts female frog for matting.
10. Frogs have specialized ---------- to catch insects.
11. ---------- is the larvae stage of a locust.
12. Fish use ---------- for breathing.
13. ---------- are adapted for moving by jumping in frogs.
14. Fish use ---------- for swimming.

III. Choose the correct answer from the given alternatives.

15. Which of the following insects has incomplete metamorphosis?
    A. Locust B. Mosquito C. Moth D. Honey bee
16. A structure which is **not** common to all insects is ----------
    A. three segmented body parts C. three pairs of legs.
    B. a pair of antennae D. sucking mouth.
17. Fish may feed on:
    A. algae B. insect`s larvae C. worms D. all of the above
18. Which of the following stage of moths useful for silk production?
    A. Larvae B. Pupa C. Adult D. All of the above
19. The colony of honey bees consists of three groups. Which groups make honey?
    A. Queen B. Drone C. Workers D. Both B and C
20. One is different from others?
    A. Toad B. Lizard C. Snake D. Turtle

IV. Answer the following question accordingly.

21. Outline the three means of breathing in frogs?
22. List some useful aspects of insects.
23. How do reptiles adapt to live on land? Mention at least two structural adaptations?
24. Mention one property of structure which is common to the following pairs of organisms.
    I. Insects and frogs
    II. Amphibians and reptiles

III. Fish and tadpoles

IV. Insect and reptiles

V. Amphibians and fish

25. How do fish adapted to live in water? Mention at least three features?

26. Mention at least two foods that usually silk worm feeds on.

Unit 5
Our body

Contents	
Section	**Learning competencies**
5. Our body **5.1 Excretion** • What excretion? Excretion and their functions • Organs of excretion and their functions. • Hygienic latrines importance and constructing a model.	• Define excretion as the loss of waste products which are produced by metabolic processes in the body. • Name organs of excretion • Indicate the structure of organs of excretion. • Tell the functions of the structures of exertion. • Describe what a hygienic latrine is • Explain the importance of a hygiene latrine • Discuss the methods of keeping a hygienic latrine clean • Construct a model pit latrine using car board or other available materials.
5.2 Food hygiene ▪ Keepings food hygiene. ▪ Food preservation methods.	• Describe methods of keeping food hygiene. • Demonstrate some of the methods of keeping food hygiene. • Demonstrate some of the method of food preservation. • Describe methods of food preservation.

5.3 Food as a source of heat energy • Comparing our body with an engine • Mechanisms of heat transfer	• Explain how food serves as an energy source. • Compare human body with an engine regarding energy change.
	• Explain the three mechanism of heat transfer • Give examples for the three mechanisms of heat transfer. • Demonstrate the three mechanisms of heat transfer.
5.4 Food shortage • Causes and solutions	• Explain the causes of food shortage • Recommend solutions for food shortage
5.5 Harmful practices • Eating raw meat • Drinking un- boiled milk • Disposing human waste at wrong places	• Mention eating raw meat, drinking un boiled milk and disposing waste at wrong place as harmful practices • Discuss the harmful effects of eating raw meat, drinking un boiled milk and disposing waste at wrong places.

Our Body

Activity 5.1.

* How do you keep our body healthy?
* How your body is organized

Discuss in groups

Excretion: is the removal of any wastes from the body.

Deficiency disease: are diseases that come due to lack of balanced diet.

Our body is organized from different systems. A system intern organized from organs. Each system has different functions.

Different factors may affect the body`s functions. Some of these may be infectious diseases and deficiency diseases. By avoiding these, we can make our body healthy. A healthy body performs its normal functions. Some of these functions are feeding and excretion.

5.1 Excretion

Activity 5.2

* What is excretion?
* Why is excretion needed?
* Which organs of the body are involved in excretion?

Discuss in your group

Our body produces many waste products. Some of them are poisonous. The body must remove these unwanted substances. This process is known as excretion. The main organs of excretion are skin, kidneys and lungs.

Organs of excretion

A. The skin as organ of excretion

The skin has two layers. The thin upper layer is called the epidermis. Beneath the epidermis is a thicker layer called dermis. The dermis is line up on the flat layer. In the dermis there are millions of sweet glands.

The skin has two main functions. Firstly, it serves as protective cover to the body. Secondly it helps in the excretion of excess water and salt. But the skin cannot control water or salt loss. It also helps to regulate our body temperature.

***Epidermis*:** is the outer layer of our skin.

Dermis: the inner layer of the skin.

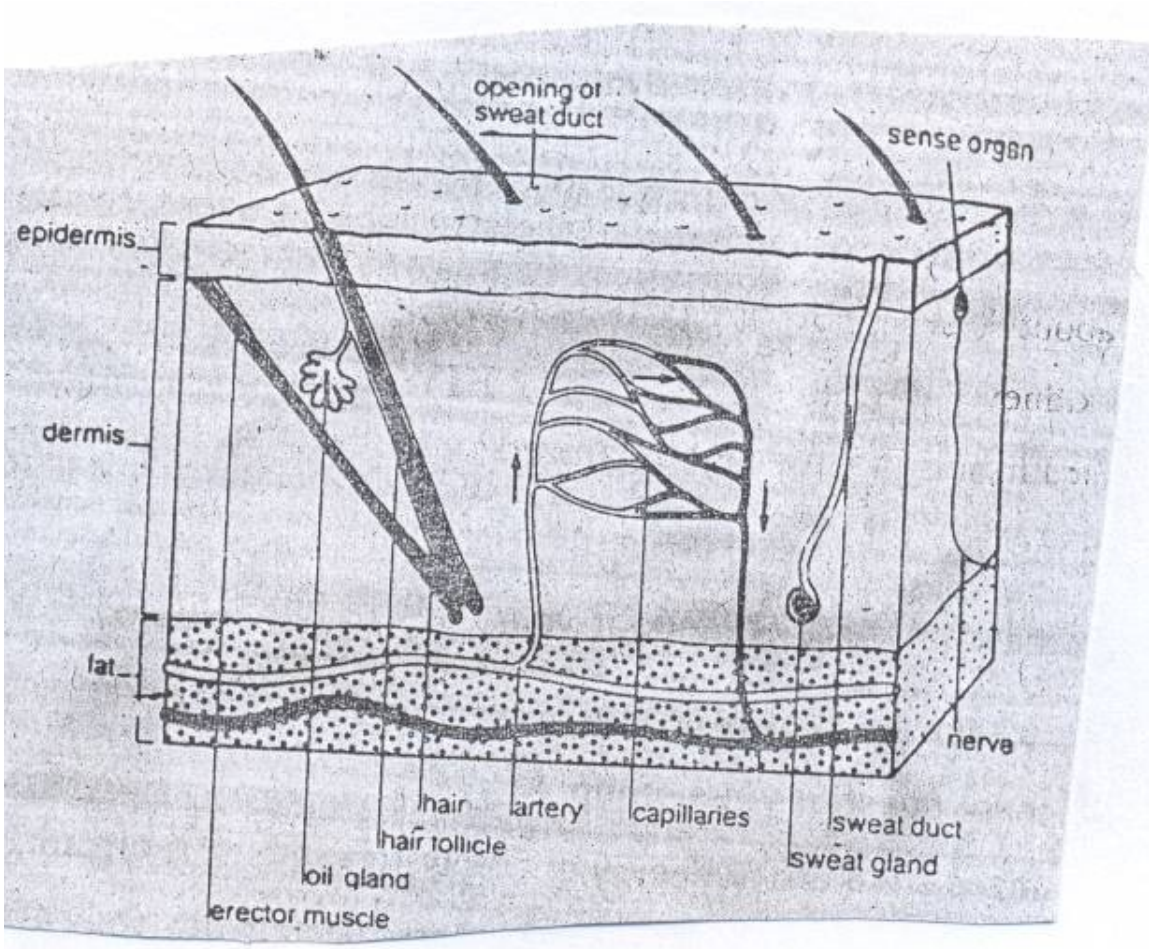


Fig 5.1 structure of the skin

B. The kidneys

* Have you ever seen kidneys from slaughtered animals such as sheep or goats?

* What do you observe about their shape and size?

* Do you think that your kidneys are similar to those animals?

Discuss in your group

Humans have two kidneys. They are located on each side of your abdomen just a little above your waist. Kidneys are shaped like a bean. They have external part called cortex, and internal part medulla. There are other related structures. These are blood vessels and ureters. Ureters are two tubes one from each kidney run to the bladder.

The main functions of kidneys are filtration and excretion. They can also regulate the amounts of salts and water. Blood that carries wastes enter to the kidneys, kidneys filters and cleans the body by removing the wastes. The waste are taken to the bladder by the ureters and temporarily stored there. Such waste is called urine. It contained urea, certain salts and excess water. From the bladder, urine is discharged through the tube called urethra. This is called excretion.

Ureter: a tube that transport urine from kidneys to bladder.

Bladder: is a sac that store urine temporarily.

Urethra: a short tube that is carries urine out of our body.

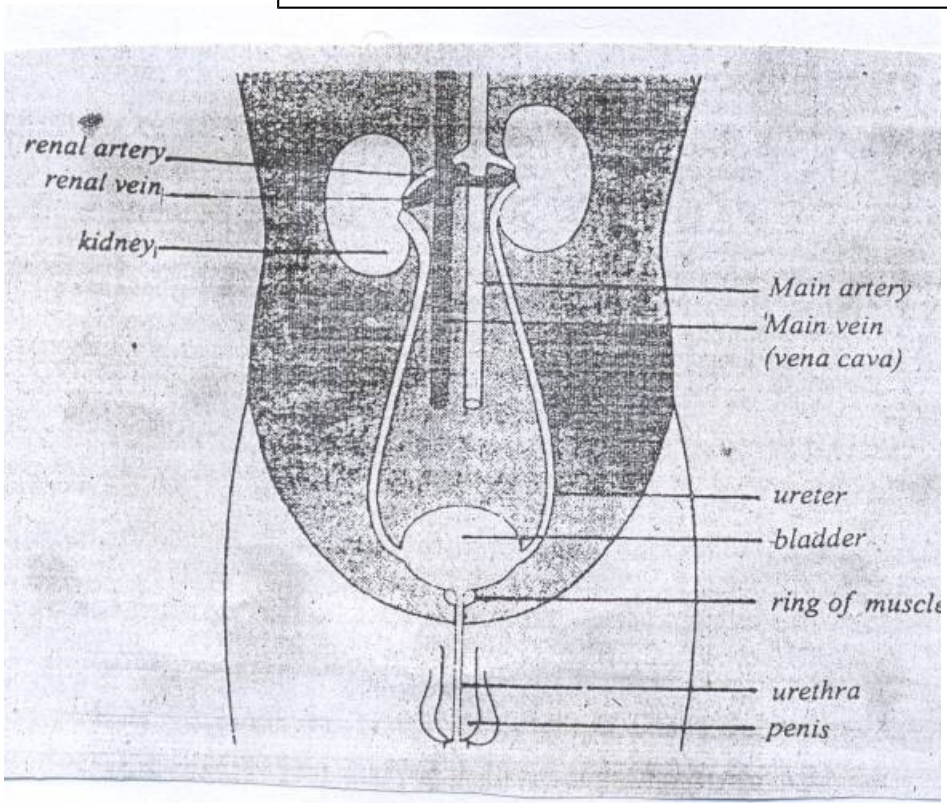


Fig 5.2 Structure of the kidneys

C. The lungs as organs of excretion

* Why do lungs considered as organs of excretion?

* What other functions do the lungs perform?

Discuss in your group.

The lungs are spongy structures. They are two lungs situated in the chest cavity. In connection with lungs, there are series of air passages. Lungs help in getting rid of carbon dioxide. Carbon dioxide is a waste product of respiration. Lungs also help to remove excess water and heat. Deoxygenated blood coming from different body parts enters to the lungs .The carbon dioxide molecules are separated from the blood and diffuse to the lung. Then, the carbon dioxide removed from the lungs through the air passages.

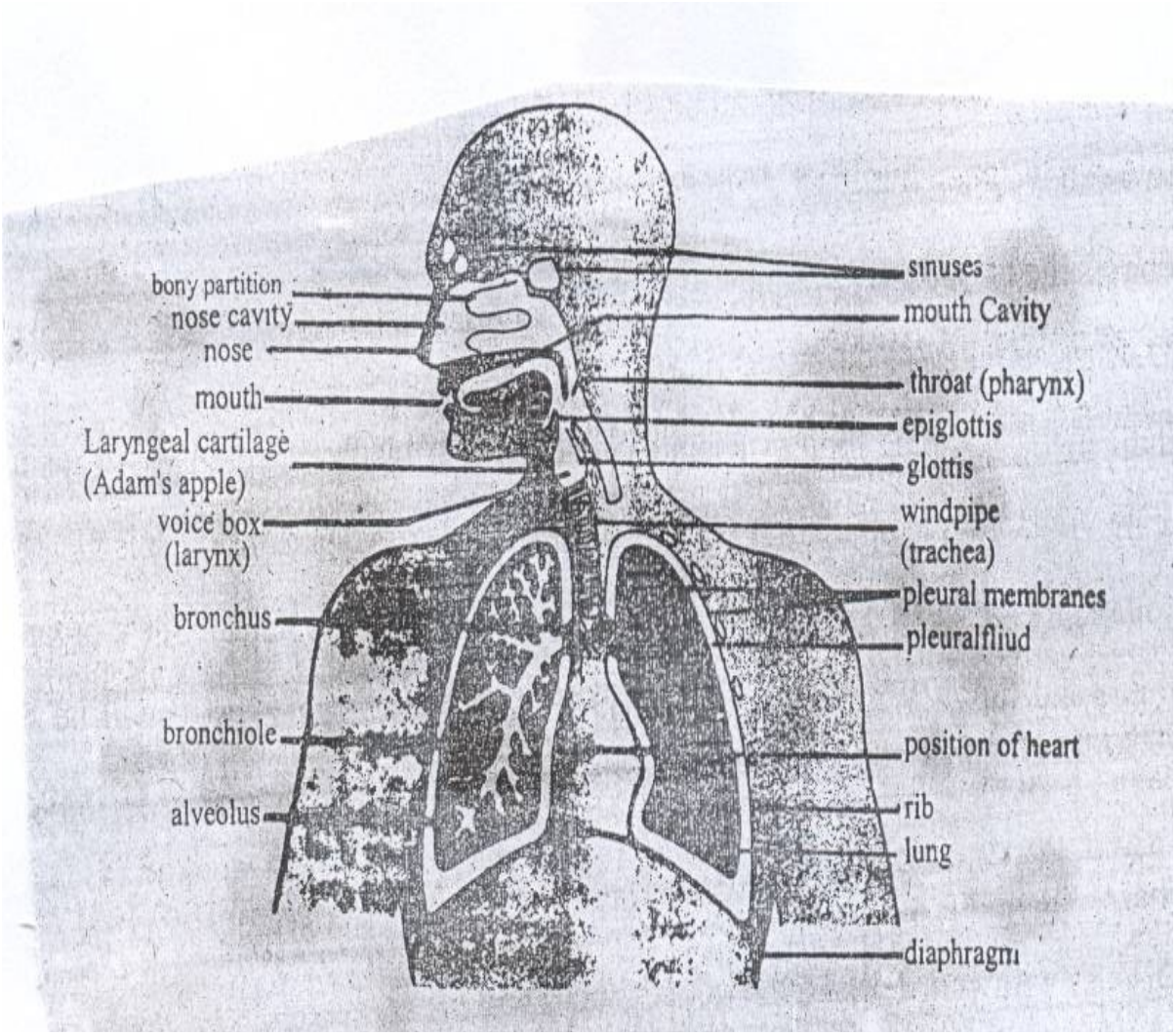


Fig 5.3 The structure of lung.

Hygienic Latrines, Importance and Constructing a Model.

Activity 5.3

* What is hygienic latrine?

* Why hygienic latrine is needed?

* Where do people in your locality urinate and defecate?

  - every where?
  - in unhygienic latrine?
  - in hygienic latrine, etc?

Discuss in your group.

Hygienic latrine is a specially designed pit (hole) in which defecation and urination is discharged in the constructed house. It is protected from being the source of infection. A feces is a waste materials passed out from the gut of humans. It may contain pathogens that can cause diseases. Such diseases are called fecal borne. The pathogens (disease causing living things) found in feces includes bacteria, viruses, giardia, amoeba, varies worms, etc. Some of the fecal borne diseases are:

Shigella : caused by bacteria

Polio : caused by polio virus.

Giardiasis: caused by a protozoan called giardia.

Amoebic dysentery: caused by a protozoan called amoeba.

Ascariasis: caused by a round worm called ascaris.

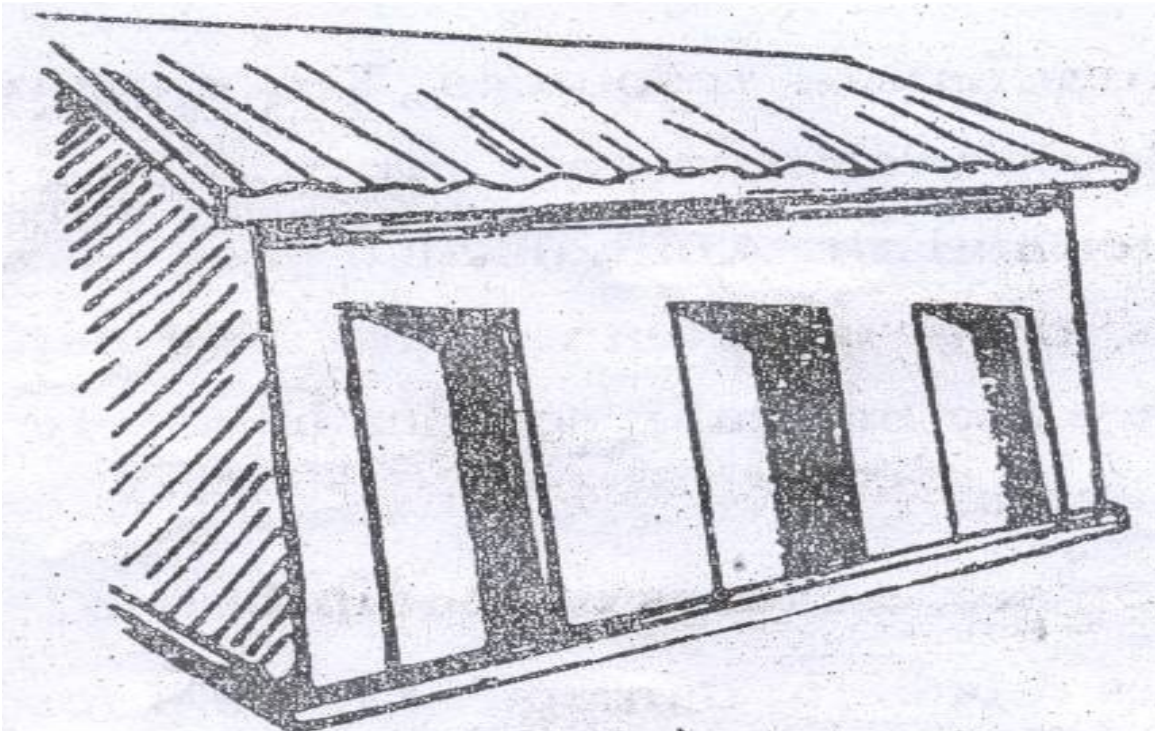


Fig 5.4 Hygienic pit latrines

Project work 5.1

Students should build a model of pit latrine.

Materials: carbon board (other available materials)

Exercise 5.1

1. Write the organs of excretion.
2. Which organs of excretion regulate (control) the amount of salt and water?
3. What is execration?
4. What is epidermis?
5. What is dermis?

5.2 Food Hygiene

Activity 5.4

* What is food hygiene?

*How can we keep our food clean and safe for eating?

*What is the importance of food hygiene?

Discuss in small groups

Food hygiene means keeping food clean and safe. Clean food is free from disease causing organisms. Food can be contaminated and spoiled at any time. Because disease causing organisms are found everywhere. They can be found in air, water, with dust and food equipments. Such organisms include bacteria, viruses, and fungi. When food is contaminated by these disease causing organisms, it will be spoiled and if such food is eaten, there will be food poisoning.

If food is kept in hygienic conditions, it will be free from disease causing agents. It is also safe to eat and there will be no health problems we can also be free from certain diseases such as typhoid, cholera and amoebic dysentery. Because the source of these diseases are unhygienic food.

Food hygiene is needed in homes and in shopping areas. To keep foods hygienic, care should be taken in all of the following activities:

- ❖ Clean hands.
- ❖ Clean working surface.
- ❖ Clean cooking utensils and dishes.
- ❖ Ensure that the ingredients should be fresh and of good quality.
- ❖ Ensure that clean water is used to wash ingredients.
- ❖ Keep the food from flies and other pests by covering.
- ❖ Keep the food by using refrigerate if necessary.
- ❖ Cook the food thoroughly, etc.

These, are some activities for keeping the food hygienic to in sure that no, bacteria can have the chance to contaminate the food we eat every day.

Food Preservation Methods

Activity 5. 5

* How do you preserve food without being spoiled?

* Assume you need to keep meat for a month. What traditional methods can we use?

* List the food preservation methods applied in your locality.

Discuss in small groups about the methods.

Foods can be preserved by different methods. The methods used depend on the kinds of food preserved. But all methods have one common role, which is keeping the food without being spoiled or contaminated. Because preservation methods inhibit the growth of food spoiling organisms. The common methods include the following:

1. **Salting**

   Example: meat "*Quanta*"
2. **Pickling in vinegar**

   * Do you know about "*acheto*"?
3. **Drying** : evaporating the water content

   Example: meat, "*Quanta*"
4. **Cooling**: keeping in highly reduced temperature in the refrigerator.

   Example: Fruits, milk, meat, etc.
5. **Bottling and Canning**

   Bottling: to preserve food in bottles with air tight seal.

   Canning: to preserve food by putting in a closed container without air.
6. **Sterilization**: boiling or heating the food to a maximum heat.
7. **Pasteurization:** boiling foods in moderate heat.

   Example: milk

Exercise 5.2

1. What is food hygiene?
2. In which area food hygiene is needed?
3. What are the steps to be taken when you feed yourself in your home?
4. Write at least three methods of food preservation?
5. How foods are contaminated?

5.3 Food as a Source of Heat Energy

Heat: is a form of energy that transfers from a body of having high temperature to low temperature.

Activity 5.6

*Compare energy production by our body with that of engines.

*What are the similarities and differences between them?

*What is heat energy?

Discuss in small groups

When we compare the energy production with engine and our body, the fuel in an engine and the food in humans` body have provided a similar functions and produces heat energy.

Engines: Fuel + Oxygen ⟶ carbon dioxide + Water + energy

Our body: Food + Oxygen ⟶ carbon dioxide + water + energy

But in case of the human body, the heat is essential to maintain body temperature where as in an engine it has to be removing by cooling system.

Mechanisms of Heat Transfer

Heat transfers from one body to another in different ways. There are three ways by which heat energy is transferred from one body to another. These are: conduction, convection and radiation.

A. **Conduction**

Practical Activity 5.1 Conduction of heat

Objective: to show the transfer of heat by conduction.

Materials: metal rod, plastic rod, wooden rod and heat source stove, candle, etc.

Procedure: 1. obtain rods of metal, plastic and wooden that are of similar length and thickness.

2. hold one end of the metal rod and place the other end in a candle flame (in any heat source) as shown in the fig below.

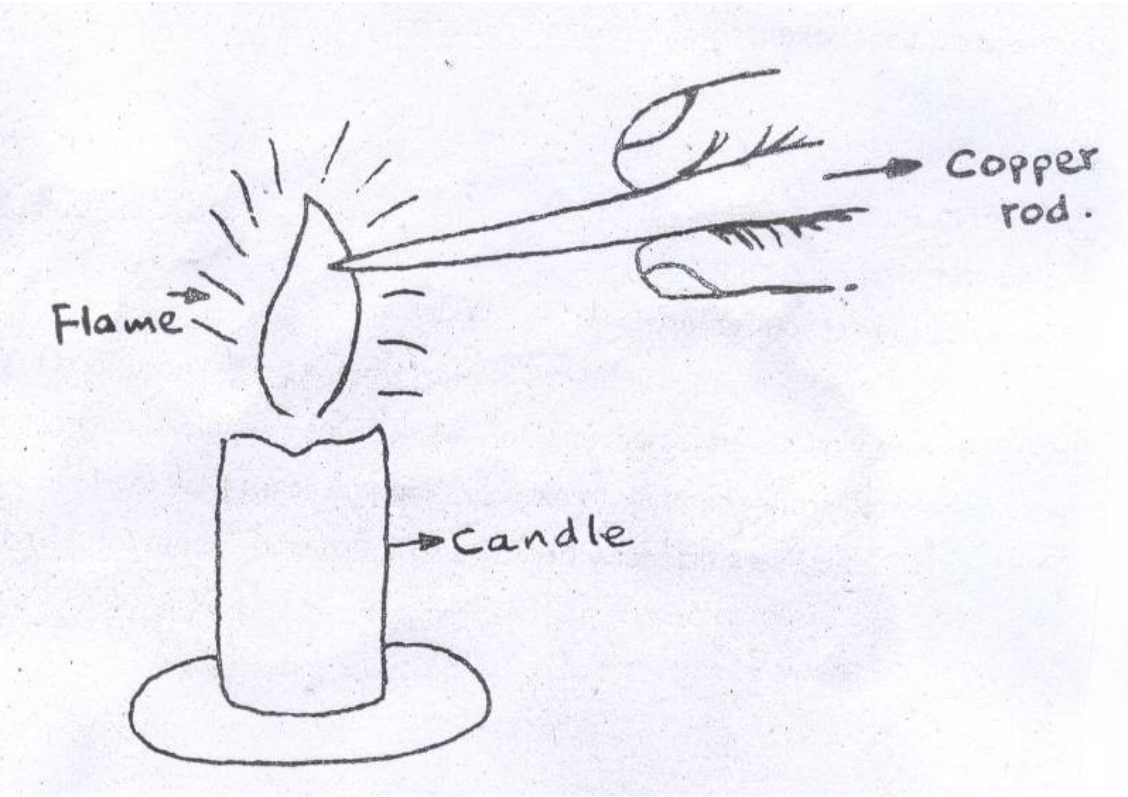


Fig 5.5 Conduction of heat

Questions: What do you feel after 3 minutes later?

How does the heat reach to your hand?

Repeat the activity using plastic and wooden rods instead of metal rod.

Does the heat flow to your hand? Why?

B. **Convection.**

Practical Activity 5.2 Heat transfer through convection

Objectives: to explain that convection types of heat transfer takes place when liquid or gases is heated.

Materials: beaker, cold water, heat source, color or dye (potassium permanganate), glass tube.

Procedure: 1. fill a beaker with clear cold water almost to the top

2. use a piece of glass tubing to direct a color or dye (potassium permanganate) to a corner at the bottom of the beaker, remove the glass tube.
3. using small flame gently, heat the beaker just below the color or dye (potassium permanganate).

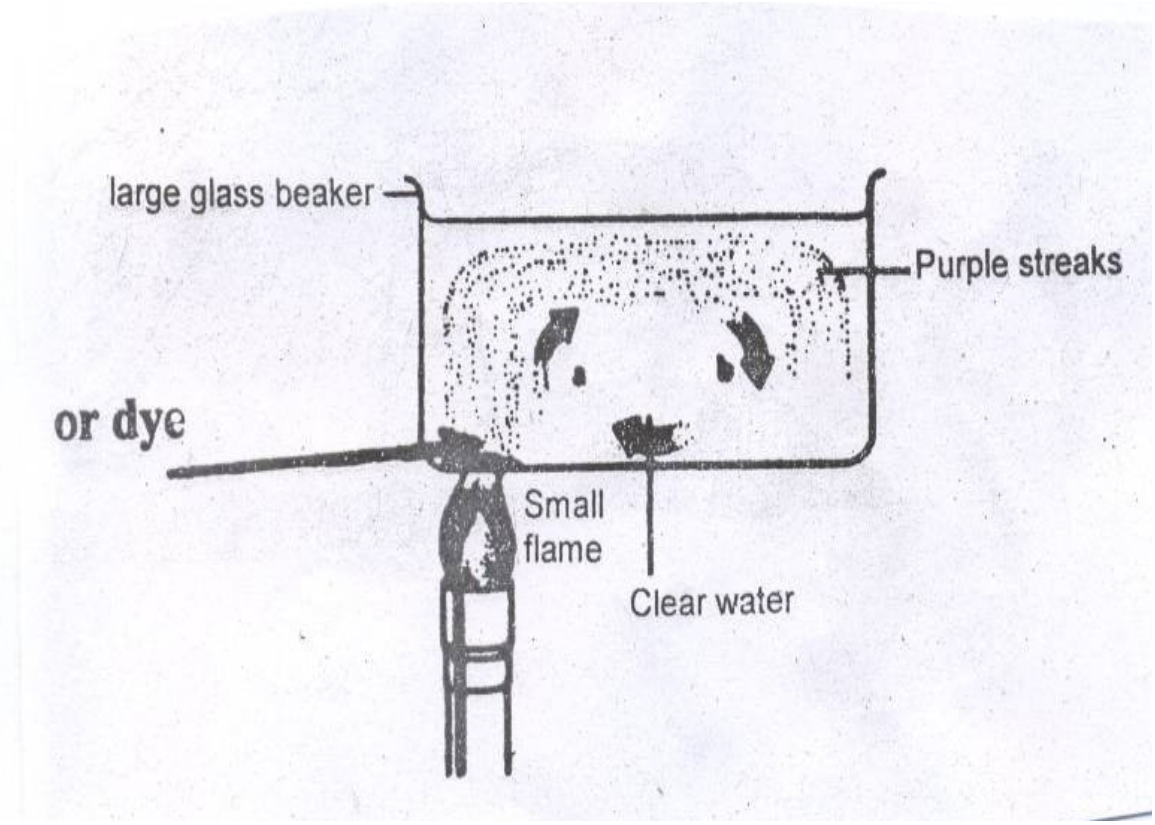


Fig. 5.6 Convection of heat

Question: What happens to the color or dye (potassium permanganate)?

C. **Radiation**

Radiation is a transformation of heat from hot body to cold without the help of medium. Our environment receives heat from the sun by means of radiation.

A black body absorbs all of the radiation, which strikes it and emits the energy as heat energy. In short, black bodies are good absorbers and good emitters of heat, but shining surfaces are poor absorbers and poor emitters of heat.

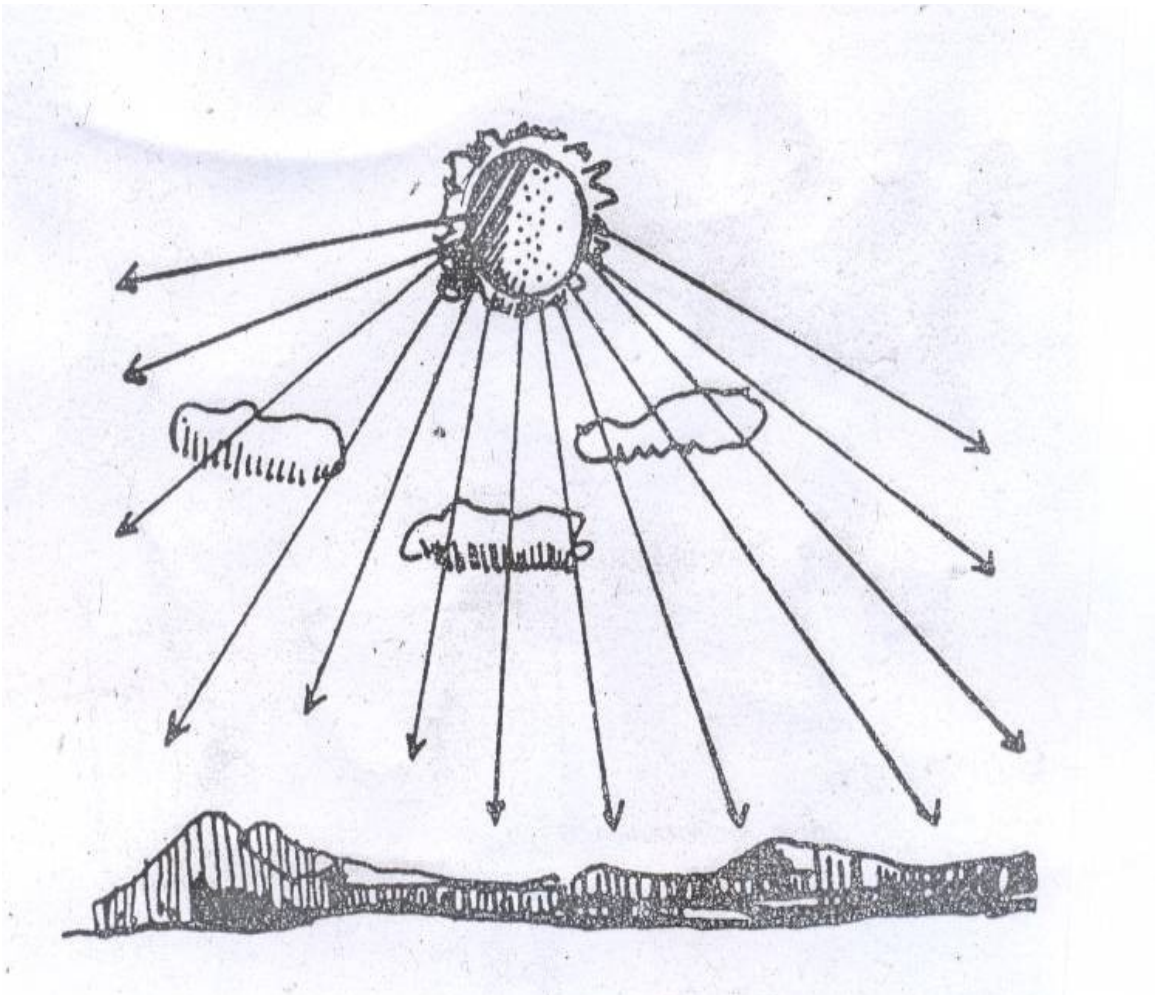


Fig 5.7 Radiation of heat energy from the sun.

Exercise 5.3

1. What is the difference between fuel and food?
2. What is heat energy?
3. Write the three ways of heat transfer and explain about them.

5.4 Food shortage

*What is the use of food?

*What is food shortage?

Food is one of our basic necessities like air, water and shelter. We can not live without food. So, food supply should be one of our main concerns. Food provides energy for everything when we are learning and working. The foods of human beings and other animals are plants or animals sources. Among these two sources, plants supply most of the foods that we eat. This means, we depend mainly on plants as sources of food.

Activity 5.3

> ***Food**:* anything that is taken into the body

*List a type of food which is source of plants?

* Do you mainly depend on sources of plants? Why?

The demand of food (plants sources) depends on the activities of farmers. Farmers are the supply of food to people. The amount of products (crops) is not constant. It varies from year to year and country to country even within a country. Sometimes the crops that farmers collect from their farms become less. This time food shortages became the problems that we face every time.

*Why do people suffer from shortages of food?

*Is there shortage of food that is being occurred in your community? What are the reasons of the shortages of food?

> ***Food shortage:*** in short supply of food

Food shortage is occurred when the food supply is becoming less when the required amount is needed. It is seen in every continent of the world as history tells us.

Caused of Food Shortage

*What are the reasons for food shortages?

Discuss with your group and present your findings to the class.

The shortage of food is caused by many factors. But, in general, it is possible to categorize as natural disasters and the humans activities. The human activities take a large percent. Because natural disasters like floods and climate changes, etc. are the results of human activities.

The causes of food shortages are also due to:-

- insufficient rain
- crop diseases
- damage by pests
- exceptional weather conditions

Activity 5.4 Discuss on the above four causes of food shortages relating with your community.

Solutions of Food Shortages

*Have you ever observed the problems that are caused by not getting enough rainfall in your locality?

*What solution do you recommend as a member of the society?

The food which is produced in one year supply the needs of the people and put as reserves. Reserving food is necessary to full fill the shortage of food after bad farming years. The bad farming years might be due to the absence of rainfall. In some places of Ethiopian, the farmers collect rain water in large ponds or reservoirs. They use this water for their crops in the dry seasons.

In addition to this in some areas the fields which are near to the rivers use an artificial water ways to their crops.

The other solutions for shortage of food include the following:

- farmers work intensively to increase the yields
- work on mechanization to improve yields
- use chemicals like fertilizers, pesticides, etc
- use alternative crops which give better products.

Activity 5.4

*Can farmers work more efficiently to increase their yields?

*Would mechanization improve yields?

*Is it possible to store large quantities of food?

Discuss in your group about the above four questions.

5.5 Harmful practices

*What are harmful practices in your society?

Discuss in groups

Every society has cultural practices. These cultural practices reflect values and beliefs which are held by members of a society. A society has its own traditional, cultural practices and beliefs.

*Are all traditional practices beneficial to the society?

Some of the traditional practices are useful to the society while others are harmful practices.

*List some of the harmful and useful practices in your locality.

Eating raw meat, drinking un boiled milk and disposing wastes in wrong places are some of the harmful practices, because they have an impact on our health.

Harmful practices :an attitude or practice that have a negative impact on the society.

Fig. 5.8 Latrine

Harmful bacteria are one of the causes of food borne diseases. Some bacteria have a chance getting to on out foods. Raw foods are the most common sources of food borne illnesses because they are not boiled. For example, raw meat has become contaminated when sheep, ox or goat are slaughtered for food. Therefore, it is necessary to cook our food in order to keep our health. Because the micro- organisms or harmful bacteria are killed when we cook our food.

*What are the effects of disposing wastes in wrong places? Discuss in group the effects and the solutions.

Insects are very common vectors of diseases. They can transmit diseases either by their body parts, bite or feces. Flies and mosquitoes are the best examples in transmitting diseases.

For example, flies are attached to both food and dirty places like human feces. They transfer diseases causing organisms from the feces of an infected person to the healthy one.

Vector: an organism that transmits diseases causing small organisms from patient to normal person
Disease : disorders of functions in a human body (interruption of the normal functions of any body part).

The disposing of raw sewage in water causes water born diseases. Some of them are cholera, bilharzias and diarrhea. This can kill people if we do not take medical care on time. Therefore, disposing wastes in water surfaces disturb our day to day activities and spread diseases.

*Are there diseases (water born) like cholera, bilharzias, and diarrhea in your locality?

*What are the causes of these diseases?

Discuss in groups about their solution?

5.6 HIV and AIDS

*What is HIV?

*What is AIDS?

*Is there HIV/AIDS club in your school? What is your contribution to the club?

HIV is an English word formed from initial letters of a name. The meanings are:

H = human

I = immuno deficiency

V = virus

As the name indicates, HIV is a virus that causes AIDS. It weakens the immune system and exposes to other diseases like TB. The presence of HIV in the blood is only known by blood test.

AIDS are also an English word formed from initial letters of a name. The meanings are:-

A=Acquires

I = Immuno

D = Deficiency'

S = Syndrome

AIDS mean Acquired Immune Deficiency syndrome. It is a disease caused by HIV. It makes the body expose to a wide range of infections. AIDS is one of the leading causes of death in Ethiopia .Most of the people are infected by HIV. This shows us that the number of working people is becoming less. Other European, African, America countries are also faces this problem.

Modes of transmission.

*What is the most common ways that the virus is transmitted in many parts of the world?

HIV can be transmitted from an infected person to another person in three main ways. These are:

1. **By un safe sexual intercourse**
   - during careless and free sexual intercourses the virus is transmitted from an infected person to another
   - the HIV mainly transmitted through this way
2. **By blood contact**
   - direct contact with infected blood by sharing needle (syringe)
3. **By mother to child transmission**
   - transmission from an infected woman to her baby or fetus
   - the virus can pass from mothers to the fetus (baby) at the time of:
     - pregnancy
     - delivery or birth
     - breast feeding.

* Discus how to minimize the risk of the becoming infected with HIV by each of the methods above

Method of Prevention of HIV

HIV/AIDS are the main problem to human beings because it kills thousands and millions people every year. This also has an impact on the nation's developments.

*What are the methods of prevention of HIV?

*Is AIDS curable disease? (Is there medicine to cure a patient with HIV?)

Some suggested methods in prevention of HIV are:

1. **Preventing sexual transmission of HIV by:**
    - abstain before marriage
    - use condom
    - careful selection of sex partners

2. **Prevent transmission through blood contact by:**
    - not using the same(sharp materials) like needles in common.
    - not taking blood without inspection.

3. **By Counseling**

4. **By preventing the transmission of HIV mother to chilled by medical counseling**

5**. By bringing behavioral changes**

* List out the life skills that you think help in controlling HIV/AIDs

It is helpful that people develop personal skills. Because it helps individuals as decision maker to reduce the risk of getting HIV/AIDS

This personal skill includes:

- Decision making
- Assertiveness
- Critical thinking (problem solving)
- Coping with emotions
- Interpersonal communication skills

* Discuss the importance of being assertive to prevent the spread of HIV.

In preventing HIV/AIDs the safest way is being faithful within marriage. It is also contributes in providing good relationship between parents and children. Similarly, *everyone should support people with HIV/AIDS in controlling the disease*.

* Do you take testing services concerning HIV/ AIDS?

* What is your opinion about testing services and discuss in groups.

Summary

- Our body produces many waste products. These waste products can be removed through excretion by the help of organs of excretion such as skin, lung and kidneys.
- Hygienic latrines is a specially designed pit (hole) defecation and urination with constructed house, and protects from being the source of infection.
- Food hygiene is keeping food clean and safe in homes, trade area, and other areas where food organized.
- Food preservation methods are important to preserve our food from contamination and that are affected by bacteria. Some of food preservation methods are salting, drying, cooling, bottling and canning , sterilization, pasteurization, etc.
- Food as a source of heat energy for our body and produce an energy (heat energy)
- Heat energy can be transferred in three ways: convection, convection and radiation.
- Food shortage is caused by poor harvesting, droughts, floods, crop diseases, insufficient rain.
- Mechanized farming and store large quantities of food are contributors in food securities.
- Eating raw meat, drinking un boiled milk and disposing wastes at wrong places are some of harmful practices.
- Harmful practices are the causes of diseases in many countries.
- Taking alternatives like using boiled milk instead of un boiled milk avoid the diseases of harmful practices
- HIV is the virus that causes AIDS,
- HIV/AIDS transmitted from infected person to other through blood, semen, fluids from sex organs and breast milk.
- Give awareness to people in schools, and in communities are the good approaches in preventing HIV/AIDS

Review Exercise

True/False

1. HIV infected person cannot transmit the virus to other at carrier stage.
2. Stomach is an execratory organ.
3. Plants are source of our food.
4. All cultural practices are useful
5. Insects are vectors of many diseases.
6. AIDS is a virus that causes HIV.
7. Built reservoirs around farming places have no use to improve food shortages.

Choose the correct answer from the given alternatives.

1. HIV/AIDs are transmitted from the infected person to other person through the body fluid_____ and _____
    A. blood, breast milk
    B. blood, tears
    C. semen, tears
    D. semen, blood
2. The main causes of food shortage are:
    A. insufficient rain
    B. poor farming
    C. bad weather conditions
    D. all
3. Which one of the following are **not** harmful practices?
    A. Throwing wastes in water surfaces
    B. Not use toilet
    C. Eating the food after boiled
    D. Use stream or river for avoiding wastes from home.
4. Which one is not faecal borne disease?
    A. TB. C. Cholera

B. Ascaris D. Shigella

5. One is an excretory organ?
   A. Tongue C. Eye.
   B. Skin D. Heart.
6. Which one is harmful practice?
   A. Eating raw meat C. Excreting on open surface
   B. Drinking un-boiled milk D. All of the above
7. Which one of the following is the best way of HIV prevention for students?
   A. Faithful partnership C. Using condom
   B. Delay in sexual practice. D. All of the above

III. Give short answer for the following questions

1. The outer layer of our skin is called _____
2. A tube that carries urine from kidney to bladder is _____
3. Write the three mechanism of heat transfer.

Unit 6

The Earth

Contents	
Section	**Learning competencies**
6. Earth **6.1 Components of the Solar System** • The sun position, temperature, as a source of energy • The planets – names position, why the reported number of planets vary. • Model of the solar system. • The solar system, other celestial bodies asteroids, comet and meteor	• Define the solar system • Indicate the position of the sun in the solar system. • Explain the importance of the sun as a source of energy. • Name the eight planets. • Acknowledge that the reported number of planets varies from time to time at new scientific findings are published. • Identify the planets that have their own satellites. • Locate the position of each planet using a model. • List the components of the solar system • Mention asteroids, comets and meteors as celestial bodies other than the solar
6.2 **The Earth in the Solar System - Motion of the Earth** • Types of Earth motion , rotation and revolution • Effects of Earth motion	• Identify types of the motion of the Earth. • Explain the effects of the motion of the Earth.
• Eclipses – lunar and solar.	• Explain eclipses of the sun and moon. • Demonstrate eclipses of the sun and moon.

Section	Learning competencies
6.3 Artificial Satellites **Importance** • Communication, weather and space study.	• Explain the uses of artificial satellites.

UNIT 6

THE EARTH

Introduction

This unit deals with the solar system, components of solar system, motion of the Earth and artificial satellites.

The unit will encourage you to think about the relationship between planets, including the Earth and the Sun.

At the end of this unit summary different exercises and activities are given.

6.1 Components of the Solar system

> ***Solar system:*** the sun, planets and their satellites, asteroids, comets, and related objects that orbits the sun.

Activity 6.1

* What is solar system?

* What are the components of the solar system?

Discuss in your group.

The solar system is a body that consists of the sun and eight planets including three dwarf planets and also natural satellites or moons. It also includes celestial bodies. These are asteroids, comets and meteors.

* Are there other members of the solar system?

The Sun

The sun is the centre of the solar system. It accounts 99% the mass of the solar system. The mass of the sun is over 300,000 times that of the Earth. Most of the sun's mass consists of gaseous hydrogen (75%) and helium (25%). The sun rotates in a counter close wise direction on its own axis.

The most important source of energy for the Earth is the sun. The sun's radiation provides the power to set in motion for most of the physical processes.

The sun is important to life, including the movement of the atmosphere that redistribute energy, produce weather and drive the oceanic circulation. Solar energy also causes the growth of plants, which in turn substatin all animals' life on our planets.

The sun has a surface temperature of about $6{,}000^{0}$c and in its central core; the temperature is 15,000,000 ^{0}c, where nuclear fusion occurs. This results in hydrogen which is being changed to helium and the whole range of electromagnetic radiation from gamma rays to radio waves is emitted. The sun is a yellow dwarf star estimated to be about half way through its lifetime to 10 billion years.

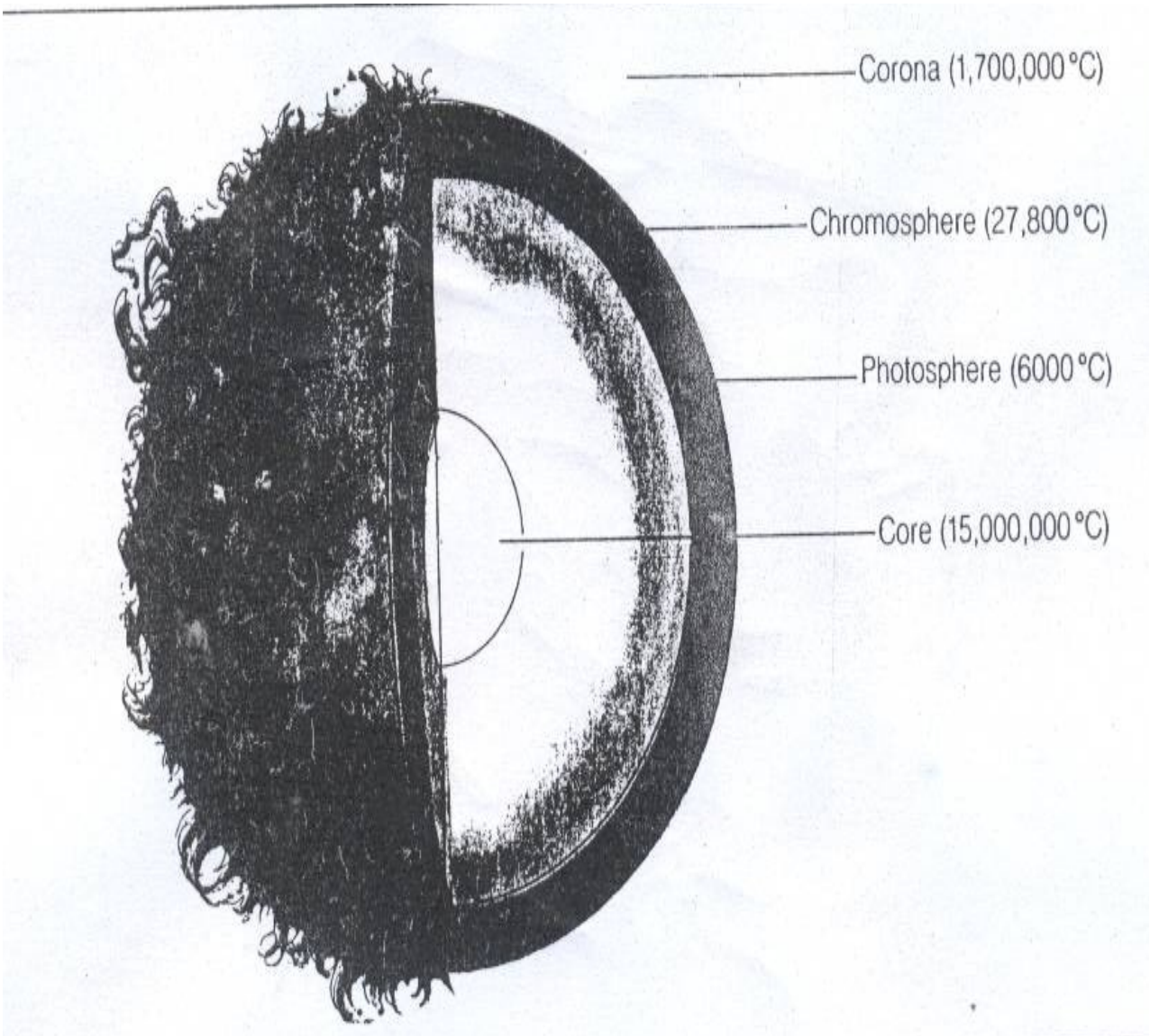


Fig 6.1 Layers of the sun

The Planets

* What are planets?

Planets are heavily bodies revolving around the sun. Next to the sun they are the largest objects in the solar system.

These are:

1. Mercury
2. Venus
3. Earth
4. Mars
5. Jupiter
6. Saturn
7. Uranus
8. Neptune

> ***The sun***: a star that is found at the center of the solar system.
>
> ***Planets:*** are the part of the solar system that revolve around the sun.

N.B. Pluto, Eris and Ceres are called as dwarf planets because, they are too small to be called as true planets.

The planets naturally fall into two classes according to the size at their orbits.

Inner planets: Mercury, Venus, Earth and Mars

Outer planets: Jupiter, Saturn, Uranus and Neptune.

Pluto, Eris and Ceres appear to be in a special case, therefore, they are not considered as inner or outer planets. Most of the planets in the solar system spin on their axis in prograde rotation (forwards rotation), and planets which show pro grade rotation spin on their axis in the same direction. As seen from the surface of a planet they prograde east ward and set in the west. Venus is an exception to the rule. As seen on the surface of Venus, the sun and stars would rise in the west and set in the east.

> ***Orbit:*** the path on which planets travel around the sun.

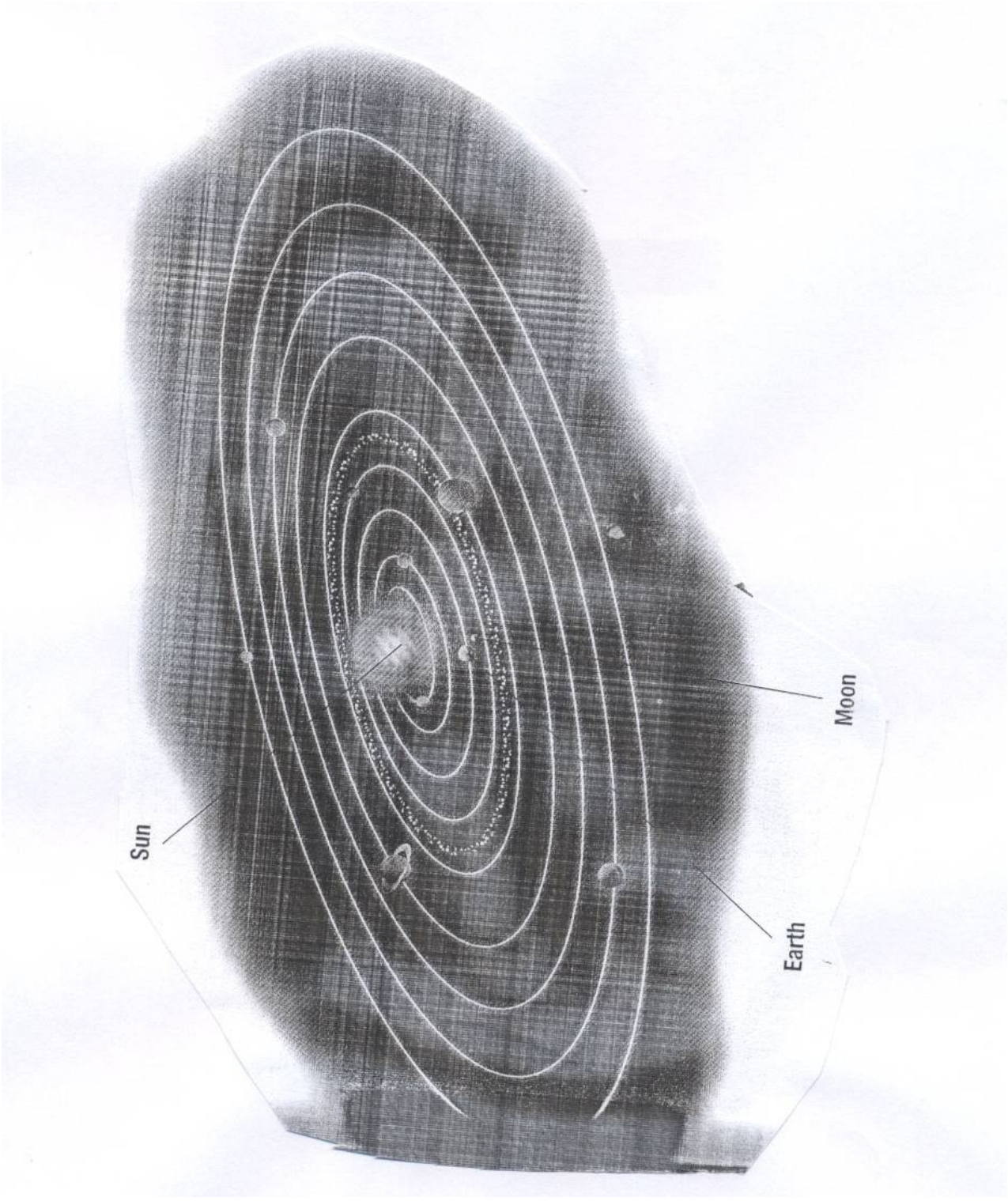


Fig 6.2 Solar system

Solar system data

Planets name	Average distance from the sun (in Km)	Average orbital speed in (km/s)	Orbital period	Rotational period	Diameter (in km)	Mass (in kg)	Average density (in kg/m^3)	Escape speed (km/s)	Surface temp. (in ^oC)	Gravity (in m/s^2)	Number of moon	Surface	Atmosphere
Mercury	$5.79x10^7$	47.9	87.97 days	58.65 days	4,879	$3.3x10^{23}$	5,430	4.3	Day 250 Night-170	3.822	0	Cratered rock	None
Venus	$108.2x10^8$	35	224.7 days	243.01 days	12,104	$4.8x10^{24}$	5,240	10.4	AV 480	8.918	0	Rocky + cloud	Carbon dioxide
Earth	$1.49x10^8$	29.8	365.25 days	23.94 hr	12,756	$5.97x10^{24}$	5515	11.2	AV20	9.8	1	Rocky water cloud	Nitrogen, oxygen
Mars	$2.28x10^8$	24.1	686.98 days	24 hr 37 min	6,794	$6.42x10^{23}$	3940	5	Max 20 Min -40	3.72	2	Cratered rock	Carbon dioxide Argon
Jupiter	$7.78x10^8$	13.1	11.864 years	9hr 50min	142,984	$1.899x10^{27}$	1330	59.5	-100	24.5	>20	Gaseous Outer layer	Hydrogen, Helium
Saturn	$1.43x10^9$	9.7	26.47 years	10hr 14min	120,536	$5.69x10^{24}$	690	35.5	-180	10.78	>20	Gaseous Outer layer	Hydrogen, Helium Methane
Uranus	$2.87x10^9$	6.8	83.75 years	17.24 hr	51,118	$8.66x10^{26}$	1290	21.3	-218	8.82	15	Gaseous Outer layer	Hydrogen, Helium Methane
Neptune	$4.5x10^9$	5.5	163.73 years	16.11 hr	49,528	$1.03x10^{26}$	1640	23.5	-218	10.78	8	Gaseous Outer layer	Hydrogen, Helium Methane
Pluto	$5.91x10^9$	4.7	248 years	6.387 days	2,300	$1.3x10^{22}$	2030	1.2	-369	0.686	1	Rocky	

Activity 6.2

Refer the data on the table and answer the following questions.

1. Which planet is roughly the same size as Earth?
2. Which one is the largest planet in mass?
3. Which plant has a day which is a similar length of the Earth?
4. Which planet has the greatest orbital period?
5. Which planet has no atmosphere?
6. Which planets have the greatest number of moon?
7. Which planet has smaller surface temperature?
8. Which planet has the greatest gravity?
9. How many planets revolve the sun?
10. If you could take an unlimited supply of oxygen which planet would offer the best chance for survival?

Exercise 6.1

I. Write TRUE or FALSE

1. Pluto is the nearest planet to the sun.
2. Venus rotates retrograde rotation.
3. The sun is the source of energy.

II. Choose the correct answer

1. The sun is composed of:

   A. hydrogen and helium C. hydrogen and oxygen

   B. hydrogen and nitrogen D. oxygen and carbon dioxide

2. The center of the solar system is _____

   A. the Sun B. the Earth C. the Moon D. None

3. Which of the following is **not** the inner planet in the solar system?

   A. Saturn B. Venus C. Mars D. Earth

4. All planets spin in the same direction **except:**

   A. Mercury B. Mars C. Venus D. Earth

Other Celestial Bodies of the Solar system.

Asteroids

* Have you ever seen a flash of light in the night sky?

There is a large gap between the orbit of Mars and Jupiter. In this space asteroids are found. This area is known as asteroids belt.

Asteroids are pieces of rock or fragments of planet like materials of varying in size which are floating in space. Asteroids are by far smaller than the planets. It is thought that asteroids were remnants of exploded planets. They orbit the sun in an average of 4.6 years.

> ***Asteroids:*** small group of objects floating in space.
> ***Meteors***: are shooting stars.
> **Meteorite**: a piece of meteoroid that lands on the earth after passing through the atmosphere.

Meteors

Sometimes small objects in space come very near to the Earth. The nights of the sky seems filled with these streaks. Many people call than shooting stars. They are really small in bits of stony materials when they enter the Earth's atmosphere, they are called meteors. Meteors get burning hot as they fall through the atmosphere. This heat usually burns up the meteors.

Some meteors reach the surface of the Earth. A meteor that hits the Earth is called meteorite.

Comets

A comet is a ball of ice, dust, and gases that revolves around the sun in a long, narrow path. Comets are often very large. They have heads and usually have very long tails. Some take thousands of years to orbit the sun but others take much less time. When a comet is near to the sun, energy from the sun strikes the head. The energy pushes some of the lighter matter out of the head.

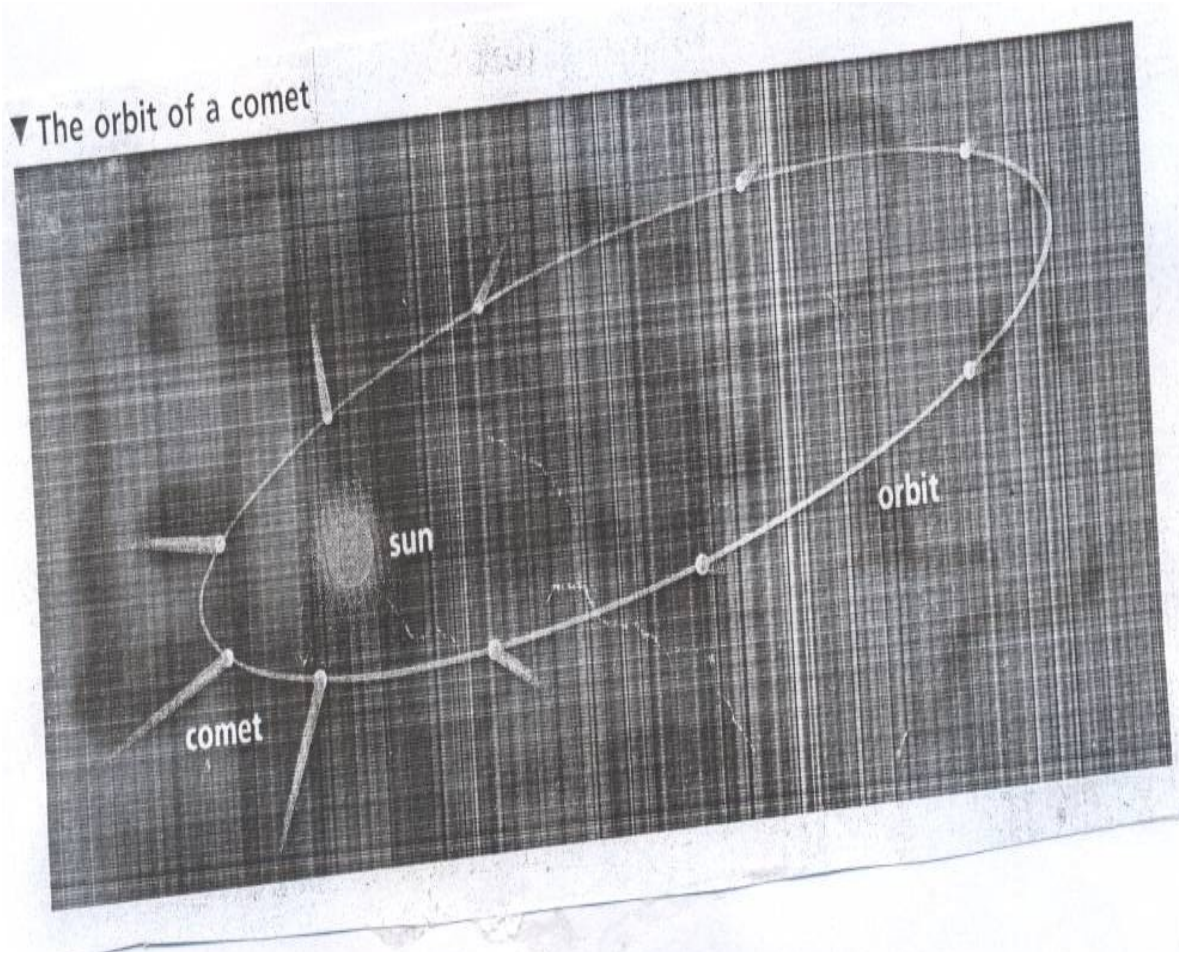


Fig. 6.3 The orbit of the comet

Halley's Comet

One of the famous comets is Halley's Comet. This comet makes regular trips around the sun. It comes near to the Earth in every 76 years. They were observed in 1986 and they will come back in 2062.

The short- period comet is Halley`s comet. It is named after discovered by the English astronomer Edmund Halley.

Fig 6.4 Halley's comet

Exercise 6.2

I. Write TRUE or FALSE

1. Pluto is a part of a solar system.
2. Asteroids are celestial bodies.
3. A meteor that has hits the surface of the Earth is known as meteorite.

II. Choose the correct answer.

1. The solar system consists of

A. the Sun C. moon

B. planets D. all

2. The large gap between Mars and Jupiter is known as_____

A. asteroids C. asteroid belt

B. comet D. None

3. _____are shooting stars.

A. Asteroids B. Meteors C. Comet D. None

6.2 The Earth in the Solar System

Activity 6. 3

* How seasons occur?

*What causes day and night

Discuss in your group.

The Motion of the Earth.

The earth carries out two different kinds of motions. These are: revolution and rotation**.**

Revolution: is the movement of the earth around the Sun. Its takes one year (365¼ day) to complete its trip around the Sun. Revolution of the earth causes seasons.

Rotation: is the movement of the earth on its axis. As the earth moves around the sun, it also spins about its axis. This motion of the earth complete every 24 hours. This creates day and night. Day for the half of earth is surface which faces the sun and night for the other half.

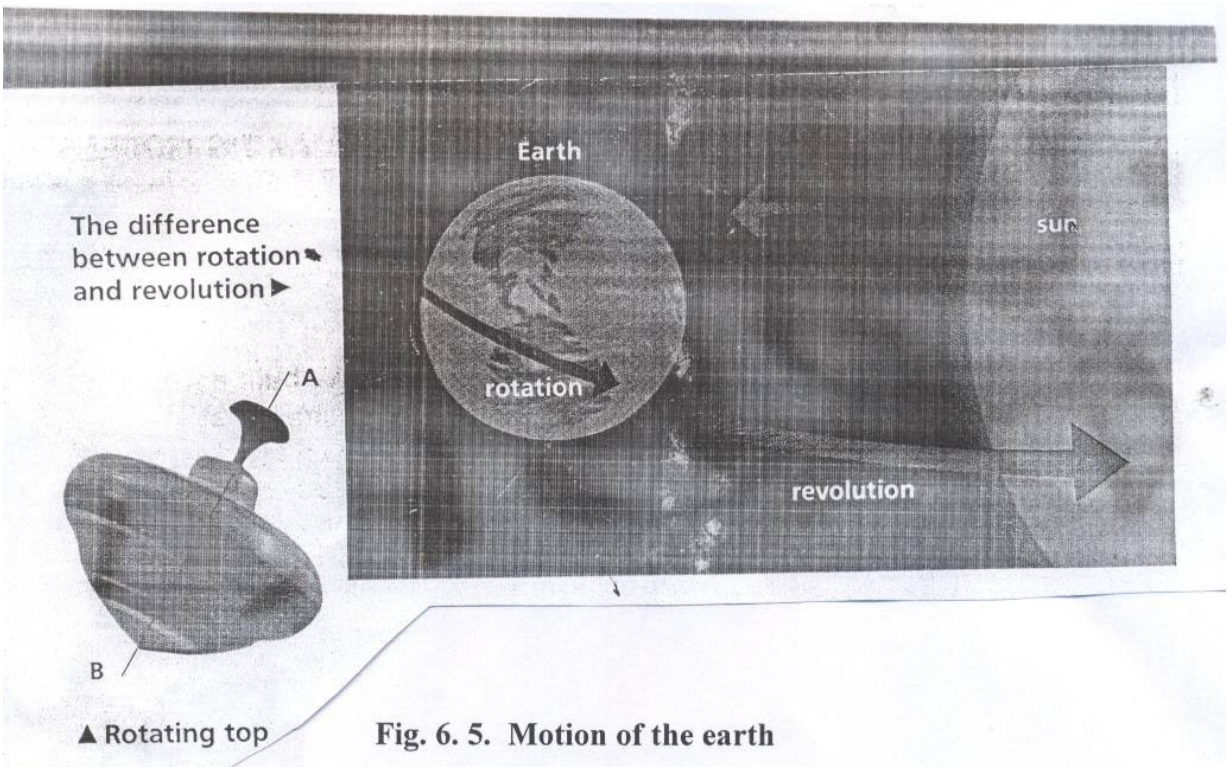


Fig. 6. 5. Motion of the earth

Eclipses

Refers to the blocking of the sun light from reaching the earth`s or moon`s surface. Eclipses occur only when the sun, the earth and the moon are both on the same line. The sun, Earth and the moon all happen to lie along a straight line from time to time. When this occurs, the shadow of the Earth can fall on the moon or the shadow of the moon can fall on the Earth. Such phenomena are called eclipses. There are two kinds of eclipses. They are lunar eclipse and solar eclipse.

Lunar eclipse (Eclipse of the Moon)

It occurs when the moon passes through the Earth's shadow. This happens when the Earth in between the sun and the moon.

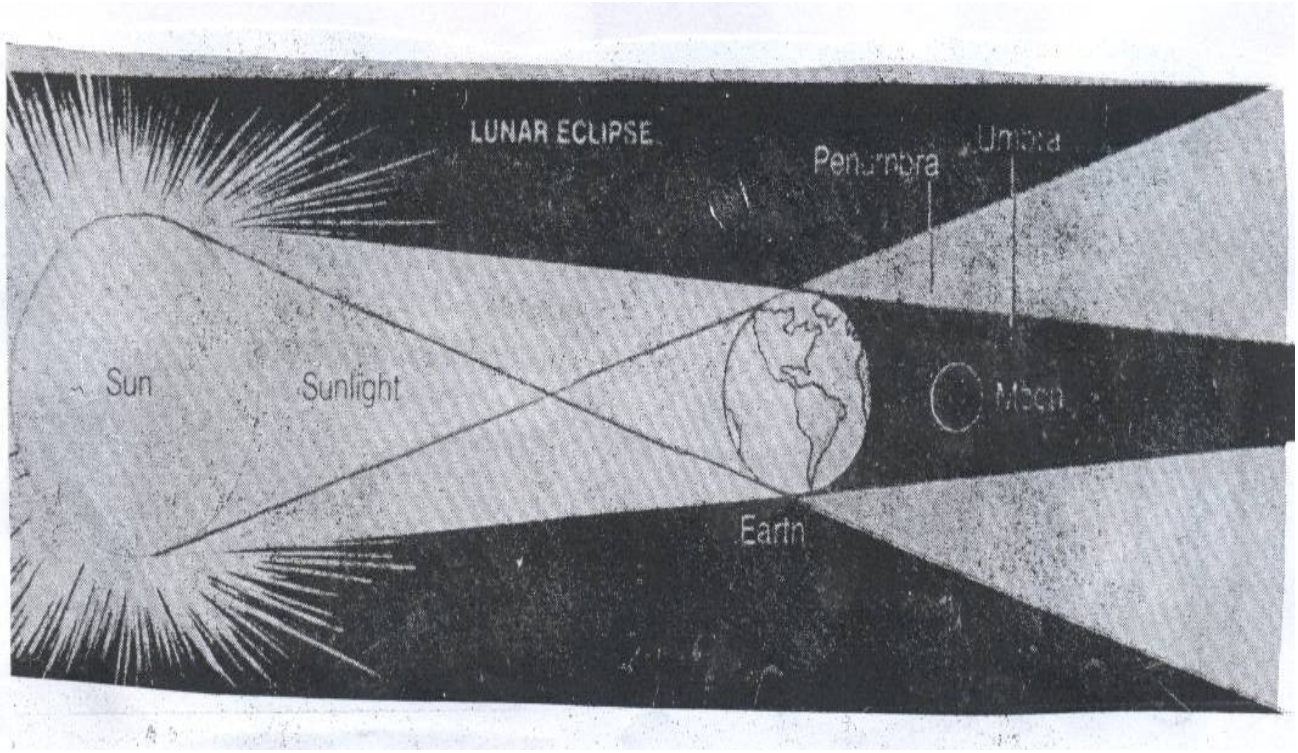


Fig 6.6 Eclipses of the moon

Solar eclipse (Eclipse of the sun)

It occurs when the Earth passes through the moon's shadow. As seen from the Earth, the moon moves in front of the sun. This happened only when the moon is in between the Sun and Earth.

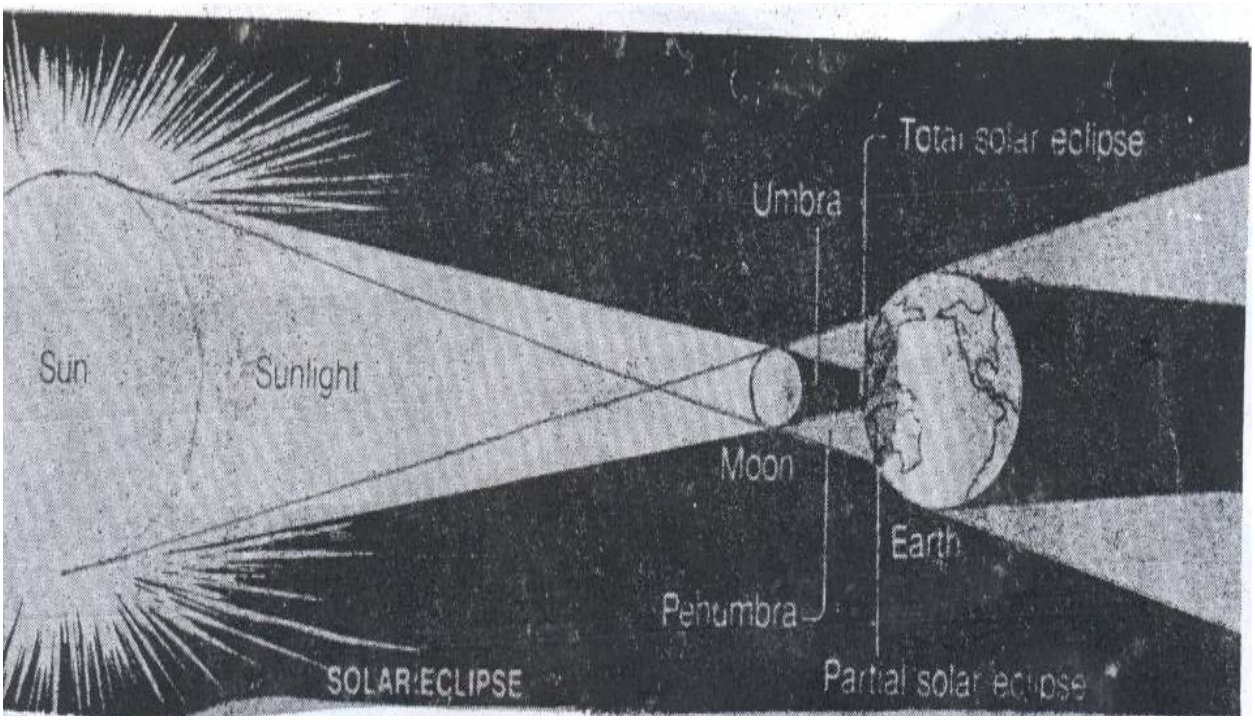


Fig 6.7 Eclipse of the sun

6.3 Artificial satellites

* What are satellites?

Discuss in group.

A satellite is any object that revolves around a large, primary body. The moon is a natural satellite of the Earth. Now the Earth is surrounded by many artificial satellites (Man-made satellites). There are over 200 working satellites now in orbit around the Earth. Artificial satellites can be put in geostationary orbits in which they move around at the same speed as the Earth rotates, so they are always above the same location on the Earth. Polar orbits in which they rotate over the north and south poles and viewed at a different section of the Earth on each orbit.

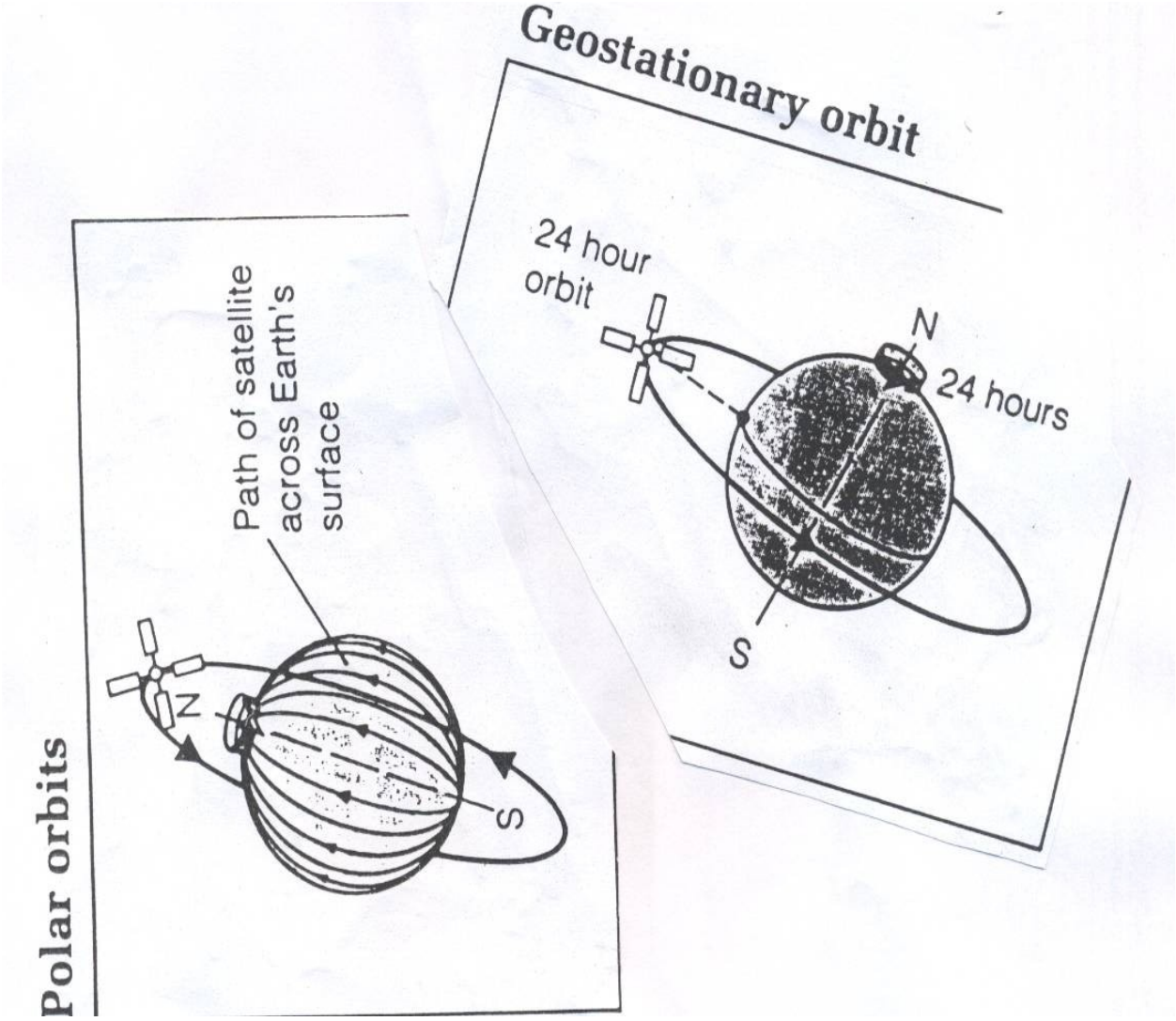


Fig 6.8 Satellite in orbit (polar and geostationary orbit)

Uses of Artificial Satellites

Communication satellites: are used to transmit telephone call, television broad casts, and other electronic pieces of information from one country to another. Global positioning satellites transmit data so that ships and aircrafts can locate their position to with in 100 meter. And need to be in geostationary orbits to relay information between locations.

Weather satellites: Trios the first civilian weather satellites which was launched in 1960 E.C. Some weather satellites are positioned far above the Earth's surface to give on over all view of

cloud formations and movements. Other orbits closer to the Earth, give more detailed information on clouds and temperature. Its polar orbits allow them to view different sections of the Earth on each orbit, so a picture of the weather over a large area can be built up.

* How artificial satellites are launched into space?

Discuss in group

In order to take satellites into space they must be attached to a rocket. A rocket is used to launch a satellite into space. A rocket which carry a satellite in space, must reach a speed that allows it to escape the Earth`s gravitational pull. This speed is called escape velocity.

Project 6.1 Constructing a balloon rocket.

Materials: Balloon, Masking tape, Scissors, 9m string, Drinking straw or (hollow pen plastic tube), Meter stick

Procedures:

1. cut the drinking straw (hollow pen plastic tube) in half. Pull the string through one of the halves .
2. low up the balloon and hold the end, so that the air does not escape out. Do not tie the end of the balloon.
3. have someone tape the drinking straw (hollow pen plastic) with the string pulled through it to the side of the balloon as shown in the figure below.
4. have two students pull the string fight between them
5. move the balloon along the string to one end of the string. Release the balloon and observe its flight toward the other end of the string,

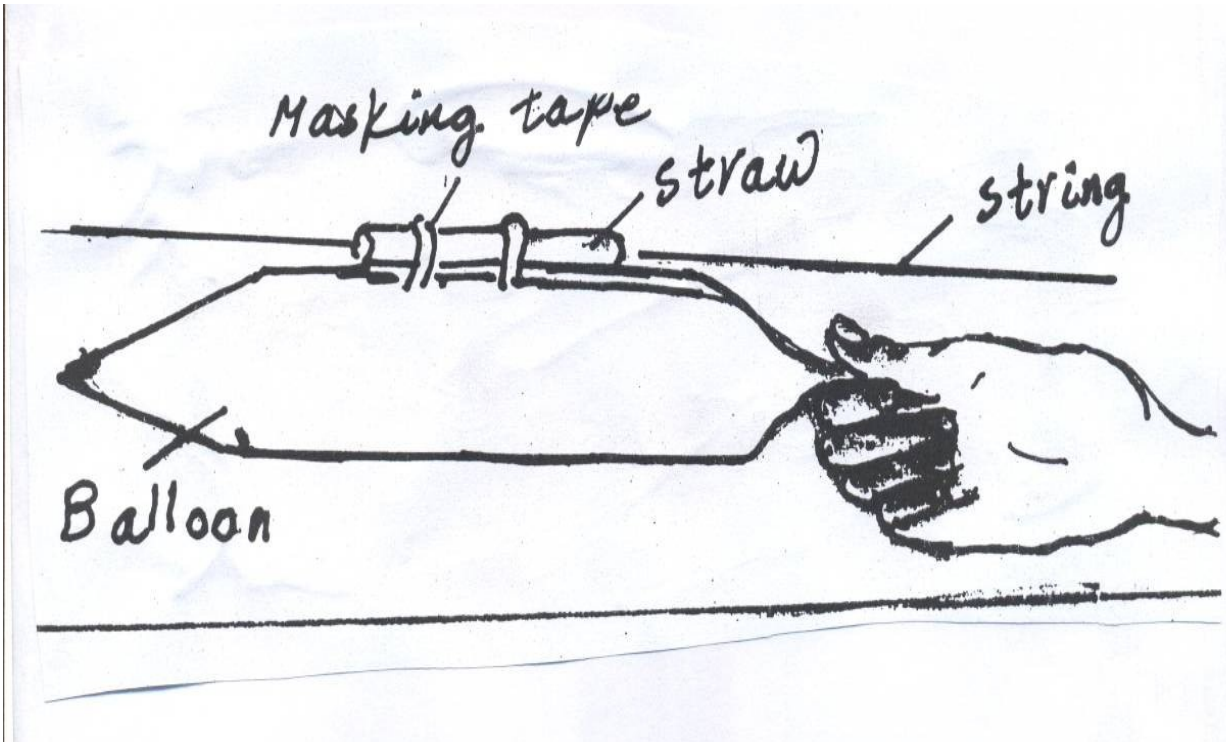


Fig 6.9 Balloon Rocket

Unit Summary

- The solar system consists of the eight planets and three dwarf planets, satellites, asteroids, comets and meteors.
- The sun is the center of the solar system and composed of hydrogen and helium.
- Planets are heavily bodies revolving around the sun and these includes Mercury, Venues, Earth and Mars (inner plants),and Jupiter, Saturn, Uranus and Neptune (outer planets) and also three dwarf planets Pluto, Eris and Ceres.
- The Earth carries two types of motions. These are revolution and rotation.
- Revolution: revolves around the sun
- Rotation : rotates in its own axis
- Eclipse: the cutting off part or all light from celestial bodies by another.

- Satellites – natural or artificial. Artificial satellites (man made satellites) which are used for human civilization

Review Question

I. Write TRUE or FALSE.

1. Asteroids have equal size as planets.
2. Halley's Comet is the short-period comet.
3. Ceres is a dwarf planet.
4. A lunar eclipse occurs when the moon is between the Earth and the Sun.
5. The moon is natural satellite.

Part II Choose the correct answer

1. Which of the following are parts of the solar system?

   A. Planets C. Satellites

   B. Comets D. All of the above

2. One is not a true planet.

   A. Mercury C. Pluto

   B. Jupiter D. Earth

3. The earth`s atmosphere composed of _____

   A. hydrogen and Helium

   B. Nitrogen and oxygen

   C. Oxygen and Hydrogen

   D. Helium and Nitrogen

4. Which one of the following planet has no moon?

   A. Neptune C. Pluto

   B. Venus D. Earth

5. Day and night occurs due to _____ of the earth

   A. revolution C. eclipse

   B. rotation D. None

III. Explain the following

6. Solar system
7. Inner and outer planets
8. Eclipse
9. Artificial satellites
10. The motion of the earth.