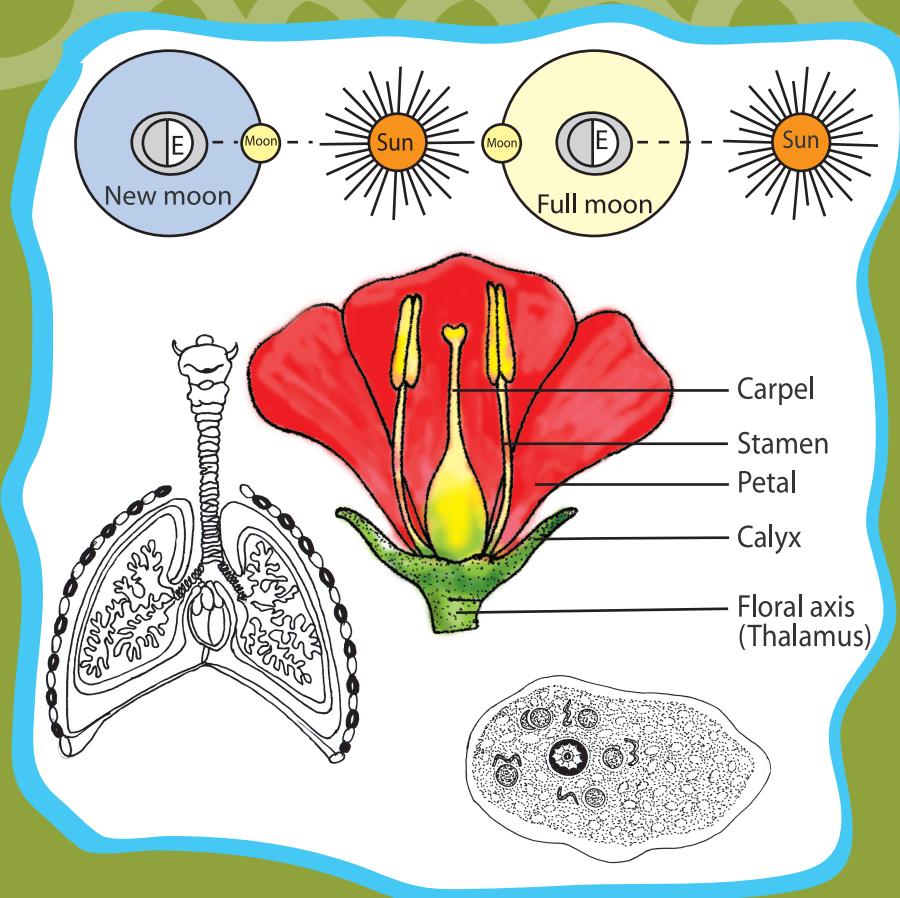


# Science

## Class Seven



NATIONAL CURRICULUM & TEXTBOOK BOARD, DHAKA

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Prescribed by the National Curriculum and Textbook Board  
as a Textbook for class Seven from the academic year 2013

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# **Science**

## **Class Seven**

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**Published by**  
**National Curriculum and Textbook Board**  
69-70, Motijheel Commercial Area, Dhaka

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**Trial Edition**  
First Edition : December, 2012

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For free distribution from academic year 2010 by the Government of Bangladesh

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Printed by :

## Preface

Education is the pre-requisite for the holistic development in our national life. To cope with the challenges of the fast changing world and to lead Bangladesh to the doorstep of development and prosperity, a well educated and skilled population is needed. In order to build up a nation imbued with the spirit of the Language Movement and our Liberation War, the secondary education aims at flourishing the talents and prospects inherent in the learners. Besides, the other aims also include expansion and consolidation of the basic knowledge and skills of the learners acquired at the primary level in order to make them fit for entry into higher education.

The aims of secondary education further emphasise on developing these learners as skilled and competent citizens of the country through the process of acquiring knowledge at the backdrop of socio-economic, cultural and environmental settings.

Keeping the aims and objectives of National Education Policy 2010 ahead, the curriculum at the secondary level has been revised. In the revised curriculum the national aims, objectives and contemporary needs have been reflected. Along with these expected learning outcomes have been determined based on the learner's age, merit and level of acquisition. Besides, efforts have been made to raise, starting from the level of moral and humanistic values down to awareness on history and tradition, the spirit of the Liberation War, passion for art-culture and literature, patriotism, feelings for nature and equal dignity to all irrespective of religions, caste, creed and sex. Efforts have also been made to apply science in all spheres of our life in order to build a nation advanced in science. Attempts are also there to make the learner capable of implementing the goals envisioned in Digital Bangladesh-2021.

In the light of the present curriculum almost all the textbooks at the secondary level have been introduced. While introducing the textbooks, the capacity, aptitude and prior knowledge of the learners have been taken into utmost consideration. While selecting the contexts and their presentation special attention has been given on the expansion of the learner's creative faculty. Adding learning outcomes at the beginning of each chapter, hints about the achievable knowledge of the learners have been given. By adding variety of activities, creative and other questions evaluation has also been made creative.

The objective of science education is to expand the power of observation creating inquisitiveness in the minds of the learners and to create positive attitude about different elements in environment. In fact, keeping all these in consideration and in line with the revised curriculum the textbook titled **Science** has been introduced. To make the book joyful to the learners along with theoretical aspects of science some activities for learning by doing have included in it.

Considering the challenges and commitments of 21<sup>st</sup> century and following the revised curriculum the textbook has been written. Therefore we welcome with our highest consideration any suggestions, both constructive and rationale as well for the further improvement of the book. Amidst huge activities needed for introducing a textbook, this one has been written within a very short span of time frame. We will continue our effort to make the next edition of this book more beautiful, decent and free from any types of errors.

We appreciate the endeavours of those who assisted very sincerely with their merit and hard work in the process of writing, editing, translating illustration, introducing sample questions and printing of the book. We hope the book will ensure joyful reading and achievement of expected skills from the learners.

**Prof. Md. Mostafa Kamaluddin**  
Chairman  
National Curriculum & Textbook Board, Dhaka.

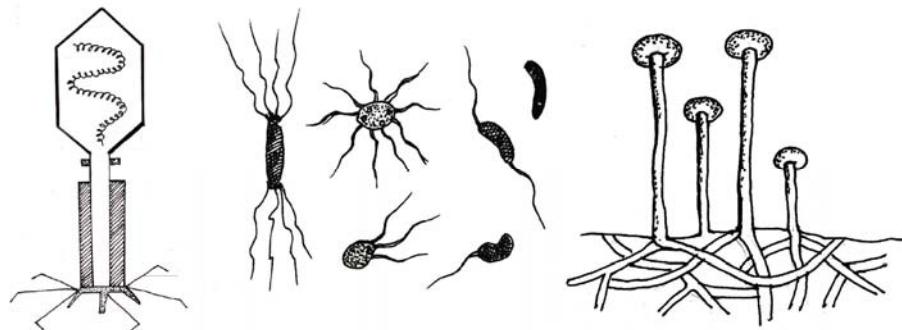
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## Chapter One

# LOWER ORGANISMS

Virus, Bacteria, Fungi, Algae, *Amoeba* etc. are called lower organisms. Virus, Bacteria and *Amoeba* are not visible without the help of a microscope. These are microorganisms. Few fungi and algae can be seen with bare eyes but other need microscopic support. These lower organisms cause disease of man, domestic animals, birds and economic plants. These organisms also have beneficial effects on environment.



**After the study of this chapter, we will be able –**

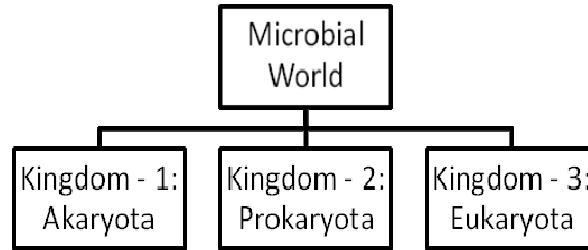
- to explain the characteristics of microorganisms.
- to classify microorganisms.
- to explain characteristics of virus, bacteria and *amoeba*.
- to explain the roles of *Virus*, *Bacteria* and *Entamoeba* in creating health hazards in human body
- to explain the risks and way out from human health hazards created by *Virus*, *Bacteria* and *Entamoeba*.
- to explain the characteristics, beneficial and harmful role of algae and fungi.
- to explain how to resist the fungal infections.
- to be self conscious and make others conscious about fungal infections.

## Lesson - 1, 2: Microbial world

Can we realize the existence of thousands of microorganisms in the air around us? Number of invisible organisms outnumbers greatly the organisms that can be seen by bare eyes.

Microbes cannot be seen with naked eyes. So, microscopes are needed to see them. *Virus* cannot be seen under a light microscope. To see *virus* particles electron microscope is needed.

Whittaker and Margulis proposed to place microorganisms under Monera, Protista and Fungi kingdoms according to five kingdom classifications. Now the microbiologists classify the microorganisms into three kingdoms.



**Kingdom – 1:** Akaryota or Acellular: These organisms are so small that they cannot be seen even under a light microscope. An electron microscope is needed to observe them, such as – Virus.

**Kingdom – 2:** Prokaryota or Primitive celled: Members of this kingdom do not have well organized nucleus. Cell without organized nucleus is termed primitive cell, such as Bacteria.

**Kingdom – 3:** Eukaryota or True Celled: Microbes having true cells are called Eukaryota. Algae, Fungi and Protozoa are Eukaryotic microbes.

**New Words:** Akaryota, Prokaryota, Eukaryota, Microbes, Virus.

## Lesson – 3, 4: Virus and bacteria

‘Virus’ is a minute parasitic organism composed of nucleic acid and protein, which can show few living characteristics while in a living cell.

‘Virus’ means poison. They cannot be seen without electron microscope. Virus particles have no cell wall, plasma membrane, organized nucleus, Fig. 3.1 A virus particle cytoplasm etc. So virus body is called acellular. They are composed of only protein coating and nucleic acid (DNA or RNA). A T<sub>2</sub> Bacteriophage virus has head, tail and tail fibres. Virus, Rickettsia, Fungi, Bacteria, Algae, and Protozoa etc. are present in our environment in innumerable numbers. Most of them are harmless. Of course some of them are responsible for producing diseases in human body. Now we will know about few microorganisms.

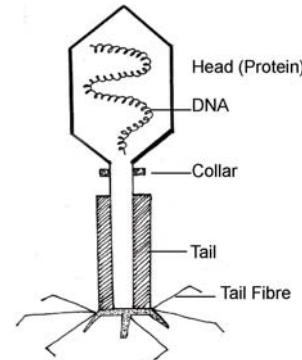


Fig. 3.1 T<sub>2</sub>-Virus Particle

**Virus-** These are simplest organisms. Body mainly composed of Protein and Nucleic Acid.

If Nucleic acid gets out of protein coating they lose all characters of life. But it is interesting that if the constituents are gathered again they got the signs of life again. Virus is true parasite that is they have no existence without living host. Outside of living host they do not show any signs of life.

**Work:** Draw a figure of a Virus Particle in a poster paper and hang it on the wall.

Virus may be round, rod shaped, tadpole like or bread shaped. Virus causes Pox, Measles, Sneezing, Influenza etc. in human body. Trungro of rice and mosaic diseases of tobacco caused by Virus. Pox, Measles, Sneezing, Influenza etc are airborne diseases.

**Bacteria:** We have learnt about bacteria in the previous class, now we are to have a broader look. Bacteria is non green, unicellular microscopic Organisms with primitive nucleus. Antony von Leuen Hoek found the for the first time. Bacteria cell may be rod shaped, rounded, comma shaped or spiral. Bacteria can be classified according to their shape as follows-

- Coccus: Rounded shaped bacteria cell are named as coccus. They remain singly or in groups. Such as Pneumonia causing Bacteria.
- Bacillus: These are elongated rod shaped bacteria. Tetanus, Blood Dysentery etc are caused by Bacillus.
- Comma: Shaped like bend rod. Such as Bacteria causing Human Cholera.
- Spirillum: Spiral Bacteria.

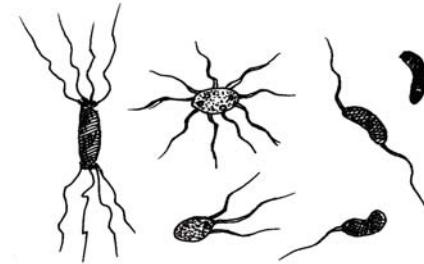


Fig. 4.1: Different types of Bacteria

#### Usefulness of Bacteria:

- Helps in decomposition of dead bodies and organic wastes.
- Only bacteria fixes nitrogen in the soil.
- Helps in removing jute fibres.
- Used in preparation of curds.
- Preparation of life saving Antibiotics.
- Very much important in Genetic engineering and in laboratory research.

## LESSON 5, 6: Algae and fungi

### Algae:

Algae are chlorophillous and autophytic plants of order Thallophyta. They like lighted places. They can grow on soil, water and other plants.

Their bodies can be unicellular or multicellular. Their colour may be various such as green, red, brown etc. They can be found in ponds and sea as "Plankton".

They can produce sex organs from every cell of the body. They reproduce both asexually and sexually. 'Spirogyra' can be found in any water body. They are abundant in rainy season.

**Useful roles:** Elgin, an essential ingredient of ice-cream is extracted from marine algae. Marine algae are good source of iodine and potassium. Phytoplankton has special role in pisciculture. It is mainly composed of algae.

**Harmful Role:** They sometimes produce diseases of man and plants. Red rust of tea is a serious disease. Algae produce water bloom in pond resulting in oxygen shortage for fish and other aquatic animals.

**Fungi:** We know fungi are non green thalophytic plants. As they have no chlorophyll, they cannot produce food through photosynthesis. So they are heterophytes. That means they are dependent on other organisms living or dead for their food. Saprophytic fungi grow on soil rich in humus or dead organisms. They also grow on stale foods and rotten food staffs, fruits, vegetables, wet bread, wet leather, cow dung etc.

Vegetative body may be unicellular or multicellular thread like. Unicellular fungi reproduce by cell division, budding etc.

### Economic Importance of Fungi:

Fungi play both beneficial and harmful roles. We get many valuable medicines, including Penicillin from Fungi. Argot mixture used for vitality is also the product of a fungi. Yeasts are used for preparing bread. They are used in vitamin tablets as they are very rich in vitamins. Now a days *Agaricus* is used as fancy food. At present *Agaricus* is cultivated in many countries including our country.

Fungi are very efficient in rotting food staffs and producing diseases. Fungi are responsible for many diseases of man, animal, bird and plants. They have important role in putrifying waste products and mix them with soil.

Fungi cause diseases of men, animals, birds and economic plants. Ring worm and freckles are fungal diseases. It can cause inflammation of the trachea (respiratory system). Fungi are very efficient in causing plant diseases. Disease like late blight of potatoes, black band disease of jute, red rot of sugarcane etc. are caused by fungal infection. They easily attack furniture made of wood, bamboo, cane etc. and damage them enormously.

**Prevention of fungal infection:** Different fungi produce different diseases. To remain safe from those diseases, the most important thing is to have clear idea about the spread of causal organism. Fungal diseases are highly contagious. It means a person may get infected on coming in contact with an infected person. To avoid such risk the following measures are suggested:

- Avoid wearing clothes of the persons with ringworm or freckle infection.
- Dandruff is also caused by a kind of fungus. Avoid using other persons comb, hair brush, hair clip etc. to remain safe. And one should not wear other's caps and head gears.
- The sole especially under the heel of man get cracked when infected by athlete's foot fungus. So one should not walk barefooted on the floor where the infected person walks.
- Avoid mixing with diseased persons and clean hands, feet and face with soap after mixing with such persons.
- Spraying insecticides on infected plants or uprooting and burn them up.
- Gargling with saline water every night before going to bed is helpful for avoiding probable infection of the trachea of the respiratory system.

**Amoeba:** *Amoeba*, a member of the kingdom Protista, is a unicellular organism. Their body is very small. They cannot be seen without a microscope. They can continuously change their body shape. Small finger like structure is produced from their body. They are called **pseudopodia**. With the help of these pseudopodia *Amoeba* takes food and moves from one place to another. The body bears some water vacuoles, food vacuoles and contractile vacuoles. The body is surrounded by a thin transparent membrane. It is called plasmalemma.

*Amoeba* grows in water, wet soil, rotten waste material, organic debris at the bottom of the pond etc. They are also found in the clay sediment of drains, such as *Amoeba proteus*. Few members of Protista kingdom cause diseases, example *Entamoeba*.

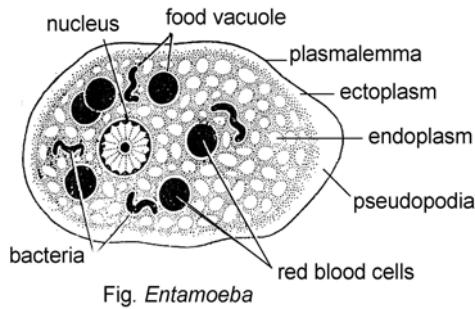
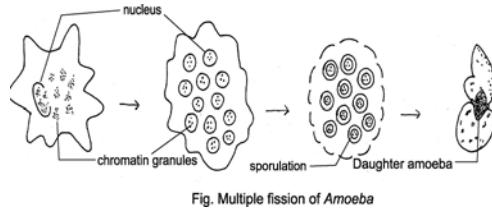
Reproduction:

*Amoeba* usually reproduces asexually. Asexual reproductions are of two types, such as –Cell division and formation of spores. The cell divides into two and produces two *Amoeba*. In case of spore formation the nucleus of the cell divides into many small nuclei. Each of these nuclei with small amount of cytoplasm forms daughter *amoeba*. In this process a large number of *Amoeba* are produced from a single cell.

## Lesson – 7: Cause of dysentery

There are two types of dysentery, such as – Amoebic and Bacillary. One type of bacillus bacteria is responsible for causing bacillary dysentery. Amoebic dysentery is caused by the infection of one kind of unicellular animal, *Entamoeba*.

**Entamoeba:** *Entamoeba* is a unicellular organism. They are the members of Phylum Sarcomastigophora. They cannot be seen with naked eyes. Its body has no definite shape because they continuously changes size and shape like amoeba. The body is transparent and jelly like. In adverse environment sometimes they cover the body with hard and round covering. This condition is known as cyst. Sometimes they take Red blood corpuscle (RBC) and Bacteria as food.

Fig. *Entamoeba*Fig. Multiple fission of *Amoeba*

They live in large intestines of man, monkeys, cats, dogs, pigs and rats. Usually they are not harmful but sometimes they cause dysentery for some unknown reasons.

**WORK:** Draw Sporulation process in *Amoeba* in a poster paper and hang it on the board.

*Entamoeba* reproduces by cell division and sporulation processes. In sporulation process, protoplasm of the cell divides into many parts and produce small spores. In favourable condition each spore grows into a new *Entamoeba*.

To resist amoebic dysentery, the following steps are to be taken:

- Hands should be washed thoroughly with soap or ash before taking meals and after defecation.
- Will have nail cuts regularly.
- Will have to drink safe or boiled water. Water from tube well is also safe for drinking, bathing and washing.
- Will have to use sanitary latrines.

It is very difficult to cure amoebic dysentery completely. Patients often forget about the existence of the disease when suffers for a long time. Organisms are carried without having any symptoms of the disease. The disease is completely cured when a competent doctor is consulted and taken proper medicines.

### Lesson – 8, 9: Role of microbes in creating health hazards

Bacteria may get entrance in many different processes. Dirty hands may act as suitable carrier. Bacteria can enter into the mouth through dirty hand. Bacterial spores may also be transported with the clothes that we use.

Bacterial spores may travel from one place to another with the dust in the air. We used to shake hands and exchange salam when we meet each other. Bacteria may easily get transferred through shaking hands. Germs disperses easily

through stale and rotten foods. These microbes sometimes are waterborne and get dispersed dangerously with water. In the past due to this type of germs a huge number of villagers perished. Cholera and Typhoid are bacterial diseases. Once spread of diseases caused by virus, bacteria and *Entamoeba* was very high. Now we can say that it was caused due to shortage of safe water. Defecation and urination hither and thither create risk in public health. Animals feeding on these fecal matters disperse the germs from one place to another. Besides, the rain water and tidal water also spread the germs to distant places. Like fecal matters, there is a chance that saliva may spread the germs. Spitting here and there may spread virus and bacteria and create threat to public health. Returning from the latrine if hands are not washed properly with soap or ash, there is a chance of entering the germ into the mouth and ultimately settles in the stomach.

**Work :** Make a survey of your village to see how many houses have sanitary latrines, Make a list of those houses and aware them who have not. Write a report on the works you have done and submit it to your teacher

In some village areas there is no sanitary latrine and the people use fields or unhygienic latrines for defecation. *Entamoeba* infested fecal matters get mixed with the soil. Handling that soil contaminates hands. Vegetables grown in those soils are also contaminated. Vegetables sometimes contaminated with *Entamoeba* germs. After normal cooking *Entamoeba* germs are still alive. *Entamoeba* is transmitted in these ways.

When infected with virus, sometimes it is cured normally within 2/4 days without any medical help. But some diseases need long term treatment. Virus particles of cough and cold spread through coughing and sneezing. Mosaic diseases of plants are transmitted with simple contact. AIDS (Acquired Immune Deficiency Syndrome) disease is still not curable. This disease is transmitted when blood from infected person is taken, taking drugs by those who are addicted, using same needle while taking injectable medicines and involvement in immoral trafficking. Mumps, Pox, Measles etc. are very painful diseases. These viral diseases are transmitted through air and get into the respiratory tract.

### **Lesson -10: Prevention and remedy of health hazards caused by microbes**

For prevention and remedy of the diseases caused by Virus, Bacteria, Fungi and *Entamoeba*, a joint effort is needed to follow the rules of hygiene carefully. It should be kept in mind that a weak health runs the risk of being attacked by diseases. So everybody should take balanced diet regularly according to body need.

**Work:** Make a list of those classmates who have not cut nails and have not brushed their tooth and make them aware about the importance of these health activities.

Only meat and fish cannot meet the demand of the balanced food. Only fish and meat can not fulfill the requirement of balanced diet. Taking vegetables and fruits along with these can fulfill the demand of balanced diet. Vitamins and mineral salts are important for maintaining good health and developing resistance against diseases. Next comes the

use of sanitary latrine, cleaning and washing hands and mouth following health rules. Having regular nail cuts, brushing the tooth and taking bath using toilet soap is also very important for the prevention of diseases. Not spitting on the road, using masks or handkerchief while walking in dusty road and covering face with handkerchief while coughing and sneezing are good efforts for resisting spreading of germs. After wiping of cough with the handkerchief, it is essential to wash it on returning home. If possible you can use tissue paper for wiping cough. One should avoid using or coming in contact with usable things of the diseased persons. It is important that drinking water should be safe. To avoid cholera, Typhoid and bacterial diseases it is a must to take safe drinking water. We should use safe water for drinking, bathing, washing clothes and utensils. Water from arsenic free tube well is safe. Even clear water from ponds and rivers should be boiled properly before use.

Man, animal and birds should be treated properly when they are ill. Birds with bird flu virus should be killed and buried under the soil. Cattle when suffer from mad cow or anthrax diseases should be killed because during its treatment other animals may be attacked with such diseases.

**Work:** Visit houses in your village and see which houses have arrangements for safe water. If anybody does not have such arrangement, tell them what they should do.

Encourage everybody for leading a hygienic life. You are to have clear idea about how germs get inside human body and how to resist them. Discussions may be initiated in schools, mosques, temples, play grounds, market places and places where a large number of people gather. Best preventive measure is to make people aware of it. When attacked one should go to a good doctor and take his advice. If needed medicine should be taken. Treatment of a quack doctor leads to complication instead of curing it. You have much responsibilities regarding it.

#### WHAT I LEARNED FROM THIS CHAPTER

- Virus, Bacteria, Fungi, *Amoeba* etc. are lower organisms.
- Virus is an acellular organism.
- Virus, Bacteria and Fungi are disease producing organism.
- Water, air and dirty hands spread germs.
- Healthy living prevents diseases.

#### EXERCISE

##### Fill in the gaps:

1. Cause of Typhus in man is \_\_\_\_\_.
2. The germ responsible for amoebic dysentery is \_\_\_\_\_.
3. Outside living body \_\_\_\_\_ do not show any symptom of life.
4. Fungus named \_\_\_\_\_ is used in bakery.
5. Rod like bacteria is called \_\_\_\_\_.

## **Short Answered Questions:**

1. What is meant by true parasite?
  2. Write names of four bacterial diseases.
  3. Who are the microbes?
  4. What are the materials virus particles made of?

## **Multiple choice questions:**

1. Which Bacteria is responsible for Pneumonia?
    - a. Spirillum
    - b. Bacillus
    - c. Coccus
    - d. Comma
  2. Algae used in -
    - i. preparation of ice creams.
    - ii. pisciculture
    - iii. preparation of medicine.

Which of the following answers is correct?

- a. i and ii
  - b. i and iii
  - c. ii and iii
  - d. i, ii and iii

Read the following Stem and answer the questions Nos 3 and 4:

While chewing, Tareque marked red scar on sugar cane. His father told him that it was caused by one kind of parasitic organism.

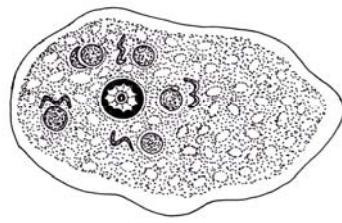
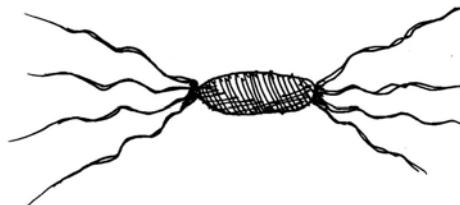
3. Parasite mentioned in the above stem produces –

  1. Red rot
  - ii. Inflammation of trachea
  - iii. Dandruff of the scalp

## **Which one of the following is correct?**

### Creative questions

1.

**A****B**

- a) What is Algae?
  - b) Why are Fungi termed as saprophytes?
  - c) Explain the preventive measures against the disease caused by **A**.
  - d) **B** is a harmful organism but it is important for environment. Give your comments with reasons.
2. Sohail is suffering from influenza. His father told him to use handkerchief while coughing and sneezing.
- a) What is a virus?
  - b) Why is virus called acellular?
  - c) What are the reasons for telling Sohail to use handkerchief?
  - d) How would Sohail make others aware of the preventive measures against the disease?

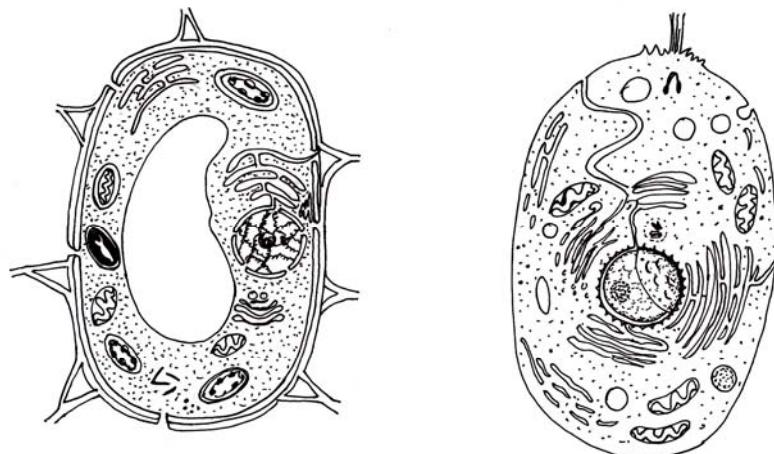
### Do yourself:

1. Soak a piece of bread with water and keep it in a dark room for few days. White or black layer will appear on the bread. Take a bit from that layer, examine under a microscope and draw sketches of what you see. Discuss with your teacher.
2. Collect wrinkled leaves of papaya, Lady's Finger and other plants and discuss amongst your team members about the probable cause. Take the help of your teacher needed.

## Chapter Two

### CELLULAR ORGANISATION OF PLANTS AND ANIMALS

In natural environment one can observe many similarities and dissimilarities amongst various plants and animals irrespective of their size, structure and activities. The main similarity is that the bodies of the organisms are composed of cells. For last few centuries scientists made many research works on structure, shape, nature and other areas of organization. Structure of all cells of one single organism is not similar, rather different. We shall discuss cell structure, but all organelles described in the following pages are not found in a single cell. So one cell is reconstructed with all the organelles in it which are found in various cells. The idea Scientists got about a cell from compound light microscope was confirmed and elaborated when electron microscope was invented. In this context discussion on a typical cell is being initiated.



#### **After studying this chapter, we will be able –**

- to draw labeled drawings of plant and animal cells,
- to compare plant and animal cells,
- to explain structure and functions of different organelles,
- to differentiate plant and animal tissues.

## Lesson -1, 2: Description of a plant cell

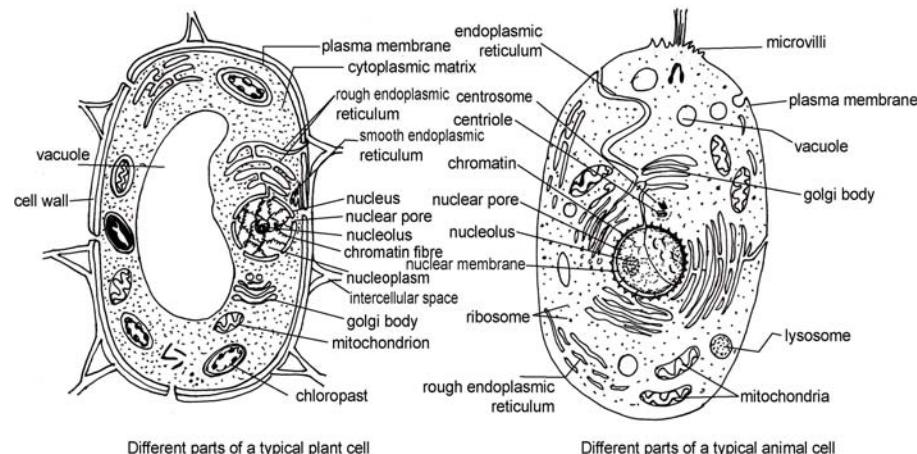
Body of all organisms are composed of one or more cells. A typical plant cell comprises of two parts – cell wall and protoplasm.

**Cell wall:** In plant cell there is a hard and thick non-living wall, which is called cell wall. It is composed of cellulose. Animal cells do not have this wall. It is covered with a thin membrane, called plasma membrane. The main function of cell wall is to protect the living parts of the cell and delimiting the boundary of the cell.

**Protoplasm:** Protoplasm is semisolid, jelly like sticky and granular living substance. Signs of life emerged due to various reactions within the protoplasm. It is composed of various organic and inorganic substances. The water constitutes the 67-90% of the Protoplasm.

**Cytoplasm:** Jelly like substances outside the nucleus is named as cytoplasm. Living structures inside cytoplasm, that take part in various physiological activities of the cell are called cytoplasmic organelles. In a typical cell, normally the following organelles are found –

- |             |                 |               |                          |
|-------------|-----------------|---------------|--------------------------|
| 1. Plastid  | 2. Mitochondria | 3. Golgi body | 4. Endoplasmic Reticulum |
| 5. Ribosome | 6. Lysosome and | 7. Centriole. |                          |



Cellular living organelles and nonliving substances are present in the cytoplasm. In plant cells non living substances include various reserve foods, excreted and secreted substances. In cytoplasm there are large and small vacuoles full of liquid substances (cell sap). These are called cell vacuoles. Usually animal cells do not have cell vacuoles, but in certain cells when vacuoles are present, they are very small in size. In plant cells large numbers of vacuoles are present and their sizes are comparatively large. Different organic acids, salts, carbohydrates, proteins etc. are present in soluble form in the vacuoles and make up cell sap.

Work: Observing the diagrams write down the differences between plant and animal cells and present in a poster paper before the class.

### Lesson 3 - 5: Introduction of cell organelles

Small living structures covered with definite membranes present in cytoplasm are the cell organelles. Short discussions of these structures are given below:

**Plastid:** Round or elliptical organelles with or without pigments present in living cells are the plastid. Normally animal cells do not have plastids. This organelle is a unique characteristic of plant cells. The primary functions of plastids are synthesis of food, pigmentation and storage of food. Depending on the presence and absence of pigments, plastids are of two types: Chromoplastids or coloured plastids and Leucoplastids or colourless plastids. Chromoplastids are of two kinds, chloro plast and chromoplast. It has three parts such as, covering membrane, grana and stroma. Chloroplasts are present in green parts and contain chlorophyll pigments. Its main function is to help photosynthetic processes. Chromoplast produces various colours in flower petals and fruits. During ripening of green fruits, chloroplasts are converted to chromoplast and produce variations of colour in the fruits. The brilliant red colour of tomatoes you see is due to lycopene pigment found in chromoplasts. In chromoplast, yellow, orange and red colour pigments are present. Leucoplasts are present in plant parts where light cannot reach, such as plastids of root cells. Leucoplasts when exposed to sunlight converts to chloroplast. You might have seen that when green grass is covered with brick, grass becomes white; the chloroplasts of those grasses become white. When the brick is taken away, the white grass gradually becomes green due to sun ray. It is proved that one type of chloroplast may be changed to another type.

**Mitochondria:** Small rod like organelles dispersed in cytoplasm of plant and animal cells are the mitochondria (sing: Mitochondrion). Every mitochondrion is surrounded by two layers of membranes. Outer layer is smooth but the inner one is folded inward like fingers. Mitochondrion is the source of all energy used in metabolic activities in an organism. So it is called “power house” of the cell. Energy is produced through oxidation and reduction process. Number of mitochondrion is large in green plant cells but the number is more than one thousand in liver cells.

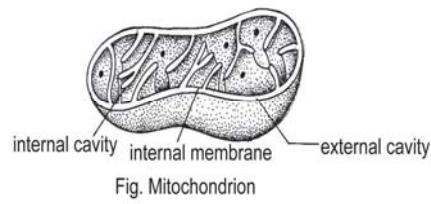


Fig. Mitochondrion

**Golgi body:** These are round or thread like organelles covered by membranes and lies near the nucleus. Its function is to secrete enzymes, hormones etc.

**Centriole:** Near the nucleus of an animal cell there are two tube like organelles, called centriole. Centriole is usually covered by non granular transparent cytoplasm. This area is called Centrosome. Normally centriole is absent in plant cells, but lower plants like fungi have centrioles. The main function of centriole is to form aster during cell division in animal cells.

**Nucleus:** We have learned cell has two parts- cytoplasm and nucleus. Densest part of protoplasm covered by membrane is the nucleus. Every nucleus consists of four parts, namely- i) nuclear membrane ii) nucleolus iii) nuclear reticulum and iv) nucleoplasm.

Best time for examining nuclear parts is in inter-phase stage just before the cell division.

Parts of nucleus are discussed below:

- i) **Nuclear membrane:** The double layered membrane which surrounds the nucleus, is the nuclear membrane. This membrane is extensively porous, These pores are called nuclear pores.  
Functions of nuclear membrane are to establish linkage between cytoplasm and nuclear materials and protection of the nucleus.
- ii) **Nucleoplasm:** Jelly like, granular and transparent semi solid matter covered by the membrane is the nucleoplasm or karyolymph. It functions as matrix for chromosomes, nucleolus and controls physiologic activities of the nucleus.
- iii) **Nucleolus:** Inside the nucleus there is a small, round, bright and comparatively dense structure, is the nucleolus. Normally one nucleolus is present in a nucleus.
- iv) **Nuclear reticulum or chromatin fibres:** Inter twined thread like structure floating in nucleoplasm is called nuclear reticulum or chromatin fibers. At the time of cell division nuclear reticulum breaks into pieces, called chromosomes.

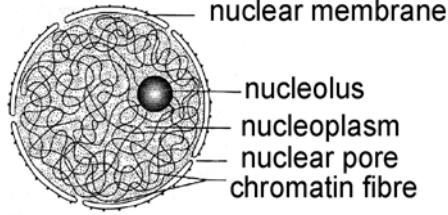


Fig. Different parts of nucleus

**Work:** Cut a potato into pieces and rub it in water. Now take a drop of water and examine under a microscope and compare with the figures. Are these structures cell organelles or other structure? Which parts of the cells are they?

**New words:** Cell membrane, Protoplasm, Cytoplasm, Plastid, Mitochondria, nucleic acid and chromosome.

### Lesson:6-7: Characteristics and functions of plant tissues

Body of an organism may be unicellular or multi-cellular. Organisms which are made of only one cell is called unicellular. All physiologic activities, like nutrition, excretion, respiration and reproduction are performed in one cell only. Organisms with a number of cells are called multi-cellular organisms. Tissues which make the body structure are classified and show division of labour. If all the cells would perform the same physiologic functions at a time, irregularities and anarchy would prevail in structural

variations and physiologic activities of the organisms. So to ensure smooth life activities of organisms, different type of cells form groups to act unitedly. If a number of cells more or less similar in size and shape with same origin and perform the same functions and stay in groups are called tissue.

### **Plant tissues:**

Plant and animal body is composed of different types of tissues. Different types of tissues perform different specific functions.

Depending on power of cell division, tissues are classified into a) meristematic tissue and b) permanent tissue. Tissues are further subdivided based on different characteristics.

### **Meristematic tissues:**

Tissues whose cells have the ability to divide are called meristematic tissues. They are found in developing regions of the plant, specially at the apical regions of stem and root.

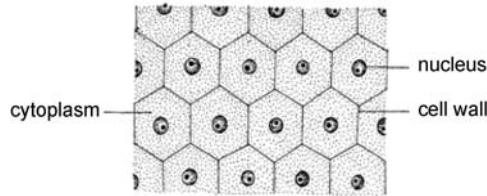


Fig. meristematic tissue

### **Functions:**

- Meristematic tissue gives rise to new cells and tissues due to continuous division.
- It increases the height and girth of plants.
- Meristematic tissue forms new tissues.

**Permanent tissues:** Matured tissues originating from meristematic tissues, having definite shape and incapable of dividing, are called permanent tissues. Permanent tissues are found in almost every part of plants.

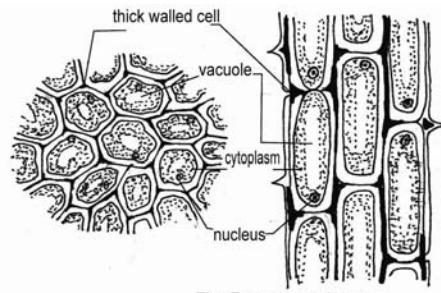


Fig. Permanent tissue

**Work:** Separate the identifying characteristic of meristematic and permanent tissues. Write it down in poster paper and present in a group.

### Lesson-8-10: Characteristics and functions of animal tissue

How do we walk and move? Mark how we eat and how we breath. These activities are separate and of different nature. We walk with foot, write with hand, eat with mouth and chew with the help of teeth. These activities are done by different organs. Structure and functions of cell and tissues are different in these organs. Bones, muscles and brains etc are constituted with many cells, whose structures and functions are different in nature.

In multi-cellular animals when a number of cells unite to form a group and perform a certain work are called tissues. Aims of these cells may be the same but their shape, size and structures may vary. It depends on nature of work of the cell and tissue. Animal bodies are made of different types of tissues, such as –

- a) Epithelial tissues;
  - b) Muscular tissues;
  - c) Connective tissues;
  - d) Nervous tissues.
- A) **Epithelial Tissues:** Tissue that makes the open areas of the body and makes up the internal covering is called epithelial tissue. External layer of our skin and internal layer of our chick are made of epithelial tissue. Different glands of the body are also made of epithelial tissues.

#### Characteristics of epithelial tissue:

- Epithelial tissues are arranged in one or more strata.
- Cells are arranged on a thin foundation membrane.
- This type of tissues do not have any inter cellular matrix.

**Functions:** These tissues protect the internal and external organs from injury. Stomach and intestinal epithelial tissues secrete gastric juice. Epithelial tissues of the tongue function as taste centres.

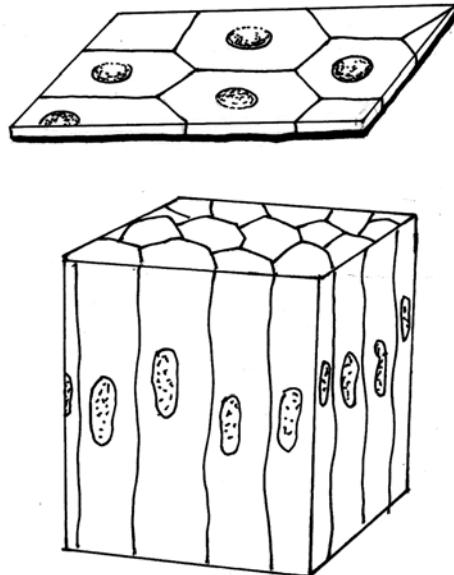


Fig: Epithelial tissues

**Work:** Observe which tissue makes internal lining of your buccal cavity, body covering, inside of nose and ear. Write down the functions of these tissues.

**B. Muscular Tissue:** We can move few muscles on our will, such as – muscles of hands and legs. But there are muscles which we cannot move at our will. These types of muscles move voluntarily at their will, such as muscles of stomach. From the discussion we learned that muscles are of two types, such as:

1. Voluntary Muscles
2. Involuntary Muscles

**Work:** First bend and then straighten your elbow. What sort of change you observed in your muscle? Why and how? Observe carefully

**1. Voluntary Muscles:** When we bend our elbow, muscles of the upper arm contract and draw lower arm and make it bend. Muscles that we can contract and expand at our will and make our organs move, are called voluntary muscles. Number of voluntary muscles in human body is more. These muscles stick to the bone and help to move the organ.

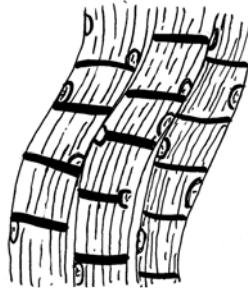


Fig. Meristematic tissue

**2. Involuntary Muscles:** Transportation of food stuff in digestive tract is the responsibilities of the intestinal muscles. We do not have any control on these types of muscles. It means the muscles that do not contract at our will are called involuntary muscles. Cardiac muscles are another category of specialized involuntary muscles. These muscles supply blood to the whole body by alternate contraction and relaxation in a self controlled rhythm. Only heart is constituted with this type of muscle.

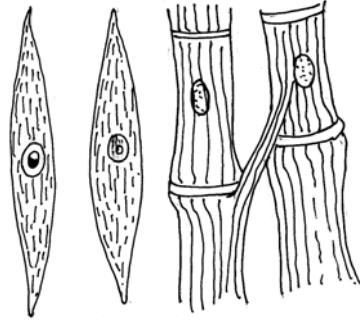


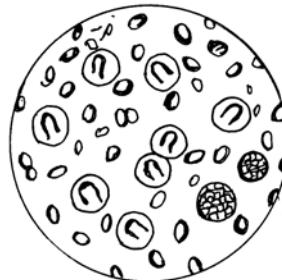
Fig. Involuntary muscle

**Functions of Muscles:** Muscles give shape of the body and help in bone movement also, help in movement and locomotion. It protects internal organs, heart muscles contribute to blood circulation in the body.

**Work:** Sit down on a table in such a way that the legs remain in hanging position. Straighten one leg and then bend. Which muscles took part in this movement? Try to feel. touching with your hand.

### Lesson- 11: Connective tissues

The connective tissue establishes connection among different tissues and organs. These tissues are mainly solid, liquid or fatty. Blood, bone, cartilages and fatty tissues are the examples of connective tissues.



Blood



Fig: Connective Tissue

#### Functions of Connective Tissues:

Bones give structure, bear the weight and give mechanical support to the body. Main constituents of bone are calcium. Tendons attach muscles with the bones. Fatty tissues store oils and fats. Fibrous connective tissues help contraction and expansion of walls of lung and blood vessels. Cartilages are softer than bones and can bear more pressure and stretch, such as cartilages of nose and ear. Blood carries various substances (oxygen, food, excretory substances) from one part to another in the body. Besides blood gives resistance against germs. Blood is a liquid connective tissue.

#### Nerve Tissues:

Tissues of an organism that on responding to stimuli can create appropriate sensation are called nerve tissues. Neuron is the unit of nerve tissue. Brain is constituted with neurons. Every neuron is composed of three parts, such as- a) Cell body b) Dendron and c) Axon.

#### Functions of nerve tissues:

1. Send impulses from different sense organs and impulse producers of the body to the brain.
2. Active parts of the body respond to stimuli, such as when a mosquito bites, this stimulus is sent to the brain. The brain informs the hand and the hand tries to kill the mosquito.

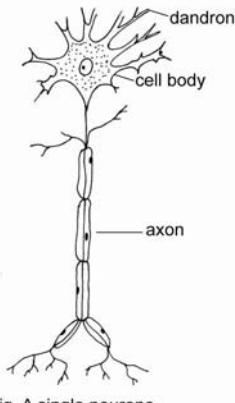


Fig. A single neurone

3. Storage of the stimuli or incidents in the memory.
4. Co-ordinate among different physiological activities of the body.

**Work:** Close your eyes. Can you see anything? Close your ears with your palms. Can you hear anything? How can you remember as you read? Which tissues help to perform all these activities? Draw one cell of this tissue and label its different parts.

**AFTER COMPLETION OF THIS CHAPTER WE HAVE LEARNED THAT--**

- Structural and functional unit of the body is the cell.
- Scientist Robert Hook is the first person who discovered cell.
- Total living content of a cell is protoplasm.
- Living organelles within cytoplasm are Nucleus, Plastids, Mitochondria, Golgi body, Centriole etc. Plastids are of three kinds, such as chloroplasts, chromoplasts and leucoplasts.
- Mitochondria are called the power house because energy produced in respiration is the highest in mitochondria.
- Having same origin when cells of same or different sizes in a group perform the same function is called a tissue.
- Plant tissues are of two kinds, meristematic tissue and permanent tissue. Permanent tissues originate from meristemetic tissues.
- Tissues that continuously divide and produce new tissues are called meristematic tissue.
- The tissues whose cells have definite shape, lost dividing power and originated from meristemetic tissues are called permanent tissues.
- Cardiac muscle is a special kind of involuntary muscle.
- Fatty tissues store fats.

### **EXERCISE**

**Fill in the gaps:**

1. \_\_\_\_\_ tissues are unable to divide.
2. Plant tissues are of two types: \_\_\_\_\_ tissue and \_\_\_\_\_ tissue.
3. Cardiac muscle is a type of \_\_\_\_\_ .
4. Brain is composed of innumerable \_\_\_\_\_ cells.
5. \_\_\_\_\_ is the powerhouse of a cell.

**Short answered Questions:**

1. Describe the functions of muscles.
2. Write down the characteristics of epithelial tissues.
3. Describe the structure of muscles.
4. Mention the functions of plastids.
5. Describe the structure of a mitochondrion.

**Multiple choice questions:**

1. Which of the following structure is absent in meristematic cell?

- |                 |              |
|-----------------|--------------|
| a. Cell Wall    | b. Nucleus   |
| c. Cell Vacuole | d. Cellulose |

2. The cell vacuole contains-

- i. Organic Acid and Salt
- ii. Protein and carbohydrate
- iii. Organic Acid and inorganic acid

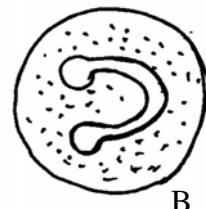
Which of the following answers is correct?

- |               |                  |
|---------------|------------------|
| a. i and ii   | b. i and iii     |
| c. ii and iii | d. i, ii and iii |

From the following Stems **A** and **B** answer question umber 3 and 4:



A



B

3. The function of figure **A** is –

- i. To give mechanical support    ii. To store fats    iii. To produce red blood cells.

Which of the following is correct?

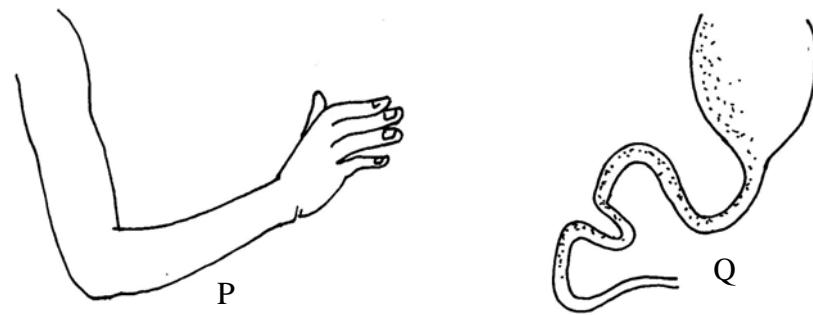
- |               |                  |
|---------------|------------------|
| a. i and ii   | b. i and iii     |
| c. ii and iii | d. i, ii and iii |

3. Characteristics of A and B are –

- i. They are connective tissue
  - ii. They transport oxygen
  - iii. Their main constituent is calcium.  
  - a) i
  - b) iii
  - c) i and ii
  - d) i, ii and iii

## Creative Question:

1.



- a. What is blood?
  - b. What is meant by epithelial tissue?
  - c. Explain the importance of bones in figure P.
  - d. Compare the tissue of the figure P and Q.

2.



M

- a. What is a cell wall?
- b. Why is mitochondria called powerhouse?
- c. Why is figure N coloured though it is a root?
- d. Explain the changes of the plant in figure M that would occur after 8 – 10 days.

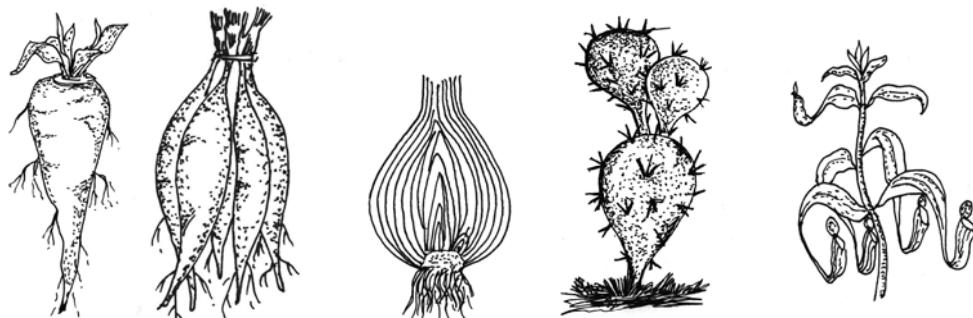
**Do Yourself:**

1. Observe the presence of different types of tissues in your body. In which parts of the body do these tissues exist? Write down their characteristics.

## Chapter Three

### EXTERNAL MORPHOLOGY OF PLANTS

Sometimes roots, stems and leaves are modified in such a way that they cannot be identified. This chapter will deal with why they are so modified and how they can be identified.



**After the study of the chapter, we will be able –**

- to explain the structure of modified roots.
- to explain the structure of modified stems.
- to explain the structure of modified leaves.
- to explain the importance of modified roots, stems and leaves.
- to realize the importance of modified roots, stems and leaves in our life.
- to draw figures of modified roots, stems and leaves.

### **Lesson -1: Modifications of main root**

Roots may be modified for performing special functions. Now modifications for food storage will be discussed. We are familiar with radish, carrot and turnip and take them as food. Are they roots or stems? Check it now whether they bear nodes and internodes? Do they have leaves? No, they don't have. Leaves found above the soil grow from small stems just above the roots. On the basis of their shapes, they are of four types, such as –

1. Fusiform
2. Conical
3. Napiform
4. Tubercular



1. Fusiform

2. Conical

3. Napiform

Fig. Different types of modified root

**Fusiform roots:** These roots store food and become thick and juicy. The middle portion of this root is thick and two ends are gradually tapering, such as Radish.

**Conical roots:** They store food, so the main root becomes thick and juicy. The upper side is broad and the lower side is gradually tapering, such as Carrot.

**Napiform root:** In this case, upper portion of the root becomes rounded due to storage of food. Lower part suddenly becomes thin, such as Turnip.

**Tubercular root:** The main root swells irregularly due to storage of food. They have no particular shape. such as *Mirabilis* (*Sondhya maloti*)

### **Lesson : 2 – 4: Modified adventitious roots**

Adventitious roots are modified for performing special functions. It is modified mainly for three reasons, such as storage of food, mechanical support and physiological activities.

#### **Modified for storage of food:**

Different types of roots are modified for storage of foods for future use and become swollen to attain different shapes, such as root tuber of Sweet potato, fasciculated root of Dahlia and Asparagus and moniliform roots of Bitter gourd. Root tuber of Sweet potato grows from nodes near the soil level and becomes irregularly swollen for storage of food and attain an indefinite shape. Storage of food is the modified function of these roots.

**Tubercular roots:** Adventitious roots sometimes swell up irregularly due to storage of food such as Sweet potato.

**Fasciculated roots:** It is like root tubers that swells irregularly due to storage of food. But when the roots form a fascicle or bunch and all the roots of the bunch swell up due to storage of food, it is called fasciculated roots.

**Nodulose roots:** For storage of food when roots swell up at their tip, they are called nodulose roots such as Amada.

**Moniliform roots:** When adventitious roots swell and constrict alternately are called Moniliform roots such as Bitter gourd.

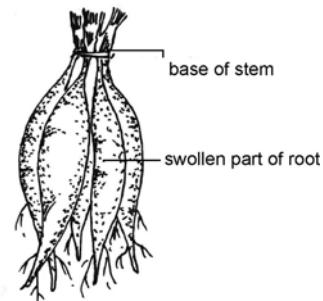


Fig. fasciculated root of dahlia

### MODIFIED FOR MECHANICAL SUPPORT:

These roots help the plants to stand straight, to climb, or to float in the water. For these reasons, adventitious roots are modified variously such as prop roots, stilt roots, climbing roots, floating roots etc.

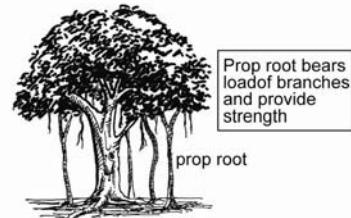


Fig. Prop root of banyan tree

**Prop roots:** These types of roots grow from the stem of the branches and come down and enter into the soil. Finally they become so thick that it looks like a pillar, such as Banyan.

**Stilt Roots:** Few plants have weak stems and cannot stand erect. So few roots develop from the lower part of the main stem and tangentially reach the ground and grow, such as stilt roots of Screw pine.

**Climbing Roots:** These roots grow from the nodal regions of weak stems and help the plants to climb clinging with another plant such as betel vine.

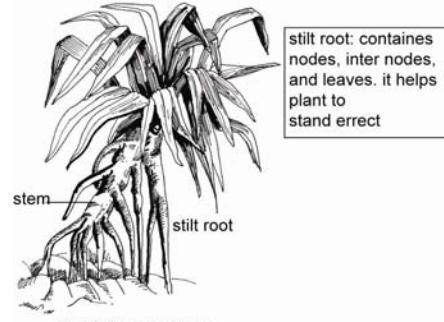


Fig. Stilt root of keya

### Modified for performing physiological functions:

Besides the normal functions, adventitious roots sometimes modified to perform special physiological functions.

**Aerial roots:** One kind of root absorbs moisture from the environment, such as orchid.

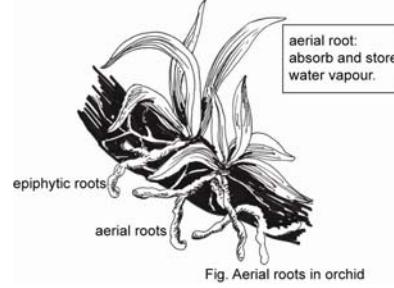


Fig. Aerial roots in orchid

**Parasitic roots or Sucking roots:** Parasitic plants

do not have chlorophyll. So they push their special type of roots inside the body of the host plant in search of food. It is called sucking or parasitic roots such as Dodder.

**Respiratory roots:** Branch roots from the main root come up from the saline and muddy soil in coastal region. These roots have small pores on them, these modified roots are called pneumatophore or respiratory roots such as Sunodri, Goran etc.

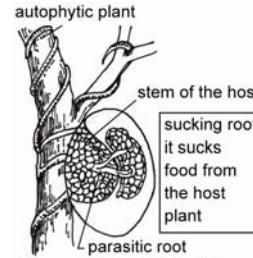


Fig. parasitic root in dodder

**Reproductive roots:** Roots of some plants take part in reproduction such as sweet potato.

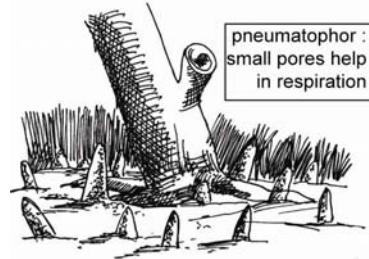


Fig. Pneumatophor

### Lessons- 5 – 7: Modified stems

We know that the stems usually grow above the soil level and bear leaves, flowers and fruits. But in exceptional occasions for performing few special functions stems change their position and structure. These changes are called modifications of stems. Based on position the stems are of three types, such as – 1. Underground modified stem  
2. Subaerial modified stem and 3. Aerial modified stem .

**Underground modified stems:** To survive from adverse conditions, storage of food and vegetative propagation, stems of few plants grow beneath the soil surface. These are underground modified stems. They are of four types, such as Tuber, Rhizome, Bulb and Corm.

**Tuber:** Potatoes are the example of tuber. Tubers bear nodes, inter nodes, scale leaves and auxiliary buds. Cavities at the leaf axils of scale leaves are called 'eyes'. In favourable conditions axillary buds grow from 'eyes' and give rise to new plants. Tubers are round and swollen due to storage of food.

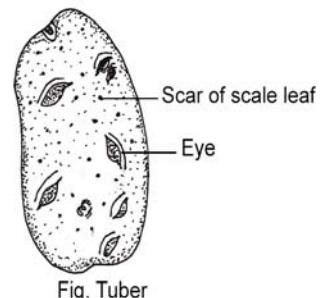


Fig. Tuber

**Rhizomes:** Stems of Ginger, Turmeric etc. plants are examples of rhizome. They grow parallel to soil surface or erect and store foods. It bears clear nodes and internodes. Scale leaves and roots at nodes, and buds at the axes of scale leaves are found.

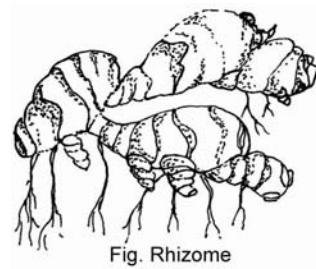


Fig. Rhizome

**Bulbs:** Stems of onion, garlic etc. are bulbs. Their stems are very small and rounded and convex (elevated at the middle). Nodes and internodes are compressed. Thick and juicy scale leaves are so arranged that the bulb cannot be seen. This stem produces profuse fibrous roots.

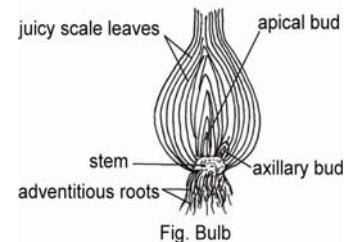


Fig. Bulb

**Corms:** *Amorphophallus* (B.ol) is the example of corm. This stem is very big and more or less rounded. It bears prominent nodes and internodes. Buds from the axils of scale leaves grow laterally and give rise to daughter corm.

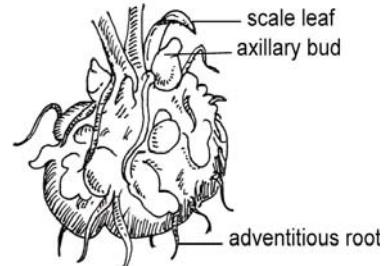


Fig. Corm

#### Sub aerial modified stems :

Plants with soft stems (herbaceous stems) give rise to special branches. These branches produce new plants through vegetative propagation. Some weak stems lying on or under the soil surface are called sub aerial modified stems. They are of four types.

**Runner:** From the axillary buds of lower nodes of *Hydrocotyle* (B. Thankuni), *Oxalis* (B. Amruli), *Cynodon* (Durba) plants give rise to some weak stems called runner.

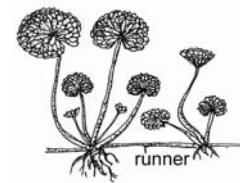


Fig. Runner

**Stolon:** These are special types of runners. From the base of Arum (Man Kochu) grow some horizontal long branches. Nodes of the branches give rise to some roots which attach with the soil and the rest portion of the branch is a bit erect.



Fig. Stolol

**Offset:** Inter nodes of some aquatic plants like *Pistia* (B. Topapana) and *Eichornia* (B. Kochuripana) are thick and short, so the stems look dwarf.

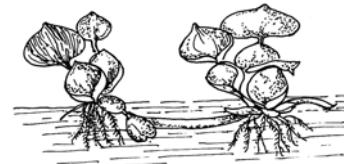


Fig. Offset

**Sucker:** Axillary buds of Chrysanthemum (B. Chandramallika), Bamboo (B. Bansh) grow laterally beneath the soil surface and produce new plants.

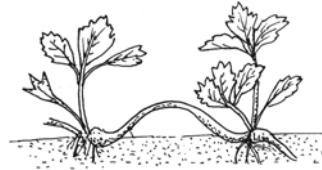


Fig. Sucker

#### Aerial modified stems:

These stems remain above the soil like normal stems but they are modified to perform special functions like synthesis of food, vegetative reproduction, self defense, climbing etc. They are of four types:

**Phylloclade:** Cactus (B. Phonimonosha) is the example of phylloclade. They are flat and green like leaves and can manufacture food. Leaves of this stem are modified to spines and are used for self defense.

**Thorn:** Sometimes axillary buds are modified into stout and sharp thorns instead of developing as leaf buds. In wood apple (B. Bel), *Lawsonia* (B. Mehendi), Maina Kata etc. plants develop sharp thorns.

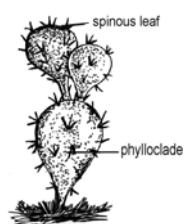


Fig. Phylloclade



Fig. Stem tendrils



Fig. Thorns

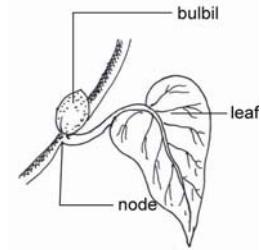


Fig. Bulbil

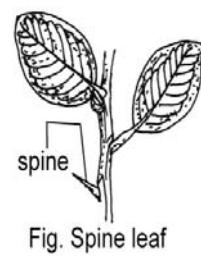
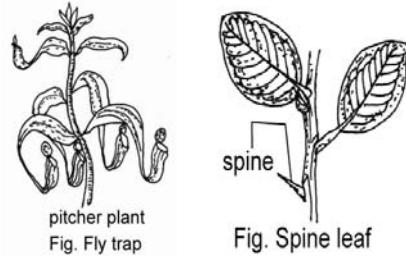
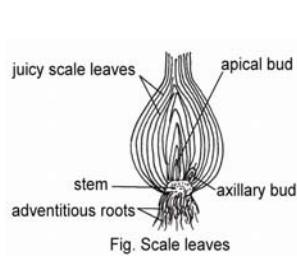
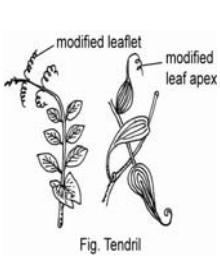
**Stem tendril:** Passion flower, Harjora etc climbers develop thread like thin and spiral long structures which are called stem tendrils.

**Bulbils:** In some climbers axillary buds do not develop as branches but store food & become rounded ball like structure which are called bulbils such as *Dioscorea* (B. Chupri aloo ).

## LESSON- 8: MODIFIED LEAVES

To perform special functions leaves change their normal structure. Now we will know about modified leaves.

- a) **Leaf tendrils:** Apex of leaf or whole leaflets are sometimes modified into a spring like structure called leaf tendril. With these tendrils plants can cling to some support. In wild pea such structures are found.



- b) **Storage of foods:** Leaves of Onion, garlic and *Aloe vera* are thick and juicy. These plants store foods.
- c) **Fly traps :**Pitcher plant is a climber and dodder is an aquatic plant, whose leaves are modified to pitcher or bags. When insects enter inside the pitcher, the lid of the pitcher is closed and the plants absorb juice from the insect body.
- d) **Reproductive leaves:** In few plants buds grow from the margins of leaves. Gradually these buds develop roots and ultimately when detached from the leaf, become independent plants such as *Bryophyllum* (B. Patharkuchi).
- e) **Leaf Spines:** Leaves are sometimes modified to spines such as Lemon.
- f) **Scale leaves:** Sometimes underground stems develop scale like leaves such as potato, ginger, turmeric etc. These are scale leaves. Juicy scale leaves store foods and protects the epical buds.

### Group Work:

1. Group discussion and presentations on the importance of adventitious roots.
2. Presentation of the importance of modified stem in our life on poster paper.
3. Presentation of importance of leaf modifications with reasons.

**What we have learned from this chapter-**

- Ginger and potatoes are modified stems.
- Stems and leaves may be modified to thorns, spines or tendrils.
- Roots, stems and leaves are modified for storage of foods, performing physiologic functions, reproduction etc.
- Modified roots, stems and leaves play many important roles in human life.

**EXERCISE**

**Fill in the Blanks:**

1. Sweet potato is a modified \_\_\_\_\_.
2. Turmeric is a modified \_\_\_\_\_.
3. Cactus is a modified \_\_\_\_\_.
4. Water is carried from roots to leaves by \_\_\_\_\_.
5. Main function of leaf is \_\_\_\_\_.

**Short answered questions:**

1. Why are potatoes not roots?
2. Whether the body of a cactus is stem or leaf- explain.
3. Mention the reasons why leaves are modified.
4. Mention the special functions of stems.
5. What are the reasons of root modifications?

**Multiple choice questions:**

1. In which plant Moniliform roots are found?
  - a. Dahlia
  - b. Mango ginger
  - c. Sweet Potato
  - d. Bitter Gourd
2. Characteristics of Rhizome are –
  - i. Definite nodes and inter nodes.
  - ii. Nodes and internodes are compressed.
  - iii. Stay in horizontal position under the soil.

Which one of the following is correct?

- a. i and ii
- b. i and iii
- c. ii and iii
- d. i, ii and iii

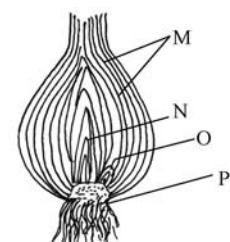
Now follow the **Stem** and answer question number 3 and 4.

**3. Functions of M marked structure –**

- i. Store foods
- ii. Protect axillary buds
- iii. Help in reproduction

Which one of the following is correct:

- a. i and ii
- b. i and iii
- c. ii and iii,
- d. i, ii and iii



4. From which parts of the **Stems** seedlings grow?

- a. M and N
- b. N and O
- c. O and P
- d. M and P

**Creative Questions:**

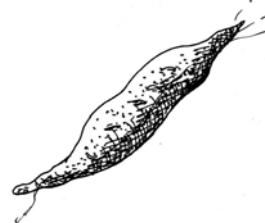
1.



X



Y



Z

- a) What is a bulbil?
- b) How does reproduction occur through leaves in Bryophyllum?
- c) Explain the use of X.
- d) Compare and discuss the characteristics of Y and Z.

2.



M



R



N

- a. What is an offset?
- b. Why pitcher plant is called insect trap?
- c. Explain the necessity of the part M in the first diagram.
- d. Compare the plants R and N.

**Do Yourself:**

Collect Chili plant, grass, a piece of ginger, a piece of turmeric, Oxalis plant, weak stems of arum, cactus and thorn of wood apple. Write down the names of stem nature of these collected plant parts with reasons.

## Chapter Four

# RESPIRATION

Every plant and animal has life. For every physiological function in the body energy is required. In the cytoplasm energy is stored in starch, carbohydrate, protein and fat molecules. In every organic cell for all organic reactions oxygen is essential. Actually the potential energy trapped in food from solar energy is converted to kinetic energy and heat energy by oxygen, is the primary aim of respiration. With this energy organisms take food, move, excrete, grow, reproduce and perform all other physiological activities. Respiration is a kind of burning process where foods are oxidized to release energy.

**After completing this chapter we will be able to –**

- explain the energy producing process,
- describe functions of main parts of respiratory system of animal,
- describe causes and symptoms of diseases of respiratory system,
- compare the processes of photosynthesis and respiration,
- draw the diagrams of main parts of respiratory system.

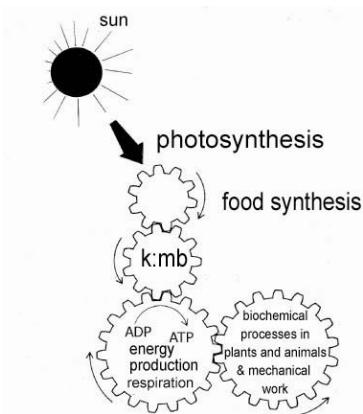


Fig. Energy flow in a cell

### Lesson - 1: Respiratory process

The only aim of respiratory process is to produce energy for performing all physiological functions. Oxygen is used to burn food during respiration in the body of organisms. As a result energy and carbon dioxide is produced. So, respiration is the physico-chemical process where food is oxidized and potential energy stored in food is converted to kinetic energy and heat energy is released in presence or absence of oxygen where carbon dioxide and water is produced.

Respiration is a metabolic process. In this process every organism takes oxygen from atmosphere and releases carbon dioxide. Few lower plants and animals complete respiratory process without the presence of free oxygen. In every case carbon dioxide is released. Respiration is a continuous process that occurs day and night in every living cell of plants and animals.

## Lesson – 2: Respiration in living world

Respiration is an intra cellular metabolic process. This process in living cells of plants and animals is alike. But the process of taking oxygen and releasing carbon dioxide vary in different organisms. In plant body, this exchange of oxygen and carbon dioxide during respiration is comparatively simple. Plants do not have any definite respiratory organ. Oxygen enters inside plant body through stomata, lenticels and inter cellular spaces. Submerged plants take oxygen through entire body surface. Animals respire through different organs in various ways. In lower animals respiration occurs mainly through skin and trachea. Higher animals have special respiratory organs for gaseous exchange. Such as fish and tadpoles perform these activities with the help of gills and higher vertebrates with lungs.

### Proof of energy production in respiration:

Production of energy (heat) can be proved by the following experiment:

**Materials Required:** Two thermos flasks, two thermometers, some germinating gram seeds, water boiled gram seeds and one rubber cork with a hole.

**Experiment:** Put germinating gram seeds in one flask and close it with rubber cork. Push one thermometer through the hole of the rubber cork in such a way that the mercury portion remains within the germinating seeds. Similarly fill up the other flask with water boiled gram seeds. Then place the other thermometer in the flask in similar process. Mercury level in every thermometer is marked and noted.

**Observation:** After few hours the mercury level is changed in the thermometer placed in germinating gram seeds due to release of heat. But in other flask mercury level in thermometer remains unchanged because no heat was released .

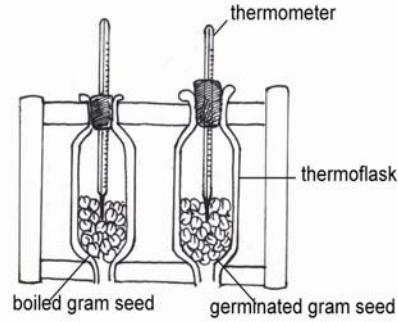


Fig. Experiment of respiration with gram seed

\* Why does the mercury level in thermometer placed in thermos flask with germinating gram seeds raised?

\* What is proved by this?

## Lesson – 3: Respiration in animals

We breathe with the help of nose. What are the gases we get in and release outside during breathing? Plants and animals take oxygen from the atmosphere and release carbon dioxide. This process continues throughout their life. But the process of taking

oxygen and releasing carbon dioxide is different in plants and animals. Plants take oxygen through one type of pores in leaves called stomata. Gaseous exchange occurs through various different organs in lower and higher animals, such as gills, lungs etc. Organs that take part in respiratory process is collectively called respiratory system. Human respiratory system is composed of the following organs:

1. Nostril and nasal cavity
2. Nasopharynx
3. Larynx
4. Trachea
5. Bronchus
6. Bronchiole
7. Alveolus

**1. Nostril and nasal cavity:** Nasal cavity is a triangular shaped cavity placed above the buccal cavity. It runs from nostril to pharynx. A thin membrane separates the two from one another. Its anterior part is covered with hairs and the posterior part by a membrane. The process of taking air through nostril is called **inhalation** and when air contains dusts and germs, the hair and the membrane obstruct them.

**2. Nasopharynx:** Nasopharynx is the last portion of nasal cavity. The air enters the trachea through Nasopharynx.

**3. Larynx:** It is situated at the junction of pharynx and trachea. Larynx has sound producing cords called vocal cord. On the larynx hole there is a lid. It covers the larynx during the intake of food so that food cannot enter the larynx. It opens again during inhalation.

**4. Trachea:** Starting from larynx upto bronchus is the trachea. Through this trachea air enters into lungs.

**5. Bronchus:** The trachea divides into two bronchus from near the lungs and enter into the left and right lungs. They are called right and left bronchus (plu. bronchi). After entering the lungs these branches again divide into innumerable branches. They are termed as bronchioles.

The structure of a bronchus is like trachea.

**6. Lungs:** There are two lungs on two sides of the heart inside the chest cavity. It is soft like sponge. The right lung is a bit larger than the left one. Lungs are covered with two fold membranes, called pleura. In between pleural folds, some slimy substances are present. So it prevents friction with chest wall. Bronchus branches profusely enter the lungs. These small bronchioles enter into air cells or sacks. Each air



Fig. Nostril and nasal cavity

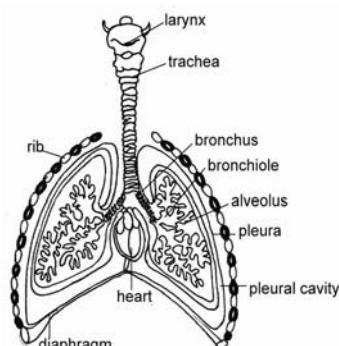


Fig. Human respiratory system

sack is made of epithelial cells. These cells are surrounded by capillary vessels. When air enters into these cells, they swell up like balloon and then automatically shrinks. Walls of air sacks and capillary vessels are so thin that air can pass through them easily.

**7. Diaphragm:** The muscular layer that separates abdominal cavity and chest cavity is the Diaphragm. It looks like an open umbrella. When diaphragm shrinks, it goes down and the area of chest cavity increases. When it expands, it goes up and the chest cavity shrinks. Breathing function is done due to expansion and contraction of the diaphragm.

**Do yourself:** Draw a labeled diagram from the chart and describe the functions of lungs.

**New words:** Trachea, Air sack, Larynx, Bronchioles, Bronchus .

### Lesson 4-6: Respiratory process

We inhale air through nostrils. We term this as respiration. This is a wrong concept. Our chest continuously expands and shrinks and takes oxygen and drives out carbon dioxide like balloons. As a result the area of the lungs increases and decreases in volume. Lungs continuously expand and shrink to inhale oxygen and exhale carbon dioxide. This is called breathing. This is one step of respiration. Respiration is divided into two types, such as 1. External respiration and 2. Internal respiration.

1. **External respiration:** The process where gaseous exchange occurs through lungs is external respiration. In this process exchange of oxygen and carbon dioxide occurs between lung and capillary vessels. External respiration is completed in two steps such as:

- i) **Inhalation:** We take in oxygenated air from the atmosphere. It is called inhalation. During this process muscles in between diaphragm and chest cavity shrinks.
- ii) **Exhalation:** After inhalation exhalation phase starts. In this stage muscles of diaphragm and chest cavity relax and squeezes. As a result, area of lungs becomes small. The air and carbon dioxide from the alveoli transported through bronchus and trachea, are expelled outside through nostril.

**Do Yourself:** Observe the breathing of your classmates. Try to do this pressing hard the diaphragm. What happened? Why? Explain.

2. **Internal respiration:** Oxygen that enters the blood of the lung moves with the blood to distant capillary vessels and hence the internal respiration starts. Oxygen reaches the inter cellular juice through the walls of capillary vessels. Oxygen from this oxygen carrying juice enters into the cells where they react with food and produce energy.

**Transportation of Oxygen:** Oxygen from alveoli of lungs enter blood vessels. Red blood cells of blood contain haemoglobin pigment. Oxygen is loosely bonded with this haemoglobin. In this way haemoglobin pigment takes part in oxygen transportation.

**Transportation of Carbon Dioxide:** Carbon Dioxide mainly remain in soluble condition in blood plasma and reaches the lungs through veins.

**New Words:** External respiration, Internal respiration, Inhale and Exhale.

Flowchart of Respiratory system is given below:

Nostril → Nasal passage → Nasopharynx → Trachea →  
Bronchus → Branchiole → Alveoli or Air Sac

**Do Yourself:**

Stand up and sit down or run for some time. Count your breathing. You'll find that the breathing rate will be higher than in resting state. Count breathing per minute of your sister and brother.

## Lesson - 7: Common disease of respiratory tract

Mr. Hakim is suffering from Tuberculosis. Profullo Babu is suffering from Asthma. Small baby Bikash is attacked with pneumonia. What are the causes of these diseases? What precautions should they take to avoid these diseases? What are the remedies of these diseases? Certain portion of these diseases could be prevented if cause, symptoms, remedy and preventive measures of these diseases are known.

**Tuberculosis:**

Tuberculosis is a well known infectious disease. This disease is easily transmitted. Persons who are weak, do hard physical labour and live in unhygienic environment and suffer from malnutrition or live with tuberculosis patients are liable to suffer from this disease.

**Cause:** One type of bacteria is responsible for this disease.

**Symptoms:**

- Body weight is gradually lost and the patient becomes weak.
- Occasional cough with bleeding.
- Fever in the evening and sweat at night.
- Pain in the chest and back, occasional stomach disorder.

**Remedy:**

- The patient should be given nutritious food.
- According to the advice of a physician treatment should be started quickly.  
Long treatment is needed and should be continued till complete cure.
- Treatment must not be discontinued without the advice of a physician.

**Prevention:**

- Preventive measure for Tuberculosis is BCG Vaccine. New born baby should be vaccinated within one year.
- The new born baby should be vaccinated as soon as possible.
- Tuberculosis patient should be kept separately. Best suggestion is to send the patient to the hospital. It ensures proper treatment.
- Cough and spit of the patient should be buried under the soil because they contain large number of germs.
- Mouth should be covered with handkerchief when coughing and sneezing.
- Children should not be allowed to go to tuberculosis patient.

**Pneumonia:**

It is a disease of the lung. Severe cold attack is responsible for this disease. After measles and bronchitis a patient may be attacked with pneumonia if the patient catches cold severely. It is a fatal disease for children.

**Cause:** The disease mainly caused by infection with one type of bacteria.

**Symptoms:** Patients suffer from Cough and breathing difficulties. The nostril becomes wider during inhalation. High fever with feelings of constant pain in the chest.

**Remedy:** Immediate advice of the physician is to be taken. Food and medicine according to the advice of the physician should be given. More and more water and liquid food (Soup, fruit juice) should be given. The patient should be given nutritious food.

**Preventions:** When children are attacked with measles or bronchitis, more care should be taken.

**Bronchitis:**

Tracheal infection is called bronchitis. Unhygienic environment, dusty weather, catching cold and smoking may cause this disease.

**Cause:** One type of virus is responsible for this disease.

**Symptoms:** Cough with respiratory trouble, often cough comes out. The patient suffers from fever and gradually becomes weak.

**Remedy:** Stopping smoking. Treatment according to doctor's advice.

**Asthma:**

Asthma is not an infectious or contagious disease.

**Cause:** The cause of this disease may be some food, dusts in the air or pollen grains when inhaled. In children cough and cold is the main cause of this disease.

**Exception:** In certain seasons or at the time of season change abundance of the disease is marked.

**Symptoms:** Suddenly breathing trouble shoots up. Sometimes breathing is about to stop. The patient tries to breathe forcibly. The alveoli of the lung do not get proper supply of oxygen or the supply is blocked. As a result the patient is in trouble. During inhalation skin in between ribs is pushed in. Sometimes white colored cough comes out with cough but no fever. The patient cannot take hard food and sometimes the patient vomits and become weak.

**Remedy:** The patient should live in a well ventilated and well lighted house. Avoiding eating foods and coming in contact with things such as woolen clothes that can intensify the disease. Follow doctor's advice and avoid dust and smokes. Give up the habit of smoking. Taking medicine relieves respiratory trouble but it is not cured fully. It is necessary for the patient to carry respiratory trouble relieving medicine with them.

**LESSON - 8:**

You have learned about photosynthesis while reading in class six. Complete the following work:

**Work:** Write down the point of differences between photosynthesis and respiration and present on a poster paper.

What we have learned from this chapter:

Respiration is indispensable for energy.

**Stomata and guard cells:** Guard cells help opening and closing of stomata. Guard cells contain chlorophyll. At day time photosynthesis occurs in guard cells and as a result stomata opens. Respiration is essential for organisms.

**External respiration :** Oxygen enters capillary vessels from the alveoli of the lungs and carbon dioxide comes from blood to alveoli. This gaseous exchange of the lungs is called external respiration. Inhalation and exhalation is included in external respiration.

**Internal respiration:** Inside mitochondria within cell oxygen acts on food in some enzyme controlled reactions. Internal respiration goes like this.

**Lymph:** It is a transparent mild alkali. It is a special modified tissue fluid.

## EXERCISE

**Fill in the blanks:**

1. In \_\_\_\_\_ food is produced but in \_\_\_\_\_ food is oxidized.
2. \_\_\_\_\_ is called the power house of a cell.
3. Lung is composed of a large number of \_\_\_\_\_ .
4. \_\_\_\_\_ is an infectious disease.
5. Respiration is a \_\_\_\_\_ process.

**Short answered questions:**

1. What is internal respiration?
2. What are the causes and symptoms of pneumonia?
3. Mention the necessity of respiration.
4. Mention the function of alveoli.
5. Explain respiration in plants and animals.

**Multiple choice questions:**

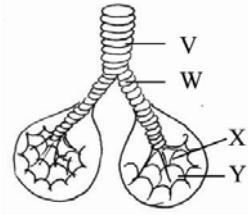
1. Which one is not a part of respiratory system?  
a. Skin                      b. Lenticel  
c. Guard Cell              d. Stomata
2. Lower animals respire with the help of –  
i. gills and skin    ii. skin and trachea    iii. lungs and gills

Which one of the following is correct:

- a. i                          b. ii  
c. i and ii                  d. i and iii

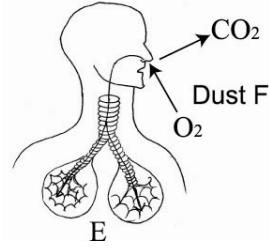
See the **Stem** and answer question numbers 3, 4 and 5:

3. What is the name of 'W' labeled part:  
a. Alveolus b. Bronchus c. Bronchiole d. Trachea
4. In which part of the stem exchange of O<sub>2</sub> and CO<sub>2</sub> occur?  
a. V b. W c. X d. Y
5. Name the disease produced by the infection of part 'V'  
a. Asthma b. Bronchitis c. Pneumonia d. Tuberculosis

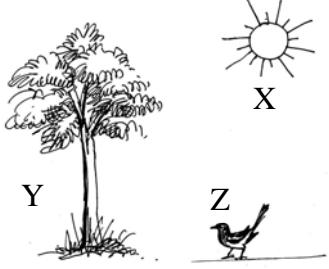


#### Creative Questions:

1.
  - a. What is pleura?
  - b. Pneumonia is a fatal disease – Explain.
  - c. Explain the process shown in the diagram.
  - d. Analyze the remedies of the problem created when 'F' substance enters 'E' part.



2.
  - a. What is respiration?
  - b. How does stomata help in respiration? Explain.
  - c. Which one of 'Y' and 'Z' utilizes product of 'X'.
  - d. For gaseous exchange how 'Y' and 'Z' are inter dependent on each other. Write with arguments.



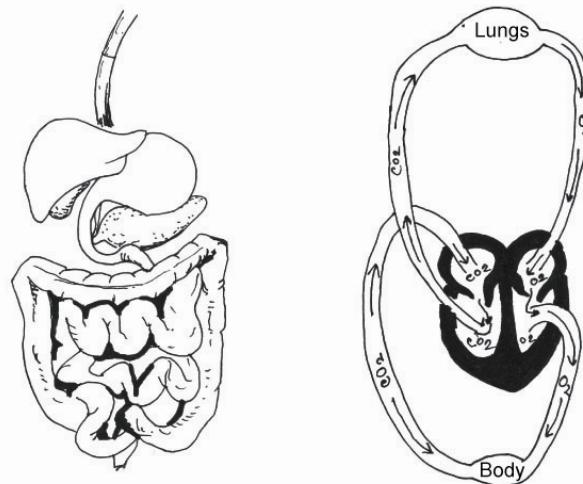
#### Do Yourself:

1. Draw a diagram of respiratory system and label it. Discuss the importance of lungs in respiration.

## **Chapter Five** **DIGESTIVE SYSTEM** **AND BLOOD CIRCULATION SYSTEM**

The foods that we take are mostly complex foods. These complex foods cannot be utilized directly by our body. The process by which complex and insoluble foods are changed into absorbable, soluble and liquid form of food with the help of specific enzymes, is called digestion. The system that takes part in digestion is called digestive system.

Cell is the smallest unit of physiological functions. Every cell needs food and oxygen to remain alive. Few useless and harmful substances are produced during metabolic activities. The removal of such substances is very much essential. So inter-relationship of different systems is necessary. Blood circulation system performs this function.



**After completion of this chapter we shall be able –**

- to explain the functions of major organs of digestive system with a flow chart,
- to explain the role of enzymes in digestion of food,
- to explain the functions of digestive system,
- to describe the causes and symptoms of diseases of digestive tract,
- to explain remedy and preventive measures of the diseases of digestive system,
- to become aware and make other members of the family aware about these diseases of digestive system,
- to draw diagrams of main parts of digestive system,
- to explain the functions of blood and blood cells,
- to explain the functions of a heart,
- to explain the ways of keeping heart healthy.

## Lesson – 1: Digestion of food

Food is necessary to remain alive. What are the foods that we take? Why do we take food? Let us try to understand them through following questions and answers:

- a) What are the necessities of food in our body?
- b) What are the main three types of foods?
- c) How do three types of foods meet our physical demand?
- d) What are the necessities of vitamins and mineral salts?
- e) Why are indigestible fibrous foods necessary? In what type of foods are they found?

You have learnt answers of these questions in class VI, chapter no 13. We will know about the changes of food that occur in our body. We take food through our mouth. After swallowing we don't see the food. After few hours food is digested and converted into simple ingredients that the body can absorbs. Undigested and useless materials are expelled as fecal matter. We do not have any control on the changes that occurred inside the body. In a healthy body these jobs are done in usual course. We can see only taking of food through mouth and expelling fecal matter through anus. What changes happen to the foods in between these two activities?

The group of organs that take part in bringing these changes are called digestive system. The digestion of food that we take starts from the buccal cavity. What changes happen in the buccal cavity that we can observe by performing the following experiment.

**Work:** This experiment needs two students. Put toast biscuits or dry bread (boiled potatoes or rice) into the mouth of one student and tell him to chew for some time and to keep it inside the mouth without swallowing. Ask the other student to observe the activities. Then the second student will repeat the same activities and the first student will observe the activities of the first student. Now both of them will jointly answer the following questions.

- a) Which parts of buccal cavity moved while chewing foods?
- b) Did the dry bread show changes while inside the mouth?
- c) After chewing did any change occur in taste?
- d) What types of food constituents are there in bread and biscuits?
- e) Which parts of your body moved during swallowing foods?
- f) After swallowing where do the foods go? Observe how it moves.

**New Words:** Digestion, food component.

## Lesson – 2: Saliva and enzymes

You like sweets very much and one plate of Rasogolla (sweetmeat) kept in front of you. Could you feel any change in your mouth? Could you feel presence of some liquid substances like water inside your mouth? Wash your right hand carefully with soap. Take some fluid from your tongue with your clean figure. What is its color ?

Let us compare the following with what we have learned from the above experiment. We take food through our mouth. We start chewing with teeth after taken it inside the mouth. The tongue stir the food so that it is chewed well. The food mixes up with saliva inside buccal cavity. Saliva is a colorless fluid. Saliva is secreted from the salivary gland situated at the back side of the tongue. Saliva has a special role in digestion. It makes food slippery and help to swallow. Saliva contains one type of enzyme. May be you are thinking what the enzyme is?

- Such a material that mixes with food helps the reaction but does not take part in it and remains unchanged.
- The enzymes work well up to a certain temperature.
- Enzymes perform definite and specific functions such as Tripsin acts only on proteins.

Enzyme present in saliva turns starch into sugar (maltose). For this reason, when carbohydrates are chewed and kept inside the mouth it tastes sweet. Tongue helps us to swallow food materials. From the last portion of the mouth two pipes grow inside the body. This pipe like structure through which food materials reach the stomach is the oesophagus. Food and water reach the stomach through this pipe line.

How the foods get into the stomach?

### Do Your Self:

Take one marble and a piece of rubber pipe. Take care that the size of the marble is not bigger than the girth of the pipe. Push the marble into the pipe. Now press at the back side of the marble. It will move forward through the pipe. Similarly food moves forward through the oesophagus. The oesophagus has ring like muscles. These muscles expand and contract. Muscles posterior to food material contract and muscle anterior to food expands. This expansion and contraction is called peristalsis. As a result, food materials gradually reach the stomach.

**New Words:** Peristalsis, Oesophagus, Enzyme

### LESSON : 3 – 5: DIGESTIVE SYSTEM

We know food is essential to remain alive. We take complex foods. We have already known that complex foods cannot be accepted by the cells directly. So, complex foods need to be converted to simple foods and water through complex chemical processes. It is known as digestion of food. To complete digestive process a number of organs form the digestive system along with few glands secreting digestive juice and enzymes. The digestive system is constituted with mouth, buccal cavity, oesophagus, stomach, small intestine and large intestine. Besides, three glands are there who secrete digestive juice and enzymes, such as stomach glands, pancreas and liver. Moreover few small glands in the inner walls of stomach and small intestine secrete digestive juice and enzymes. Our digestive system extends from buccal cavity to anus. Following are the descriptions of different organs of digestive system:

- Mouth:** From the mouth the digestive tract begins. On the upper side of the mouth is upper lip and on the lower side is the lower lip. Through opening and closing of these lips we control taking of foods. Foods enter into the buccal cavity through this opening.
- Buccal cavity:** Next to mouth is the buccal cavity. The buccal cavity is surrounded by two jaws and teeth on the front side. Above this is palate and beneath it is muscular tongue. Moreover there are three pairs of salivary glands on two sides. Teeth cut food materials and help grinding them. At this stage the tongue feels the taste of food and repeatedly send food under tooth for chewing. Saliva from salivary glands make foods slimy and help to swallow. Saliva contains one type of enzyme that partially breaks down starchy food and convert it to sugar. Number of permanent tooth is 32 having 16 in each jaw. Teeth are of four types, such as – Incisor teeth that cut food particles into small pieces. Canine teeth cut and tear hard parts like meat. Premolar teeth chew and grind food materials. Molar teeth help chewing and grinding of food substances. Besides, after growing other teeth, the wisdom teeth grow.
- Pharynx:** Next to buccal cavity is the pharynx through which food materials move from buccal cavity to oesophagus.
- Oesophagus:** Its location is in between pharynx and stomach. Food materials pass through it from pharynx to stomach.

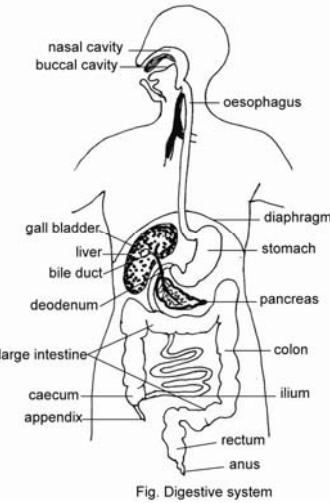


Fig. Digestive system

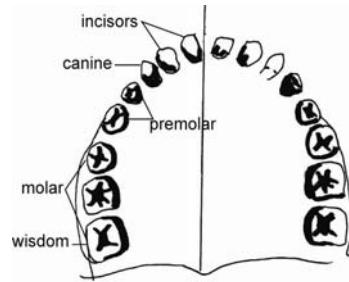


Fig. Types of teeth

5. **Stomach:** Its location is in between oesophagus and small intestine. Due to peristaltic movement of pharynx and oesophagus slimy foods are stored here. Shape of stomach is like a bag. Its wall is thick and muscular. First and last part of stomach contains muscular rims. On the stomach wall large number of gastric glands are found. The food temporarily stays here. Digestive juices from gastric glands help in digestion.
6. **Small Intestine:** It is the next part which is the longest part of digestive tract. Small intestine is divided into three parts, such as –
  - a) **Duodenum:** This is the first part of small intestine. Next part of small intestine looks like ‘U’. Bile from gall bladder and pancreatic juice from pancreas comes here through ducts and mixes up with food. These juice also participates in digestion. Here digestion of proteins, carbohydrates and lipids occur.
  - b) **Jejunum:** It is the part in between duodenum and ileum.
  - c) **Ileum:** This is the last part of small intestine. In inner walls of ileum there is a absorption zone. There are finger like projections in the wall to perform the function of absorption through different processes. They are called villi. After digestion the essential parts of food is absorbed by villi surface.
7. **Large intestine:** Large intestine starts just after the small intestine. It extends from ileum to anus. At the joining point of small intestine and large intestine, there is a valve. It is smaller than small intestine in length but its inner diameter is greater than the inner diameter of small intestine. Large intestine is divided into three parts, such as – a) Caecum b) Colon &
  - c) Rectum .

Rectum is the last part of large intestine. It looks like a bag. Undigested parts of foods are deposited here.
8. **Anus:** Anus is the last part of digestive system. The digestive canal opens outside through this part.

#### **Digestive Glands and their Functions:**

When secretions of any gland outside the digestive canal participate in digestion the glands are called digestive glands. You have already learned that salivary gland, liver and pancreas are digestive glands. Salivary glands secrete saliva. Saliva contains enzyme and water. Water makes food soft. The enzyme in saliva is ptyalin.

**Liver:** Largest gland of the body is liver. Bile is produced in liver. Bile is stored in gall bladder. During digestion bile through bile ducts comes to help in digestion of fats and oils.

**Pancreas:** Mainly three enzymes are produced in pancreas, such as – amylase, tripsin, chymotripsin and lipase.

Tripsin and chymotripsin help in digesting proteins, lipase helps digesting fats and oils and amylase helps digesting carbohydrates.

**Gastric Glands:** Gastric glands are found in interior walls of stomach. Juice secreted by these glands are called digestive or gastric juice.

**Intestinal Glands:** Villi of small intestine contain a larger number of glands. These are called intestinal glands. The juice secreted by these glands is intestinal juice.

**Large Intestine:** No digestion happens in large intestine. Here no digestive juice or enzymes are produced. Large intestine mainly absorbs water from the food. This function is very essential. It helps expulsion of excess water from the body.

Undigested part of food is stored in rectum and expels outside the body through the anus when necessary.

**New Words:** Stomach, Pancreas, Liver, Tripsin, Amylase, Lipase.

### Lesson– 6: Common disease and their remedy

1. **Gastritis:** Usually taking too much spicy and oily foods and taking meals irregularly, result in burning in the chest due to secretion of extra acids. It causes burning and bad feeling inside the belly or the chest. Burning sensation is felt in throat and pain in the stomach including other symptoms also crop up. If timely treatment is not done, ulcer may form in the stomach and intestine. It is called gastric ulcer. This disease can be prevented by taking meals timely and avoiding too much spicy foods.
2. **Dysentery:** Dysentery is a well known disease in our country. It is of two types, such as –
  - a) **Amoebic dysentery:** When *Entamoeba*, a unicellular organism entering human intestine, creates diseases like this. The symptoms of this disease are - pain in the abdomen and mucous or bleeding with stool.  
Drinking water from tube well or boiled water, taking care so that water and vegetables are not contaminated and saving food stuffs from flies and cockroaches are the measures that can prevent infection of this disease. But the infected patients should seek doctors' advice and take proper medicine as a remedy.
  - b) **Bacillary dysentery:** When *Shigella* bacteria attacks, intestine causes this type of dysentery. This germ attacks epithelial layer of large intestine. As a result repeated defecation with stool mixed with mucous. Occasional bleeding occurs. So it is called blood dysentery. One should not neglect this disease. Treatment according to doctor's advice is essential. This disease can be prevented when one follows the general health tips.
3. **Constipation:** Actually constipation is not a disease. Constipation has various causes. Such as – slow movement of food through intestine, not taking green fruits and vegetables, not going for defecation when feeling for defecation comes etc. Making habits of clearing bowels regularly, taking vegetables, fruits and foods containing dietary fibres can remove these difficulties.

**Work:** Students will write names of diseases of digestive system. They will write in groups the causes of these diseases. One from every group will present their findings and other will compare with their own notebooks.

### Care of Digestive system:

1. **Tooth:** Teeth should be brushed and cleaned after every meal. Food particles that stick to the teeth gaps get rotten and spread bad breath. It causes tooth caries. One should not take too much sweets. Sweets are responsible for tooth caries.
2. **Food:** Foods should be clean and boiled properly. Stale and rotten foods should not be taken. One should cut nails regularly. Plates and other crockery and hands should be cleaned before taking meals.
3. **Taking Food:** Meals should be taken in time. Do not eat much. Always take balanced food. Drink sufficient water after sometime of taking meals. Always drink boiled water after cooling. Take food chewing slowly. One should not take much spicy and oily foods.

**New Words:** Constipation, Bacillary dysentery, Amoebic dysentery.

### Lesson :7-8: Blood circulatory system

Transportation of blood is called blood circulatory process. Circulatory system in human body is constituted with blood, heart, artery, vein, lymph and lymph ducts. The system through which blood is circulated in the body is the blood circulatory system. Blood circulatory system includes heart, blood and blood vessels.

#### Blood and its constituents:

You have seen slaughtering of hen, cow or goat. During slaughtering blood comes out in a spout. What is the color of blood? What type of substance the blood is? Blood is a deep red fluid. It is a liquid connective tissue. Its taste is alkaline. Blood contains two constituent materials, such as-

1. Plasma
2. Blood corpuscles

**1. Plasma:** Plasma is the liquid part of blood. Normally 55 percent of blood is plasma. It contains protein, salts and food substances absorbed from the intestine. Blood cells float in plasma. It contains fibrinogen that helps in clotting of blood.

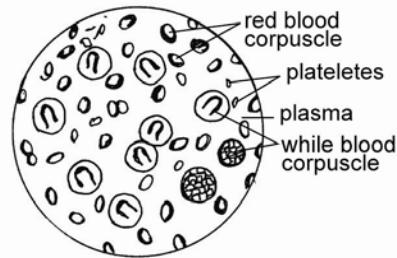


Fig. Constituents of blood

#### Functions of blood plasma:

1. Blood plasma carries oxygen, food substances to different parts of the body
2. It carries harmful substances (such as carbon dioxide, urea, uric acid etc.) from all over the body and expels them through different excretory organs.

**2. Blood Corpuscles:** In blood there are three types of blood cells, such as-

- a. Red blood corpuscles
  - b. White blood corpuscles
  - c. Platelets
- a. **Red Blood corpuscles:** Blood looks red due to red cells. It contains one pigment called haemoglobin. Oxygen mixed with haemoglobin reaches every cell of the body. Red blood cell is biconcave (both the surfaces are curved inward). It is a round disk like cell. There is no nucleus in human red blood corpuscles. It is produced in bone marrow.
  - b. **White blood corpuscles:** White blood corpuscles are a bit larger in size and irregular in shape. They contain nucleus. They are produced in spleen and bone marrow. They kill germs that enter into the body. It acts as a security guard of the body. They can be compared with soldiers.
  - c. **Platelets:** It looks like a circular or round structure. They are smaller than red blood corpuscles. They do not contain any nucleus. They stay in clusters. They are produced in red bone marrow. In case of bleeding from the wound, it helps in clotting of the blood.

### **FUNCTIONS OF BLOOD:**

Blood is an essential constituent of our body. It has various functions such as –

1. **Transportation of food:** Foods that we take are converted to simple foods and get mixed up with blood. Food extracts are carried to different parts of our body by blood. The body cells are nourished by this way.
2. **Transportation of Oxygen:** Oxygen is necessary for every activity of the body. Organic cells cannot survive without oxygen. So oxygen along with food is to be supplied to them. Haemoglobin of red blood cells takes oxygen from the lungs and carry them as Oxy-hemoglobin to every cell.
3. **Carbon dioxide exchange:** Blood plasma carries carbon dioxide from cells of different organs to the lungs.
4. **Expulsion of waste materials:** Blood helps expulsion of nitrogenous waste products.
5. **Prevention of diseases:** When germs infect the body, white blood cells kill them as preventive measures.
6. **Transportation of hormones:** Ductless glands of the body produce hormones. Bloods transport hormones to different parts of the body.
7. **Control of temperature:** Blood carry temperature of different parts and maintains temperature equilibrium of the whole body.
8. **Clotting of blood:** If any part of the body gets cut, bleeding occurs. Platelets help clotting of blood. As a result bleeding stops.

**New Words:** Red blood cell, white blood cell, platelet, plasma, hormone, ductless glands

## Lesson : 9 – 10: Blood vessels

On the upper side of your palm you can see one type of blue coloured vessels. These are veins. Veins are one type of blood vessels. What is a blood vessel? Vessel through which blood flows is called blood vessel. Our body has three types of blood vessels, such as:

- a) Artery
- b) Vein and
- c) Blood capillary

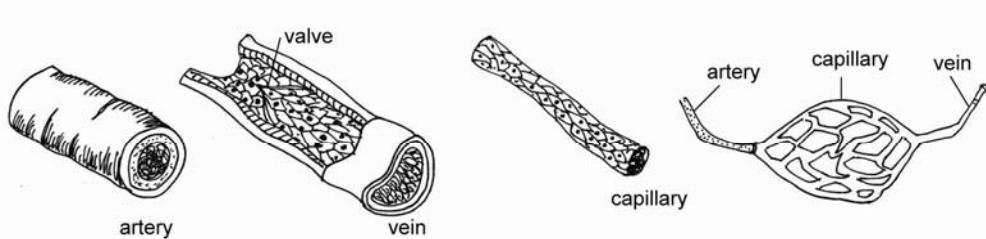


Fig. Artery, vein & capillary

- a) **Arteries:** Blood carrying vessels originating from the heart those carry blood to different parts of the body. They are placed at the inner side of the body. Their wall is thick with small cavity and without any valve. Artery transports oxygenated blood.
- b) **Veins:** Vessels through which blood from all over the body come back to the heart are the veins. Its walls are comparatively thin. Its cavity is large with valves inside. Veins originate from the capillary network. With few exceptions veins carry deoxygenated bloods (with carbon dioxide).
- c) **Capillaries:** Artery divides into branches and branchlets and ultimately produces very fine tubes. These are called the capillaries or capillary network. Veins originate from capillaries. The walls of the capillaries are thin and composed of only one celled thick epithelial layer. Capillaries stay surrounding the body cells.

Do Yourself: Fill up the following table and find out the differences between artery and vein		
Origin	Artery	Vein
Valves		
Cavity		
Wall		
Quantity of oxygen		
Quantity of carbon dioxide		

### **Heart:**

Heart is a conical shaped organ situated in between two lobes of lung at the left side of the chest cavity. It is covered with two layered thin membranes, called pericardium. Heart is composed of heart muscles. Heart muscles are independent involuntary muscles, capable of expanding and contracting without other's control. Heart expands and contracts on average 72 times in every minute. Keep your hand at the midpoint of your chest. Could you feel any rhythmic beat? Why does it happen like this? It is due to expansion and contraction of the heart. This is heart beat.

**Do Yourself:** Count your friend's heart beat with the help of your watch.

Heart is composed of three layers, such as –

- a) Outer layer or Pericardium
  - b) Middle layer or Myocardium
  - c) Inner layer or Endocardium.
- Myocardium is the thickest among the layers. Its contraction pumps blood for circulation.

Heart is a four chambered hollow organ. Upper two chambers of the heart are right and left atrium. Lower two chambers are right and left ventricles. Walls of atria are thin and that of ventricle are thick. Atria and ventricles are separated by two walls. Atria are smaller in size than the ventricles. In between right auricle and right ventricle there is atrio-ventricular aperture. That aperture has valves. Blood can enter ventricles through these apertures. Similarly valves are present in between left atrium and left ventricle. Here also blood from left atrium can enter left ventricle only. Besides, Aorta-and left ventricle joint and pulmonary artery and right ventricle joint have similar valves. These valves control the direction of one way blood flow.

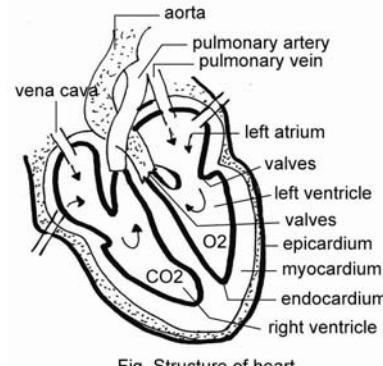


Fig. Structure of heart

**Do yourself:** Once Sagar's father was ill. Sagar's elder brother is a physician. He placed his hand on his father's wrist and was looking at the watch. Sagar noticed it. At night he asked his elder brother that what he was examining placing his hand on father's wrist. What is the name of the vessels on the upper side of the hand? Elder brother told that he was examining father's pulse. What is pulse? Beats created in the artery by alternate expansion and contraction of heart is known as pulse. Artery remains in interior side while veins are on the upper surface of the body. Now you examine your friend's pulse. Observe veins of his hands. Your friend will examine your pulse. Now you run in your school field for five minutes. Tell your friend to examine your pulse. Do you find any change? Physical labor increases expansion and contraction of the heart that enhances the pulse rate.

**Blood Circulation through Heart:**

Heart is formed by a special type of involuntary muscle called cardiac muscle. When the heart contracts, blood from the heart flows through artery to different parts of the body. When the heart expands, blood from different parts rush to the heart through vein. In this way blood flows from the heart to the different parts of the body and comes back to the heart when heart contracts and expands.

**New words:** Valve, artery, vein, capillary, atrium, ventricle.

**LESSON 11 - 12: HEART DISEASES**

Mr. Aman is a bank employee. He has a medium fatty body. He likes to eat fatty fish and meat and oily foods. He is a smoker. He works continuously from morning to night. With mental labor he smokes too much. He scarcely goes for walks or takes any physical exercise. One day returning from the office suddenly he felt pain on the left side of his chest. Soon this pain became serious. He lost his sense. His wife rushed him to a hospital. After examining him, the doctor told that Mr. Aman is suffering from heart diseases. Now tell what are the causes of heart diseases.

**Causes of Heart Diseases:** We have come to know about the causes of heart diseases from the above stanza. These are :

- Taking too much fatty and oily foods.
- Taking no balanced foods.
- Too much smoking.
- Excessive mental labour.
- Not taking part in games, movements , walking or physical exercises etc.

**Preventive measures against heart diseases:**

1. Avoid taking high protein and starchy food.
2. Develop the habit of doing regular physical labour, such as playing, walking, physical exercise.
3. Taking balanced foods regularly.
4. Give up the habit of smoking.
5. Try to avoid too much heavy mental labor, too much mental pressure and remain anxiety free.
6. Develop the habit of taking fresh fruits and vegetables.
7. Not allowing body weight to increase much. Overweight enhance blood pressure of the heart. As a result heart is affected.

**Do yourself:** Draw a labeled diagram of heart. Show the path way of blood flow in the heart. Make a chart showing how awareness about heart disease can be created.

**What we have learnt from this chapter:**

**Artery:** Originating from the heart, artery transports usually oxygenated blood to all parts of the body. But pulmonary artery is the exception. This artery carries deoxygenated blood to the lungs.

**Vein:** Originating from different parts of the body, veins carry deoxygenated blood from all over the body to the heart. But the pulmonary vein is the exception. Oxygenated blood comes to the left atrium through pulmonary vein.

**Red Blood cell:** Hemoglobin pigment is present in the red blood cells. Haemoglobin mixing with oxygen produces Oxyhaemoglobin.

**Platelets:** Platelets help blood to clot.

## **EXERCISE**

**Fill in the gaps:**

1. Enzymes help in \_\_\_\_\_.
2. \_\_\_\_\_ foods when digested are converted into amino acids.
3. In red blood cells \_\_\_\_\_, a type of pigment is present.
4. \_\_\_\_\_ helps in blood clotting.
5. \_\_\_\_\_ functions as security guard of the body.

**Short answered questions:**

1. Where and how digested foods are absorbed?
2. Explain the necessity of cleaning teeth.
3. Describe how foods move from the mouth to stomach.
4. Explain the importance of blood cells in your body.
5. What functions do the blood vessels perform in our body?

**Multiple Choice Questions :**

1. Which one is the largest gland of the body?  
a. Pancreas                  b. Intestinal glands  
c. Gastric gland              d. Liver
2. Which one is available in saliva?  
a. Ptyalin and water        b. Tripsin and water  
c. Lipase and water         d. Pepsin and water

**Follow the Stem answer question nos. 3,4,5**

3. Nucleus is absent in-

- i. M, N
- ii. N,O
- iii. O, M

Which one of the following is correct?

- a. i
- b. ii
- c. i and ii
- d. i and iii

4. Function of **P** is to—

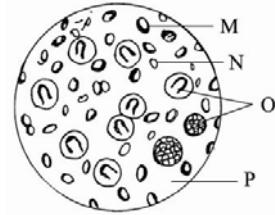
- i. carry food extracts
- ii. act as security guard
- iii. help expulsion of wastes

Which one of the following is correct?

- a. i and ii
- b. i and iii
- c. ii and iii
- d. i, ii and iii

5. Which one of the following helps blood to clot?

- a. M
- b. N
- c. O
- d. P

**Creative Questions:**

1.

- a. What is villus?
- b. Why should one brush teeth after taking foods? Explain.
- c. What are the functions of Y-marked part?
- d. When Z-marked part is damaged, what are the problems arise in human body?



2.

- a. What is Pericardium?
- b. What does the word Lipase mean? Explain.
- c. Explain arrow marked pathway of transportation of blood in the Stem.
- d. Write with reasons why should we take care of the organ in the Stem to keep it healthy .

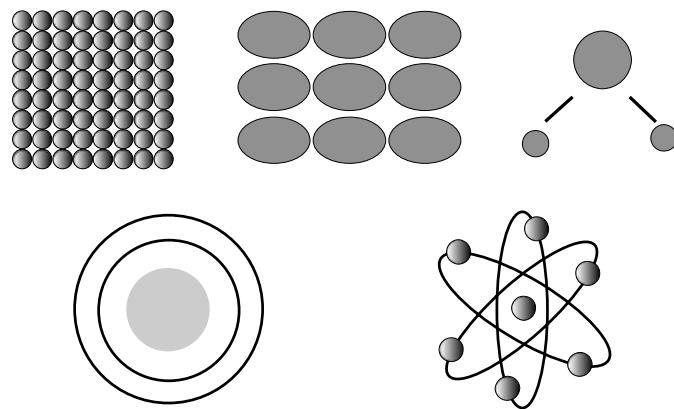
**Do yourself:**

1. How would you examine your friend's pulse? Examine your friend's pulse after physical exercise. Can you find any change ? Explain the causes of these changes.
2. In a group, prepare a chart of the human digestive system and write down the functions against each organ giving reasons.

## Chapter Six

# Structure of Matter

In different spheres of our daily life we use or keep in touch with various types of objects or matters like air, water, iron, foods, books, chalk etc. Some of them are elements, some are compounds and some of them are mixture of various matters. Do you know exactly by what a matter is composed of or what the structures of those matter are and how they are made of ?



### By the end of this chapter we will be able to

- explain the structure of matter.
- differentiate between atom and molecule.
- differentiate among elements, compounds and mixtures.
- identify the selected elements and compounds by using symbol and formula.
- describe the initial concept of periodic table.
- demonstrate the use of water as universal solvent.
- prepare compounds from elements using an experiment.

## LESSON 1- 2: STRUCTURE OF MATTER

In our surrounding we can see different types of matter that we use in various works. Just after waking up in the morning, we use water to wash our face and hands. This water is a matter. Similarly chalk, sugar, salt, iron, copper etc all are matters. Though all of them are matters, they are not made of same components.

### What is the reason of the variation of matter?

The reason of variation in matter is its structure. As the structure of matters is different from one another, they look different. Their properties become different as well. For that reason they are used in different works according to their properties.

Now let us take a look at the structures of some of our widely used matters. Let us talk about iron and copper first. What is the structure of iron? The iron we use in various works are mainly made of some small iron particles mainly. This is similar to copper. Copper is made of some small particles of copper. If we break iron, we will find some small particles of iron only. That means iron consists of only one component. Likewise, only some small particles of copper will be found by breaking copper and it consists of only one component as well.

The matters that are made of only one component like iron and copper is called Element.

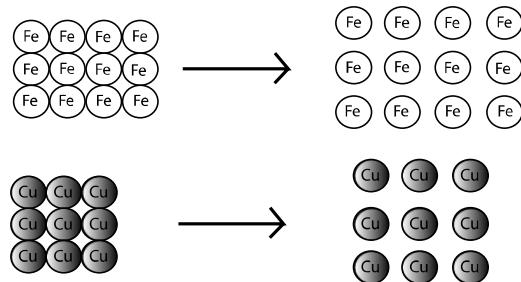


Fig: Iron and Copper.

Like iron and copper, our well known hydrogen and oxygen are also made of only one component and they are elements as well.

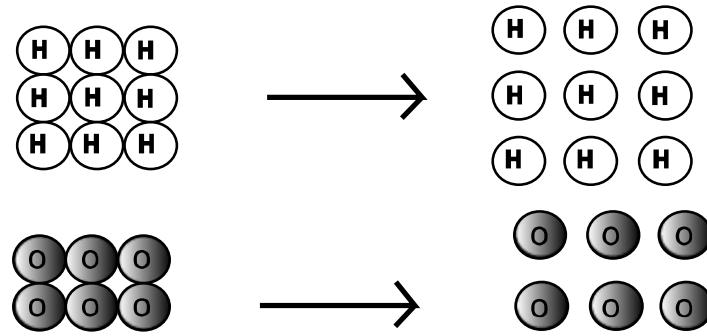


Fig: Hydrogen and Oxygen.

On the other hand, salt and sugar are the two most essential matters of our daily life. Salt is a matter which is made of two different components named sodium and chloride; its chemical name is Sodium Chloride. Sugar is made of three different components named carbon, hydrogen and oxygen, whose chemical name is Glucose.

The matter that is made of more than one component of different properties like salt and sugar is called Compounds.

If we start to break salt or sodium chloride, the large particles of salt will turn to small particles, that small particles will become smaller and then smallest, it will no longer be seen with bare eyes. Though it is a small molecule of salt, there is one sodium chloride in it. Sodium and chlorine will be found by breaking the molecule. That means, two different molecules will be found. On the other hand, we can say that, as salt is made of two different components, at a particular stage we can get two different components by breaking it innumerable times.

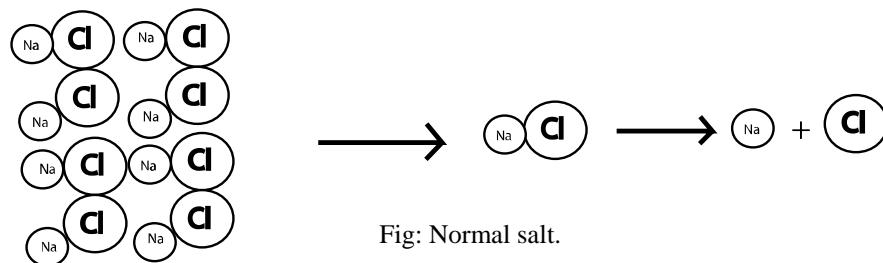


Fig: Normal salt.

Similarly, as sugar is made of carbon, hydrogen and oxygen, three different components will be found by breaking it indefinite times.

**Can you say which one is element and which one is compound between coal and chalk?**

Coal is an element that is made of carbon mainly and chalk is a compound, named as calcium carbonate is made of calcium, carbon and oxygen.

Now you tell if we start to break chalk like salt, which components will be found? As chalk consists of three different components or elements called calcium, carbon and oxygen, by breaking chalk those three components or elements will be found continuously.

Who does not know about rusting on iron? If dark grey-coloured iron made rod (which is an element) is kept outside for some days, light yellowish red coloured layer named rust will be seen. Actually with the presence of vapour, an element (iron) conducts reaction with another element named oxygen and creates rust which is a compound called iron oxide. It can therefore be said undoubtedly that, a compound substance consists of two or more elements.

**Mixtures:** Stir a glass of water by adding some salt into it. Such substance with salt and water is made of more than one matter which is called mixture. Similarly, air is also a mixture where different matters like nitrogen, oxygen, vapour etc exist. It is

also noticeable here that, air is such a mixture where both the matter: element and compound exist. On the other hand, both water and salt that exist in the mixture are called compounds.

### **Lesson 3 – 6: Smallest particle theory**

In the previous lesson we have seen that if we continue breaking elements and compound, it will turn into small particles. Over the time scientists and philosophers had proposed different theories on these small particles. During 400 BC the first theory on small particles of matter was given by Greek philosopher Democritus. According to him every matter is made of some small indivisible particles (which cannot break anymore). He called such small particles as Atom. The word atom came from the Greek word *Atomos* which means indivisible or things that cannot be broken. During that time, two contemporary philosophers of Democritus named Plato and Aristotle stood against the theory. According to Aristotle, matters are continuous and they have no limit of division. That means, if breaking continues, the particles will become smaller and smaller.

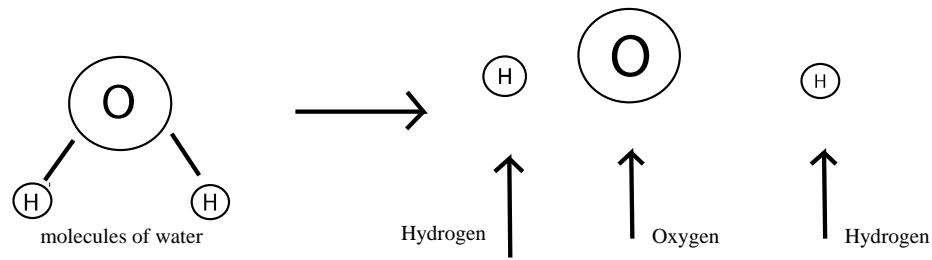
During 1803, John Dalton, an English scientist, gave a theory based on the experimented information on small particles of matter. This theory is called as Dalton's Atomic Theory. He is also called the father of modern atomic theory. According to Dalton-

1. Elements are made of extremely small particles called atoms.
2. All the atoms of an element are same. The atoms are identical in size, mass, and chemical properties.
3. Atoms of one element are different from other elements. That means, atoms of different elements differ in size, mass and other properties.
4. Compounds are made of more than one element. Atoms of different elements combining in simple whole-number ratios form compounds.
5. In chemical reactions, atoms cannot be created, or destroyed. Only their combination can be rearranged or separated.

Thus, from the different theories of small particles of matter we came to know that atoms are the smallest particles of elements.

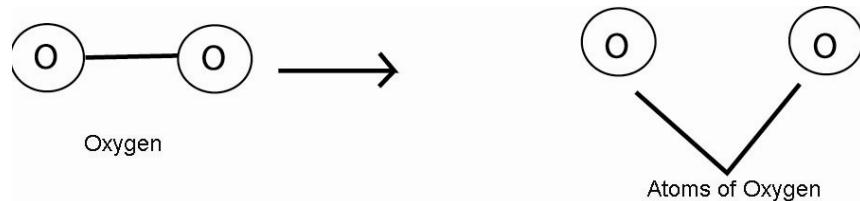
Any question may peep at your mind that can there be any smallest particles of compounds? If so what are they called?

Let us think about water. If we start to divide water in small parts by taking that into a pot, we will get big drops of water and then small drops after a certain time. Likewise, if we continue divide the small drops several times, after a certain time we will reach in such a condition where we would not get any water by dividing the small drops of it, water will turn into hydrogen and oxygen. Such smallest particle of water which consists of all the characteristics of water is called the atom of water.

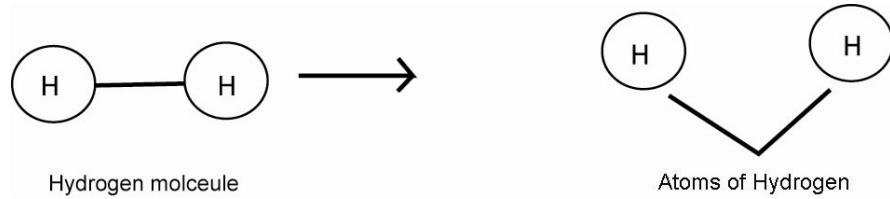


Thus it can be said that atoms are the smallest particles of elements and molecules are the smallest particles of compounds.

But that does not mean that there is no molecule in elements! Obviously they have. Let's think about an important gas called oxygen to understand this concept clearly. The oxygen gas we use is made of two atoms of oxygen. If we divide oxygen gas into small parts like water, then we will face such condition where a single particle of oxygen gas will be found in a part of that divided oxygen gas. If we again divide that particle, we will get two atoms of oxygen. The state before getting those atoms is called molecule of oxygen where two atoms of oxygen exist together.



Thus it can be said that molecules are made of two or more atoms. In case of elements, molecules are made of same types of atoms and in case of compounds, molecules are made of different types of atoms. For example: water, chalk, sugar, salt etc.



**Atom and symbol:** From the previous lesson you came to know that atoms differ from elements to elements. Now the question is how many elements are there or what types of atoms are there? Till now 118 elements have been invented, among them 98 is found in nature and the rest of 20 is artificially made elements. As we all have a name, those elements have such names. To express them shortly and easily we use symbols for each of them. Generally symbols are expressed by the first one or two letters of the Latin or English name of the elements. In case of expressing symbols with one letter, capital letter is used. In case of expressing symbols with two letters, the first one will be in capital letter and the second one will be in small letter.

Some symbols of atoms and their Latin names are given below.

Atom	Symbol	Latin name
Hydrogen	H	Hydrogenum
Helium	He	Helium
Lithium	Li	Lithium
Beryllium	Be	Beryllium
Boron	B	Borum
Carbon	C	Carboneum
Nitrogen	N	Nitrogenum
Oxygen	O	Oxygenum
Florien	F	Fluorum
Iron	Fe	Ferrum

**Molecule and formula:** We have learned that, molecules are made of combining two or more atoms. From the formulas it can be learnt which atoms a molecule contains and what the relative ratio of atoms is. We also know that the symbols of hydrogen and oxygen are H and O. Thus the formula of water will be  $H_2O$ , as it consists of two hydrogen atoms and one oxygen atom. Similarly, the formula of oxygen,  $O_2$  is made of two atoms of oxygen. Some formulas of chemical substance that are involved inextricably to our daily life are given below.

Matter	Formula	Matter	Formula
Normal salt	NaCl	Lime	CaO
	Sodium Chloride		Calcium Oxide
Chalk	$CaCO_3$	Methane gas	$CH_4$
	Calcium Carbonate		
Nitrogen	$N_2$	Carbon dioxide	$CO_2$

**Particles of atom:** Atoms are small in size. They are so small that we cannot see them in empty eyes. Not even with the help of microscope. But with the help of electron microscope atoms can be seen. Here it is mentionable that with the help of electron microscope, we can have a several million times of large view of an object.

Now the question is, can too smallest particle be found by breaking so small atoms? According to Dalton's atomic theory, atoms are indivisible that means, it cannot be divided. This opinion was widely recognized by everyone for a long period. But now it has been proved that, atoms can be divided into many small particles. Three particles can be got from dividing atoms. They are: electron, proton and neutron. In modern research it has been proved that, neutron and proton exist in the center of atoms and electron moves around the center in the circular orbit. Generally a same type of atom consists of equal numbers of electron and proton.

It is notable here that only the atom of hydrogen does not have any neutron at its centre, which means if an atom of hydrogen is broken, a proton at the centre and electron outside the centre will be found. On the other hand, there are two protons and neutrons at the centre and two electrons outside of the atom of helium. And there are eight protons and eight neutrons at the center and eight electrons outside of the atom of oxygen.

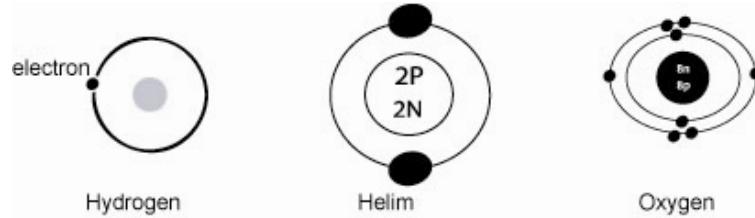


Fig. Structure of atom

### Lesson 7 – 8: Periodic table

We have known that, till now 118 elements have been invented. Each of them is important and used in different purposes. So to know their properties or characteristics is very important. It is also true that, to know and remember the properties of every substance is tough and almost impossible. Thus if they are divided in groups and a table is made by arranging the substance which shows similar properties in a group, will it be helpful? Definitely it will be, because in that case we will be able to know all the substances of a group if we know the properties of only one particular substance. Periodic table is such a table where the substances have been arranged according to their characteristics.

Periodic Table of Elements																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H	2 He	3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne	11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
Alkali metals	Alkaline earth metals	Post-transition metals	Transition metals	Post-transition metals	Metals	Lanthanoids	Actinoids	Nonmetals	Halogen	Alkaline earth metals	Post-transition metals	Post-transition metals	Metals	Nonmetals	Nonmetals	Nonmetals	Nonmetals
Li	Be	Mg	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se
Solid	Liquid	Gas	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid	Solid
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	He
57–71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
Fr	Ra	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	Uus
89–103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ac	Th	Pa	U	Np	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Tl	Lu	Uuo

Fig. Periodic table

During 1869 Russian scientist Dmitri Mendeleev had invented this periodic table. There are 8 vertical columns and 7 horizontal series in a periodic table.

The vertical columns are called group and horizontal columns are called period. The properties of every substance in a group are same. Thus knowing properties of any substance is helpful to know about other substance in the same group. For example: In Group 1, Lithium is a substance of this group, so we can assume that the property of other substance of this group is similar to Lithium. Again all the substances of group 18 show the same properties like the first substance of this group Helium (He).

Another noticeable thing is that, there are two separate series below the main periodic table. In the first series, there is Lanthanum (La) in the beginning and Lutetium (Lu) in the last. In the second series there is Actinium (Ac) in the beginning and Lawrencium (Lr) in the last. A question can arise in your mind that, why are they separate from the main periodic table? The reason is that chemical properties of every substance of first series are almost same. That means they should stay in the same place of same group. But in reality as it is not possible, they have been keeping in separate series outside the main periodic table. This is similar to the case of second series.

### **Use of Water as Universal Solvent:**

In class six you came to know that water is a universal solvent. Because it can dissolve any organic or inorganic substance that other solvent cannot. Now let's observe whether water is really a universal solvent or not.

**Activity:** Demonstration of the use of water as a universal solvent.

**Necessary equipment:** water, test-tube, different types of matter (for example: eating salt, eating soda, testing salt, bit salt, copper sulphate, sugar, vinegar, spirit, vitamin c tablet, glucose etc)

**Method:** Take about 5 millimeter of water in a test-tube. Shake it well by adding some eating salt. Have the salt dissolved in water? Yes, exactly. Now take each and every substance mentioned above and observe whether those dissolved in the water or not. Every substance or matter is dissolving. From the mentioned substance eating salt, eating soda, testing salt, bit salt, copper sulphate are the non-organic substance but sugar, vinegar, spirit, vitamin c tablet, glucose are organic substance. So it is proved that water can dissolve organic and nonorganic substance. That means water is a universal solvent.

Now take another solvent like spirit instead of water and take the above mentioned substance. See if they are dissolved or not. Are all the substances dissolving in spirit? No, they are not. Maximum solvent can dissolve a little number of substances except water. So they are not universal solvent.

### **Lesson 9 – 12: Easy experiment of preparing compounds from elements.**

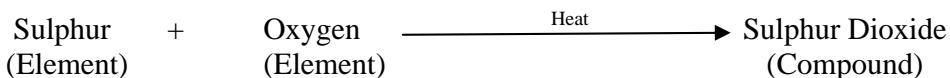
First of all the sulphur burnt and you can see the blue flame of fire. Have you smelled

**Activity:** Experiment of preparing compound named Sulphur Dioxide from two elements i.e. sulphur (S) and oxygen ( $O_2$ ).

**Necessary equipments:** a long handled combustible spoon, some sulphur, spirit lamp or burner.

**Method:** Take some sulphur into a combustible spoon. Heat the spoon with spirit lamp or burner. Could you understand the reason of using long handled combustible spoon? The spoon will gradually warm by heating it and if the handle is short your hand will burn. What can you see?

anything? When the flame of fire extinguished, is there any sulphur left in the spoon? When the blue flame of fire was seen, you have got a strong smell. The reason behind that is sulphur dioxide ( $\text{SO}_2$ ) has been prepared by combusting sulphur in the air for heating and it has created a strong smell. You have also seen the blue flame while sulphur was burnt in the air; the flame is exactly what we see when burning natural gas in furnace. Since sulphur has created a complete new substance with oxygen, so there are no sulphur left after extinguishing the flame of fire. That means,



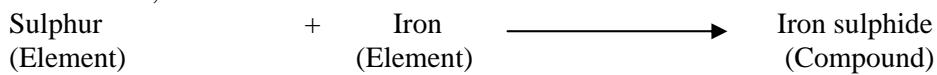
**Activity:** Preparing a compound called Iron Sulfide from two elements iron (Fe) and sulphur (S).

**Necessary equipments:** test-tube, mortar, test-tube holder, spirit lamp or burner, small scale balance, iron dust.

**Method:** Dry the test-tube after washing properly. Take 7 gm iron dust and 4 gm sulphur (proportionally the measures can be different) in a mortar after measuring. Smash it properly. Then take that into a dry test-tube. Heat the lower surface of the test-tube with a spirit lamp or a burner. Make sure that the flames of fire are small. Stop heating while the mixture in the test-tube will become reddish. Keep the test-tube above the mortar so that if the test-tube breaks, the matters won't damage. Then chill the test-tube and separate the matters by breaking it.

How does the substance of test-tube look like? It is a dark grey colored substance. Can you see any light yellow colored sulphur here? No you cannot. Because a new substance called iron sulfide has created by heating the mixture of iron dust and sulphur. So that, no sulphur was left. You can experiment the presence of iron as well. If you keep in touch a magnet to that black substance, you will get to know whether iron is there or not. If iron exists, it will be attracted by magnet. But some unchanged iron and sulphur can be found if the process does not occur properly.

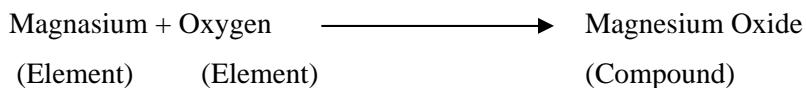
That means,



**Activity:** Preparing a compound called magnesium oxide ( $\text{MgO}$ ) from two elements named Magnesium (Mg) and Oxygen ( $\text{O}_2$ ).

**Necessary equipment:** Magnesium ribbon, forceps, hook, (lighter) spirit lamp/ Bunsen Burner.

**Method:** Hold a side of the small piece of magnesium ribbon (8 cm) with a forcep. Wear safety glasses. Hold the other side of the ribbon above the flame of Bunsen burner. You can do it with lighter as well. Observe carefully what is happening. What have you seen while the magnesium ribbon was above the flame of fire? The ribbon is burning with blazing flame as magnesium burns in the oxygen of air and we can see the blazing flame. In the same way while all the magnesium get burnt, the flame extinguishes itself. Can you see something like ash? Actually this is the magnesium oxide, that has been made by burning magnesium and oxygen.



### **We have learned from the chapter:**

- Different matters have different structures. So their properties are also different.
  - Elements are made of same types of components.
  - Compounds are made of more than one element.
  - Elements are made of small particles named atom.
  - Atoms of different elements differ in size, mass, and other properties.
  - Atoms of different elements combine in simple whole-number ratios to form compounds.
  - The smallest particle of compounds is called molecule.
  - Electron, proton and neutron are found by dividing atoms.
  - There are 8 vertical columns and 7 horizontal series in a periodic table. The properties of every substance in a group are same.

## EXERCISE

## **Fill in the blanks**

1. Elements are made of \_\_\_\_\_ component.
  2. Salt and sugar are \_\_\_\_\_ .
  3. The smallest particle of elements is called \_\_\_\_\_ .
  4. \_\_\_\_\_ is the smallest particle of compounds.
  5. There is \_\_\_\_\_ at the centre of the atom.

## **Short answered questions**

1. What do element and compound mean?
  2. Explain the difference between atom and molecule with examples.
  3. What are the main themes of Dalton's atomic theory?
  4. What particles can be found by dividing atom? Where are they located in the atom?

### Multiple Choice Questions

1. Which one is the molecule of elements?
  - a. Na
  - b. Ne
  - c. N<sub>2</sub>
  - d. NO
2. Helium, Neon and Argon belong to the same group, whereas Calcium and Magnesium belong to another group. The appropriate statement for these substances is.
  - i. If Neon is neutral, Argon is neutral as well.
  - ii. The properties of Calcium and Helium are different.
  - iii. The number of protons is same in Calcium and Magnesium.

Which one is correct from the following?

- a. i
- b. iii
- c. i and ii
- d. i, ii and iii

Give the answer to the question no. 3 and 4 according to the following stimulus:

Matter	Symbol	Formula
1		Cl <sub>2</sub>
2	Al	
3		O <sub>3</sub>
4	F	
5		NH <sub>3</sub>
6		NaOH
7	Cu	

3. Which are the substances of same properties showed through symbols and formula from the above table?
  - a. 2,4
  - b. 1,3
  - c. 1,4
  - d. 2,7
4. Which substances have equal atomic number?
  - a. 2,3
  - b. 3,4
  - c. 4,5
  - d. 3,6

**Creative Question:**

1. Three matters and their atomic numbers are mentioned in the following table.

Matter	Number of atoms
1	Na - 2
	C - 1
	O - 3
2	F - 2
3	C - 1
	Cl - 4

- a. What is the symbol of Helium?
- b. Why is coal an element? Describe.
- c. Write the chemical name of number 1 matter with the formula and explain its structure.
- d. "Formula of a compound from the table is similar to the formula of Methane, yet the two compounds are different"- analyze logically.
  
- 2. A (Element), B (Compound), C (Metal), D (Compound) are four matters. A and B dissolve in water in room temperature. C is dissolvable but after combustion in air dissolved in warm water. D is not soluble in water but soluble in oil. A can be separated from the solution A but B cannot be separated from the solution B.

  - a. Which element has eight protons?
  - b. Why is  $\text{NH}_3$  a compound? Explain.
  - c. Explain which one is compound and which one is mixture from the solution of A and B.
  - d. Water is a universal solvent - analyze according to the above situation.

## **Chapter Seven**

# **The use of Energy**

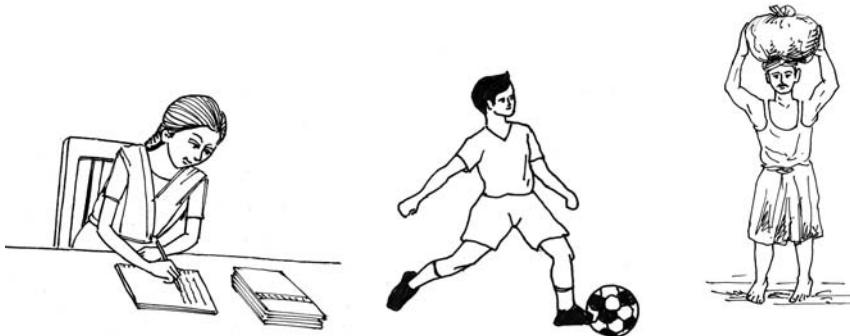
In our daily life we are involved in many works. Work is related to energy and power. Besides this, there are different types of energy and its process from one state to another. In addition to this, there are renewable and non-renewable energy. We have to search for the alternative source of energy in order to solve the crisis of energy.

### **At the end of this lesson we will be able to:**

- explain energy and work
- explain different forms of energy
- analyze the correlation among energy transformation
- explain the advantage and limitation of renewable energy
- explain the limitation of non-renewable energy
- explain the sources of renewable energy
- explain law of conservation of energy
- explain the way of elimination of energy crisis
- describe the necessity of energy in our life
- conscious and make others conscious regarding use of energy.

## Lesson 1: Work, power and energy

Let's take a look at the following pictures.



A student is reading

someone is playing football

someone is standing bearing load over his head

What are you thinking after seeing the above pictures? In the first picture the student is reading. Is she really doing work? In the second picture someone is playing football. Is he working? What do you think? And in the third picture: Is the man, standing with load over his head doing some work? Who is working more or less among them? What does actually work mean? Generally each of the above examples seems individually a work. But scientifically work means something more. In an easy term, when a displacement is happened by applying force on an object is called work. So it is found from the above examples that the student who is reading or the man who is standing bearing load over his head is not working because no displacement happened. So scientifically no work took place in these two cases. Here he, who is playing football, has changed his position, so he is working. Therefore, we can say in the language of science that if force is applied to an object and the object changes from one position to another towards the force, work happens. There are two things related to work, one is force and another is the change of position. Generally, work is the multiplication of force and distance passed by the object.

We can also see from the examples that a rickshaw puller has to work in order to go from one place to another. In other case, someone needs 10 minutes to go from one place to another and someone needs 15 minutes to pass the same distance. Who works more between these two persons? Power is related to doing work quickly. When someone does any work as quick as possible, it is called her/his power. The rickshaw puller who has more power can do more work within short time. That means if we multiply total work by total time we get power.

We can cite another example related to work. Two of the students decided to move around the playground of the school for five times. After some times of starting we found one of them has stopped moving finishing two rounds and another one has finished five rounds. Now we will consider the ability of doing work. The student who has finished two rounds lost the ability and the student who has finished five rounds has

more ability. Scientifically, this capacity for doing work is called energy. Here we have found that energy is directly related to work. Actually Work and Energy is not different thing. We need energy in order to do work. He who has more energy can do more work. This energy is measured by work. So the unit of Work and Energy are same. The unit of Energy is Joule.

## **Lesson 2 and 3: Sources of energy**

Where do we get energy which is necessary in order to make us eligible for doing work? We all know that the sun is the ultimate source of energy. Besides this, we have so many sources around us. As for example, you must see cooking by using natural gas. Again you have seen how oil is used as fuel. Actually in both the cases we use gas or oil in order to produce energy. Now we will talk about different sources of energy.

### **Mechanical Energy**

Suppose you are running or driving a car. You have to work for retrieving speed. Again you released a brick from top to down or trying to pick a mango by catapult. Here when you moved up the brick the energy stored into it allowed falling down by its own. And the catapult you moved back, stored energy into it and the stone of it attacked the mango. So there is a relation of running, driving a car, moving up a brick or picking mango by catapult with certain energy. This special kind of energy is called Mechanical Energy. Although static energy and kinetic energy is related here separately, working for the capacity of speed is called Kinetic Energy. For example: Running or driving a car. Again energy stored for the change of special state from another is called Static Energy. Such as, moving up a brick or picking mango by catapult.

### **Chemical Energy**

Energy stored in food or fuel is called Chemical Energy. Our body gets chemical energy through food. Petrol, Gas, Wood and coal all of them have chemical energy into them. Chemical energy exists in the batteries which we use inside torch light or radio.

### **Thermal Energy**

Energy which is used for cooking, running motor car or train, is called thermal energy. We may get this energy by burning coal, gas, wood, petrol or diesel. Again, we get heat directly from the sun. And this thermal energy keeps the earth warm. No animal or plants could live without thermal energy.

### **Magnetic Energy**

Another form of energy is magnetic energy. Magnet attracts ironic substance using this energy.

### **Light Energy**

Another kind of energy which comes from the sun with thermal energy is light energy. We could not see anything without light energy.

### **Sound Energy**

We produce another form of energy when we speak, sing or play a flute. This is called sound energy. We can hear each other with the help of sound energy. Sound energy is used in telephone, radio and television. Sound is also produced from the frequency of substance.

### **Electrical Energy**

A very well-known and necessary form of energy is electrical energy. Light is switched on, fan is moved, and industry is run by electricity. Train is also run by electricity in many countries. Electrical energy can be transmitted from one place to another with the help of wire.

### **Solar Energy**

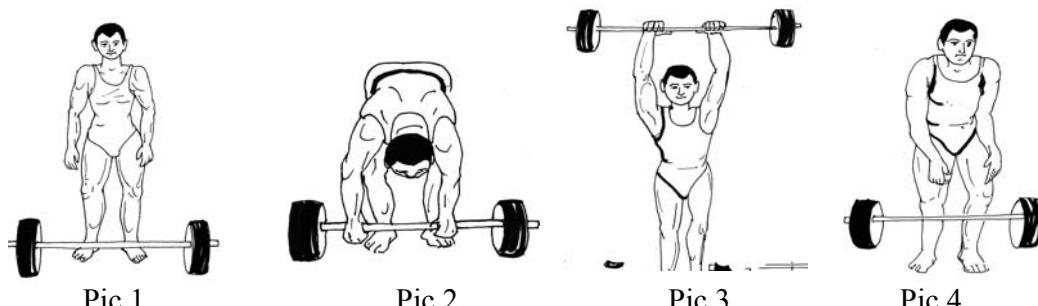
Energy received from the sun in the form of heat or light is called solar energy. In fact, the sun is the main source of energy. We use solar energy for drying clothes, jute and paddy every day.

### **Wind Energy**

Energy generated by the flow of air is called wind energy. Boats with lifted sails move with the help of wind energy. Windmills are run by the use of wind energy which can produce electricity.

### **Atomic Energy**

We know that matter is composed of atom. The inner content of this atom is bound together by a very powerful force. If this binding can be broken by any means, then a very powerful energy called atomic energy is obtained. We may get nuclear energy by applying force and separate the elements from atom. This energy can be transmitted into electrical energy and is used in our work.



## Lesson 4 and 5: transformation of energy

We knew earlier that energy exists into different forms in this universe and these states are related to each other. Let us see the following pictures.

According to the above pictures after having various foods, energy of weight lifter turns into chemical energy from food. Later on when he is trying to lift the weight, stored chemical energy turns into kinetic energy. After that when he is gradually lifting the weight over his head, kinetic energy is turning into static energy. Again when he is throwing down the weight, static energy has turned into motion, sound and thermal energy. Because sound is produced by falling down the weight on the ground and it feels warm when someone touches the weight. So there are different transformation of energy that happen inside our physiological activities.

Thus different forms of energy are related to each other. In fact, every phenomena of nature may be considered as transformation of energy. Some examples of energy conversion are as follows:

### Conversion of Mechanical Energy

It feels warm when you rub skin with hand. Mechanical energy turns into thermal energy in this case. Again mechanical energy turns into sound energy if flute is played. If a stone is hit with a metallic bar, it seems sparks coming out from there and also makes sound. Metallic bar and stone are felt warm. In this case, mechanical energy turns into thermal, sound and optical energy. When paddy is processed using a husking-pedal, mechanical energy is turned into sound and thermal energy. Similarly, conversion of static and kinetic energy happens during swinging.



Fig. Swinging

### Conversion of Thermal energy

Hot iron machine is used in order to do iron our dress. In this case, thermal energy turns into mechanical energy. In steam engine energy is produced by heat and using that energy train runs. Thermal energy turns into mechanical energy here as well.

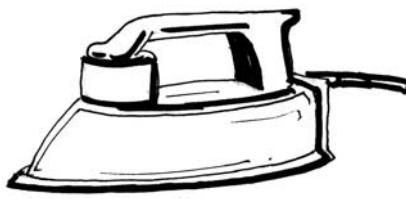


Fig. Iron

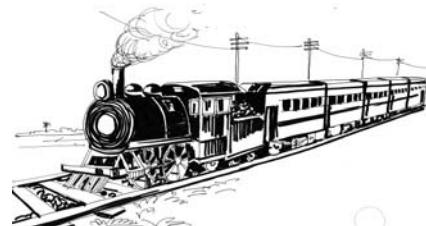


Fig. Railway engine

### Conversion of light energy

It feels hot when you touch the chimney of lantern (hurricane). Actually light energy turns into thermal energy here. Thermal energy turns into chemical energy when it works on photographic paper.

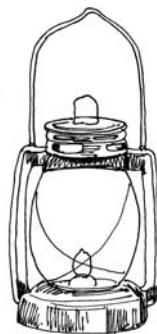


Fig. Lantern (hurricane)



Fig. Digital camera

### Conversion of Sound energy

Germs are killed by the vibration of huge sound in medicine factory. Besides this, clothes are cleaned by using such vibration of sound. Sound energy turns into mechanical energy in this case. Again sender machine of a telephone or radio turns sound energy into electricity.

### Conversion of Magnetic energy

Heat is produced when iron is magnetized or demagnetized. Here magnetic energy turns into thermal energy. Besides this, we can pick up heavy loads using electro magnet. Here, magnetic energy turns into mechanical energy.

### Conversion of Electrical energy

Heat produced when electricity passes from iron machine. Here electrical energy turns into heat energy. The electric fan moves when electricity passes through it. Here electrical energy turns into mechanical energy.

### Conversion of Chemical energy

Heat is produced when coal is burned. It also may be happened by chemical reaction. Chemical energy turns into thermal energy in this case. Usually electricity is produced by the reaction of chemical elements in an electric cell. Besides this, thermal and optical energy conversion happens from chemical energy by burning coal, petrol, kerosene or gas .



Fig. Telephone conversation



Fig. Gas stove

### Conversion of Atomic energy

Atomic energy transforms into electrical energy in atomic electricity plant.

### Conversion of Solar energy

Solar energy can be transformed into thermal energy by solar furnace. Besides this, various kinds of electronic machines such as pocket calculator, radio, electric watch use solar energy by converting it into electricity.

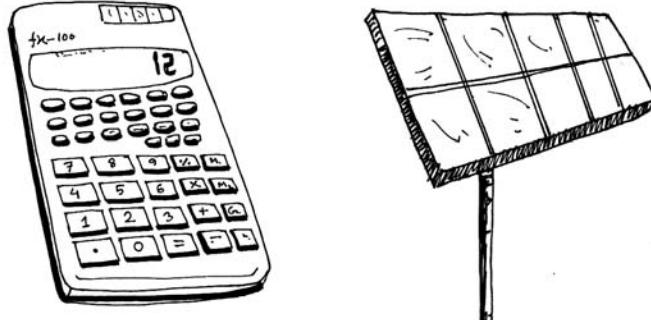


Fig. Calculator, solar panel.

### Lesson- 6: Energy conservation

Suppose, you threw tennis ball upward standing on school ground. What are you seeing? The tennis ball is moving down after going up to a fixed height. When the tennis ball is going up, its kinetic energy decreases and static energy increases. When the kinetic energy will be 0, the ball will be moving down because of its static energy into it. We have found that the more the object goes down, the more its static energy turns into kinetic energy. When the ball touches the ground and remains steady, it's all static energy and kinetic energy turns into sound, thermal, optical etc. energy. We could not get any proof of heat or light. But when the ball touches the ground, we hear the sound. But sometimes if we throw stone instead of tennis ball, it may feel hot.

All of you were informed of how energy transforms one state to another. One question may arise in your mind that, does any energy waste during this transformation? It is amazingly true that total amount of energy is equal before the transformation or after. In fact we are not capable of creating new energy, even though we cannot destroy energy. This means total amount of energy is equal in the universe. The universe holds the equal amount of energy at present that it held during its creation. This is called conservation of energy.

## **Lesson 7, 8 and 9: renewable energy**

You can find out the meaning easily from the name **renewable**. It means what we renew and the way of renew. In this regards we can produce energy by an object and we can reuse the object in order to produce energy again. That means, the sources of energy which we can use again and again is called renewable energy. Among them, sunray, biogas, water, air, ebb and flow tide of water etc are mentionable.

The elements of renewable energy of biogas, solar energy, ebb and flow tide of water and air in are discussed below:

### **Biogas**

Excrement of cows, goats, horses and bulls are used as fuel from long ago. Such excrements of animals are the source of energy. Thermal energy is produced by burning dry dung in many countries of the world. The excrements from cows, pigs and hens, crops and plants are mostly used as the elements of biogas. In this case you can use only the plant elements or animal fertilizer mixture or both. The raw straw mixed with excrements from the place of pig or hens are the great mixture of animal or plant fertilizer to make biogas. But to use it, we have to take small pieces of it. In this case we have to remember that the dry plant excrements should be cut into small pieces to bring out the cover before using it. And the fresh plants should be kept outside to get rotten for at least ten days.

### **Air**

Aboriginal people were afraid of air. People are using air in different work because of the advancement of civilization and science. Ancient people used to make circles with four-five fans and used to move it through air. Bringing water from well, irrigation of agriculture, breaking barley or wheat, thread out sugarcane, cutting paddy, cutting straw etc were used to do by the ancients by using the rubbing of circle. After that people had done difficult task like splitting wood by using air. People in many regions of the world had used machines of big circles, which is called windmills now- a -days. But the use of it has become less today. But again its use has come to peoples' mind. People are thinking of its' effectively by concerning environmental pollution and lack of natural energy.

### **Ebb and Tidal flow of water**

The use of machines with the help of ebb and flow of water energy has been innovated earlier. But transforming the ebb and flow of water energy into electrical energy is not an old concept. Now- a -day's electricity has been produced by using ebb and flowing energy of water in various countries.

### Solar Energy

The energy which we get from the Sun is called solar energy. We know that the sun is the source of all energy. The energy all over the world has come from the sun or sunrays in anyways. For example, fossil fuel of modern civilization is mainly solar energy of several years.

**Activity:** Solar Energy production

**Necessary equipment:** Magnifying glass /metal disc

**Procedure:** At first take a magnifying glass.

Usually magnifying glass has convex lens. Focus sunray using the lens. You will find fire flame up if you focus the lens correctly.

Similarly, reflect the sunray by a bright metal disc.

Solar stove have been made though it. Now we can cook easily using this solar stove.



Besides this, solar energy is used in order to make the house warm in the cold countries. Solar energy is also used to dry crop, fish and vegetables. Dry fish can be saved for a long time. Vapour can be produced in boiler using solar energy and this is us used for moving the turban in order to produce electricity. Solar cell has been made by using modern technology. The characteristic of solar cell is: we directly get electricity when sunray falls upon it. Solar cell has many other uses too.

### Merits of renewable energy- Perspective of Bangladesh

There are so many merits of using renewable energy. Demand of energy is increasing with the increase of population, so renewable energy is essential now. Biogas is used as clean fuel among them. Biogas helps to get high quality organic manure which is helpful for unpolluted environment. It also helps to keep hygienic and clean environment. Solar cell is used to supply electricity in satellite. Many electronic machines such as, pocket calculator, pocket radio, electronic watch is run by solar energy. Basically, the important merit/main opportunity of renewable energy is that it is renewable. This kind of energy never ends. The merits are as follows:

- ▲ Air and solar are unlimited source of energy because it always exists.
- ▲ More energy can be produced by using water flow. In this regard the bridge made for resisting water flow develops road networking
- ▲ As the moon influences ebb-tide of water and its happens regularly, we can use energy produced from ebb-tide of water as renewable energy.
- ▲ Renewable energy is always environment friendly. Because they do not spread out CO<sub>2</sub> in the air

This energy is very much necessary in our country as well as availability. It is said that our country can be a model in the advancement of renewable energy. To continue it we

need to take necessary steps right now. There are many areas where people have not got electricity yet. In that case we can get solar energy easily. We have huge possibility in biogas production. We must look for alternative source of energy though our country is rich having natural gas. The expenditure of supplying natural gas from one place to another is very high. If we develop biogas plant, we may get double opportunities. We will be able to fulfill the demand of essential fertilizer as well as the demand of necessary energy. It is easy to get biogas element in our agriculture- based country undoubtedly. Therefore, we have to take proper initiatives in order to manage this kind of energy for the future.

### **Renewable energy: Limitations**

It has big demand and interest at present. But there are some demerits of using renewable energy. These are described as follows:

- Energy getting from biogas is very limited and less in number.
- Sources of air and water flow for renewable energy are limited. Because the plant needs suitable place to develop.
- We may get renewable energy based on solar energy if sunrays are available. But rain may interrupt here.
- Sometimes water flow of river may change its way of flow because of using ebb and tide to produce renewable energy. Besides this, it may interrupt the movement of ship by building bridge or barrage over the river.
- Renewable energy produced from sun, air and water flow is expensive.
- The main problem of producing energy from wind is that air flow does not exist always.

## **Lesson 10: Non-renewable energy**

Non Renewable energy means if we use this kind of energy once from a source we can not produce more energy from that source. Basically this is natural resource which we cannot produce more than once. This kind of energy is spent within short time that they are produced. Coals, oil, natural gas, nuclear energy like Uranium are some examples among them.

### **Merits of non-renewable energy**

It may consider the merits of renewable energy from two sides. Price and availability. Most of the vehicles and machines which are run by renewable energy need more expense if they use non-renewable energy. Such as: the vehicles run by natural gas or oil/petrol require low cost. On the other hand, it is difficult and expensive to run a vehicle using renewable energy sources such as: rechargeable battery, solar energy. At present there are many vehicles running by rechargeable battery which is very expensive and makes lack of energy. Non-renewable energy is cheap; we may get more energy from less quantity of elements. As for example, large amount of electricity can be produced from less Uranium.

### **Limitations of non-renewable energy:**

Demerits of non-renewable energy are-

- The energy is non-renewable and finished frequently: in fact does finish.
- It pollutes environment at large scale.
- Carbon di oxide spread out by its burning that causes global warming .

### **Lesson - 11: Crisis of energy**

Energy is necessary for what man does for his development and living. Consumption of energy is increasing day by day which creates the crisis. Crisis of energy causes for the following reasons:

- More energy is required to meet the demand of increasing population
- The more develop a nation is, the more expense of energy they have. From this concept sometimes each country uses energy at a high rate.
- Developing countries are building structures, roads, industries etc and using vehicles at a high rate. Energy is being used for construction purpose and vehicle maintenance.
- People are constructing luxurious buildings for better living. Energy deficiency is caused due to using of radio, TV, VCR, air-conditioner and so on at large scale.
- Business, communication and other activities of people are increasing day by day. Energy is being used largely for this purpose.

Acuteness of energy occurs if we fail to supply necessary energy for all above purposes. That is why we are looking for alternative energy.

### **Lesson 12: Searching of alternative source of energy**

Natural energy like oil, gas, coal, electricity is being used continuously till now and thus going to be finished. Though atomic energy is coming out as potential source its initial costing is high. There are uncertainty and risks in case of its supply.

Natural gas is our priceless asset. But this energy is not renewable. We cannot depend on any kind of non-renewable energy source. There are consumption of large amount of fuel which is used in order to cook food for 150 million people in our country. Wood, dry straw, cow dung etc are among them. These are helpful in increasing fertility of soil. But the use of it as organic fertilizer is limiting as it has been used in cooking. That is why fertility of land is decreasing. Wood is mostly used for cooking. This not only destroys forest resource but also makes disaster for our environment.

Considering all these issues we are looking for alternative energy source continuously. Scientists already invented biogas technology. They are successful in case of solar energy use even partially. Solar energy, ocean flow and wind energy are also individually found as energy source.

If biogas can be produced, we get electricity for fuel, light, run the TV in rural areas. If this technology is adopted, the pressure on natural forest resource will be reduced. Thus environmental balance can be maintained. We can produce more crops by saving land fertility. After all, we can keep a beautiful and clean environment for our next generation. So, necessity of adopting, developing and taking care of bio gas technology is very important.

### **Lesson 13: The effect of energy in our life and its cost effective use**

We have almost 15 million people in our country. A large number of fuel is used for cooking every year. Wood, dry straw, dry cow dung etc are most of them. That is why forest resources of our country is decreasing day by day, fertility of land is lost and environment is going to be destroyed. Our birth rate is high. We will be in trouble in order to fulfill the demand of increased population. We have to think about acuteness of fuel. We are using energy in every stage in our life. Energy is needed in order live as well as to develop the standard of our life. We cannot move without energy. Therefore, energy is very close to our life. We found that fossil fuel is an important source of energy. But this kind of energy is limited and finished once. That is why mankind is looking for alternative source of energy. Renewable energy is a possible way to solve this problem. We have to be aware and frugal in case of energy use before getting a large and new source of energy. Our ethical responsibility is to prevent misuse in our daily life. For this reason we need to take the following initiatives:

- To create mind set up to consider energy as a whole rather than personal asset.
- Radio, TV, light, Air Condition should be switched on only when necessary otherwise should keep switched off.
- More energy is needed for defected vehicle or machine. So it is important to maintain the machines properly.
- We should not run the engine of vehicles without any reason/necessity.
- Energy conservation/ energy saving decrease our personal expenditure

#### **New words from this chapter:**

Work, Power and Energy, Solar energy, Energy conservation, Renewable energy, Non-renewable energy, Biogas, Acuteness/Shortage of energy, Alternative energy source.

#### **What we learnt from this chapter-**

- Capability of doing work is energy.
- We have so many energy sources around us.
- Energy is not created or destroyed, it just can change its form from one state to another.
- Renewable energy is necessary for our country as well as easy to get.
- Use of energy is increasing day by day, so it creates crisis of energy
- Our ethical responsibility is to protect misuse and wastage of energy in our daily life.

## Exercise

**Fill in the blanks**

1. \_\_\_\_\_ of work is called energy.
2. Usually generator transforms \_\_\_\_\_ energy into electricity.
3. Biogas is produced from \_\_\_\_\_ and \_\_\_\_\_.

**Short answered questions:**

1. What is the difference between power and energy?
2. Explain that amount of energy remains unchanged.
3. Mention the reasons of energy crisis .
4. How can we get the benefits of non-renewable energy?

**Multiple Choice Questions:**

1. Which one is the source of non-renewable energy?
  - a) Air b) Flow of water c) Solar Energy d) Coal
2. Sometimes Atish studies using a charger fan with light. In this regard he uses-
  - i) Light Energy
  - ii) Electrical energy
  - iii) Chemical Energy

Which one is correct from the following?

- a) i and ii
- b) ii and iii
- c) i and iii
- d) i, ii and iii

**Answer the question no 3 and 4 according to the following stimulant:**

A gymnast lifts the weight of 200 kg and keeps it down. Then after taking some rest s/he is having food with listening music.

3. Which is the correct energy transformation serial from weight lifting to keeping down?
  - a) Chemical energy → Mechanical energy → Static energy → Mechanical energy
  - b) Mechanical energy → Static energy → Mechanical energy → Sound energy
  - c) Static energy → Mechanical energy → Sound energy → Thermal energy
  - d) Mechanical energy → Static energy → Mechanical energy → Static energy

4. Which two of the energy are related to having food and listening music of the weight lifter?

- a) Heat and Sound
- b) Heat and Electricity
- c) Chemical and Sound
- d) Static and Heat

**Creative question:**

1. There is no electricity till now in Adib's village named Nabottampur. That is why many of the villagers use solar electricity/power. He went to Kaptai with his uncle during last Eid vacation and found that electricity was being produced from water also.
  - a) What is the main source of energy?
  - b) Why is natural gas non-renewable energy? Explain.
  - c) Explain the way of producing electricity from water seen by Adib at Kaptai.
  - d) Explain the merits and demerits of using solar energy according to Adib's villagers.
2. Now a day Mr. Rashed is producing one kind of gas from the excrement of animal firms. He can sell extra gas after fulfilling the demand of his own firm.
  - a) What is power?
  - b) Describe the necessity of energy transformation.
  - c) Explain the nature of the source of energy of the gas produced by stimulator.
  - d) Analyze the necessity of activities of Mr. Rashed regarding energy conservation.

## **Chapter Eight**

### **About Sound**

When a spell of rapping sound is made at the door of your house, you can understand that someone is waiting at your door. We can understand that someone has come when the doorbell rings. You can understand that someone is coming hearing the sound of foot steps. What we hear is sound. Sound plays an important role in our life. It helps to communicate with others. We hear different types of sound around us. Tune of a flute, horn of a car, dog's barking, baa baa of goat, crows of hen, sweet rote of bird etc. Sound is an energy which helps to hear. How does sound produced? How does sound circulate? We shall discuss in this chapter how we can recognize different sounds.



#### **At the end of this chapter we -**

- Will be able to describe the characteristics of sound.
- Will be able to explain the circulations of sound.
- Will be able to compare the velocity of sound through solid, liquid and gaseous.
- Will be able to explain how animal can hear sound.
- Will be able to explain the limit of audibility and noise.
- Will be able to explain the ways of producing sound by the sound making machine.
- Will be conscious and will make other conscious about the bad effect of making sound (noise and pollution) in our daily life.
- Will listen to our teammate in group work, will take part actively and will co-operate to take decision.

## Lesson-1: Sound and its characteristics

What we hear is sound. Drop a steel bowl on the floor, you will hear sound. When you talk you hear a sound from your mouth. Arian gets up from sleep hearing his alarm clock. She hears different kinds of sounds on the way to school. Birds chirping, sounds of rickshaw bell, horns of cars, and men's noise are different kinds of sound. When friends talk, you can recognize all sounds from his voice and you can say who is producing the sound. Some sounds we hear are pleasing to the ear. It contains tunes and is pleasing to ear. Such sounds are tune of flute, and sound of Harmonium. Some are noisy, tuneless and disturbing. Such sounds are sound of vehicles, sound of cutting iron and dogs' barking.

**Work:** To identify tuneful and tuneless sound.

**Process:** Form different groups taking 5/6 pupils in each. Discuss and decide yourself which one tuneful and which one is tuneless from those different sounds which you hear. Make a list of tuneful and tuneless sound from your discussion. Then anyone of each group present it to the class.

Tuneful and tuneless sound whatever it may be, all the sounds have a source. Sound is produced from any source. We can understand the source of sound from its characteristics. Such as: by hearing the sound of barking, we can understand that the dog is barking. To raise the telephone receiver we can understand that someone is talking from the other end.

## Lesson-2 and 3: Origin of sound

Sound is a kind of energy for which why we can hear. Now we will do some works from which we can understand that how does sound is produced? When your school bell rings, then touch it. Can you feel that the bell vibrates?

**Work:** To know the cause of origin of sound.

**Required equipment:** A metallic pot, some ropes and a stick.

**Process:** Hang the metallic pot (it may be steel or aluminium) with a rope. Keep it in mind that it does not touch anything. Now strike the pot with a stick. Touch the pot with the help of your finger softly. Do you feel the vibration of the pot? Strike the pot with a stick again and instantly hold the pot tightly. Are you hearing the sound yet? No, you can't hear.

Strike the pot again, you'll hear the sound. Touch the pot when the sound is stopped. Is the pot vibrating yet? No, it is not vibrating.



Fig. Origin of sound

**Work:** To know the cause of origin of sound.

**Required equipment:** A metal (steel) plate, a spoon, and some water.

**Process:** pour water on the plate. Strike the one edge of the plate with spoon. Are you hearing sound? Strike the plate once again and touch the plate instantly. Do you feel that the plate is vibrating? Are you hearing the sound yet? No, you don't hear. Strike the plate again and look at the water. Do you see any wave on water? The water is vibrating as a result of vibration of plate and it is making wave on water.

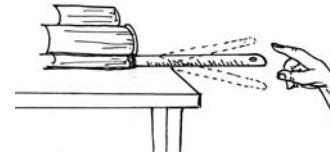


Fig. origin of sound

**Work:** To know the cause of origin of sound.

**Required equipment:** A metal or plastic ruler, a book and a table.

**Process:** set the ruler on the table in such a way that three-fourth of it remain out of the table. Press the edge of the ruler which is on the table with a brick or a heavy book. Pull the edge of the ruler which is out of the table down and then set it free suddenly. What do you see? You'll see that the ruler is going back to its previous place and is vibrating. Subsequently it is making sound. The moment when the vibration stops, instantly the sounds will also go stop



Fig. origin of sound

We have come to learn from the above activities that sound is produced through the vibration of the object. Vibrating object which produces sound is called source of sound.

#### Lesson-4: Circulation of sound or propagation of sound

We know vibrating object makes sound. How does the sound reach to the listeners? Let us consider an example. Any vibrating wire of a musical instrument or any vibrating arm of a tuning fork vibrates the molecules of air around them. The vibration passes or transfers to next molecules of the air. The sound reaches to the listeners by turns from a source like wave. The movement created by the vibrating particles of any medium which is circulated through a medium is called wave. Take a long spring, strike its one end and you will find, as a result of its construction and expansion, it circulates energy. The wave of sound circulates in the same way. The movement of sound from one place to another is called the circulation of sound.

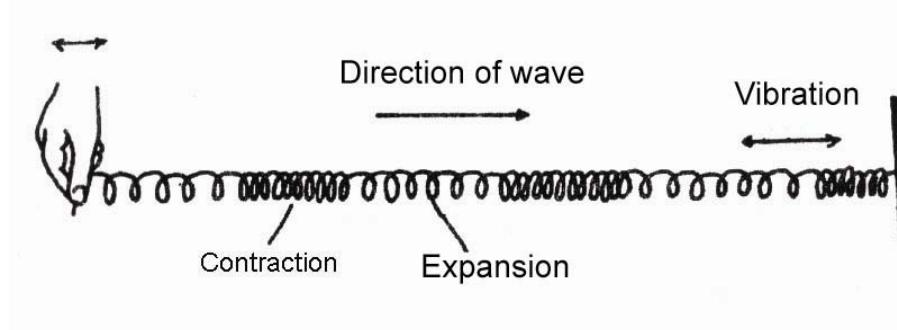


Fig. circulation of sound

Circulation of sound needs a medium. The medium may be solid, liquid or gaseous. Sound circulates very fast through solid medium, then liquid medium and then gaseous medium. We will prove it later through activities.

Can sound be circulated without medium? We will do an activity for the answer of this question.

**Work:** To know sound does not circulate without medium.

**Required equipment:** A metallic musical instrument, a stick with small diameter, a wide mouthed bottle and a cork.

**Process:** Tie up a musical instrument with thread at one end of the stick. Push the other end of the stick through the cork. Now the full arrangement is pushed into the bottle in such a way that the cork works as a stopper. Tight up the stopper well and shake the bottle. Keep it in mind that the musical instrument does not touch one wall of the bottle. You will hear the sound of musical instrument from outside. Now open up the cork and keep it at a little height. Now heat the bottle with a burning candle. All the air will come out from the heated bottle. Then tight up the cork of the bottle. Shake the bottle when it is cooled. Do you hear a sound? No, no sound is heard or you can hear a little sound. What does it mean? It means sound that cannot be circulated without medium.

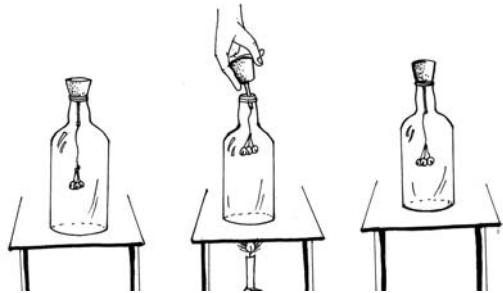


Fig. Sound does not circulate without medium

### Lesson-5: propagation of sound through liquid and velocity of sound.

We have told before that circulation of sound needs a medium. Sound cannot be circulated without medium. Sound circulates fast through solid, then liquid and then gaseous. We will prove it through work:

**Work:** Circulation of sound through liquid.

**Required equipment:** A balloon and some water.

**Process:** Fill the balloon with water. Give your ear to one side of a balloon and scratch the other side of the balloon softly. Are you hearing the scratching sound?

You will hear the scratching sound loudly and clearly.



Fig. Sound through liquid

**Work:** Circulation of sound through liquid.

**Required equipment:** A metallic bell and a bucket of water.

**Process:** Ring the bell and hear the sound, now dive the bell into the water and ring the bell keeping your ear on the water surface. Are you hearing the sound more loudly and clearly than before?

You will hear the sound more

clearly in liquid than air, because the velocity of sound in water is more than that of air. The velocity of sound in air is 330 m/sec, and 1440 m/sec in clear water. The velocity of sound in sea water is 1500 m/sec.



Fig. Circulation of sound through liquid

## Lesson-6: Circulation of sound through solid and its velocity of sound.

Sound circulation is fast and more clear through solid medium than air and liquid.

**Work:**

**Required equipment:** A metallic scale and a long metallic rod.

**Process:** Put an end of scale or rod to your ear and ask your friend

to scratch the other end slowly. Are you hearing the sound of scratching? Ask your friends who are standing beside you whether they are hearing sound or not?



Fig. Circulation of sound through solid substances

You can do the same test with a wooden or metallic table. Do the work and see and note down in your notebook what you have found. You will learn from this experiment that sound can be circulated through metal or wood. The velocity of sound varies with the variation of solid substances.

The velocity of sound in glass is from 5000 to 6000 m/sec.  
 The velocity of sound in steel is 5000 m/sec.  
 The velocity of sound in brick is 5000 m/sec.  
 The velocity of sound in aluminium is 6420 m/sec.  
 The velocity of sound in granite is 6000 m/sec.

So the velocity of sound differs from medium to medium. Sound can be circulated fast and more clearly through solid substances than the medium of liquid or air. On the other hand sound can be circulated fast and more clearly through liquid than the medium of air.

### **Lesson-7: How can animals hear sounds?**

We know the vibrating objects produce sound and that sound is circulated all the directions through medium. Now the question is: how can we hear sound?

The outer shape of our ear looks mostly like a funnel. When sound enters into it, then sound goes through a hole where there is a stretched thin layer at the end. This is called Tympanum.

This layer plays an important role. The role is that the vibration of sound vibrates the Tympanum, vibration reaches inside the air through this. Sound reaches to the brain from there. Thus the ear can hear the sound. We will do the test to know the important role of Tympanum.

**Work:** How does the vibration of sound vibrate on Tympanum?

**Required equipment:** A tin pot (you can take a piece of soft drink can) and a rubber balloon.

**Process:** Cut the two end of the can. Close the one end of the can with the balloon which is tied up tightly with thread or rubber band. Put 4 or 5 grains of wheat or rice on the tightly tied up balloon. Ask your friend to make a sound 'hurrah', 'hurrah' in front of the open end of the can. Be aware of what happens to wheat or rice. Why does wheat or rice jump up and down? The vibration of sound created by your friend vibrates the balloon. That's why wheat or rice was jumping.



Fig. Vibration of sound vibrate on Tympanum

### **LESSON 8 - 9: LIMIT OF AUDIBILITY AND NOISE.**

We know that sound is produced as a result of vibration of an object. Can we hear the sound of all vibrating objects? No, we cannot hear the sound of all vibrating objects. Man cannot hear the sound which creates 20 vibrations/ second. Such sound is not audible. Such sound is called inaudible sound. On the other hand we cannot hear the

sound which produces more vibration. We cannot hear the sound which produces more than 20000 vibrations / Second. Such sound is also inaudible. Such sound is called ultrasound. So the limit of audibility for man is created sound ranging from 20 to 20000 vibrations. The number of vibrations per second of an object is called the frequency. It is denoted by the unit Hertz. When any object vibrates 20/second, its vibration is 20 Hz, if it vibrates 20,000/second, the vibration is 20,000 Hz. So the limit of audibility of man is from 20 to 20,000 Hz. Such vibration of sound is called audible sounds.

Some animals can hear the sounds which has more than 20,000 Hz. The dog has this ability. Police uses high frequency whistles which the dog can hear but man cannot. In medical science we are familiar with excess sound creating machine. One of them is ultra-sonogram. The machine works with more than 20,000 Hz of frequency.

**Well audible sound and noise:** We can hear different sounds all around. Out of them some sounds are pleasing to ear and comfortable. Such sounds are tune of songs, tune of flutes, the sound of Harmonium, and play on Sitar etc. Such sounds are called well audible sounds. Many sounds are unpleasant, harsh and disturbing to the ear. Such sounds are- the sound of pushing nail, sound of construction, the sound of chalk while we write on the board. The uniformed of vibration of an object produces well audible sound. The sound which is unpleasant to the ear uncomfortable and disturbing is called noise. The non-uniform vibration of an object produces noise.

**Sound pollution:** We all are acquainted with pollution of air and water. We call pollution of water when it contains foreign particles. In our environment if there is excess or unexpected sound, then we call it pollution of sound. Let us list down some sources of contamination of sound. The main causes of pollution are: horn of vehicles, explosion, and sounds of machines, sound of mikes, and sound of construction works. Besides watching TV or listening to radio with excessive sounds, the sounds from kitchen, sound of air cooler etc. are the causes of sound pollution.

**Work:** Point out the causes of sound pollution in your area and note down the causes after discussion. You can make a group of 5-6 persons.

What harms does sound pollution causes?

You know the excessive sound all around creates health hazards. The problems are insomnia, sleepless headache, high blood pressure, disturbance, depression and many other problems. If a man hears a loud sound, it may be the cause of hard of hearing even he/she can be deaf.

How can we prevent contamination of sound?

If we want to prevent the contamination of sound, we have to control the source of sound. How can we do it? If we want to prevent contamination of sound in a residential area-

- We should keep out all the things which create noise.
- We will not establish any factory in residential area which creates noise
- Less use of horns of vehicles.
- We should not use radio, TV and other musical instruments with loud voice.
- We have to plant trees around the houses, which are by the side of a road so that they can prevent sound.

Besides in order to prevent contamination of sound, silencer should be used with the engine of aero-plane, vehicles, engines and machinery of factory. Silencer is an arrangement which does not allow sound to go out by fits and starts.

### **Lesson-10 & 11: Sound Making Machines**

Sound making machines are of two kinds- Musical instruments and non-musical instruments. Musical instruments are: flute, harmonium, one stringed and two stringed instruments and Sitar etc. Our familiar non-musical instruments are the horn of vehicles and the bell of rickshaw.

**Flute:** sound is created by the inside vibrating air of a flute. Air is pushed inside the flute pipe by blowing. The intensity of sound depends upon the length and number of holes of the flute.

**Work:** To observe the change of intensity of sound with the length of tube.

**Required equipment:** a straw or tube which is used in drinking, a scissors.

**Process:** Make the tube flat, cut the flat end which will be pointed, blow the cutting end with your mouth.

Observe what kind of sound produces. Now cut the other end of the tube and make it shorter. Can you hear the difference of intensity of sound?

The intensity of sound is more of the shorter tube.



Fig. change of intensity of sound with the length of tube

**Mono chord musical instruments and two stringed musical instruments:** These are stringed based musical instrument. The instruments produce pleasing sound with the help of vibrating string/wire. The string of a musical instrument vibrates and creates melodious sound when it is pulled or pushed by something. The intensity of sound can be changed by increasing or decreasing its length or thickness of the string.



Fig. Mono chord and two stringed musical instruments

**Bell of a bicycle or rickshaw:** We are familiar with the sound of bell (Tung Tang). Do you know how this bell produces sound? A round metallic bowl is put upset. A metallic hammer is inserted under the bowl. It has a handle by which the hammer can be moved to and fro which hits the bowl. It produces sound Tung/Tang as a result of vibration of the bowl.

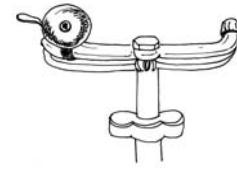


Fig. Bell of a bicycle

#### New words learnt from this chapter:

Audible, Inaudible, ultrasound, Tympanum, act of hearing- pre sound, act of hearing- post sound, pleasing sound, noise, contamination of sound.

#### What we learnt from this chapter:

- Sound is produced through the vibration of sound.
- Propagation of sound needs medium. Sound cannot move through the medium of vacuum.
- The limit of audibility of man's ear is 20 to 20000 Hz.
- Dog can hear the sound which has frequency more than 20000 Hz.
- Below 20 Hz frequency is called hearing pre-sound.
- Above 20000 Hz frequency sound is called hearing post-sound.
- The velocity of sound is the highest in solid and the lowest in the air.
- Disturbing sound is called noise.
- The presence of excessive sound in the environment is called contamination of sound. Contamination of sound is injurious to health. Sound may be the cause of insomnia (sleeplessness), headache, high blood pressure, disturbance etc.
- Contamination of sound may be reduced to a minimum level by planting trees around the houses and by the roadsides.

## EXERCISE

#### Fill in the gaps

1. Sound does not circulate without \_\_\_\_\_.
2. The limit of audibility of man is from \_\_\_\_\_ Hertz to 200000 Hertz
3. Unexpected & disturbing sound is called \_\_\_\_\_.
4. The velocity of sound in the air is the \_\_\_\_\_.
5. The sound above 20000 hertz vibration is called \_\_\_\_\_.

#### Short answered questions

1. What are the differences between audible and inaudible sound?
2. What do you mean by audible and inaudible sounds?
3. What are the differences between noise and pleasing sound?
4. Can we hear the sound of all vibrations? What is the limit of our audibility?

**Multiple Choice Questions:**

1. Which medium circulates the highest velocity of sound?  
 a. Vacuum      b. Solid      c. Gaseous      d. Liquid  
 medium      medium      medium      medium

**Read the passage given below attentively and answer the question No. 2 and 3.**

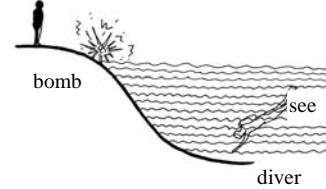
The explosions on the surface of the moon and shooting a gun on the surface of the earth, in both cases the flashes of light are seen.

2. To hear the sound of explosion from the earth-  
 i. The distance of moon will be less  
 ii. The medium must be in between the earth and the moon  
 iii. The limit and audibility will be 20 to 20000 Hz.

Which one is the correct?

- a. i      b. ii      c. iii      d. ii and iii  
 3. Which one will be observed last if both the incidents take place at a time?  
 a. The sound      b. The light      c. The sound      d. The light  
 of bullet of      created by      of      of  
 a gun      the gun      explosion      explosion  
 4. Which instrument produces sound with the help of its inside vibration?  
 a. Sitar      b. Monochord      c. Guitar      d. Flute  
 instrument

**Creative questions:**

1. The velocity of sound is 330 m/sec (air). The velocity of sound in sea water is 1500m/sec. The man standing on the sea shore hears the sound after 6 minutes of the bomb explosion.
- a. What is sound?  
 b. Why do you hear the sound of railway movement from a distance if you put the ear on the rail?  
 c. Determine the distance of the man standing on the bank from the place of explosion.  
 d. What distance and in which direction will the diver move if the man and the diver want to hear the sound of the bomb explosion at the same time? Explain mathematically.
- 
2. The sound of school bell was not heard for a long from Tapan's house. Recently the shape of the bell has been changed keeping the weight as before. As a result now he can hear the sound of the school bell from his residence.
- a. What is pleasing audible sound?  
 b. What change will come to the flute if the length of the tube of the flute is lesser?  
 c. Describe the techniques of reaching sound to Tapan's ear from the school bell.  
 d. What kind of change has been made to the bell for which Tapan can hear the sound from his residence? Analysis this with appropriate causes.

## **Chapter Nine**

# **Heat and Temperature**

Heat is a form of energy which is important for man. Heat gives us the sensation of hotness. How much hotness we feel is expressed with temperature. Heat always flows in three processes from a substance at a higher temperature to the substance at a lower temperature. The pressure of air and humidity changes when heat is applied or heat is removed as a result of changes to the temperature. Thus we are being influenced in different ways with the influence of heat.

### **At the end of the chapter we:**

- Will be able to distinguish between heat and temperature.
- Will be able to relate between Fahrenheit scale and Celsius scale.
- Will be able to measure the temperature precisely using thermometer.
- Will be able to explain the pressure of air and humidity.
- Will be able to analyze the effect of change of temperature over the pressure of air and humidity.
- Will be able to explain the thermal expansion of substance.
- Will be able to explain the transfer of heat which causes different incidents all around.
- Will be able to distinguish between radiator and absorber.

### **Lesson 1: What is heat?**

You know all things in the universe are divided into two. One is matter which has weight or mass, occupies place and resists while force is applied. Another is energy. Energy has no weight, does not occupy place and does not resist while force is applied. We can feel them with our sense. Heat is a kind of energy. Heat can only be felt with the skin out of five senses.

**Activity:** First take two glasses. Touch the glasses and see how cold or hot they are. Now pour hot water into one glass and put pieces of ice in another one. Wait for two minutes. Now throw hot water and ice out of the two glasses. Now hold and touch the two glasses by turns. How did you feel of the glasses? One is hot, another is cold. Now you discuss yourself, what does the hot glass contain for which it is hot? Why did the other glass feel cold? What does it have in it or does not have in?

**Caution:** Pour hot water in such a way so that it does not fall on your body. Never touch the hot water pot or glass with your bare hand.

Now we can say that anything hot or cold is the cause of heat. We feel anything hot or cold due to heat. An object becomes hot when it absorbs heat and becomes cold when it releases heat. The hot glass has absorbed heat from hot water. That's why it feels hot. On the other hand the other glass releases some heat. That's why it feels cold.

### **Lesson 2: What is temperature?**

You know that heat is a kind of energy for which any object becomes hot or cold and we feel hot or cold. Let us do another activity.

**Activity:** Touch a steel glass with your hand. Whether it is hot or cold? Keep it in your mind how much hot it is. Now fill the steel glass with hot water. Now touch the glass after one minute. The glass is becoming hotter gradually. Now throw the water out of the glass and touch the glass after a minute. The glass is getting cold.

**Caution:** Pour hot water in such a way so it does not fall on your body. Never touch hot water pot or glass with your bare hand. You will not hold the glass which is filled up with hot water for a long time.

Have you found that the hot water glass has got hot gradually? On the other hand, it has got cold when hot water was thrown out. How much cold or hot? To understand it, temperature is used. When the glass is too hot, the temperature is high. When the glass is cold, then the temperature is low. It means temperature of an object is a measure of how much hot or cold the object is. Thus temperature expresses the thermal condition of anything.

Then what did you understand the difference between heat and temperature?

Heat is a kind of energy which gives us the sensation of hot or cold for anything. On the other hand, temperature of anything is the measure of how much hot or cold the thing is i.e. temperature is the thermal condition of anything.

### Lesson 3-5: Measurement of temperature

You have seen before that the hot water glass gets hotter gradually. One morning we feel less hot but we feel hotter at noon. We can understand by means of the touch anything or with our skin whether the hotness is more or less. We understand a bit how much the heat has increased. But temperature of an object cannot be determined accurately by means of touch. For correct measurement an instrument is used. The name of the instrument used to measure temperature is thermometer. Temperature of a human body is measured by means of thermometer. Meteorologists use thermometer to measure the temperature of air. Constant temperature is kept in industries. That's why in industries they also use thermometer to measure the temperature.

You will learn very clearly in the next lessons that when temperature changes then the volume of liquid increases or decreases. Temperature can be measured by the variation of the volume of liquid. Temperature is measured by using different liquids such as: mercury, alcohol etc. A description of a mercury thermometer is given below:

The type of thermometer that uses mercury as an indicator of temperature is called the mercury thermometer. You have certainly seen the thermometer which is used to measure fever. It is mercury thermometer. It consists of a thick-walled glass tube with a narrow and uniform bore. At one end there is a thin walled bulb. The other end is kept open at first. The bulb is filled with pure and dry mercury through the open end. The rest of the tube does not contain anything except a small amount of mercury vapour. The tube is then graduated according to a fixed scale for measuring temperature. The bore in the tube of the thermometer is extremely narrow. So mercury goes upward to a great extent if the temperature of the bulb slightly increases. How much temperature increases can be understood by observing the mercury level on the scale.

**Do yourself:** Determination of fever by using thermometer.

The normal temperature of human being is  $98.4^{\circ}$  Fahrenheit. It is called fever when temperature goes beyond that. If the temperature is less than  $101^{\circ}$  Fahrenheit no need to go to a doctor. Measure the temperature of five learners of your class using clinical thermometer and write down them. Decide from this whether anyone feels feverish.

#### Scale of measuring temperature:

In order to measure anything, the first step is to fix a unit of the thing as a standard for measurement. In measuring temperature, two fixed temperatures are considered as standard. These are known as the fixed points. One is the freezing point and the other is the boiling point.

**The freezing point:** The temperature at which pure ice melts under normal atmospheric pressure is called the freezing point.

**The boiling point:** The temperature at which pure water boils to vapour under normal atmospheric pressure is called boiling point.

The interval between the boiling point and the freezing point is divided into a suitable number of equal divisions. The interval which is divided into a suitable number of equal divisions gives us different scales based on it. Presently two scales of temperature are followed. Two scales are explained below:

**Celsius Scale:** The freezing point in this scale is marked  $0^{\circ}$  and the boiling point is marked  $100^{\circ}$ . The interval between two points is divided into 100 equal divisions. Each division is called one degree Celsius ( $1^{\circ}\text{C}$ ).

Scientist Celsius introduced this scale. It was then named Celsius scale after his name. This scale is used for scientific works in different countries of the world including Bangladesh. Such as: you listen to weather forecast that the maximum temperature of the day was 30 degree Celsius. As the interval between the two points is divided into 100 divisions is also called centigrade (centi means one hundred and grade means divisions) scale.

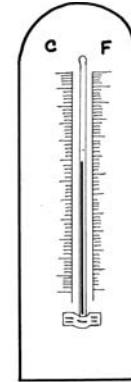


Fig. Celsius and Fahrenheit Scale

**Fahrenheit Scale:** In this scale the freezing point is marked 32 degree ( $32^{\circ}$ ) and the boiling point is marked 212 degree ( $212^{\circ}$ ). The interval between the two points is divided into 180 equal divisions. Each division is called one degree Fahrenheit ( $1^{\circ}\text{F}$ ).

Scientist Fahrenheit invented this scale. It is called Fahrenheit Scale after his name. Such as: when you have fever, anyone can say that your fever is 101 degree. In reality the temperature of your body was 101 degree Fahrenheit.

#### Relation between the Celsius and Fahrenheit Scales:

If you know the temperature in Celsius Scale, it can easily be transformed into Fahrenheit Scale and vice versa. For this, you have to know an equation.

$$\text{The equation is } \frac{C}{5} = \frac{F-32}{9}$$

Where, C = the temperature in Celsius Scale,

F = the temperature in Fahrenheit Scale

Let us set an example:

**Activity:** Take a Celsius Scale and Fahrenheit Scale which is used to measure fever. Measure the temperature of your five friends in your class using the Fahrenheit Scale. Using the formula transform the measured temperature into Celsius Scale and fill up the table given below.

Name of learners	Temperature in Fahrenheit Scale	Temperature in Celsius Scale	Remarks
1.			
2.			

## Lesson 6, 7: Expansion of matter due to effect of heat

Most of the substances expand in volume by the application of heat. The expansion is no minor for solid. Most of the liquids do not expand so much by the application of heat but the gaseous substance expands more by the application of heat.

Expansion of solids:

**Activity:** Proof of expansion of solids.

**Required equipment:** A brass ball, ring, fire and stand.

A brass ball and a ring are so made that the ball can simply pass through the ring when it is cold. Insert ring and ball to stand as shown in the figure. Now try to pass the ball through the ring at the moment state. You will see that the ball has passed through the ring. Now take the ball and heat it. Try to pass the ball through the ring. Is the ball going to pass through the ring? No, it is not passing.



Fig: Expansion of solid

Why is not the brass ball passing through the ring when it is heated? The reason is that the ball has expanded. The ball has expanded a little due to heat. It proves that most of the solids expand by the application of heat. But this expansion is so minor that we cannot understand easily. Generally metal expands a great by the application of heat in the solid matter.

### The effect of expansion of solids in our daily life

We will understand how we make the best use of expansion of solid in our daily life from the examples given below:

1. Have you ever seen that the neck of some glass bottle (which contains jam, sauce) is so tightly fitted that it cannot be opened easily? At this stage generally the metallic neck of the bottle is heated. Then it is opened so easily by twisting. Why does the neck open so easily then? Because due to heat the metallic neck expands and opens up. So it opens so easily then.
2. Have you seen rail lines? The train runs on the two parallel iron strips. You may have seen that there is a gap between two consecutive rails of a rail line. What is the cause of it? In fact, some gaps are kept between two consecutive rails willingly. The iron rails turn hot when the trains run on it and it is caused due to the friction of wheels with them. As a result the lines increase in length. If there is no gap left between the rails, the line will be twisted. The rails increase and fill us the gap so that the lines do not twist or bend.

**Expansion of liquid:** The expansion of liquid is much higher than the expansion of a solid in volume. Thermometer is made using the expansion of liquid metal mercury. Already you have learnt it. You will learn in the chapter titled 'The Change of Climate' that the temperature of the earth is increasing. As a result the height of the sea surface is increasing as well for the expansion of the volume of the sea water.

**Expansion of gases:**

**Equipment:** A glass bottle, two water tubs, hot and cold water, balloon, thread.

**Activity:** Take a strong and empty glass bottle. Tie a balloon with a thread to the neck of the bottle. Take boiling water in one tub and cold water in another tub. Now dip the bottle in hot water cautiously. What do you see? The balloon has blown away a little. Now dip the bottle in cold water. Has the balloon soaked? Why is it happening?

The gas expands a great while it is heated. If we dip the bottle in hot water, the gas of inside the bottle gets heat and expands. As a result the balloon has blown away after receiving the air from the bottle. If we dip the bottle in cold water, the inside air of the bottle contracts. As a result the air of the balloon comes back into the bottle. That is why the balloon is soaking. It proves that the gaseous substances expand due to heat.

The effect of expansion of gas: The effect of expansion of gas is formed in nature and in our daily life. Have you seen baking bread? At one stage the bread goes up a great. If we put a hole on the bread, something comes out with a sound. Why does such happen? You know that bread is made with the combination of flour and water. The inside water in the bread turned into vapour. Vapour expands more while heated. As a result the bread swells.

Engine is driven by the use of expansion of gas due to heat. You will understand more when you will be grown up. Fuel burnt heat expands gas which helps drive the engine. Engine is driven by the shocks of the expanded gas. Atmospheric change is found for the expansion of air due to heat. We will know about this from the discussion given below.

**Lesson 8: The effect of temperature over humidity and atmospheric pressure**

The particles of air move to and fro in air. They apply force when they are obstructed. As a result, pressure exists in air. The applied force of air per unit area is called the pressure of air. The air exerts pressure at all directions. The atmospheric pressure of anywhere depends upon their temperature. The atmospheric pressure is increased within a confined pot when the temperature rises. The reason is that the atmosphere is not confined, it is open. Air gets lighter and goes up when heated. For this, the density of air decreases and air pressure decreases. This is why if the temperature of a place increases then air pressure falls down i.e. depression takes place. High pressure takes place where temperature is low.

**Water vapour, air humidity and temperature:** You know that the water of earth's surface turns into vapour and mixes with air. Air contains water vapour more or less all the time. The amount of water vapour in air is expressed as the humidity of air. If air contains more water vapour, the humidity will be more. If air contains less water vapour, the humidity will be less. The water turns into vapour when temperature increases. On

the other hand, air absorbs more water vapour if temperature increases. In our country we feel sultry weather during the month of Srabon and Bhadro. Then by the influence of monsoon a lot of water vapor floats and come to land from the Bay of Bengal. Sweating of our body takes place when humidity is more in the air. When water vapour increases too much, at one stage it is condensed and turns into cloud and at last it rains.

### **Lesson 9-10: Transmission of heat**

Have you ever marked that a steel spoon gets hot when it is kept in a hot curry bowl. How does heat flow away from curry to hand? Heat flows from places of higher temperature to places of lower temperature. The process of heat that transfers from one place to another is known as heat transmission. Heat follows by the processes- Conduction, Convection and Radiation.

**Heat conduction:** Heat flows through the spoon from hot curry bowl by the process of conduction. Heat flows to solid substances by this process. You know the particles of solid substances cannot change their positions. They can vibrate from their own positions. Hot particles push adjacent cold particles and they are heated in turn and vibrate rapidly. In this way heat goes from one end to the other. Thus the heat flows from hot end to cold end without changing the position of the particles.

Among solid substances, metals such as; Iron, Copper, Brass, Aluminum, Zinc conduct away heat rapidly. For this utensils are used to cook which are made of metals. Heat is conducted away to a minimum by non-metals such as; wood, cotton, cloth, soil etc. That's why we use a cloth to hold the hot pots. For this reason, wooden stick is convenient for cooking purpose.

**Convection:** Heat flows to liquid and gas by this process only. Take a pot and put some water and place it on the burner. Then the whole water gets heated. In this case, the particles of water absorb heat and get energy. After getting energy water particles become lighter and goes up. The top particles of cold water goes down and absorb heat. Thus all the particles in turns absorb heat and get heated. Then heat transfers from one place to another. Thus hot water from the bottom carries heat above the cold water which goes downward and gets itself heated and then goes up again. The process continues until all the water is equally heated and attains the same temperature. This process of heat transfer is called convection. Like the particles of liquid, particles of gases get heated and transmit heat so easily by changing its positions. Have you ever stood by the side of a fire in winter? The villagers bask by burning woods or twigs during winter. We feel hot while standing by the side of fire. But if you put your hand over the fire carefully, you will feel warmer. Because by the process of convection the particles of air get heated and go up but do not go aside. So we feel hotter over the fire rather than standing aside.

**Heat radiation:** The sun is the main source of heat. The distance between the earth and the sun is open place. There is no gaseous substance. Then how does the heat come to the earth from the sun? Heat comes from the sun through radiation. Heat transfers through radiation where there is no non-living body. You will know it in upper class

that heat is a kind of wave which can be transformed from hot place to cold place. Heat transforms or flows in the form of wave during radiation.

Some substances radiate heat so easily and they are called radiator. Radiators tend to be cold through radiating heat. Radiators absorb heat as well. On the other hand some substances absorb heat. They are called absorber. Absorber absorbs heat and gets heated. Liquid water, vapour, carbon dioxide, methane, glass, plastics: these substances absorb heat. The sun radiates heat. So we can call it radiator. The earth gets heated by absorbing heat from the sun. The earth may be called an absorber. But simultaneously the earth is also a radiator. At night the heated earth radiates heat and gets cold. You will know in the chapter Climate Change that carbon in the atmosphere, carbon dioxide, vapour, methane such types of gases act as an absorber of radiated heat which is influencing our life.

### **What we have learnt from this chapter**

- Heat is a kind of energy by which we feel hot or cold. On the other hand how much cold and hot we feel can be expressed by temperature.
- Mercury is used to measure temperature and simple work. Temperature has two scales. Celsius Scale and Fahrenheit Scale.
- Generally matter expands by the application of heat. Solid or liquid expands a little. But the gas expands a great.
- Air pressure and humidity changes with the change of temperature which play a role for changing weather / climate.
- Heat transmits in three processes- through conduction, convection and radiation.

## **EXERCISE**

### **Fill in the gaps:**

1. Heat flows through liquid and gas by the process of \_\_\_\_\_.
2. The temperature which boils pure water and turns into vapour in normal pressure, is called the \_\_\_\_\_ point.
3. The freezing point of Celsius Scale is \_\_\_\_\_ degree Celsius.
4. The freezing point of Fahrenheit Scale is \_\_\_\_\_ degree Fahrenheit.
5. \_\_\_\_\_ of air decreases when the amount of vapour is less.

### **Short answered questions:**

1. What are the differences between heat and temperature?
2. Why is a gap kept between two consecutive rails of a rail line?
3. We feel warm by the side of a fire. We feel warmer or hot if we keep our hand over fire. Why does that happen?
4. Why do we not hold cooking hot pot with bare hand? Why do we use a piece of cloth?
5. Why does the pressure of atmosphere decrease when temperature increases?

**Multiple choice questions:**

1. Which acts as a well absorber of atmosphere?  
 a. Nitrogen      b. Water vapour      c. Oxygen      d. Dust

2. Characteristics of temperature is;

- a. Can be felt      b. Can be measured  
 c. A kind of energy      d. Resists while force is applied

Watch out the figure below and answer the question number 3 and 4:

3. Thermometer as shown in figure 2:

- (i) Freezing point  $320^0\text{F}$   
 (ii) Fundamental division  $200^0\text{ F}$   
 (iii) Melting point  $232^0\text{ F}$

Which one is correct?

- a. i      b. ii  
 c. i and ii      d. i, ii and iii

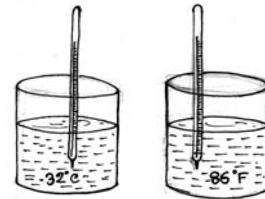


Fig. 1

Fig. 2

4. In figure 1 and Figure 2 what will happen to liquid with the thermal touch?

- a. The flow of heat will be from 1 to 2  
 b. The flow of heat will be from 2 to 1  
 c. The flow of heat will be continued  
 d. Both temperatures will reach to room temperature

**Creative questions:**

1. Sharmin reads in class seven. One evening she feels feverish. They measured the temperature in Celsius Scale  $37^0\text{ C}$ . Sharmin can understand Fahrenheit Scale temperature instead of Centigrade Scale. Being anxious she went to a doctor to measure the temperature and found no fever.

- a. What is temperature?  
 b. Explain the advantage of mercury thermometer.  
 c. What was the temperature in Fahrenheit Scale at Sharmin's body?  
 d. Why did the doctor say that Sharmin had no fever? Explain what benefit would Sharmin derive if she knew the relation between Fahrenheit and Centigrade Scale?

2. Kajal observes daily activities that happen in his life very carefully. One day he saw that the lid of the cooking pot fell down due to heat. On the other hand he noticed some gaps in their door in winter season where he found no gap in the summer. Both the incidents made him thoughtful.

- a. Which matter expands more due to heat?  
 b. Why is a gap kept between two consecutive rails of a rail line?  
 c. Explain the cause of incidents which Kajal observed while cooking was going on.  
 d. Analyze the cause of the two behaviour of wooden door which Kajal observed during winter and summer season.

## Chapter Ten

# Phenomena of Electricity and Magnet

Electricity is lightening our home, school or office. It has been running fan, radio-television, iron, heater, motor, computer and many other things. The use of magnet has also flourished our daily life like electricity. In this chapter we will discuss different phenomena related to electricity and magnet.

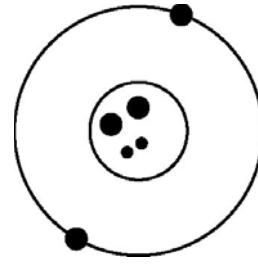
**By the end of this chapter we will be able to –**

- explain the property of charge.
- explain conductor, non conductor and semi conductor.
- demonstrate the properties of charge through creating static electricity.
- prepare a simple circuit.
- explain the use of electricity in daily used machine.
- differentiate between magnetic and non magnetic substance through demonstrating the property of magnets.
- demonstrate the process of preparing magnets from non magnetic substance.
- explain electric magnets.
- explain earth's magnetic field.

## Lesson – 1 and 2

### Origination of charge

We know that elements are composed of many small particles. It is called atom. Atoms are composed of electron, proton and neutron. It has nucleus at the centre which is composed of proton and neutron. Electrons move round the nucleus. Proton is positively (+) charged, electron is negatively (-) charged and neutron is neutral particle.



But it is interesting that the atom itself behaves neutral. Atom is neither positive nor negative. There is no charge necessary equipments in atom. What is the reason? The reason is that an atom contains similar number of proton and electron. That is why atom is charge neutral. When two matters are rubbed, electrons from one substance can move into the other. Thus the number of electrons can be raised in a substance. Now let's give an example. A glass bottle has been rubbed with a piece of silk cloth. It will be seen that silk cloth will attract electron towards it. For that the bottle will be positively charged and the silk cloth will be negatively charged. So it is clear that no charge is created because of rubbing rather the existing change of the matter moves from one to another.

### Property of charge

Now we can definitely understand that how charge is produced. Now we will see what types of properties are shown by the charge (positive and negative). For that we will do the following activities.

**Activity:** Knowing the properties of charge.

**Necessary equipments:** two combs, woolen cloth.

**Method:** Suspend a small comb by tying it with a ribbon on a dry stick. It should be suspended in such a way that it cannot touch any other things. Now suspend one more plastic comb on another dry stick so that it can move freely. Now rub both of the combs with wooden cloth for some time. Now bring the combs close to each other. What do you observe? The combs are repulsing each other. Now bring the woolen cloth close to the comb, it will attract the woolen cloth.

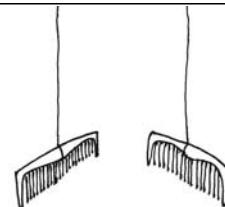


Fig: Knowing the properties of charge

**Activity:** Demonstrating properties of charge.

**Necessary equipment:** two balloons, ribbon, woolen cloth or sweater, piece of paper.

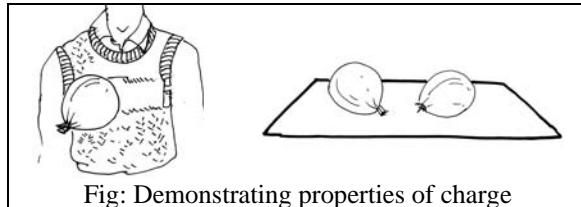


Fig: Demonstrating properties of charge

**Method:** Tie the two balloons with ribbon by blowing them up. Now rub the balloon with woolen cloth or sweater and bring it to the pieces of paper. It will be seen that the balloon will attract the pieces of paper. What is the reason? The reason is that rubbing creates charge in woolen cloth and balloon. What will happen when first balloon will bring to the second one? You will see that two balloons are going far from one another because the rubbing has created similar charge to both of the balloons.

Could you take any decision from the above activity?

Yes, two decisions can be made from this:

- Charges of same nature repel each other (in terms of two balloons and two combs)
- Charges of opposite nature attract each other (Woolen cloth and balloon)

### Lesson – 3 : Existence of charge

Now we will prove the existence of charge through an easy experiment.

**Activity:** Proving the existence of charge.

**Necessary equipments:** A plastic comb, a piece of news paper.



Fig. Proving the existence of charge

**Method:** Take a portion of newspaper and cut it into pieces. Now spread the pieces over a table. Now could you tell what will happen if a plastic comb is brought to those pieces of paper? Now bring the comb to those pieces of paper by rubbing it through woolen cloth (you can also rub the comb with your dry hair). Could you tell what will happen and why? You will see that the pieces of papers will jump to the comb.

Here the plastic comb has become positively charged by receiving electron from woolen cloth during rubbing which leads to the attraction towards the pieces of paper. The reason is the negatively charged comb is attracting the electrons on the pieces of paper from the upper surface when it is brought to them. In this case the comb is attracting the negative part of the paper. Thus the pieces of paper are rising up to the comb. It is static electricity.

### Lesson 4: Conductor, non conductor and semi conductor

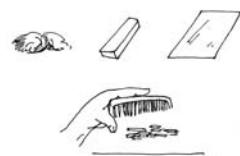
We are familiar with the words conductor and non-conductor. The electrons of conductors can move from one atom to another easily. For example, metals, especially, silver, copper, aluminum. A new form of carbon, graphite is conductor though carbon is a non metal.

Electrons cannot move freely in atoms of non-conductor. But it can be charged by rubbing. Besides if electron is received or left, it can be charged. For example: plastic, glass and rubber.

At low temperature the semi-conductor behaves like non conductor. It behaves like conductors when the temperature increases. Generally the semi-conductors are solid but some of them are liquid. Silicon, Germanium, Gallium etc are the examples of semi-conductors.

**Activity:** Identifying conductors and non conductors.

**Necessary equipments:** plastic comb, iron, gold-silver made thing, glass, wood, plastic, small pieces of paper.



**Method:** First of all let's rub a comb with a woolen cloth. It will be seen that the comb will attract the small pieces of paper. Now rub the comb with iron and it will be seen that the comb will not attract the pieces of paper because iron is conductor and electron is transferring to iron from comb. Again, it will attract the piece of paper if it is rubbed with woolen cloth. It will attract the pieces of paper again if it is touched to glass because the electrons of comb cannot transfer as glass is non-conductor. In this way it will be understood which things are conductor and which things are non-conductor in our house.

Fig. identifying conductors and non conductors

### LESSON – 5: Producing current electricity from static electricity

From the previous experiments we have seen that, plastic combs attract small pieces of paper after being rubbed through woolen cloth. It will not attract the small pieces of paper if it is touched by hand. What can be understood from this? It has been understood that, there is no static electricity in the comb. Where has that static electricity gone? This electricity has gone to the ground through hand from the comb. The electricity, which flows through a body from one place to another or one matter to another, is called current electricity.

Here it is important to remember that, a specific and little amount of charge is produced because of rubbing. This charge moves to the ground just after being touched with hand or metals. The flow of electricity stops when the charge is finished. Thus the flow of electricity is created for a while. To continue this flow the continuous supply of electricity from any source should be ensured. We will have more idea on it later.

## Lesson – 6: Simple circuit and its use

The flow of electricity needs a path like man needs a path to move on. This path of the flow of electricity is known as an electric circuit. Generally the complete path of flowing electricity from the positively charged end of the source from negative is called electric circuit. Generally bulb and battery are connected with wire in this circuit. When they are connected the circuit completes. The simple circuit is shown in the following figure.

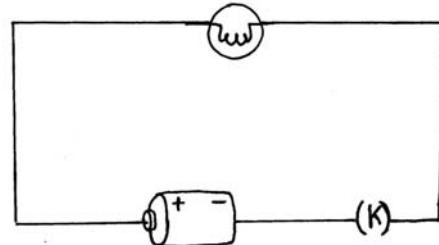


Fig: Simple circuit

## Lesson – 7 and 8

### Use of static and current flows

Light and heat can be produced from the flow of electricity. Even various works can be completed through using its mechanism. Now we will introduce you to the uses of electric bulb, torch light, iron, heater, electric fan and photocopy machine citing examples.

#### Electric bulb

We all are known to this bulb. Two thick wires are placed inside the air free or neutral gas filled air tight bulb. There is a coil of a very thin tungsten wire inside an electric bulb. The coil is called filament. This bulb produces a lot of heat when it is connected with the electric source and this filament of bulb emits a huge amount of light.

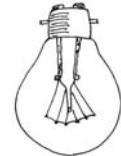


Fig. Electric Bulb

#### Torch light

We all are known to torch light. There is a small bulb with the battery in torch light. The light turns on when the switch is on. To spread the light a glass is used in front of it. In this case static electricity exists in the battery of the torch. It turns to current electricity after the switch is on.

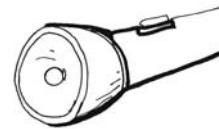


Fig. Torch light

#### Electric fan

In electric fan the flow of current is used to do the mechanic activities. Here the electrical energy transform into mechanical energy to rotate the fan. A regulator is used to control the motion of fan.

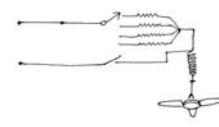


Fig: Electric fan

### Electric heater

Many of us are known to electric heater. There is a round disk made of non conductor in the heater. A coil of Nichrome wire is arranged in the coil. The wire becomes hot if electricity flows and radiates much heat. In our house this electric heater is used to cook food.



Fig. Electric iron

### Electrical iron

The structure of electric iron is like electric heater. Here the Nichrome wire heats the smooth lower iron made surface. The production of heat depends on the flow of electricity. If flow increases the heat of iron will increase.

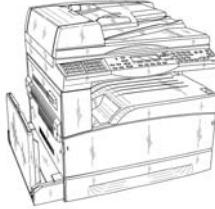


Fig. Photocopy machine

### Photocopy machine

You have already seen the process of charging balloon with sweater. The same process occurs in photocopy machine. Mainly there is a drum and a toner inside it. First of all the drum gets charged. After being charged it attracts the particles of toners. Thus a photocopy machine can copy a paper of black writings.

## Lesson – 9 and 10: What is magnet?

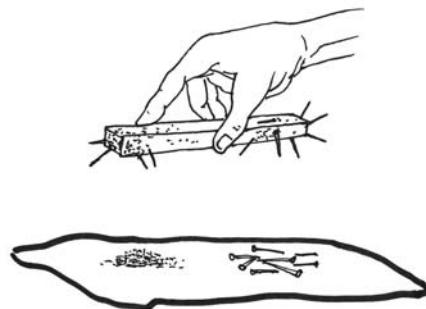
There was a shepherd named Magnes who used to live at a place named Magnesia in Asia Minor. He used to graze sheep in the fields by day and back them home in the evening. One day while returning home, he noticed that he could not lift up his stick from the ground. The head of it was stuck to a stone. He noticed that the stone hold the iron made top of the stick. That means, Magnes observed that iron attracted that unknown stone. This stone was named after the name of Magnes. Bengali word of magnet is chumbok. We have also observed that, magnet has power to attract iron. Attraction is a kind of force. Work can be done by force. Therefore, a magnet has capacity of doing work. So magnet is a kind of energy.

### Properties of magnet

**Activity:** Property of magnet.

**Necessary equipments:** white paper, iron fillings, pin, a bar magnet.

**Method:** sprinkle some iron fillings over a white paper. Keep a bar magnet over the sprinkled iron fillings or the pins, and lift it up after moving it a few times. What has been observed? You will observe that iron fillings or pins remain stuck to the body of the magnet. It will be seen by careful observation that most of the iron fillings or



pins remain stuck to the two ends of the magnet. Amount of iron fillings stuck to the magnet gradually decreases from the end to its middle. You may not observe any iron fillings or pins in its middle. It is understood from this, that the power of attraction of the magnet is maximum at two points near the two ends of the magnet. These two points are mainly called two different poles of the magnet.

Now take two similar bar magnets close to each other. You don't know about the poles here. Suspend the bar magnets by tying it with a thread at the middle. What has been seen? The magnet is practically lain pointing north and south. Do the same thing with the other magnet. It will be seen that the magnet will also practically be positioned pointing north and south. It is understood from this that hanging magnets, without obstruction, always lie pointing towards north and south.

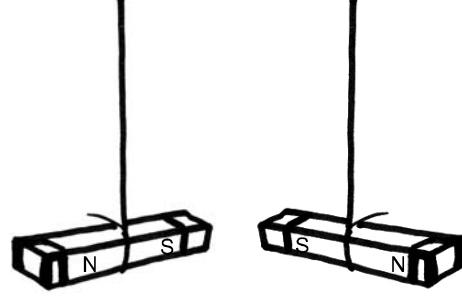


Fig: Properties of magnet

Now let us mention the poles of magnets by **N** or **S**. Now bring the north Pole of the first magnet near the north pole of the second magnet. What are you seeing? Repulsion occurs. From this it is understood that, like poles of magnets repel each other.

Now bring the north pole of the first magnet near the south pole of the second magnet. What has been observed? Similarly bring the North Pole of the second magnet near the south pole of the first magnet. They have come close to each other very easily. From this we can take decision that, unlike poles of magnets attract each other. Therefore, like poles of magnets repel each other and unlike poles of magnets attract each other.

### **Lesson – 11: Magnetic and non-magnetic substance**

Will magnet attracts all substances? No, magnet does not attract all the substances. Magnet mainly attracts iron, nickel, cobalt and maximum steels. These substances are called magnetic substance. Again, magnet does not attract many substances. For example: copper, aluminum, brass, gold, silver, mercury etc.

**Activity:** Identification of magnetic and non magnetic substance.

**Necessary equipment:** a magnet and different things of own house.

**Method:** Take the magnet in front of each thing separately. See which one attracts magnets and which not. Now fill the table below.

Name of various things of house	magnet attracts or not	What type of substance?

## Lesson – 12 and 13

### Transforming magnetic substance into magnets

Magnets can be prepared in many artificial ways. Rubbing and electrical method have been discussed below.

#### Method of rubbing

A bar magnet and a steel bar is needed for this experiment. Rub the steel bar from one to another end with a pole of bar magnet. Do this for several times. Does the steel bar attract a pin? Thus, a steel bar converted into a magnet through rubbing. If it has been rubbed through North Pole of the magnet, it will be seen that North Pole will be created at the first portion of rubbed steel bar and south pole at the end.

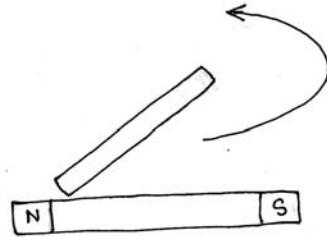


Fig: Method of rubbing

#### Electrical method

Take a long iron nail. Coil it with ordinary electrical wire available in the market. Connect its two ends with a battery's two ends. Now it is seen that any part of the nail can attract a pin. The nail does not attract a pin if the electric current flow is stopped. So it is understood that, the nail has been converted into a temporary magnet. Strength of electro magnet depends on the flow of electric current through it.

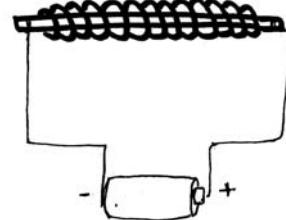


Fig: Method of rubbing

### **Terrestrial magnetic field**

If a bar magnet suspends by tying it with a thread at the middle, the magnet practically lay pointing north and south. It occurs because of terrestrial magnets. The behaviour of a bar magnet in a globe is similar to the behaviour of terrestrial magnets. The effect of terrestrial magnet exists everywhere. Two poles of suspend bar magnet indicates two poles of Earth's magnet. Here the north pole of bar magnet indicates the north side. But a north pole always attracts a south pole. Therefore the south pole of Earth's magnet works as North Pole.

### **New words learned from this chapter**

Charge, static electricity and current electricity, conductor, non-conductor and semiconductor, simple circuit, magnetic substance, non magnetic substance and Earth's magnet

### **From the chapter we have learned that**

- No charge is created because of rubbing rather charge in matter transforms from one substance to another.
- Charges of same nature repel each other and charges of opposite nature attract each other.
- In order to maintain supply of electricity, there should be a source, which can supply electricity continuously.
- Electricity flows in every part of simple circuit continuously.
- The attraction of magnet is highest near two poles.
- Like poles of magnets repel each other and unlike poles of magnets attract each other.
- Hanging magnets, without obstruction, always lie pointing towards north and south. It occurs because of Earth's magnet.

## **EXERCISE**

### **Fill in the blanks:**

1. \_\_\_\_\_ moves round the nucleus.
2. Semi conductors generally behave like \_\_\_\_\_ in low temperature.
3. The behaviour of a \_\_\_\_\_ in a globe is similar to the behaviour of \_\_\_\_\_ magnets.

### **Short answered questions:**

1. How is charge produced?
2. How does electric bulb spread light?
3. How magnetic substance can be transformed into magnet?

**Multiple choice questions:**

1. The aim of using regulator in electric fan is to –
  - a. Increase the longevity of fan
  - b. decrease sound
  - c. Control motion
  - d. decrease cost
  
2. Based on the properties of magnets which of the following substances belong to same group?
 

a. Nickel, silver, copper	b. gold, cobalt, silver
b. Cobalt, iron, nickel	d. iron, mercury, aluminum

Observe the following figures carefully and answer the question no 3 and 4.

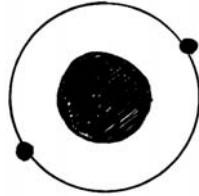


Fig: A

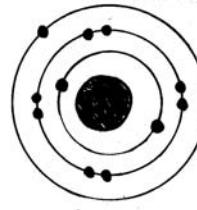


Fig: B

N →	neutron
P →	proton
• →	electron

3. The characteristics of figure **A** is: it is
  - i. Charge neutral
  - ii. Positively charged
  - iii. Imbalance in charge

Which one of the following is correct?

  - a. i.
  - b. ii
  - c. iii
  - d. ii and iii
  
4. In case of figure **A** and **B**-
 

a. A is negatively charged	b. B is positively charged
b. A and B have no attraction	d. A and B have no repulsion

**Creative Question:**

1. Samiha has a bar magnet. She prepared a magnet by rubbing method and another by electrical method.
  - a. What is called magnetic substance?
  - b. Explain that the earth is a huge magnet.
  - c. Describe the first method of preparing 1st magnet.
  - d. “The second type of magnet is strong though temporary”- analyze the quotation.

2.

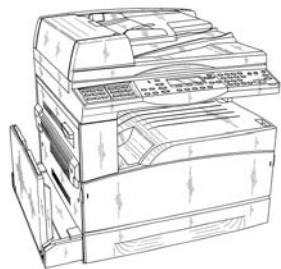


Fig.1

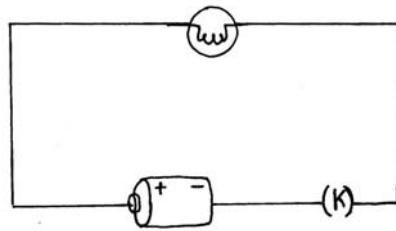


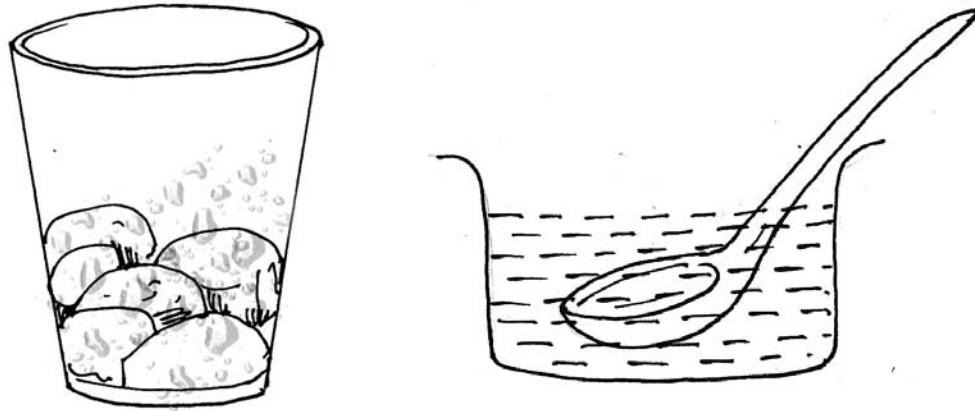
Fig. 2

- a. What is called static electricity?
- b. Why metals are conductor of electricity? Explain.
- c. Explain the function of the number 1 machine?
- d. There are two types of electricity in the second figure. Analyze it by mentioning the areas.

## Chapter Eleven

# Change in Surrounding and Various Incidents

In our surrounding different types of change have been occurring in every moment. Some of them are essential for our survival and some of them can be the reason of various harms for our life. These physical and chemical changes of different matters have been occurring through this various incidents of nature.



### By the end of this chapter we-

- Will be able to explain physical and chemical change of various incidents of nature.
- Will be able to realize the importance of preserving metal.
- Will be able to show some practical application of chemical reaction and change.
- Will listen to the classmates, will participate actively and will help in taking decision in group works.
- Will be conscious in taking necessary safety measures in experimental activities and will make others conscious.
- Will be able to use the equipments appropriately in experimental activities.

## Lesson 1: Melting and boiling

**Activity:** Wait for sometimes after keeping some ice cubes in a small pot. What is happening? The ice is turning to water by melting gradually. Well, now tell, are water and ice the same matter or different? Water and ice are the same matter, they are not different. The states are different only. While it is in the shape of water, it is liquid and while it is in the shape of ice, it is solid.



Figure: Glass with ice

Heat exploits when solid turns liquid and liquid turns into gas, and heat emerges when gas turns into liquid and liquid turns into solid.

Only the change of state where ice turns to water is called physical change.

What happens if water is heated? The temperature of water increases and the water starts to boil at a certain point. Is boiling point of water physical change? Yes, obviously it is a physical change, because it turns water from liquid to gaseous state, even it does not turn into a new substance and its property remains unchanged.

Again, if you cut a big paper into small pieces, will it be a physical change? Yes, it will be a physical change as well, because of that the paper only turns into small pieces but it remains the same substance and its property has not changed as well.

Thus the change of matter which leads the transformation in the state or shape but does not create a new substance and keeps the properties of matter unchanged are called physical change.

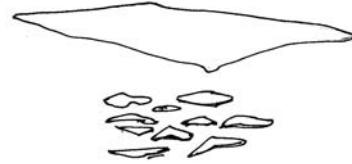


Fig. Paper sheet and pieces of paper

## Lesson 2: Decaying of metal

All of you are well known about rod made from iron. Rust occurs in iron rod if it is kept outside for some days and gradually the rod becomes wear off. Do you know what rust is and how is it formed?

**Activity:** Take a pot containing half water. Carefully drop the pin into the water of that pot. Keep that pot for 2/3 days. Could you see any change in the pin? Yes, there is rust at the surface of the pin.

What is the change called occurring in this iron? Is it a physical change? Here ferric oxide has formed from the reaction of iron, oxygen and water. This water mixed ferric oxide is called rust. Thus it can be observed that iron transforms into a different substance called ferric oxide which has completely different properties than iron.

*Such changes where one or more than one substance transforms completely into a new substance having different properties is called chemical change.*

The rust comes off if it is rubbed. That means rust creates destruction in iron.

Similarly other metals like aluminum and copper decays if it is kept in air. But some metals like gold, platinum do not decay in the open air. That is why they are used in making ornaments and coin.

### Lesson 3: Stainless steel

Well, do you know what stainless steel is or whether rust is seen in it or not?

Stainless steel is prepared by mixing carbon, nickel and chromium with iron. Mainly it is a mixture. Stainless steel is several times stronger and harder than iron. Most interestingly rust does not occur in it. Now let's confirm it from experiment.

**Activity:** Take two third of water in a pot and dive a spoon made of stainless steel into it for some days. Is there any rust in the spoon? No, there is not, because the property of iron in stainless steel is different from original iron, so it cannot create rust by reacting with oxygen and water.

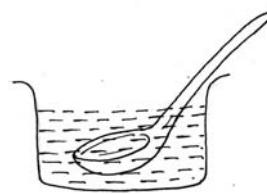


Figure: Spoon and water pot

Prepare a list of metallic stuffs used at home and observe which of them are decaying gradually and which are not. Think the reason behind that.

If the metallic substances gradually decay it will be unable to use. But if we are conscious of using those with proper care, then it will be possible to prevent the erosion. For example: we can keep iron made stuffs like hammer, spike etc far from water in a dry space. It is possible to avoid the rust by steeping those in oil or grease.

Now a question can be raised that what should be done to avoid rust in metals?

Galvanizing, painting and electroplating are some ways to avoid rust in metals. Now let's be acquainted with them.

**Galvanizing:** In our daily life we use zinc in various activities. Galvanizing is one of the best of them. To give a layer of zinc in an iron stuff is called galvanizing. The layer of zinc oxide occurs by the reaction of zinc and oxygen for galvanizing, which protects iron from oxygen and water. Thus rust cannot be seen. Iron does not decay as well. The metals can be protected by giving layer on tin instead of zinc.

**Painting:** The erosion of metals can be controlled through painting. To avoid such erosions refrigerators, selves, cars, stuffs made of steel can be painted with colour. These paintings can be damaged with the passage of time. In that case it is better to paint that as soon as possible.

#### **Electroplating:**

Electroplating is a process of making layer of metal in the surface of other metal through electrolysis. In this process nickel, chromium, tin, silver and gold is generally used to make the layer. It not only prevents the erosion of metal but also increases the attraction and shine. Electroplating of tins carries out in case of iron or steel made food pots, cycle etc.

#### **Lesson 4: Combustion**

**Activity:** Light a candle with a match-stick. Observe carefully, what is happening? Some portion of candle is burning and some portion is going downward by melting and coagulating. What type of change is occurring when a portion is being burnt? And what type of change is occurring when another portion is being coagulated at downward?

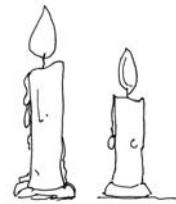


Fig. Combustion of candle

One portion of the candle is burning through the wick. Candle turns to carbon dioxide and water by reacting with oxygen and producing light and heat energy. Since the produced carbon dioxide is colourless and the water is colourless and becomes vaporized, we cannot see that. Thus such transform in candle is chemical change because in this situation the wax of candle turns completely to different substance named carbon dioxide and water. On the other hand the portion that is melting and kept at downward is not chemical change, which is physical change, because here the wax returns to its previous state just after melting and that does not make any change in its property.

The chemical change of wax that creates heat energy by reacting with oxygen in the air is called Combustion.

The cooking process in house by burning natural gas or straw is a sort of combustion. Here the gas or straw produces a huge amount of heat energy by conducting reaction with oxygen in air that helps us in cooking. Similarly, burning coal and wood is nothing but combustion.

Do you know how our food is digested or from where and how we get the energy to do different works?

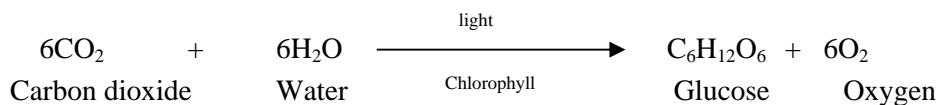
The various foods we eat become stored in stomach. There the foods produce a huge amount of heat energy with the presence of enzyme by reacting with the oxygen which we receive through breathing. We do various works by using that heat energy. If the heat energy was not produced, we won't get energy to do any work. Thus it has become clear that the process which helps to give us energy from food is a kind of combustion.

What happens if we do not eat for a long time? We don't get energy. We cannot work as well because the combustion in stomach stops if we do not eat. That leads to stop the production of heat energy and thus we do not get any energy too.

Every combustion is chemical change.

## **Lesson 5 – 6: Photosynthesis, water cycle, carbon cycle and oxygen cycle.**

**Photosynthesis:** We know that with the help of sunlight the plants prepare their own food through photosynthesis. Do you know how this happens? Is it physical or chemical change? In photosynthesis the plants produce glucose and oxygen by the reaction of carbon dioxide and water with the help of light. The produced glucose works in the growth of plants and oxygen helps us in breathing.



Thus it has been observed that, the produced substance in photosynthesis, glucose and oxygen, are completely different than reactant carbon dioxide and water. That is why it is chemical change rather than physical change.

**Water cycle:** Do you know what water cycle is? Water cycle is such a cycle where we can know how and in what process water moves from one place to another or one state to another. The water cycle is shown below:

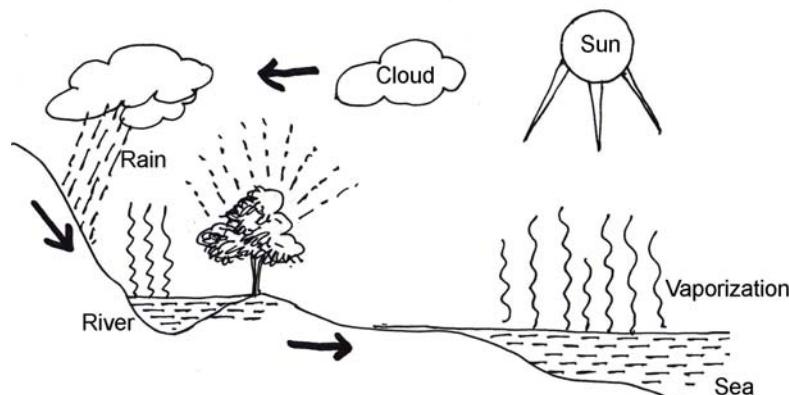


Fig. Water cycle

Some important changes related to water cycle is vaporization, condensation, rain, transpiration, infiltration.

**Vaporization:** In this process water from pond, river and ocean enter into atmosphere through transforming into vapour with the heat of sun. Now tell, is vaporization a physical or chemical change? It is definitely a physical change because here the water only turns into vapour from liquid state; any different substance has not been produced.

**Condensation:** The vapour created after vaporization gradually goes up where the temperature is comparatively low. For that the vapour turns into little drops of water or cloud after condensation. The process where vapor turns into cloud is called condensation. This is a physical change as well and mainly opposite to vaporization. In this process water turns from vapour to liquid, the property remains unchanged.

**Transpiration:** In this process plants lose water. This is a physical change because here no new substance is created rather the water enters into atmosphere from plants in vaporized form.

**Rainfall:** In this process rain occurs from cloud. This is a physical change as well because no new substance is created here.

**Infiltration:** By descending gradually a part of rain water stores at the down layer of soil and this process is called infiltration. Other parts slide towards river, ponds or ocean. Beside that a part of rain water moves towards the plants through their roots.

**Carbon Cycle:** In carbon cycle, we mainly see how carbon dioxide moves from one state or to another in a cyclic process. The diagram of Carbon cycle is given below:

Do you understand what type of process or change is related to it? One of the related changes is photosynthesis here. We have already come to know that in this process plants prepare their food (glucose) by reaction of carbon dioxide and water with the help of sunlight and produce oxygen for us. Do you remember what type of change it is? Carbon dioxide enters into plants body from atmosphere through this process. An important step of carbon cycle is to transfer into fossil fuel from plants. The body parts of dead plants break down through bacteria and is stored as fossil fuel in the bowels of earth at a certain stage. Natural gas, coal, kerosene or petrol is prepared through this process. But when dead plants break down through bacteria, a part of it enters into atmosphere by converting directly into carbon dioxide. What type of change occurs when the fossil fuel is formed? After combusting we use fossil fuels in various works such as in cooking, cars, industries and so on. Fossil fuel enters into atmosphere by transforming into carbon dioxide and water through this type of change. Plants then absorb carbon dioxide through photosynthesis from atmosphere.

Is there any other process where carbon dioxide enters into atmosphere except combustion?

Yes, other faunas like human being also leave carbon dioxide gas during breathing and that enters into atmosphere. On the other hand, like plants, some fossil fuels are produced from the body of faunas as well. Is there any other process where carbon dioxides are being absorbed from atmosphere except plants?

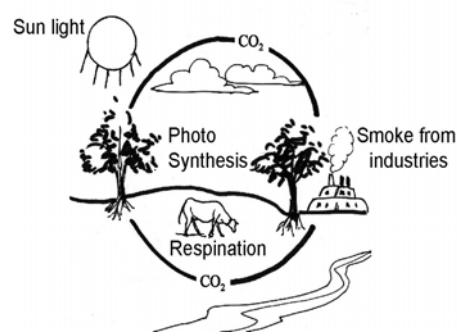


Fig: Carbon Cycle

Yes, a part of carbon dioxide from atmosphere is dissolving into the water of river, ponds and ocean naturally. But in this process carbon dioxide produces carbonic acid by reacting with water which is not a permanent compound. Water breaks down into carbon dioxide when the temperature increases and enters into atmosphere.

Carbon dioxide from atmosphere turns into carbonic acid through dissolving in water naturally, is it chemical or physical change? Undoubtedly it is a chemical change because the produced carbonic acid and the carbon dioxide in atmosphere are completely different substance.

Well, do plants only prepare their foods by absorbing carbon dioxide? Don't they release carbon dioxide? Yes, plants release carbon dioxide through breathing like human and other faunas?

Now tell, what type of change it is where fossil fuels are produced from the bodies of plants and animals?

This is definitely a chemical change because the produced fossil fuel is completely different from starch, protein etc.

**Oxygen cycle:** The diagram of oxygen cycle is given here. What type of process is related to this process? Observe carefully. Plants release oxygen through photosynthesis and preserve foods (glucose or starch) for themselves. On the other side other faunas including human beings receive oxygen that plant already released and produce energy by the digestion of foods with oxygen and release carbon dioxide which plants use to prepare their foods.

Thus it has been observed that, photosynthesis, carbon cycle, water cycle and oxygen cycles are closely related to our lives directly or indirectly.

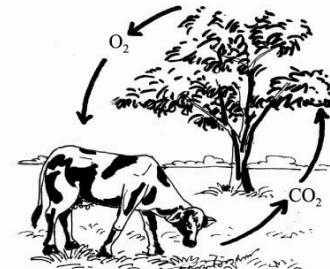


Figure: Oxygen Cycle.

## Lesson 7, 8:

**Activity:** Observation of the combustion of magnesium and air.

**Necessary equipments:** magnesium ribbon, forceps, ring, (lighter) Spirit lamp/ Bunsen burner.

**Method:** Hold a side of a small piece of magnesium ribbon with forceps. Wear safety glass. Hold the other side of ribbon over the flame of Bunsen burner. It can be done with lighter as well. Observe carefully what is happening? While holding the magnesium ribbon over the flame of fire what has been seen? The ribbon is burning with blazing flame as magnesium burns in the oxygen of air and we can see the blazing flame.



Fig. Combustion of magnesium and air

In this way while all the magnesium get burnt, the flame extinguished itself. Can you see something like ash? Actually this is the magnesium oxide that has been produced by burning magnesium and oxygen.

**Activity:** Observation of the reaction of carbonate compound and acid.

**Necessary equipments:** chalk, a spoon, light hydrochloric acid, glass dropper.

**Method:** Smash the chalk. Take the powder of the chalk in a spoon. Now add some light hydrochloric acid in the spoon with the help of glass dropper. Can you see any change? Are the bubbles coming out? Yes, the bubbles are coming out from the gas and are looking like foam

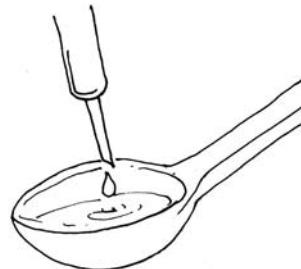


Fig: Reaction of carbonate compound and acid

What is the reason? The reason behind this is chalk, which is mainly Calcium carbonate ( $\text{CaCO}_3$ ). A reaction between calcium carbonate and hydrochloric acid occurs after adding light hydrochloric acid and calcium chloride and carbon dioxide are produced. We see the bubbles and foams because of the carbon dioxide. When carbon dioxide vanishes, we can see the clear solution of calcium chloride and water.

What type of change it is? Physical or chemical change? This is chemical change because the produced substance (calcium chloride, carbon dioxide and water) is completely different from calcium carbonate and hydrochloric acid and their properties are different as well. You can use the egg-shell instead of chalk as it is full of calcium carbonate.

## Lesson 9, 10:

**Activity:** Observation of the reaction of metals and acid.

**Necessary equipments:** Magnesium ribbon, light hydrochloric acid, spirit lamp, test tube.

**Method:** Take light hydrochloric acid half of the test tube. Take some small pieces of magnesium ribbon into the acid. Is there any bubble of gas? If no, heat the surface of the test tube with the help of spirit lamp. Is there any bubble of gas now? These are the bubbles of hydrogen gas produced from the reaction between magnesium and hydrochloric acid. You can test whether it is hydrogen gas or not. Observe what is happening by holding a blazing match stick at the top of the test tube. Is it blazing with pop pop sound? Yes, exactly. If it was another gas except hydrogen, it would not make such sound. The reaction of light hydrochloric acid with metal, what type of change it is? Definitely chemical change because completely different substance has been produced here.

You can also do this experiment with zinc, aluminum, copper or other metals like magnesium ribbon.

### The process of formation of rocks

Previously you have learnt rocks are of three types, i.e. igneous rock, alluvial rock and metamorphic rocks. The process of structuring rocks depends on its types. First come to igneous rock. Do you know how igneous rock originated? Thousands of years ago the temperature of the earth was very high and today's habitable earth has been created by decreasing the temperature gradually. The hot and melting rocks (known as magma) trapped inside the bowels of the earth while the earth was getting cold. This magma transformed into cool hard rock and is known as igneous rock. That means igneous rock is made of cooling hot mixture mainly rather creating a new substance. Thus the process of structuring igneous rock is definitely a physical change; it is exactly the same process of producing water or cloud from vapour through condensation.

Now let's see how alluvial rock originated. The igneous rock decays by the influence of air, water, snow and glacier, ocean-current, storm, cyclone etc which is the consequence of climate change.

The rocks turn into small pieces. Water or air takes these pieces to the ocean through rivers and is stored at the lower level of the ocean as alluvium. Dead body parts of plants and animals trapped inside the layers of alluvium mud at that time. The stored alluvium gradually transforms into hard rock through various chemical reactions with the pressure and temperature of water; which is alluvial rock. As various chemical reactions are related to the origin of alluvial rocks, chemical change occurs in the process of formation of the rocks.



Fig: Rocks

Now let's see the developing process of metamorphic rocks. It occurs from igneous or alluvial rocks. The new rocks produced from igneous or alluvial rocks through temperature, pressure and chemical change is called metamorphic rocks. For example, sandstone is a alluvial rock and as it transforms into quartz is called metamorphic rocks. Similarly as marble comes from lime stone and graphite from coal, marble and graphite are metamorphic rocks. As the property of metamorphic rock is completely different from the main rock and chemical reactions are related to it, the structure of metamorphic rocks is considered as chemical change.

**What we have learned from this chapter are:**

The physical change leads to the change of state or shape of the matter without creating new substance or changing the properties of the matter.

- In chemical change one or more substances change completely into new substance which has different properties of its own.
- To give a layer of zinc in an ironic stuff is called galvanizing.
- Electroplating is a process of making layer of metal in the surface of other metal through electrolysis.
- A substance reacting with oxygen of the air produces heat energy in combustion.
- Some important change related to water cycle is vaporization, condensation, rain, transpiration, infiltration.
- Rocks are of three types, i.e. igneous rock, alluvial rock and metamorphic rocks.
- Physical change is related to igneous rock and chemical change is related to alluvial and metamorphic rocks.

## EXERCISE

**Fill in the blanks:**

1. Boiling is a \_\_\_\_\_ change.
2. Mixing sugar in tea is a \_\_\_\_\_ change.
3. Burning paper is a \_\_\_\_\_ change.
4. Infiltration is related to \_\_\_\_\_ cycle.
5. Lime stone is a \_\_\_\_\_ stone.

**Short answered question:**

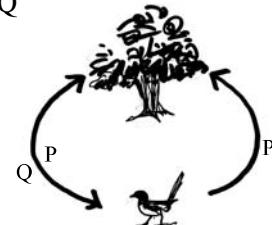
1. What is physical and chemical change? Give examples.
2. What is combustion? Explain with examples.
3. What type of change occurs while straw or gas is burnt in furnace, physical or chemical change? Give reasons for your answer.
4. Discuss the importance of water cycle.
5. What are the characteristics of igneous rock, alluvial rock and metamorphic rocks?

**Multiple choice questions:**

1. Which one of the following is the chemical change?
  - a. Melting
  - b. vaporization
  - c. Photosynthesis
  - d. Filtration
  
2. 'P' and 'Q' is appropriate for-
  - i. Animals release P during respiration
  - ii. The major respiratory element of animals and plants is 'Q'
  - iii. The major element of photosynthesis is 'P'
  

Which one is correct of the following?

  - a. i
  - b. ii
  - c. ii and iii
  - d. i, ii and iii



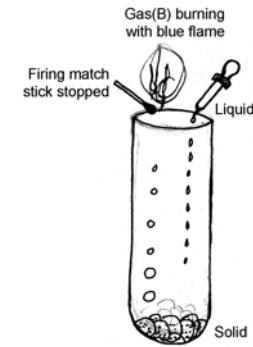
Give the answer to the question no. 3 and 4 according to the following stimulus:

Mr. Anis is a building contractor. Generally he uses the metamorphic rocks of limestone to increase the beauty of the building. But sometimes he uses granite which is originated from magma.

3. Which of the following gas will be produced if acid is applied to the metamorphic rock mentioned in the stimulus?
  - a. O<sub>2</sub>
  - b. CO<sub>2</sub>
  - c. N<sub>2</sub>
  - d. H<sub>2</sub>
  
4. What type of granite has been mentioned in the stimulus?
  - a. Igneous
  - b. Alluvial
  - c. Metamorphic
  - d. Fossil

**Creative Question:**

1. a. What is the formula of rust?  
 b. Why does rust not occur in the stuffs made of stainless steel? Explain.  
 c. Energy is produced with the chemical change occurring in the diagram- describe with verbose equation.  
 d. Both absorption and secretion occur in physical change – analyze according to the stimulus.
  
2. a. What is galvanizing?  
 b. The shine of gold lasts long but copper does not explain the reason.  
 c. Describe the yielding strategy of gas B.  
 d. Absence of B gas in carbon and oxygen cycle is beneficial to animal kingdom- analyze with logic.



## **Chapter Twelve**

### **The Solar System and Our Earth**

The sun is the centre around which our habitat the earth, another seven planets and some more luminaries revolve. All the revolved luminaries and the huge space centre on the sun are called the solar system. The huge universe beyond our vision is called the space. The motion of the earth is of two types. The earth rotates on its own axis and revolves around the sun in its own orbit once in a year. One of the effects of the earth's rotation is the occurrence of day and night, the change of seasons.



#### **At the end of the lesson, we will be able**

- to explain the formation of the solar system
- to compare the physical characteristics of the members of the solar system
- to draw the structural formation of the solar system
- to explain the effect of the earth's rotation and its consequences
- to realise the effect of the earth's rotation on the living world

### **Lesson 1: Not the sun, the earth moves round**

In class six, you have got the idea on the earth, the sun and the moon. Early in the morning, the sun is found to be risen in the East. Gradually it comes over our head. In the evening, the sun sets in the West. At the end of the night the next day early in the morning the sun again rises in the east. It seems from the earth that the sun moves round the earth from the east to the west. Man used to think so in ancient time but the scientists have been able to prove that in fact the sun does not move round the earth. Rather the earth moves round the sun. Why do we think that only the sun moves round the earth? You have certainly gone out for a walk by bus, launch or train. Have you marked one thing? When these run fast, the trees seem to be moving so fast backward. Actually the train, the launch or the bus is running forward but they seem to be standing still. On the other hand the trees by the side are at rest but they seem to be moving so fast backward. The earth and the sun are in the same condition. The earth is moving round the sun from the earth it seems that the sun is moving round the earth.

In ancient time, man was interested into the sun, the moon and the stars. At that time there was no instrument to observe these luminaries. They would believe as they observed with their bare eyes. You know that Aristotle was a great philosopher and scientist two thousand years ago. He used to think that the sun moves round the earth. From now to two thousand years ago famous mathematician astrologer Ptolemy told strongly that all things move rounds the earth. This motto was believed by man for a long. Some did not believe the motto of Ptolemy. But none was able to prove it wrong till now.

Copernicus, (1473-1543) an astrologer gave a new theory through observation. He proposed the model of sun centric instead of earth-centric. The main theme of his model is that the earth moves round the sun. He also told a new thing. That is, the earth rotates with its own axis. Later scientist Galileo and Kepler presented the proof of this model in favour of Copernicus. At present this model is proved and scientist and common people have accepted it.

### **Lesson 2-4: The Formation of Solar System and Its Introduction**

You have come to know that the sun is a star. The sun is the centre around which the earth, another seven planets and some more luminaries revolve. All the revolved luminaries and the huge space around the sun is called the solar system. Most of the place of the universe beyond our vision is the huge space. The eight planets are rotating according to their distance centring the sun. The description of these rotated planets as arranged are shown and the members of the solar system are introduced.

**Sun:** The sun is the centre around which all other members of the solar system revolve. The sun is one of the burning gaseous bodies like other stars. This burning gaseous body contains mainly hydrogen and helium gas. The atoms of hydrogen gas mixing with one another, turn into the atoms of helium. A lot of energy is produced in this

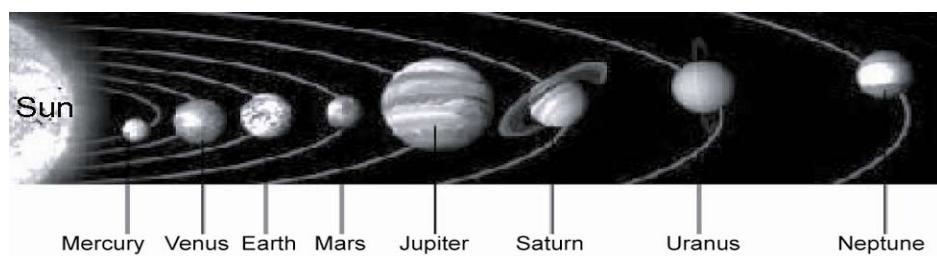


Fig. The solar system

process. This energy spreads in the solar system as heat and light. Thus we get heat and light from the sun. The sun is a medium star in size. It is bigger than the earth lac lac times more. It is situated approx. 15 crores kilometres away from the earth.

#### **The introduction of the planets:**

The eight planets are moving round the sun. He earth is such a planet. The planets are generally round. There are different gaseous bodies in the planets. But the planets do not produce any energy. So no planet gives either light or heat. They have no light of their own. All of them rotate round the sun and get light and heat although they look brighter than the earth.

**Mercury:** Mercury is the nearest to the sun. There is no atmosphere in mercury. It takes 88 days to rotate once round the sun.

**Venus:** You must have found the morning star and the evening star and might have seen it too. It is in fact not a star. It is the planet of the sun which is called Venus. The sun light falls on it so it looks lighted. It takes 59 days to rotate once round the sun.

**Earth:** Perhaps you know that the earth is the only planet in which there is atmosphere and temperature necessary for the survival of plants and animals in the world. It is the third closest planet to the sun.

**Mars:** Mars looks reddish because its surface is red in colour. The surface of it is dusty and there are very light atmosphere there and water as the available report show.

**Jupiter:** Jupiter is the largest planet of the sun. It is gaseous only. It has no solid surface.

**Saturn:** The planet Saturn is made of gas only. There is a ring all around it.

**Uranus:** Uranus is made of gas and ice.

**Neptune:** Neptune is almost a planet like Uranus.

A luminary named Pluto was called planet before but in 2009 the scientists decided that it is a small incomplete planet.

**Satellite:** You have known that the planets of the solar system revolve round the sun. Similarly the small satellite revolves round the planets. The moon is the only natural satellite of the earth. It moves round the earth. The satellites are smaller than the planets. It cannot produce heat and light. They get light from the sun. The light of the sun reflects on the surface of the moon; so we see the moon lighted.

The moon takes 27 days 8 hours to round the earth. The moon is the attractive object from ancient time. You see that the moon is not seen in one night which is called the day of the new moon? The next night a small piece of moon is seen for a while in western sky. The small piece of moon gets bigger every night. After two weeks, the moon looks like a plate, which is called full moon. The moon begins to get smaller from the next night of the full moon. Thus after two weeks in any night the moon is not seen at all. We can see the new moon and the full moon after every 29 or 30 days. Why does it happen? You will know this answer in the next class.

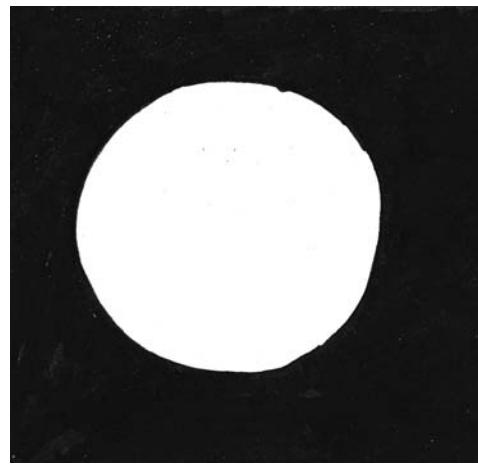
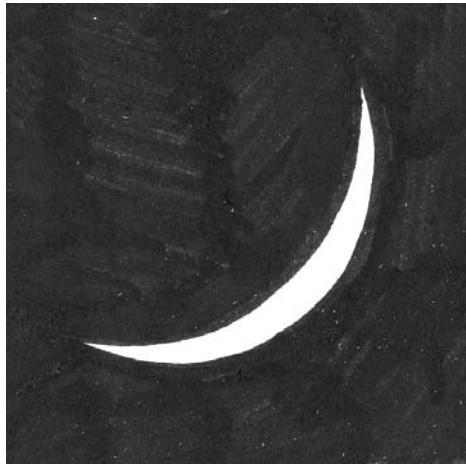


Fig. New moon and full moon

Although the moon is the only natural satellite of the earth, more than 2500 satellites sent by men are moving around the earth. These are called artificial satellites. The artificial satellites are sent in order to collect the information of wireless, telecommunication, weather and others. Other planets have natural satellites like earth.

#### **Other Luminaries of Solar System:**

There are other luminaries in the solar system without the sun, the planets and satellites. They are comets, meteors and asteroids. They revolve around the sun. They are small in size than planets, are rocky or metallic objects they are called asteroids. They are like small planets. The comets are also a part of our solar system. They are made of solid (gas, ice, dust). But it turns into gas easily when it gets heat. When the comets go near the sun, then it is scattered in the sky turning into gas or solid due to the heat of the sun. Then it turns into a watchable tail like broom. Sometimes it is found from the earth. Some comets are found after many years in the sky of the earth such as: Halley's Comet, which appears every 75 years in the sky of the earth. It appeared in 1911 and 1986. It will be appeared again in 2062.

Have you seen a gunshot flying all on a sudden at night which is like a fire sphere? These are called meteors. Meteors are the smallest luminaries which revolve round the



Fig. Comet

sun. This solid small piece when comes in contact of atmosphere burns out. This is why it is found running away or falling down like a fire sphere. Sometimes big put out meteors create big holes while they fall down.

### **Lesson 5: Our habitat the earth**

We live in the earth. How is the shape of the earth? Can we understand its shape looking around it? Does it seem like a dice or plate? Apparently the earth seems to be like a plate. It is thought that we and our house are on the dice or plate. On the other hand the plate is covered with the sky. But earth is not like a dice or plate. It is round but not completely. The earth is like an orange which is flat at North-South pole. The earth is inflated in the middle and is compressed towards the poles.

The three fourth of the earth's surface contain water and only one part is covered with soil. There is gaseous atmosphere surrounding the earth. Have you seen the globe? When we see it, we understand that the earth is like the globe. We are staying over a sphere like a globe. The question is why not we fall down from the earth. Its cause is gravitation. The earth attracts everything to its centre with this force. As a result nothing living on the earth's surface falls down.



Fig. Men on the earth's surface

### **Lesson 6, 7: The earth rotates on its own axis and revolves around the sun in its own orbit.**

You see the sun rises in the east. It sets in the west in the evening. Next morning you see that the sun again rising in the east. It seems to be for this that the sun is rotating from the east to the west centering the earth. Inancient time man used to think that the earth is static and the sun moves round the earth and the earth rotates on its own axis. You have certainly played with a top. How does the top rotate? The top rotates standing on the pointed head. At the same time it travels circular or elliptical way from once place to another on the soil.



Fig: Top's two kinds of motion

Thus the top has two way motions. One is to rotate on its own axis and another is to travel a way on the soil. The earth has two way rotations like top. The earth takes 24 hours to rotate once on its axis from the west to the east. This is called the earth's diurnal motion. The second thing is that the earth takes 365 days 6 hours to revolve around the sun in its orbit. This is called annual motion. Days and night occur because of the diurnal rotation of the earth. The experiment below shows how day and night occur.

**Experiment:** The experiment of the earth's diurnal motion. How do days and nights occur?

**Equipment:** A globe, a candle or lamp or charge light

**Procedure:** At first observe the globe carefully. Notice that there is a stick passing through the middle of the globe. This is the imaginary axis of the earth. The earth rotates from the west to the east on its axis.

Light the lamp and place it on a table or a flat floor. Next, place the lamp in front of the globe. It will be better if the room is dark. Consider the source of light as the sun and the globe as the earth. Now look at the globe. Are all the directions of the globe illuminated equally? No, one side is illuminated and the other side is dark. You can certainly see that the half of the globe is illuminated and the other half is dark. Which half is illuminated? The half that is in front of the light. The illuminated side can be considered as day and the dark side can be considered as night. Now rotate the globe slowly, and what can you observe? It is found that the dark side is becoming illuminated and the illuminated side becoming dark gradually. But all the time, half of the globe is getting light and the rest half is not getting. Thus half of the earth experiences day while the other half experiences night.

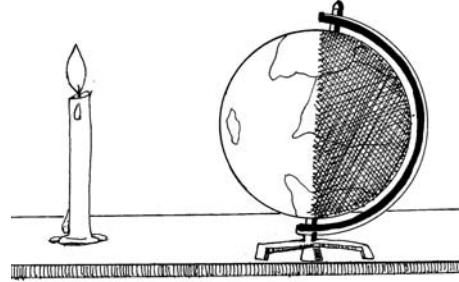


Fig. Experiment of the earth's diurnal motion

If we keep a particular place of the globe in front of the light and if we rotate slowly,

then the illuminated part (day) moves towards darkness, at one time it becomes full dark (night). If we rotate more in the same direction that particular place becomes illuminated and at one time it becomes fully illuminated i.e. at that place day returns again.

Like this experiment the earth rotates on its own axis. As a result, day comes after night, night comes after day. Again day comes, again night comes, again day. Thus the change takes place. In other word, day-night-day-night-day we see this change because the earth rotates on its own axis.

### **Lesson 8, 9: The earth moves round the sun: The earth's annual motion**

Already you have known about the earth's diurnal motion or the rotation on its own axis. Another motion of the earth is annual motion. The earth takes 365 days 6 hours to revolve around the sun in its orbit. The period the earth takes to complete the revolve is known as the solar year or simply year. Fluenation of day and night and the change of seasons occur as a result of annual motion.

Do you see the same weather throughout the whole year? In the month of January or Poush- Magh is it hot or cold? Is the weather of *Ashar* or *Bhadra* same like *Poush* or is it different? In Bangladesh we see different weather in different time. We feel cold in the month of *Poush* and *Magh* and hotter in *Baishakh* and *Jaistha*. Can you say why? You will be able to answer when you would know about how the earth moves around the sun.

The earth rotates around the sun being little bit inclined towards the sun. But the earth changes its inclined position at different time of the year. So, a particular part of the earth faces the sun at a particular time. A definite part of the earth facing the sun, gets sun heat vertically for a long line. In that part of the earth the summer prevails. You have already known that the equator of the earth is divided into two. The north part is called northern hemisphere and the south part is called southern hemisphere. We live in the Northern Hemisphere. Bangladesh comes closer to the sun on the 21st June. So at this time we find the sun above our head. So 21st June is the longest day and shortest night in the northern hemisphere. The sun reaches its northern most limits on 21st June and the date is known as Summer Solstice. But during this time, there has been down pouring due to monsoon wind in *Ashar* and *Sraban*. We call this time rainy season. On 21st June the southern hemisphere remains at the furthest distance from the sun.

21st June is the longest night and shortest day in the southern hemisphere. Then the heat of the sun becomes inclined and the heat of the sun is inclined at an angle. As a result the southern hemisphere at this time gets less heat of the sun. Then there winter comes. Such as: In Australia, June, July, August are the winter seasons.

The sun shines vertically over the equator on 21st March and 23rd September. On these two dates the sun remains in equal distance from the north and the south pole. So, on these two dates the duration of the day and night is equal.

On 21st December, a part of southern hemisphere facing the sun. Then Bangladesh is far away from the sun. So in Bangladesh the day is shortest and the night is longest. The sun shines inclined at the south. The heat of the sun is less and due to inclination. In Bangladesh then it is winter. On the other hand in Australia the southern hemisphere, the day is longest and the night is shortest. The sun shines vertically. Then it is summer in the southern hemisphere.

Again on 21st March, the earth inclines facing the sun. Then the night and day become equal over the globe. This is why in our country the day and the night are equal. At this time the weather is neither hot nor cold. Then it is spring in our country. After 21st March the earth rotates to its previous position on 21st June. Thus the fluctuation of day and night occurs due to the effect of the earth's rotation around the sun. The season also changes because of it.

Can you imagine what would happen if the earth does not move round the sun? No change of season would take place if the earth does not move round the sun. In this case perhaps our country would enjoy dry season all the year. No winter season would come or vice-versa. I.e. all the time it would be cold in the earth. Due to the change of seasons, different crops grow in Bangladesh. Otherwise only one crop would grow and it would become difficult to live.

In Russia and other cold countries, man would not be able to survive if the season does not change. Most of the parts of these countries remain covered with ice almost all the year round. At that time no crops grow. When summer comes, then the ice melts. Then man grows crops. I.e. if the summer does not come, they would not be able to grow crops.

#### **What we learnt from this chapter:**

- The earth moves round the sun.
- The sun is the centre round which our abode the earth, another seven planets and some more luminaries revolve. The huge universe beyond our vision is called the space.
- The sun is one of the burning gaseous bodies like other stars. This burning gaseous body contains mainly hydrogen and helium gas. The atoms of hydrogen gas mixed with one another and turned into atoms of helium. A lot of energy is produced in this process. Thus we get heat and light from the sun.
- The small satellites move round the planets. The only natural satellite of the earth is the moon. The satellites are smaller than the planets. They cannot produce heat and light of their own. They get light from the sun.
- The light of the sun reflects on the surface of the moon. As a result we see the moon lighted.
- There are other luminaries in the solar system except the sun, the planets and satellites. They are comets, meteors and asteroids. They are moving around the sun.
- The earth does not look like a disc or plate. It is round but not completely round. The earth is like an orange.

- The earth does not look like a disc or plate. It is round but not completely round. The earth is like an orange which is slightly flat to the north and south. We are staying on the surface of the earth.
- The earth has two way rotations. The earth is rotating on its axis from the west towards the east and it takes 24 hours. This is called the earth's diurnal motion. Secondly the earth takes 365 days 6 hours to rotate around the sun. This is called the earth's annual motion.
- Day and night occur as a result of the earth's diurnal motion. The fluctuation of day and night takes place as a result of annual motion and the season changes.

## EXERCISE

**Fill in the blanks:**

1. The sun is a medium sized \_\_\_\_\_.
2. \_\_\_\_\_ planet is moving around the sun.
3. The moon is the only \_\_\_\_\_ satellite.
4. We stay on the \_\_\_\_\_ of the earth.
5. We do not fly off from the earth due to \_\_\_\_\_.

**Answer the following questions in brief:**

1. Why did men think before that the sun moves round the earth?
2. Who told about the earth centered model?
3. Explain how the sun and the other stars produce heat and light.
4. What is comet? How does its tail create? Set an example of your acquainted comet.
5. Explain the earth's two way motion citing an example.
6. Show that through experiment how the days and night occur.
7. Discuss the effect of change of seasons over human being.

**Multiple choice questions:**

1. Which planet consists of ice and gas?
 

a. Jupiter	b. Saturn	c. Mars	d. Uranus
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2. The word which is applicable to the sun is -
 

i. A star
ii. A burning gaseous body
iii. Gives lights to all planets and stars

Which one is correct (below)?

- |      |       |             |                  |
|------|-------|-------------|------------------|
| a. i | b. ii | c. i and ii | d. i, ii and iii |
|------|-------|-------------|------------------|

Answer the question 3 and 4 from the table below:

<b>Planet</b>	<b>Distance from the sun (Crores km)</b>	<b>Time of one rotation around the sun</b>
Venus	10.80	225 days
Earth	14.96	365 days
Jupiter	77.85	Approx. 12 years
Saturn	142.70	29.5 years
Uranus	187.1	—
Neptune	449.8	165 years

3. The planet (that is not mentioned in the table) which has a distance of 22.8 crores km from the sun. Where is it situated?

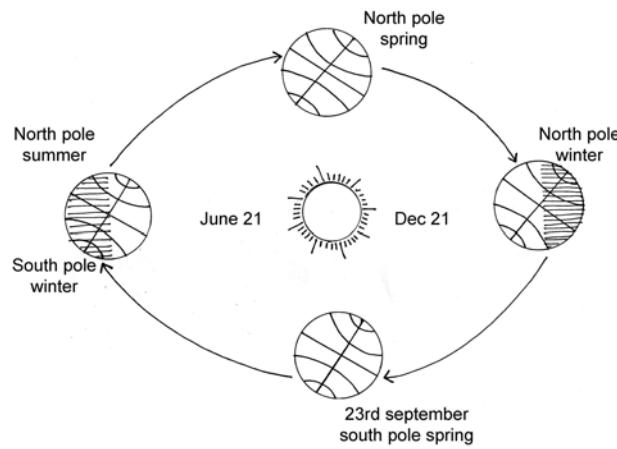
- a) In between Earth and Venus
  - b) In between Jupiter and Saturn
  - c) In between Saturn and Neptune
  - d) In between Earth and Jupiter

4. How long does the Uranus take to move round the sun?

- (a) 10 years              (b) 29 years              (c) 80 years              (d) 170 days

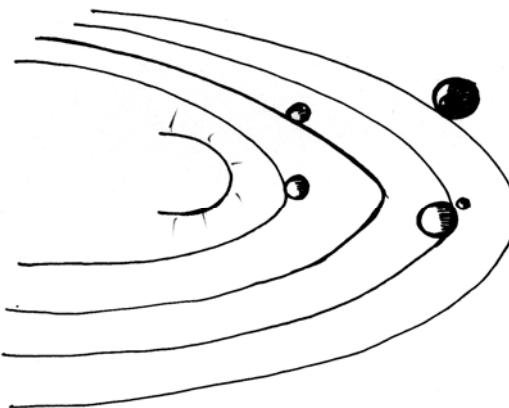
## Creative questions:

1.



- a) What is diurnal motion?
  - b) Why does it rain heavily in Bangladesh in between June and July?
  - c) When do the smallest nights and longest days occur at southern hemisphere? Explain with the figure.
  - d) What will be the length of the day and night on 30 December at the Northern Hemisphere? Answer the question showing logical grounds.

2.



- a) How long does it take for the Jupiter to move round the sun?
- b) Why is Pluto not the member of the solar system?
- c) Which one takes more period of rotation between the planet number 3 and 4?
- d) Why is the planet No.4 not suitable for human habitation in spite of having much similarities with planet no.3? Explain with arguments.

## **Chapter Thirteen**

# **Environment and pollution**

Environment is composed of living and non-living things. You know there is close relationship between living and non-living objects. Moreover there are some close relationships between organisms and the environment. As a result diverse and peculiar activities are going on continuously around us. To ensure his existence on earth man uses various materials from the natural sources to fulfill their needs. For this peoples are engaged in some activities involving the environment. So such activities have few effect on some factors of the environment.

**After the study of this chapter we will be able to:**

- explain what pollution is,
- explain the causes of environmental pollution,
- explain the effect of pollution on environment,
- explain the ways of preventing environmental pollution,
- take initiative to create awareness in the society for conservation of environment
- publish posters containing environmental pollution and it's effects.

## Lesson-1: Environmental pollution

With the progress of civilization environment around us is changing. People are using the environment in various ways to meet their necessities. Nature or human activities or their combined effect may bring changes in the constituents of the environment. So unusual conditions are created and balance in nature is lost. As a result life of human beings, plants and other animals are threatened. Discomfort prevails in the environment for organisms. We can term this as environmental pollution.

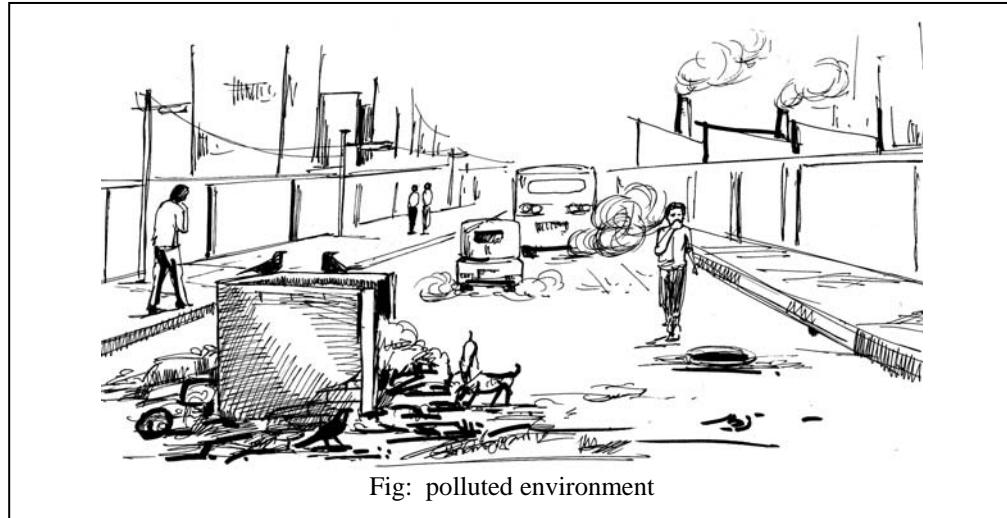


Fig: polluted environment

**WORK:** Know about Environmental pollution.

**Materials required:** Note book, Pen.

**Procedure:** Observe environment of your School and your area. Study and identify whether any pollution occurred. Discuss the pollutions in your class what you have identified.

Starting from minute microbes to all other organisms including human beings live in this environment of the earth. No part of environment is free from pollution. Human beings are not polluting their own environment only. Life of all other organisms and their environment are also affected. Living of plants and animals including human beings is disturbed by environmental pollution. Why does pollution occur? Few harmful elements are polluting our environment directly or indirectly. We call them pollutants. Smokes emitting from the chimneys of different factories, thermal electric power house, and from the vehicles; insecticides, chemical fertilizers used in the field; varieties of waste materials, polythene, plastic etc. are the examples of pollutants. These pollutants pollute different factors of environment in various ways.

## Lesson-2: Causes of pollutions of environmental elements

Environment is composed of mainly two types of factors. These are living and non-living factors. You know all plants and animals constitute the living factor.

Non-living elements include soil, water, air and all other non-living materials on earth. Due to pollution both living and nonliving factors are affected. As a result all organisms including human are threatened in the environment. Now the question is: what are the causes of environmental pollution?

**WORK:** To know about the pollution of the environmental factors.

**Materials required:** Note book, Poster paper, Marker

**Procedure:** Form groups with the help of your teacher. Observe in groups the causes of pollution identified in the previous lesson by all of you. Identify the sources of pollutants that pollute the factors of the environment. Demonstrate in poster papers the causes and sources of pollution. Observe the works of all groups and take part in class discussion.

When the number of different organisms increases, various needs for life also increase. For their existence they are involved in such activities that violate normal rules of nature. At present the population of the world is increasing gradually. So increased quantities of food, shelter and transport etc. are needed. To enhance the size of cultivable land and building their houses people are destroying forests. As a result poisonous gases are increasing in the environment.

These gases are carbon dioxide, carbon monoxide, etc. As a result temperature of the earth is increasing. Besides, CFC (Chloro Fluro Carbon ) gases from aerosol and refrigerator is damaging the Ozone layer. For the increased human population, besides food and shelter, a large number of other materials are needed. So they build up various industries. Wastes from these industries pollute environment. In this way environment of the earth is polluted.

In the following lessons you will learn about three main factors of environment: soil, water and air.

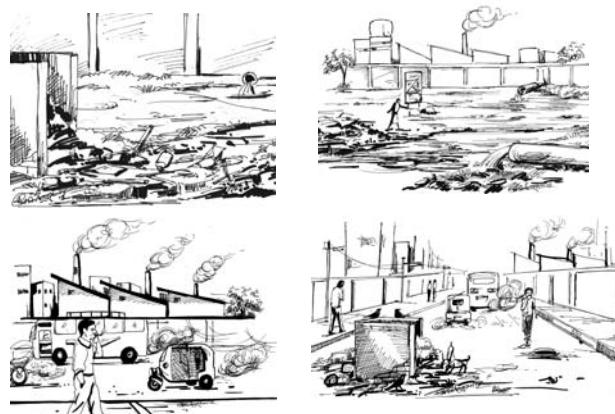


Fig: Various environmental pollutions

### **Lesson-3,4: Soil pollution**

Soil is an essential factor for our living. Various crops that we take as food grow in soil. Not only for food, we are also dependent on soil for other essential things needed for living, such as- shelter, clothing, medicines etc. are the products of plants. Soil is essential for plants and other animals for living. We are polluting soil in various ways. As a result soil is losing its fertility.

**WORK:** To know about soil pollution and its causes.

**Materials required:** Note book, Poster paper, Marker

**Procedure:** Visit different parts of your area. Observe how soil is polluted. Observe the sources of pollution and keep a note in your note book. Write down the activities you will perform to make the people aware of the preventive measures to be taken against soil pollution in your area in a poster paper. Present it in the class and take part in discussions. The garbage and wastes that we throw, bacteria help them to putrify. As a result these wastes get mixed up with the soil easily. Besides now-a-days we use such things that do not rot or get petrified in the soil. Such as glasses, polythene, plastic etc. They hamper normal growth of plants.

**Sources of Soil pollution:** Besides polythene and plastic materials, we pollute soil in various ways. Among these pollutants are different forms of garbage, fertilizers, fungicides used in agricultural land and industrial wastes etc.

#### **Actions to be taken to prevent soil pollution**

Using of non degradable materials like polythene, plastic should be stopped to avoid polluting soil. In addition wastes should not be thrown here and there.



Fig. Soil Pollution

## Lesson: 5, 6 : Pollution of water

At present there is scarcity of safe drinking water in the world. Life is not possible without water. Pollution of water is a subject to ponder over seriously. Water is polluted in various ways. It is the man who is responsible for pollution of water. It is not only our problem, it is a serious global problem.

**WORK:** To know about water pollution: its causes and sources.

**Procedure:** Visit a water reservoir of your area, near your area, or pond or river near your village home. Try to observe how water is being polluted. If you do not have such water reservoir, pond or river then discuss with your class mates how water is polluted in their area. Write it down in your note book. Try to know the causes and sources of water pollution and take part in class discussions.

You know we use water in various ways. We drink, prepare food, take bath and wash belongings. In other activities, such as—in industries nothing can be manufactured without water. Do you know from where we get water? We get water from sources like rain, river, spring, lake, small and big ponds etc. Those who live in the village, they usually collect water from these sources. Moreover they use wells and tube wells for drinking water. You know in urban areas water is supplied through long pipe lines and we get water through water taps. This water is collected from river or underground sources.

### Causes and sources of water pollution

Water may be polluted by various means. Human activities are the most important cause among other causes of water pollution. Water may also be polluted due to some natural causes. You have heard about flood. During flood excreta of domestic animals and birds along with human feces mix up with water and pollute it. Due to urbanization and industrialization sewage and industrial wastes have increased. These wastes drain out to different water bodies. These wastes fall into the river and ultimately reach the sea. To increase agricultural products various insecticides and chemical fertilizers are used. They move from fields to the sea through river. They also mix up with underground water and pollute it. You might have seen that bamboo, cane and jute plants are immersed in ponds. Cows, Buffalos, and goats are washed in ponds. Some unsafe latrines are erected over different water bodies, are responsible for water pollution.

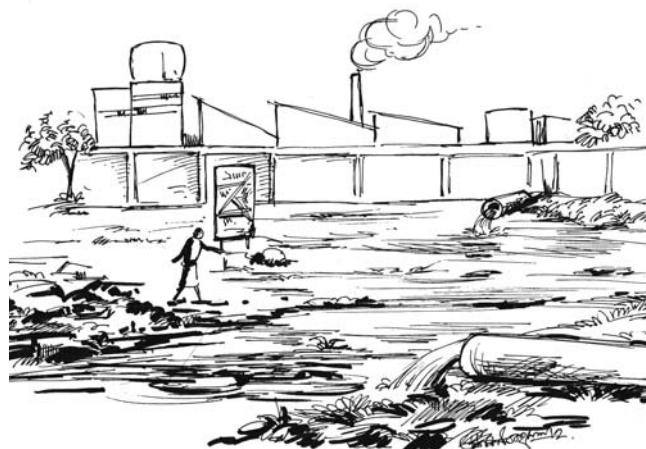


Fig. Water pollution

### **Lesson-7, 8 : Air pollution**

Our earth is surrounded by atmosphere. Man, other animals and plants live within this atmosphere. Due to man made causes quantities of some constituents of air increase or decrease which is detrimental to environment and for us. The changes in composition of air is known as air pollution. Atmosphere around the earth has become polluted in various ways.

**WORK:** To know the causes and sources of air pollution.

**Procedure:** Observe the sources of air pollution of your area. See how people are polluting air. Identify the causes and sources of pollution and write it down on a poster paper. Present it in the class and take part in discussions.

#### **Causes and sources of air pollution**

Air may be polluted by nature itself and by man. Environment scientists have mentioned few causes of air pollution. Among these are smokes expelled from vehicles and industries. It contains carbon dioxide and carbon monoxide gases. Black smokes emitting from the chimneys of brick fields also cause air pollution. As a result the atmosphere shows some abnormal changes. Moreover among other causes of pollution defective motor vehicles, trains, buses, tempo etc. release smokes. This smoke contains carbon monoxide, carbon particles and carbon dioxide which has detrimental effect to the environment. Smokes released by vehicles are not the only cause of air pollution. Smoking, asbestos various kinds of waste materials etc. make air polluted. One of the causes of air pollution is injudicious deforestation.



Fig. Air pollution

### Lesson - 9: Effect of pollution

You have learned about pollution of soil, water and air. Do you know what effect they have on the environment ?

**WORK:** To know about different types of pollution.

**Procedure:** Form groups with the help of your teacher. Make an observation of environment of your school and adjacent areas in groups. See what types of pollution is occurring in the area. Note down the effects of these pollutions on human beings and other organisms after discussing among the groups. Present your findings in the class on behalf of your group and take part in the class discussion.

#### Effect of soil pollution

You have learned the cause of soil pollution is the increase of waste materials in the soil. Various solid and chemical wastes are responsible for soil pollution. Environment is damaged in different ways due to unplanned disposal of wastes. Glass, aluminum, polythene thrown in the soil do not mix up easily with soil. As a result the fertility of soil is lost. You would be astonished to know that it takes one hundred years for aluminum to mix up with soil. Glass takes two hundred years and polythene needs about four hundred and fifty years. So you can imagine how horrible the condition is. These things make our drains and water bodies silted and are responsible for water clogging. Next they find their way to ponds, rivers, and sea. So these materials become threat to every organism. Fungicides and chemical fertilizers used in agricultural lands are harmful for all organisms. These chemicals mixing up with food stuffs may cause fatal diseases like cancer.

#### Effect of water pollution

You have learned that we pollute water in various ways. We throw food wastes, dead bodies of animals and degradable substances used in our house hold here and there. They are rotten and germs formed. These are washed away with rain water and fall into the ponds, rivers, and water bodies. So water is polluted. Drinking such water people suffer from diseases like dysentery, diarrhea, jaundice, typhoid etc. In polluted water

fish and other aquatic organisms cannot survive. As a result balance of the aquatic environment is disturbed.

### **Effect of air pollution**

You have learned that air is polluted in various ways. When air is polluted, the quantity of different gases in the air rises up. It has harmful effect on human beings. Carbon dioxide, carbon monoxide, sulfur dioxide etc. are few such gases whose names are mentionable. When the quantity of carbon monoxide increases in the air, it may cause diseases right from breathing problem to fatal diseases like cancer. Smokes from industrial plants may cause acid rain after mixing with air. Acid rains not only harm human beings, aquatic animals are also affected. It also damage the balance of aquatic environment.

As a result temperature of the earth rose much higher. Scientists say that if the rise of temperature continues, the average height of sea level will go up. As a result the land of the coastal low lying areas will be submerged. At the same time some areas will experience drought. So there will be changes in local climate. As a result not only human beings but also innumerable plants and animals will perish from the earth.

### **Lesson-10: Prevention of pollution and conservation of Environment**

You have learned that soil, water and air are polluted in different means. Soil, water and air are essential for our life. But it is due to man the environment is gradually becoming unsuitable for habitation. All organisms will face threat of extinction if the environment cannot be kept undisturbed and healthy. The only way to keep the environment pollution free is to prevent pollution and create awareness among the people.

**Work:** To know ways to create awareness about prevention and conservation of environment.

**Procedure:** Form groups with the help of your teacher. Discuss in the group what you can do to abstain yourself and others from polluting environment and note it down. Prepare slogans to create awareness. And make arrangements to exhibit them in your school.

One cannot think of the existence of the organisms without soil, water and air. All of us should keep these environmental factors free from pollution and conserve them properly. Due to the increase of population, the elements of the environment are in enormous use. As a result different types of pollutions are occurring continuously. For the prevention of pollution and conservation of environment every body should take care of the following facts:

- To maintain healthy environment, care should be taken to prevent pollution of soil, water and air.
- Trees should be planted around houses, schools and road sides.
- Defecation and urination in open places should be stopped.

- Smokes emitting from industries should be treated to make them pollution free before releasing to the environment by using modern technology.
- Use of plastic and polythene should be stopped. Instead jute goods may be used.
- Use of insecticides and chemical fertilizers should be stopped. Instead manures and biological control of insects may be used.
- Household garbage and food remains should be thrown to a particular place and buried them under the soil, not throwing here and there.
- People should be made aware of the harmful effects of pollution and the process of conservation of environments.
- Forests should be conserved. It should be kept in mind that these are the habitats of different organisms. These plants help us keep our environment pollution free.

**What we have learned from this chapter-**

- When changes occur in different factors of environment, the environmental balance is lost. As a result unfavorable condition is created for man and other organisms. We call this condition environmental pollution.
- Different activities of man and nature are responsible for environmental pollution. But for different pollutions human beings are mainly responsible.
- Because of the pollution of soil, water and air, not only man but also the existence of innumerable plants and animals will be endangered.
- One of the main ways of preventing pollution and preserving environment is to create awareness among the people.

**EXERCISE**

**Fill up the blanks:**

1. To increase cultivable land and build up houses, peoples cut \_\_\_\_\_.
2. \_\_\_\_\_ of industries are responsible for water pollution.
3. \_\_\_\_\_ help to purify various wastes.

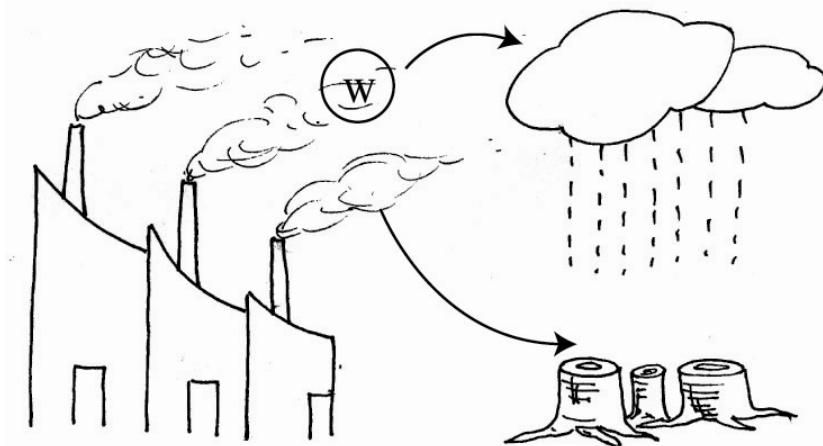
**Short answered questions :**

1. Give an example how pollutions happen.
2. What can you do to make everybody of your area aware to prevent pollution?
3. What should you do to conserve the environment of your home?
4. What role can you play in the conservation of environment of your school?
5. Mention two impacts of water pollution.
6. Why is air pollution harmful for human beings?

**Multiple choice questions:**

1. From which one water is supplied to the residential houses in urban areas?
  - a. Tube well b. Pond c. Underground d. Well.
  
2. Causes of soil pollution are -
  - i. polythene and insecticide
  - ii. Garbage and dead bodies of organisms
  - iii Chemical fertilizers and glasses

Observe the scene and answer question numbers 3 and 4 :



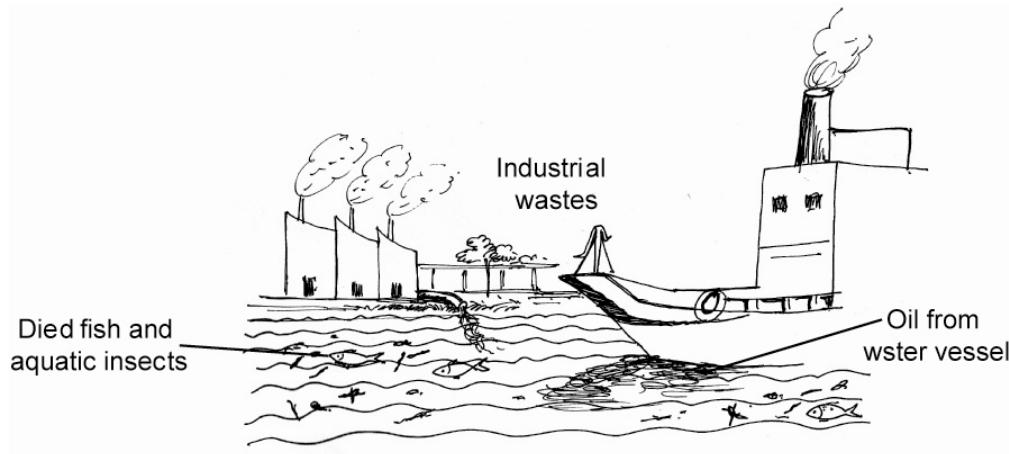
3. Which one is absent in part W of the imaginary scene ?
  - a. Carbon dioxide b. Sulfur dioxide
  - c. Chlorofluorocarbons d. Carbon monoxide
  
4. If the occurrences represented in the scene happens on earth-
  - i. Ozone layer will be damaged
  - ii. Probability of acid rain will increase.
  - iii. Green house effects will happen.

Which one of the following is correct?

- a. i and ii b. i and iii c. ii and iii d. i, ii and iii

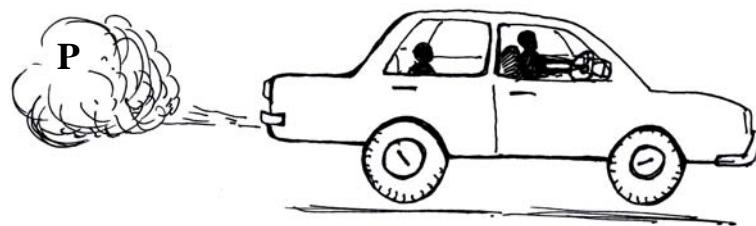
**Creative questions :**

1.



- What is acid rain?
- Why is plastic harmful for soil? Explain.
- What are the problems faced by the animals shown in the Stem? Explain.
- What steps should be taken to balance the environment as shown in the Stem?

2.

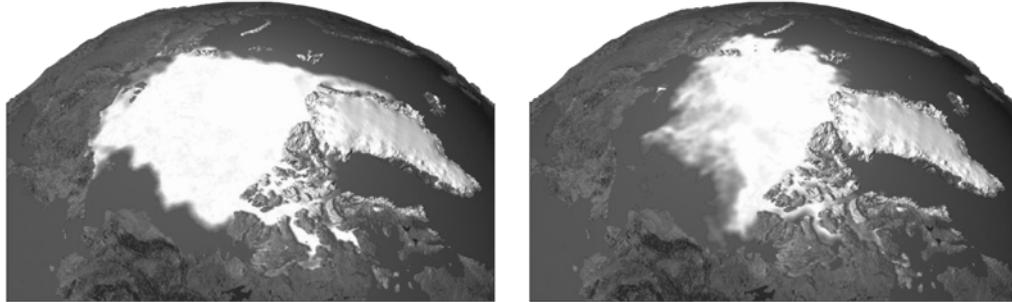


- What is pollution?
- Why is water pollution harmful?
- What problem will P of the Stem create? Explain.
- What sort of contribution can we do to solve the problems created by the Stem? Explain with reasons.

## **Chapter Fourteen**

# **CHANGE OF CLIMATE**

The earth is surrounded by atmosphere. Temperature, atmospheric pressure, wind and humidity of the atmosphere of an area for a limited time is called weather. Over all weather of an area for many years is called climate. Weather and climate influence our life in various ways .In normal weather and climate we lead normal life. Due to increase of temperature of the atmosphere, climate of the earth is changing. Bangladesh is harmed due to climatic changes.



**After this chapter we will be able to -**

- describe different layers of the atmosphere,
- explain importance of water cycle, oxygen cycle and carbon cycle,
- explain weather and climate,
- explain the causes of increase in temperature and change of climate.

## Lesson- 1 and 2 : Atmosphere of the earth

You have learned in class six that the earth was very hot. Gradually it cooled down. At this time light gaseous substances form the outer most part.

Gaseous part that encircles the earth is the atmosphere. You know that, atmosphere is mainly composed of nitrogen and oxygen. Besides there are moisture, dust particles, argon, carbon dioxide and some more gases. The earth attracts everything towards it. Due to this attraction gases of the atmosphere remains near the earth surface. That is why atmosphere near the earth surface is compact .As you ascend upward from the earth's surface, atmosphere becomes lighter and lighter. If you want to ascend to the peak of a mountain , you will have to carry oxygen with you for breathing. The atmosphere is extended to few hundred kilometers from the earth's surface. Earth's atmosphere is divided into few layers. First four layers are Troposphere, Stratosphere, Mesosphere and Thermosphere.

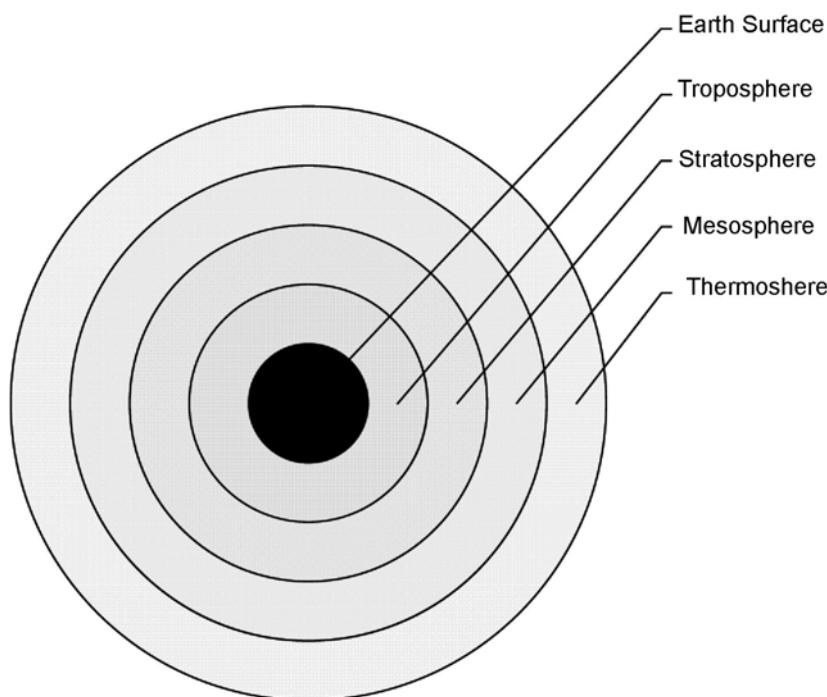


Fig. Different layers of atmosphere

**Troposphere:** From the earth surface up to eleven kilometers forms the troposphere. This layer contains most of the essential gases, like oxygen, nitrogen, carbon dioxide and water vapor. In this layer all those things happen that influence life of human beings and other organisms, such as cloud, rain, wind, storm, fog etc. For these happenings troposphere is the most important layer of the atmosphere.

**Stratosphere :** From just above the troposphere starts stratosphere. This layer starts from troposphere and extends up to about 39 kilometers from the earth's surface. This layer contains one gas named Ozone. This gas protects us from sun's harmful rays. This layer or above this layer contains less amount of other gases of the atmosphere.

**Mesosphere :** This layer starts from where stratosphere ends. With increase in height of the layer temperature starts falling.

**Thermosphere :** This layer is almost airless. Here temperature rises fast, so it is called thermosphere. Radio signals are reflected from this layer.

### Lesson- 3: Water cycle in environment

You know that we get water from various sources. Such as we get water from rain in our country. In the rainy season different areas of the country are inundated with flood water. Ok, tell me from where these flood water come? After the rainy season where do they go back? Again in the next rainy season from where do they come back?

Water moves from one source to another in a cyclic way on the earth. You know how it rains. Heat from the sun converts water into water vapors from the earth's surface; that is, pond, canal, river and sea water is converted into water vapor. Water vapor goes up and forms water drops. These water drops are combined together to form clouds that float around. Water drops of the clouds combine with each other to form large drops that come down to the earth's surface as rain drops. Water drops of the cloud when become too cold, it forms ice that come down to the soil as hail. Rain water flows to the river .From the river it flows to the sea. In this way water moves from the surface of the earth to the cloud as water vapors and from the cloud to the earth's surface as rain drop. This rain water flows to the river from where they ultimately reach the sea. This cyclic movement of water is called the water cycle. It is to be remembered that a portion of rain water goes down under the soil and makes a reservoir. It is called underground water. We lift this underground water and use it for drinking, washing and irrigation purposes.

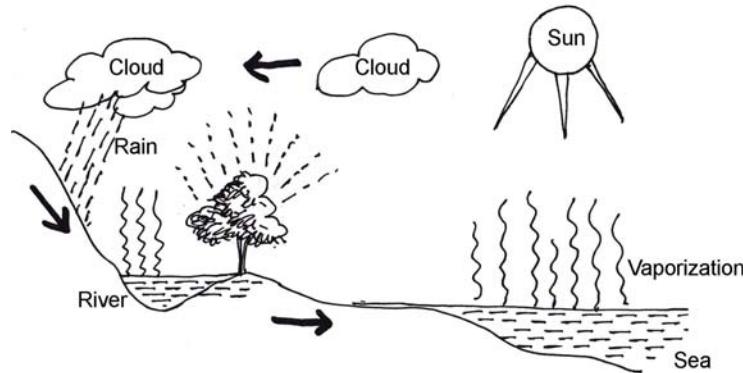


Fig. water cycle

The wind carries some water vapors as clouds and reach the peak of mountains. Clouds cool down there and form snow. In summer season the snow melts due to heat of the sun and come down the mountain. In this way small rivers are formed on the slopes of mountains. These small hilly rivers with rain water make big rivers when come down to plain land. This water ultimately falls into the sea. From water to cloud and from cloud to snow on the mountain peaks- thus water cycles. Again when this snow melts, water moves to the river and ultimately to the sea. Thus water moves in cyclic order. You can understand water cycle clearly from the following diagram.

Water cycle is very important for the environment. Say if surface water including the sea water does not evaporate and remain on the earth, what will happen? Definitely there will be no rain, no water in the river. In that situation could we cultivate crops? Even we could not get rain water or water from the river for irrigation. If there is no rain, no underground water would be available. What would happen if ice on the peak of the mountains and Polar Regions melts without remaining deposited there? Quantity of sea water would have increased. That would cause inundation of coastal areas, such as the southern part of Bangladesh.

Natural balance is maintained between demand and supply of water through water cycle. You have realized that there is a big effect of solar heat on water cycle. Any disturbance in water cycle will create problems for man and other organisms. Over raining may cause flood if rain water cannot pass speedily. Flood visits our country almost every year. Similarly rise in earth's temperature disturbs water cycle. We will know more about it in the last part of this chapter.

#### **Lesson-4: Balance of carbon and oxygen in the environment**

You know that organisms take oxygen for the purpose of respiration. After completion of the process, they release carbon dioxide in the environment. The plants take carbon dioxide to manufacture their food and in this process they release oxygen. In this way a balance is maintained between oxygen and carbon dioxide in the atmosphere. This balance in the atmosphere is very important. These two gases are essential for life. To understand the balance of these two gases one has to understand carbon cycle.

Carbon is needed for the formation of body structure of all organisms. Carbon comes from the carbon dioxide of the atmosphere. Plants prepare glucose and oxygen from water and carbon dioxide of the atmosphere in photosynthetic process. Glucose is prepared by plants. Animals get carbon through food from the plants.

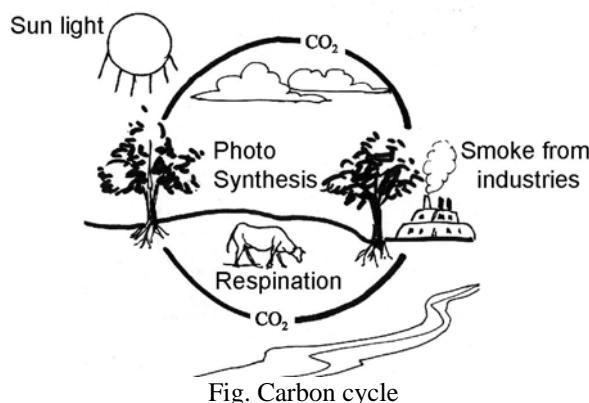


Fig. Carbon cycle

Carbon from the body of organisms comes back to the atmosphere through three processes. Firstly, plants and animals at the time of respiration break glucose to produce energy using oxygen from the atmosphere and release carbon dioxide. Secondly, when plants and animals are burnt, carbon dioxide is produced and mixed up with the atmosphere. Thirdly, when plant and animal bodies are petrified by bacteria and fungi in the soil, they release carbon dioxide. Now it is clear that the plants collect carbon dioxide from the atmosphere and deposit it in plant and animal bodies through production of glucose. Carbon from plants and animal body goes back to the atmosphere in three ways. In this way, balance of carbon or carbon dioxide in the environment is maintained.

### **Lesson-5: Weather and climate**

Gusty wind may blow tomorrow from the north-west side of Dhaka and its surroundings. Throughout the major part of the day, the sky will be free from clouds. But in the evening there is a possibility of accumulation of dark clouds in the north-east corner of the sky. Today relative humidity of Dhaka was 60 percent. Today's highest temperature was 34 degree Celsius at Kushtia and lowest temperature was 24 degree Celsius.

Did you listen such bulletins at the end of radio or television news? What is the news about? What do we learn from such news? Is there any possibility of storm or rain? Can we learn whether it will be hot or cold tomorrow? Yes, usually the last part of the news contains the bulletin whether there is a possibility of rain or storm, what the day's temperature will be how much rain fall was recorded and in which places or what was the highest and lowest temperature of the day? These are all weather bulletins. Is it possible to understand what weather is from the weather bulletin?

#### **Weather:**

Weather means the condition of atmosphere for a short period in a particular area. Temperature and pressure of air, wind direction and speed, humidity or quantity of water vapors in the air, cloud, fog and rain fall etc. make the weather.

For example, when the highest temperature was 35 degree Celsius- it means that the day's atmosphere was hot. When the highest temperature was 13 degree Celsius - it means that the day was cold. The sky was cloudy or the day was foggy- these conditions indicate weather for a short period.

#### **Climate:**

We use to say that today's weather was cool but it was too hot at noon. Weather may change in no time. On the other hand climate does not change suddenly. Climate is the average result of many years weather of an area. For example, we use to say that climate of Bangladesh is hot and moist .It means in Bangladesh one feels hot and the air is wet. Climate of Russia is mainly cold. This statement indicates that Russia is cold round the year.

### **Differences between weather and climate**

Factors of weather and climate are basically the same. Temperature, air pressure, humidity (relative quantity of water vapours), rain fall are the factors of weather and climate. When factors are same, then what are the differences between weather and climate? You have already known the relationships between this two. Climate is actually the mean result of weather for a long period. Now let us see what the differences between weather and climate are.

1. Weather condition of a particular area for short period is called weather.
2. Weather may change within a short span of time. But climate does not change suddenly. When changes occur, it takes many years.
3. Weather of nearby places may vary. For example there was rain in Faridpur but no rain in Barisal whereas usually climates of certain regions are the same. Such as climates of Bangladesh, Thailand and West Bengal of India are similar.

### **Lesson- 6, 7: Change of weather**

One day rising from the bed you may see bright sun outside, but do not feel not that much hot. With the passing of time temperature increased and you started sweating. Gradually clouds are formed and at one time the sun is covered with dark clouds. After some time it started raining cats and dogs. When the rain stopped, the sky has become clear and the heat came down. Just think how many times the weather changed in a day. Change of the weather is a normal phenomenon. Why does weather change like this?

Main role is played by the sun in weather change. Now we shall see how heat of the sun plays role in changing of weather factors.

#### **Dependence of temperature of weather on solar heat:**

Heat also reaches the earth's surface with sun rays. When sun rays reach the surface of the earth, it becomes heated. As a result, the lowest layer (troposphere) of the atmosphere also becomes heated and we feel much hot. At night when sun sets, even the surface of the earth and the lowest layer of the atmosphere remain warm. Because heat accumulated in day time could not be fully released at night. Heat radiated by the earth's surface is absorbed and retained by water vapors, carbon dioxide etc. That is why we also feel hot at night. In summer the sun shines from vertical position for longer period. So we feel very hot. On the other hand in winter the sun shines obliquely from a longer distance for shorter period, so we feel less hot.

#### **Dependence of air pressure and wind on temperature:**

Wind or blowing of air is the result of differential air pressure. For example we see water flowing from higher level to lower level. Similarly air blows from its higher pressure area to lower pressure area. With the change of temperature, there is a change in the air pressure.

Air of an area becomes hot and goes upward when temperature of that area is higher. So air of that area becomes light and a gap is created. That means the air pressure falls. This condition is called depression. As a result air from surrounding high pressure areas rush to the low pressure areas to fill up the gaps. In this way wind is created. Areas where air temperature is low, air concentration is higher. So air pressure is also higher. When air pressure is high, it is called high pressure.

In our country we see air blowing from north to south in winter. But in summer we see that it is just opposite. Why does air blow in different directions in different times? In winter the sun shines vertically in the areas south to Bangladesh. So air pressure is lower. On the other hand the areas north to Bangladesh is colder and air pressure is higher. In Bangladesh air blows from the north to the south in winter season. The air which comes from land area, contains less water vapor. So in winter season the air remains dry and produces less rain.

In summer and rainy season the sun shines from vertical position in Bangladesh. So in Bangladesh weather is very hot and air pressure is less. The region of the Bay of Bengal and the north of Bangladesh is less hot; so the air pressure is high. As a result air blows towards Bangladesh from the Bay of Bengal. This air carries a large amount of water vapor from the Bay of Bengal. This water vapor becomes cold and it rains. For this reason air is humid in summer and rainy season and it rains heavily.

### **Lesson- 8, 9, 10 : Change of climate**

By this time you have already known that climate is the overall or average weather condition of an area for many years. Climate of Bangladesh is hot and humid. You know in Bangladesh average weather is hot but cold condition is less prevalent. Winter is short, usually in the month of Poush and Magh cold is felt. After that weather becomes less cold and gradually becomes hot. In Baishakh and Jaistha it is bit hotter. We name this two months as summer. Every year in Baishakh a type of storm called nor-wester comes. From the very beginning of Ashar raining starts, so the rainy season also starts. In the months of Srabon and Bhadra air is very hot and raining continues. Then again weather starts becoming cold and winter comes back in the month of Poush. This is the normal scenario of climate in Bangladesh. The same climatic conditions existed during the time when your parents were children. The same condition of the overall weather or the climate stayed for last twenty or thirty years.

Climate of any area does not change within a short time. But the scientists predicted through experiment that the average temperature of the earth is increasing gradually. This increase of temperature of the earth is called global warming. Snow of the mountain peak and Polar Regions are melting due to rise of temperature of the earth. Sea water is rising due to increased temperature. As a result sea level is also rising. If temperature increases in this way, the water level of the sea will go higher and higher. As its consequence low lying areas of the world including Bangladesh will be inundated. Besides this rise in temperature will cause drought, excessive raining and much more natural calamities .

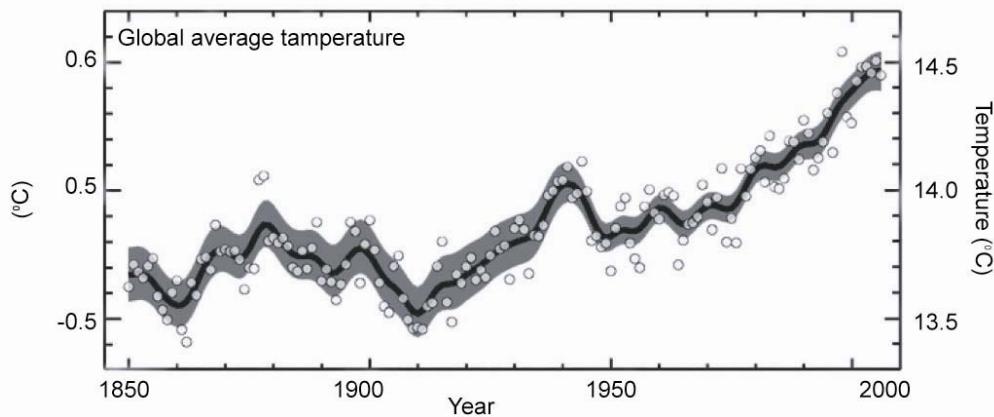


Fig. Rise of global temperature

**Causes of global warming :** The main cause of global warming is the increase of carbon dioxide in the atmosphere. You have learnt from this chapter that carbon dioxide and oxygen come back in a cyclic order. So the balance of carbon dioxide and oxygen is maintained. After industrial revolution in Europe, different countries especially industrially advanced countries started burning coal, petroleum, and natural gas. Carbon dioxide produced from burning of these fuels is not spent or absorbed. Rather the number of plants is decreasing for obvious reasons due to increased population. As a result amount of carbon dioxide has increased in the atmosphere. Now the question is: why does the temperature go up when the amount of carbon dioxide increases?

**WORK : Green house effect.**

**Materials required:** Two glasses of same measurement, measuring cylinder, water, one clean and transparent plastic bag, two thermometers.

**Procedure :**

1. Take equal quantities of water by using measuring cylinder.
2. Place one thermometer in each glass. Note the temperature of water and note it down in your note book.
3. Put one glass in the plastic bag and close it.
4. Now put both the glasses in the sun. Assume water of which glass will be hotter. Give reasons in support of your answer.
5. After one hour observe the temperature of both the thermometers. Which one is higher? Is it according to your assumption?

You will see that the temperature of the glass in the plastic bag has increased more. Can you say, why? Heat from the sun has fallen on both the glasses equally. Heat may enter the glass inside plastic bag, but it cannot come out. As a result, the rate of temperature rise is higher in the glass covered with plastic.

In cold countries plants cannot survive due to too much coldness. To produce vegetables in too much cold conditions, glass houses are constructed, called green houses. In winter season when the sun is available for a short period, the sun light enters through the glass and makes air, plants and soil heated. Heat from this house tries to radiate out. But after the increase of temperature, heat cannot go out through glasses. As a result glass houses remain warm during night and the plants inside remain alive. The phenomenon of retention of heat in the glass house is called green house effect.

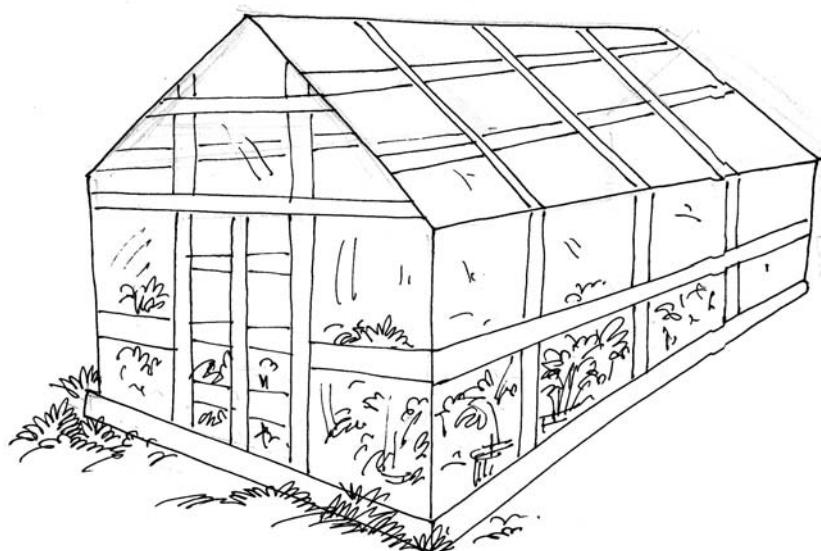
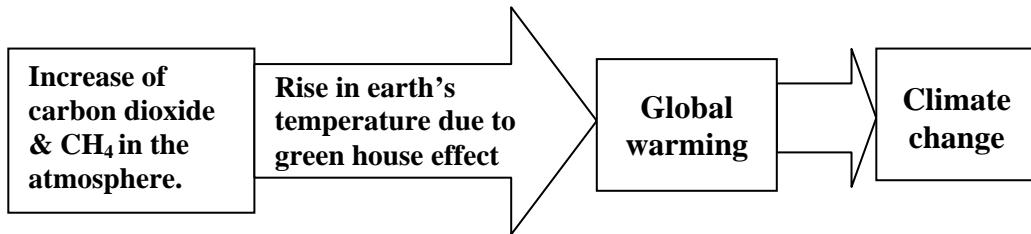


Fig. Green house

The earth may be compared with a green house. The earth is surrounded by the atmosphere. The atmosphere contains carbon dioxide, methane and water vapor, which act like green house gases. They do not resist heat from the sun from coming, so heats from the sun make the earth heated. But it resists the heat to radiate out. So the earth may remain heated at night also. These gases are called green house gases. There are carbon dioxide, methane and water vapor in the atmosphere. It is a blessing for the human civilization. Because in absence of these gases, heat from the earth would have radiated out and the earth would become too cold. Now the question is: how can a blessing be a problem? The problem is the increase of the quantity of carbon dioxide in the atmosphere. Increased amount of carbon dioxide retains increased amount of heat. So the temperature of the earth is increasing. So the main cause of global warming is the increase of carbon dioxide in the atmosphere.

### What steps can be taken to prevent global warming?

You have known the causes of climatic changes and global warming. We can draw the following flow chart from above discussions.



From the above flow chart it is clear that the cause of climate change is global warming. And the cause of global warming is the increase of the quantities of carbon dioxide and methane gas in the atmosphere. Then how can we prevent global warming and climatic changes? Simple answer is to decrease the emission of carbon dioxide and methane gas or to remove them from the atmosphere by some means. Methane gas cannot be removed because it is produced from agricultural activities. At present the main recommendation is to reduce the emission of carbon dioxide. By reducing burning of coal, petroleum and natural gas and use of renewable energy (such as solar energy and wind may be used for producing electricity) we can reduce emission of carbon dioxide. Another suggestion is put forwarded for reduction of emission of carbon dioxide, is plantation of trees and other plants. Because plants use carbon dioxide for synthesis of food. As a result the amount of carbon dioxide will be reduced.

### What we have learned from this chapter-

- Atmosphere is extended few hundred kilometers from the earth's surface. Atmosphere is divided into few layers. First four layers are troposphere, stratosphere, mesosphere and thermosphere.
- Eleven kilometers from the earth's surface of the atmosphere is the troposphere. Maximum essential factors, such as oxygen, nitrogen and carbon dioxide are present in this layer. All the activities that influence the life of man and other organisms are present in this layer such as cloud, rain, wind, storm, mist etc. So troposphere is the most important layer of the atmosphere.
- Ozone gas is present in stratosphere layer. It saves us from harmful rays of the sun.
- Water from the earth's surface is converted to water vapor; from water vapor to cloud ; from cloud water returns to the earth's surface as rain . Rain water flows to the river and ultimately to the sea. Return of water in cyclic order is called water cycle. Through water cycle a balance is maintained between demand and supply of water in the environment.
- Living Organisms take oxygen from the atmosphere for respiration. On completion of respiration they release carbon dioxide in the atmosphere. The plants absorb carbon dioxide for producing food and release oxygen. In this way balance

of oxygen and carbon dioxide is established in the atmosphere. Oxygen and carbon dioxide balance is very important for the environment especially in the atmosphere. These two gases are very important for life.

- Weather is the temperature, pressure, wind, humidity of the atmosphere of an area for a short period and the overall weather of an area for many years is the climate.
- The main role is played by the sun in weather change. Air pressure is changed as a result of the change of temperature.
- Climate of any area does not change suddenly. But the scientists observed after calculation that the average temperature of the earth is increasing gradually. This increase of temperature of the earth is called global warming. Snow of the mountain peak and polar region are melting due to the rise of temperature of the earth. Sea water is increasing due to the increase of temperature. As a result sea level is rising. If temperature increases like this, the water level of the sea will go on rising. As its consequence low lying areas of the world including Bangladesh will be inundated. Besides, this rise in temperature will cause drought, excessive raining, and more natural calamities to happen.
- Climate is changing due to global warming. The main cause of global warming is the increase of carbon dioxide in the atmosphere. So the best way to prevent climatic change is to minimize the emission of carbon dioxide.

## **EXERCISE**

### **Fill up the gaps :**

1. Eleven kilometers from the earth's surface of the atmosphere is called \_\_\_\_\_.
2. \_\_\_\_\_ saves us from harmful rays of the sun.
3. The overall mean weather of an area for many years is the \_\_\_\_\_.
4. The main role is played in climate change by \_\_\_\_\_.
5. If temperature increases sea water level also \_\_\_\_\_.

### **Short answered questions :**

1. Explain why concentration of air is more in lowest or nearest layer of atmosphere.
2. Why is troposphere most important?
3. Explain the water cycle with diagrams.
4. How balance of oxygen and carbon dioxide is established in the atmosphere?
5. What is Green House Effect? How can global warming be explained with its help ?

**Multiple choice questions :**

1. Which layer of the atmosphere is nearly vacuum?

- a. Troposphere
- b. Stratosphere
- c. Mesosphere
- d. Thermosphere

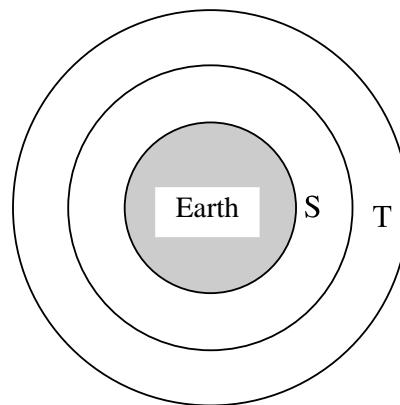
2. In case of weather and climate—

- i. weather may vary in the same day in different places of the same country.
- ii. climates of Bangladesh and West Bengal are almost the same.
- iii. Factors of weather and climate are different.

Which one of the following is correct?

- a. i
- b. ii
- c. i and ii
- d. ii and iii

**Observe the Stem and answer question no. 3 and 4.**



3. In the 'T' layer of stem there is –

- i. Oxygen and Nitrogen
- ii. Carbon dioxide and dust
- iii. Ozone gas

Which one of the following is correct?

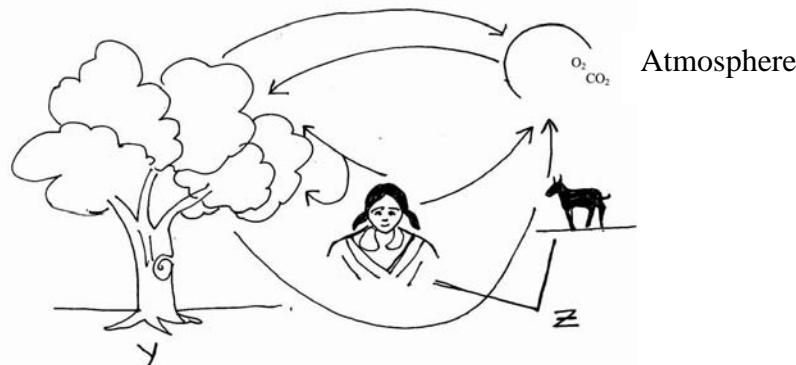
- a. i and ii
- b. iii
- c. ii and iii
- d. i, ii and iii

4. If temperature increases in 'S' layer of the stem —

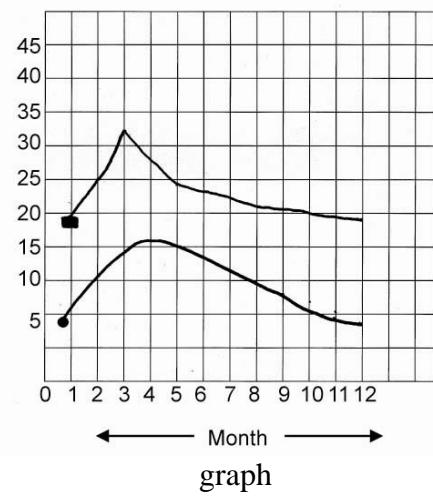
- i. Air pressure will increase
- ii. Air will be light
- iii. Air pressure will decrease

Which one of the following is correct?

- a. i and ii
- b. i and iii
- c. ii and iii
- d. i, ii and iii



- a. What is underground water ?  
 b. Describe why stratosphere is important.  
 c. How do 'Y' and 'Z' maintain balance of oxygen and carbon dioxide in the environment? Explain.  
 d. If the quantity of gas expelled from Z increases ,what disaster will happen in the environment? Explain.
2. Highest and lowest temperature of Dhaka for one year (from January to December) has been shown in the graph below :



- Highest temperature
- Lowest temperature

- a. What are the factors of weather ?
- b. Why is the atmosphere in February in Bangladesh soothing?
- c. As per the graph, in which month air pressure in Dhaka was the highest?  
Explain.
- d. In which month there was highest possibility of storm in Dhaka? Explain it  
in the light of the graph.



সমৃদ্ধ বাংলাদেশ গড়ে তোলার জন্য যোগ্যতা অর্জন কর  
- মাননীয় প্রধানমন্ত্রী শেখ হাসিনা

বিনয়ীকে সবাই পছন্দ করে



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