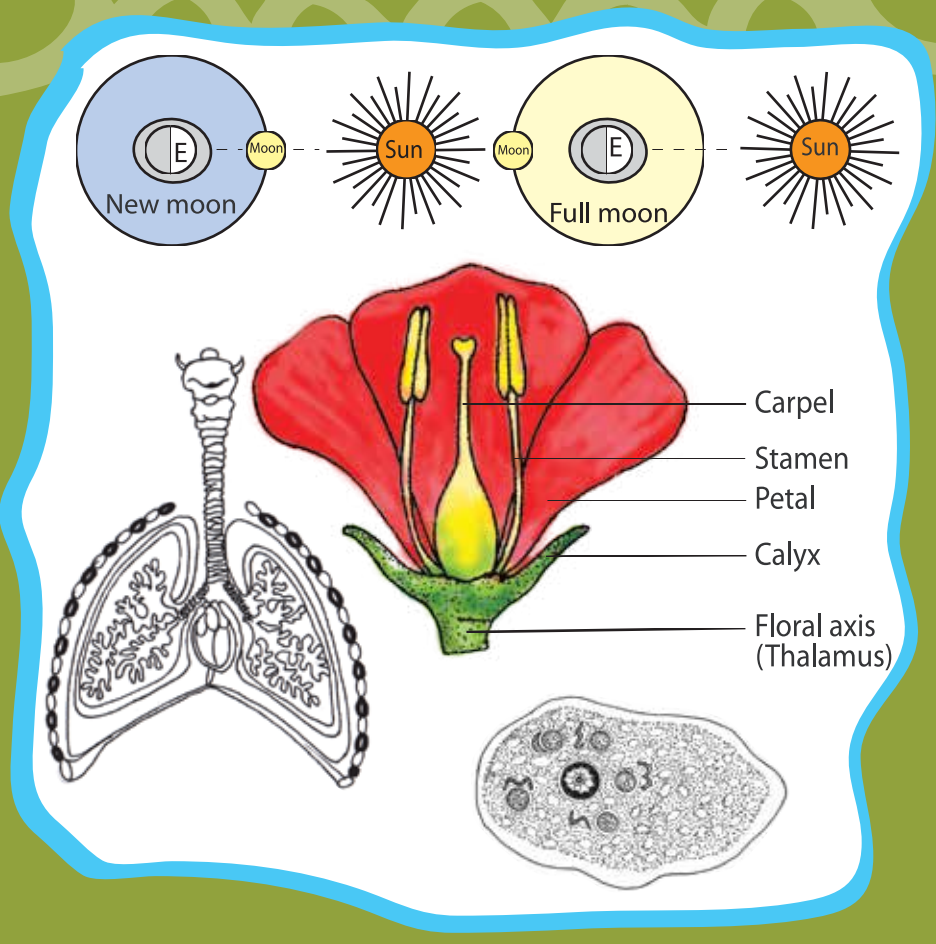
# Science

## Class Seven




NATIONAL CURRICULUM AND TEXTBOOK BOARD, BANGLADESH

## ডিজিটাল বাংলাদেশের অর্জন

- প্রধানমন্ত্রী শেখ হাসিনার একটি স্বপ্ন 'ডিজিটাল বাংলাদেশ' যার ভিশন হলো তথ্য ও যোগাযোগ প্রযুক্তির বহুমুখী ব্যবহার নিশ্চিত করার মাধ্যমে জ্ঞানভিত্তিক সমাজ প্রতিষ্ঠায় সহায়তা প্রদান। ২০০৮ সালে আওয়ামী লীগের নির্বাচনী ইশতেহার 'দিন বদলের সনদ' এ প্রথম ঘোষণা করা হয় যে ২০২১ সালে স্বাধীনতার ৫০ বছরে বাংলাদেশ ডিজিটাল বাংলাদেশে পরিণত হবে।
- তথ্যপ্রযুক্তি খাতে বিশেষ অবদানের জন্য প্রধানমন্ত্রী শেখ হাসিনা ২০১৫ সালে 'আইসিটি টেকসই উন্নয়ন পুরস্কার' অর্জন করেন। প্রধানমন্ত্রীর আইসিটি বিষয়ক উপদেষ্টা সজীব আহমেদ ওয়াজেদ এক্ষেত্রে তাঁর অনন্য কৃতিত্বের জন্য ২০১৬ সালে 'উন্নয়নে আইসিটি পুরস্কার' অর্জন করেন ।
- বিগত এক দশকে দারিদ্র্য বিমোচনসহ কৃষি, শিক্ষা, স্বাস্থ্য, মানবসম্পদ উন্নয়ন প্রভৃতি ক্ষেত্রে বাংলাদেশ এক অনুকরণীয় সাফল্যের দৃষ্টান্ত স্থাপন করেছে। এ সাফল্যের ধারাবাহিকতায় জুন ২০১৯ পর্যন্ত ইন্টারনেট সেবা নিশ্চিতে সারাদেশে ইউনিয়ন পর্যায় পর্যন্ত ১৮ হাজার ৯৭৫ কি. মি. অপটিক্যাল ফাইবার ক্যাবল স্থাপন, ২ হাজার ৪টি ইউনিয়নে ওয়াইফাই রাউটার (Wifi Router) স্থাপন এবং ১ হাজার ৪৮৩টি ইউনিয়নকে নেটওয়ার্ক মনিটরিং সিস্টেমে সংযুক্ত করা হয়েছে।
- ই-কমার্স ও ডিজিটাল প্রযুক্তির বিকাশের ফলে আইটি সেক্টরে বহুমানুষের কর্মসংস্থান নিশ্চিত হয়েছে ও প্রচুর বৈদেশিক মুদ্রা আয় হচ্ছে। ২০১০ সাল থেকে সব শ্রেণি ও পেশার মানুষকে ই-সেবার সঙ্গে পরিচিতকরণের লক্ষ্যে প্রতিবছর ডিজিটাল উদ্ভাবনী মেলার আয়োজন করা হচ্ছে।

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

# Science

Class Seven

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# Preface

The aim of secondary education is to make the learners fit for entry into higher education by flourishing their latent talents and prospects with a view to building the nation with the spirit of the Language Movement and the Liberation War. To make the learners skilled and competent citizens of the country based on the economic, social, cultural and environmental settings is also an important issue of secondary education.

The textbooks of secondary level have been written and compiled according to the revised curriculum 2012 in accordance with the aims and objectives of National Education Policy-2010. Contents and presentations of the textbooks have been bselected according to the moral and humanistic values of Bengali tradition and culture and the spirit of Liberation War 1971 ensuring equal dignity for all irrespective of caste and creed of different religions and sex.

The present government is committed to ensure the successful implementation of Vision 2021. Honourable Prime Minister, Government of the People's Republic of Bangladesh, Sheikh Hasina expressed her firm determination to make the country free from illiteracy and instructed the concerned authority to give free textbooks to every student of the country. National Curriculum and Textbook Board started to distribute textbooks free of cost since 2010 according to her instruction.

The objectives of **Science education** are to flourish the knowledge of natural phenomena by increasing observation power of learners so that they can earn the capacity to solve the various problems. Side by side the students will become more and more interested in different elements of environmental aspects. To make the textbook easy and joyful to the learners along with theoretical matters of science, some activities for `Learning by doing` have been included. To flourish the talent, creativeness, imagination and inquisitiveness of the learners, different types of tasks have been introduced here. By the help of this textbook the learners will achieve the skills and face adverse situation and to overcome the obstacle in positive attitude.

I thank sincerely all who were involved in the process of revision, writing, editing, art and design of the textbook for their intellectual labour.

**Professor Narayan Chandra Saha**
Chairman
National Curriculum and Textbook Board, Bangladesh

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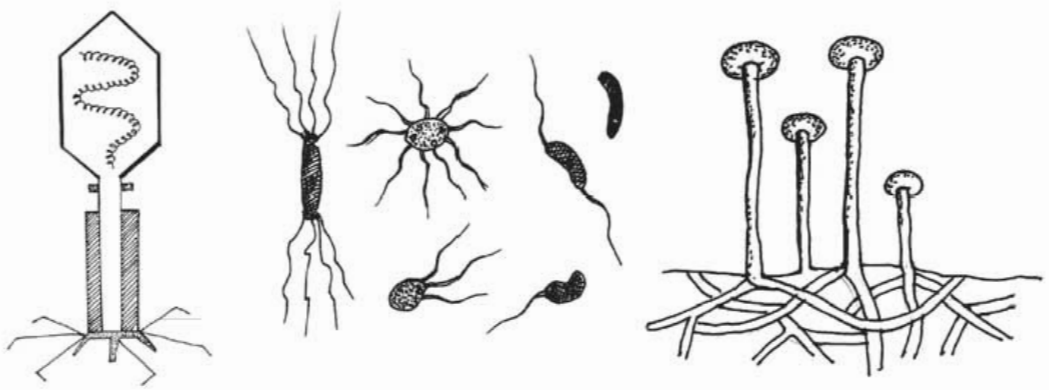
## Chapter One

# Lower Organisms

Virus, Bacteria, Fungi, Algae, *Amoeba* etc. are called lower organisms. Among them 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 or microorganisms cause disease of man, domestic animals, birds and plants. These organisms also have beneficial effects on environment.



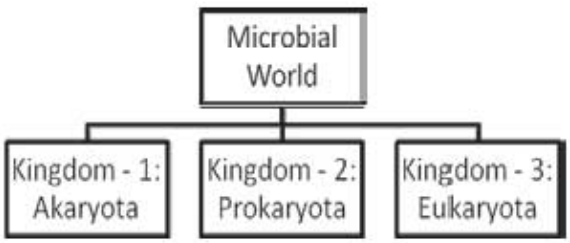
**After studying this chapter, we will be able –**

- to explain the characteristics of micro organisms.
- to classify microorganisms.
- to explain the characteristics of Virus, Bacteria and Amoeba.
- to explain the characteristics of Algae and Fungi, their benefit and detrimental effects.
- to explain how to resist the fungal and infections.
- to be self conscious and make others conscious about fungal infections.
- to explain the risks and way out from human health hazards created by Virus, Bacteria and Entamoeba.
- To be self conscious and also make other conscious to resist these health hazards.

## Lesson - 1, 2: Microbial World

We can see many organisms around us. Besides these organisms, there are numerous invisible organisms which cannot be seen by bare eyes. They do not have well-organized cells with specific nucleus. These are known as micro-organisms. In early stages, life has been initiated from these micro-organisms. For this reason, micro-organisms are termed as procaryotic or primitive organism.

In Class Six, you have seen five kingdom of classification of the living world proposed by Whittaker and Margulies. On this classifacation micro organisms are placed under kingdom Monera, Ptotista and Fungi. At present, microbiologists classify the microbial world 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 see 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, Ricketsia, Fungi, Bacteria, Algae, and Protozoa etc. are present in our environment in innumerable in numbers. Most of them are beneficial. Of course, some of them are responsible for producing diseases in human body. Now we will know about few microorganisms.

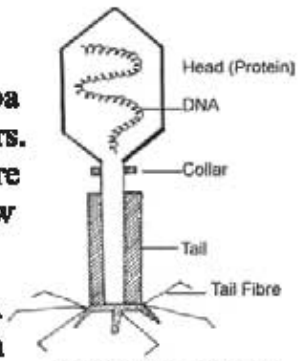


Fig-1.1 Ta-Virus Particle

**Virus-** Virus cannot be seen without electronic microscope. These are the simplest organisms. In virus cell wall, plasma membrane, organized nucleus, cytoplasm etc. are absent.

So, virus body is also called acellular. They are composed of only protein coating and nucleic acid (DNA or RNA). If nucleic acid gets out of protein coating, they lose all properties of life. When the protein coating and neuclic acid are gathered in another organism, they regain the properties of life. That is, they do not show any properties of life without living host or outside of living host. For that, viruses are the true parasites.

Bacteriophage is a common virus among all viruses. The figure gives the idea of their structure.
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 need to have a broader look. Bacteria is non-green, unicellular microscopic organisms with primitive nucleus. The scientist, Antony von Leuen Hoek found this 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-

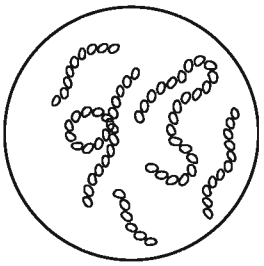


Fig- 1.2: Coccus

a. Coccus: Rounded shaped bacteria cell are named as coccus. They remain single or in groups. Such as Pneumonia causing Bacteria.

b. Bacillus: These are elongated rod shaped bacteria. Tetanus, Blood Dysentery etc are caused by Bacillus.

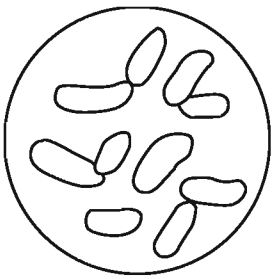


Fig- 1.3: Bacillus

c. Comma: Shaped like bend rod. Such as Bacteria causing Human Cholera.

d. Spirilum: Spiral Bacteria.

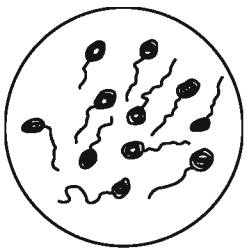


Fig- 1.4: Comma

**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 from bacteria.
- Bacteria is the main basis of Genetic engineering. Becteria is used in some cases in order to identity the desired characteristics of organisms. It is also used in genetic changes.

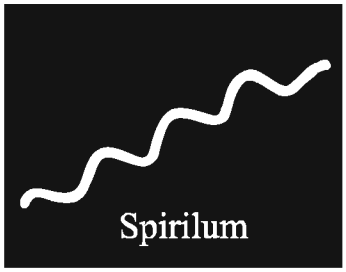


Fig- 1.5: Spirilum

## Lesson 5,6: Algae, Fungi and Amoeba

Fungi: Fungi are non-green thallophytic plants. They cannot take part in photosynthesis because they do not have chlorophyll. So, they are heterophyte or saprophytic. Heterophytic fungi grow on slate, rotten food staffs, fruits, vegetables, wet bread or leather, cow dung etc. Saprophytic fungi grow on dead organisms or on soil full of humus.

**Economic Importance of Fungi:**

We get many valuable medicines including Penicillin from Fungi. Fungi named Yeasts are used for preparing bread. Yeasts are used in vitamin tablets as they are very rich in vitamins. Now a days, a kind of mushroom named *Agaricus* is used as fancy food. At present *Agaricus* is cultivated in many countries including ours . Fungi have important role in purifying waste products and mix them with soil.

Fungi are responsible for many diseases of man, animal, bird and plants. Ring worm, inflammation of the trachea (respiratory system) and freckles are fungal 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:**

Fungal diseases are highly contagious. It means a person may get infected on coming into contact with an infected person. The following measures should be

taken to be safe from these diseases :

i. Avoid using things (clothes, combs, caps, sandals) of the infected persons.
ii. Avoid mixing with deseased person.
iii. Spraying fungicides on infected plants or uprooting and burn them up.

**Algae:** Algae are chlorophillous and autophytic plants of the order Thallophyta. They grow on soil, water and on other plants. Besides, green, red, brown etc. coloured algae are also seen. The algae named "Spirogyra" grows in the most water bodies.

**Benefits of Algae :** Elgin extracted from marine algae is used in preparing ice cream. Marine algae are also good source of iodine and potassium. Algae are used as food in fisheries.

**Harmful role of Algae :** Algae are responsible for causing various diseases of human and plants. Abundance of algae in water bodies create shortage of oxygen that may cause death of aquatic animal & fishes.

***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 change their body shape according to their necessity. Small finger like structure which is produced from their body, is 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.

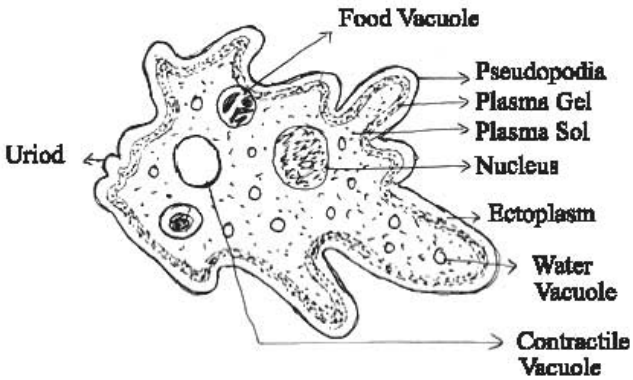



Fig-1.6: Microscopic structure of amoeba

*Amoeba* grows in water, wet soil, rotten waste material, organic debris at the bottom of the pond etc.

## Lesson – 7: Entamoeba

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 which belong to the kingdom Protista. They cannot be seen with bare eyes. Its body has no definite shape because they continuously change size and shape. Their body is transparent and jelly like. In adverse environment sometimes they cover the body with hard and round covering. This condmon is known as cyst.

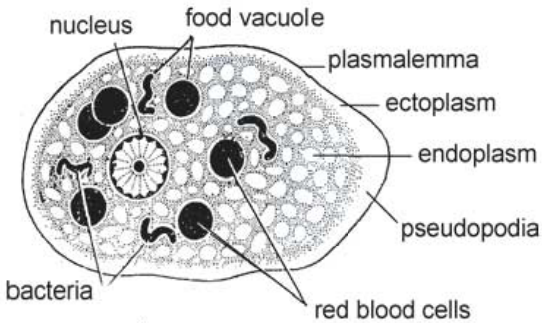



Fig-1.7 : Entamoeba

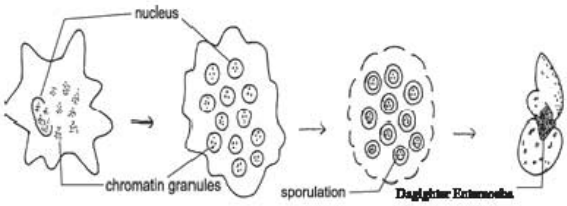



Fig-1.8: Multiple Fission of Amoeba

They live in as parasites in large intestines of man, monkeys, cats, dogs, pigs and rats. *Entomoeba* for causing a kind of dysentery is responsible .

*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.*

The patient bears the germs without any symtoms. It is very difficult to cure amoebic dysentery completely. 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 different processes. Dirty hands may act as suitable carrier for germs. 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. Bacteria may easily get transferred through shaking hands. Germs disperses easily through stale and rotten foods. Cholera and Typhoid are bacterial diseases. Once spread of diseases caused by virus, bacteria and *Entamoeba* was very high. It was caused due to the 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.

**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 many areas of our country, 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 of cough and cold spread through coughing, spitting and sneezing. Mosaic diseases of plants are transmitted with simple contact. AIDS (Acquired Immune Deficiency Syndrome) is still not curable. AIDS is transmitted when blood from infected person is taken, taking drugs by those who are addicted, using same needle many times 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 the needs of body .

**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. 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 are 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 the spread 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 into 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 flue 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 area 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, playgrounds, market places and places where a large number of people gather. The best preventive measure is to make people aware of it. When attacked, the patient should call in 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. We have much responsibilities regarding it.

**What we learned from this chapter-**

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

## EXERCISE

### Fill in the gaps:

1. Cause of Typhoid 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 the names of four bacterial diseases.
3. What 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 is 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 question no 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 as 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?

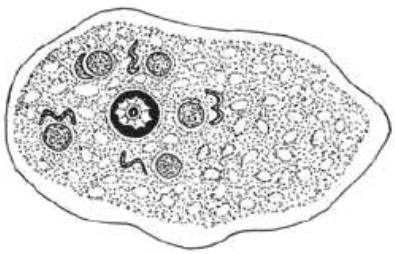
a. i and ii
b. i and iii
c. ii and iii
d. i, ii and iii

4. Which one of the following is responsible for producing the disease Tareque pointed out?

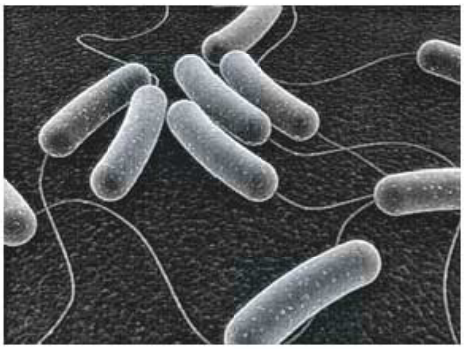
a. Fungi
b. Algae
c. Bacteria
d. Virus

## 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 virus?

b) Why is virus called acellular?

c) What are the reasons for telling Sohail to use handkerchief?

d) Analyze how Sohail would 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 if 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 explain the function of various types of tissues.
- to differentiate plant and animal tissues.

# Lesson -1, 2: Description of A Plant Cell

Body of all organisms is 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 are 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.

Protoplasm contains cytoplasm & nucleus, which are the two main parts of cell.

**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.

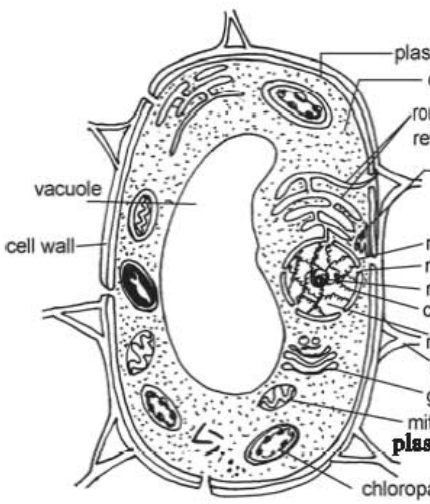



Fig- 2.1: Different parts of a typical plant cell

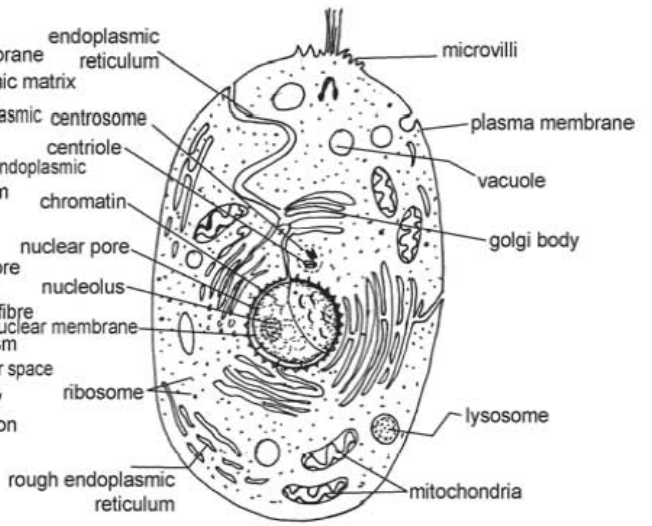



Fig- 2.2 : Different parts of a typical animal cell

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**Cell Vacuole:** Cellular living organelles and non-living 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, choloroplast 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. These are called cristae.

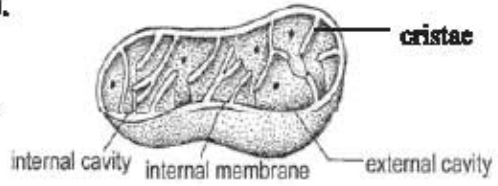

Fig- 2.3 : Mitochondrion

Mitochondrion is the source of all energy used in metabolic activities in an organism. So it is called "power house" of the cell. Number of mitochondrion is large in green plant cells but the number is more than one thousand in liver cells.

**Golgi body:** These are round or thread like organelles covered by membranes and lie 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 part 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:** Densest part of protoplasm covered by membrane is nucleus. Every nucleus consists of four parts, namely- i) nuclear membrane ii) nucleolus iii) nuclear reticulum and iv) nucleoplasm.

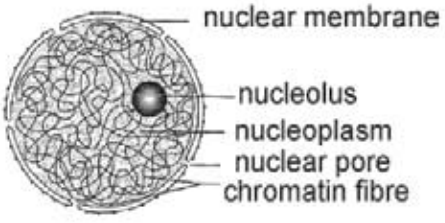

Fig- 2.4 : Different parts of nucleus

Best time for examining nuclear parts is in inter-phase stage just before the cell division. Four parts of nucleus are discussed below:

i) **Nuclear Membrane:** The double layered membrane which surrounds the nucleus, is 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 to protect 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, known as 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. Each piece is called chromosomes.

**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: Charactaristics 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 on the other hand, show division of labour. If all 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 are 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 are composed of different types of tissues. Different types of tissues perform different specific functions.

Depending on the capacity of cell division, tissues are classified into two types, such as, a) meristematic tissue and b) permanent tissue.

## 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.

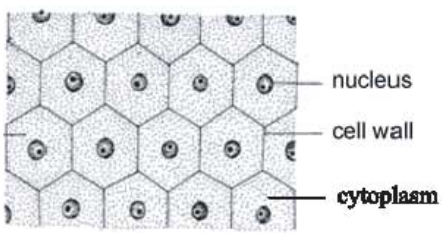


Fig- 2.5 : Meristematic tissue

## Functions:

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

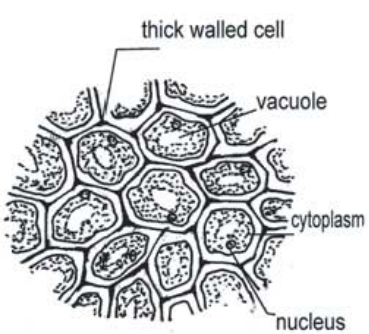


Fig- 2.6 : Permanent tissue

**Functions :**

- Production and transport of food
- Construct the body and strengthen the plant.

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

## Lesson-8-10: Charactaristics 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) Connective tissues;
c) Muscular tissues;
d) Nervous tissues.

A) **Epithelial Tissues**: Tissue that makes the open areas of the body-cover 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.

**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 have observed in your muscle? How has this change happened? Observe, and write down and present before the class.

**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.

2. **Involuntary Muscles**: The responsibilities of the intestinal muscles is to transport of food stuff in digestive tract. 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.

**Functions of Muscles**:

- Muscles give shape of the body and help in bone movement.
- Help in movement and locomotion.
- It protects internal organs.
- Heart muscles help in 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 take part in this movement? Try to feel by touching with your hand and present before the class what you have understood.

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## 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.

### Functions of Connective Tissues:

Main constituent of bone is calcium. Bones give structure, bear the weight and give mechanical support to the body. 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 numerous neurons. Every neuron is composed of three parts, such as- a) Cell body b) Dendron and c) Axon.

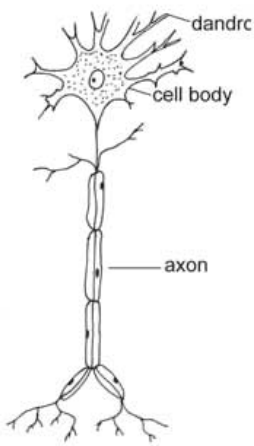


Fig- 2.7: A single neurone

### Functions of Nerve Tissues:

- Recieve impulses from different sense organs of the body and send impulse to the brain.
- 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.
- Storage of the stimuli or incidents in the memory.
- 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.

**What we learned from this chapter-**

- Structural and functional unit of the body is 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 stored in mitochondria.
- Having same origin when cells of same or different sizes perform the same function in a group is called a tissue.
- Tissues are mainly 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.
- Blood is a kind of connective tissue.

## 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 _____.
5. _____ is the power house of cell.

**Short answered questions:**

1. Describe the functions of muscles.
2. Write down the characteristics of epithelial tissues.
3. Describe the structure of nucleus.
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

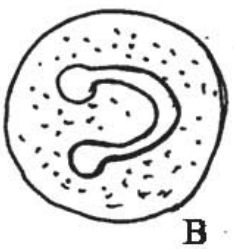
Which of the following answers is correct?

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 the question number 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.

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Which of the following is correct?

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

4. Characteristics of **A** and **B** are –

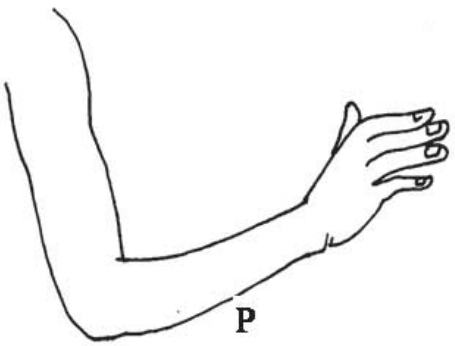
i. They are connective tissue
ii. They transport oxygen
iii. Their main constituent is calcium.

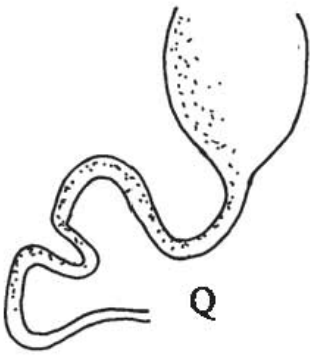
Which of the following is correct?

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

N

a. What is a cell wall?

b. Why is the mitochondria called power house?

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.

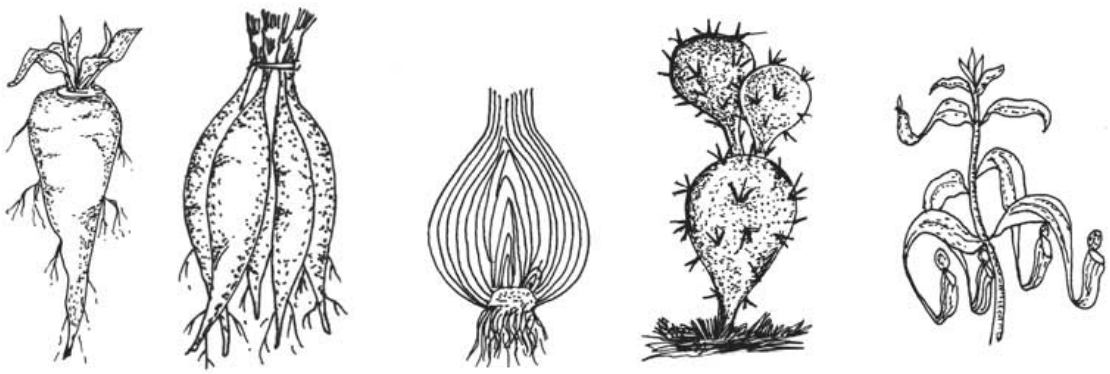
## Do yourself:

1. Which organs of your body are of voluntary muscles? Make a list of them and present before the class.

## 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.

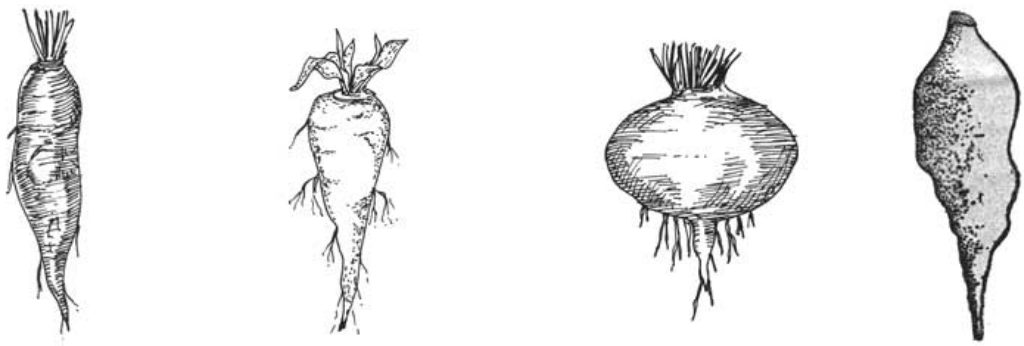


**After studying this chapter, we will be able –**

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

## Lesson -1: Modifications of Main Root

The main function of root is to entangle trees with soil. 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? Look for a while 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 –



3.1 Fusiform 3.2 Conical 3.3 Napiform 3.4 Tubercular

Fig-16: 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 a 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 attains 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.

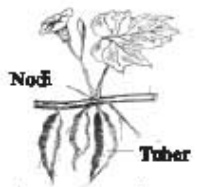


Fig- 3.5 : Tuber Root

**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. Storage of food is its main function, such as Aspasagus and Dahlia.

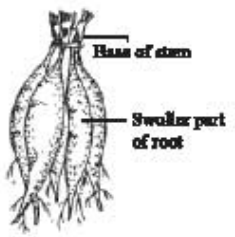


Fig- 3.6 : Fasciculated Root of Dahlia

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

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

## 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.

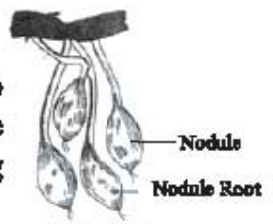


Fig-3.7

**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.

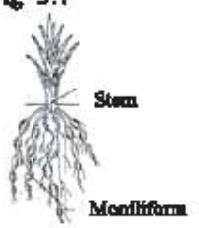


Fig- 3.8

**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.

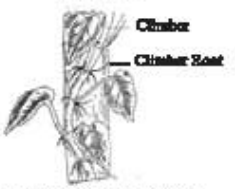


Fig- 3.9 : Climbing Root

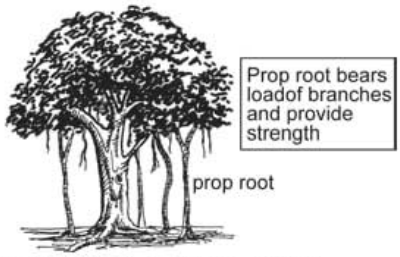



Fig- 3.10 : Prop root of banyan tree

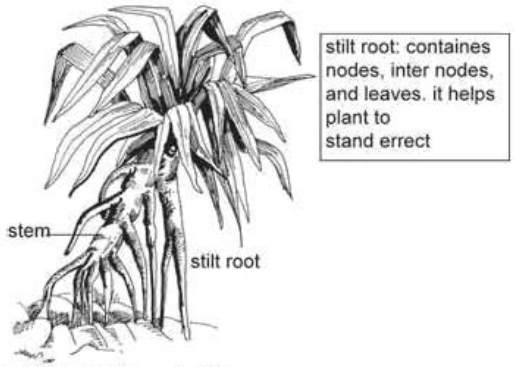



Fig- 3.11: Stilt root of keya

## Modified for Performing Physiological Functions:

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

**Aerial Roots**: One kind of root absorbs moisture from the environment. They are called Aerial Roots, such as Orchid.

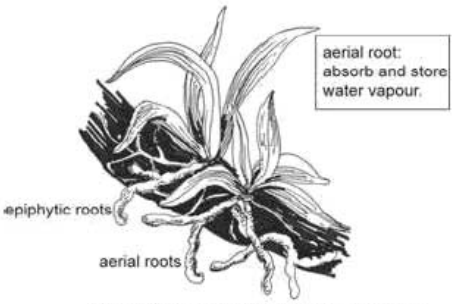



Fig- 3.12: Aerial roots in orchid

**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 Gold creeper.

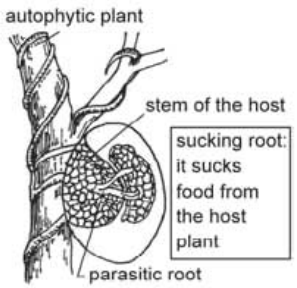



Fig- 3.13 : Parasitic root in dodder

**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 pnumatophore or respiratory roots, such as Sundori, Goran etc.

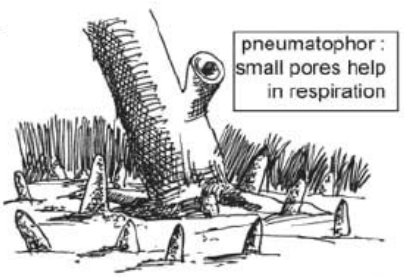



Fig- 3.14 : Pneumatophor

**Reproductive Roots**: Roots of some plants take spart in reproduction, such as sweet potato.

## 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 .

Fig-3.15: Resodoctive root

**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.

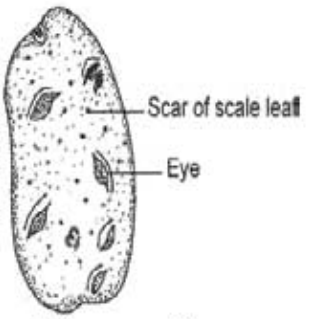


Fig-3.16 : Tuber

**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 axils of scale leaves are found.

Fig-3.17: Raizome

**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.

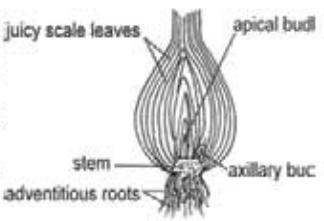


Fig- 3.18 : Bulb

**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. curved. Afterwards, new plants grow trow the buds.

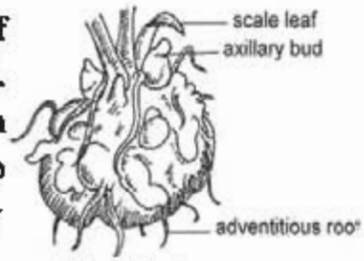


Fig- 3.19 : Corm

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

Fig-3.20: 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 curved. Afterwants, new plants grow from the buds.

Fig- 3.21 : Stolol

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

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

Fig-3.22 : Ofset

## 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.

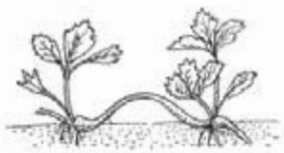


Fig- 3.23: Sucker

**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.

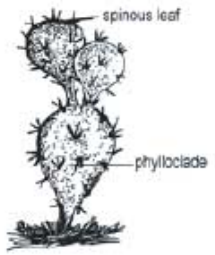



Fig-3.24 : Phylloclade

Fig-3.25 : Stem tendrils

Fig-3.26 : Thorns

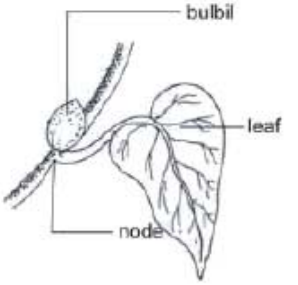



Fig-3.27 : Bulbil

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

**Bulbils:** In some climbers, axiliary buds do not develop as branches but store food & become rounded ball like structure which are called bulbils, such as *Dioscoria* (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.

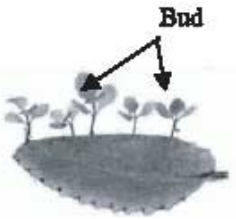



Fig- 3.28 : Bryophyllum

Fig-3.29: Tendril

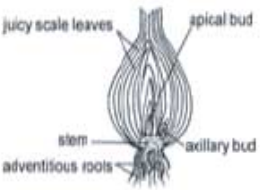



Fig-3.30: Scale Leaves

Fig -3.31: Fly trap

Fig-3.32: Spine leaf

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, such as juicy scale leaves of onion.

**Group Work:**

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

**What we 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:**

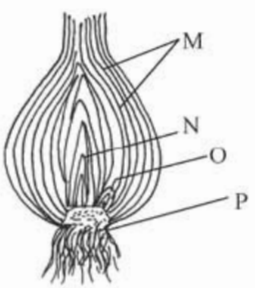
1. In which plant Moniliform roots are found?
   a. Dahlia b.Mango ginger
   c. Sweet Potato d. Bitter Gourd

2. Characteristics of Rhizome are –
   i. Definite nodes and internodes.
   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 practical use of **X**.
d) Compare and discuss the characteristics of **Y** and **Z**.

2.

M

R

N

a. What is an offset?
b. Why is pitcher plant called insect trap? Explain.
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 and 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 which 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 Studying this chapter, we will be able –**

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

## Lesson - 1: Respiratoy Process

Energy is necessary for performing different physiological activities of living organism. This energy is produced by the process of respiration. Oxygen is used to burn the cellular food in the body of the organism. As a result, energy and carbon-di-oxide is produced. So, respiration is a physiochemical process where food is oxidized (in presence or absence of oxygen) and potential energy stored in cellular food is converted and released as kinetic energy and potential energy stored in cellular food is converted and released as kinetic energy and heat energy and consequently, carbon-di-oxide 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 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 thermo 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 .

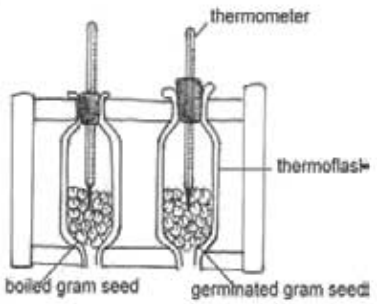


Fig-4.1: Experiment of respiration with gram seed

* Why does the mercury level in thermometer placed in thermo flask with germinating gram seeds change?

* 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, are 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. Lungs 7. Diaphragm

**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 interior 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.

Fig- 4.2 : Nostril and nasal cavity

**4. Trachea:** Starting from larynx upto bronchus is 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 into 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 on enter the lungs. These small bronchioles enter into air cells or sacks. Each air 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.

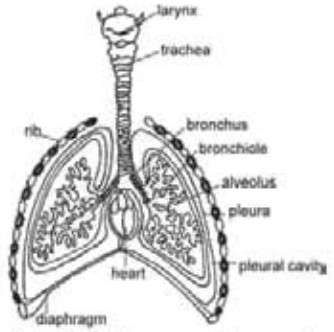


Fig- 4.3 : Human respiratory system

**7. Diaphragm:** The muscular layer that separates abdominal cavity and chest cavity is 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 shrink.

**ii) Exhalation**: After inhalation, exhalation phase starts. In this stage, muscles of diaphragm and chest cavity relax and squeeze. As a result, area of lungs becomes small. The air and carbon dioxide from the alveoli transported though 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 happens? Why? Explain.

**2. Internal Respiration**: During internal respiration, the cellular food is oxidized in presence of oxygen and converted into kinetic energy and heat energy. Oxygen that enters into the blood of the lung moves with blood to distant capillary vessels. Oxygen then reaches inter cellular juice through the walls of capillary vessels. Oxygen enters the cells via this oxygen carrying juice. Then, it reacts chemically with cellular food and produce energy. As a consequence, heat energy and carbon-di-oxide are produced. This carbon-di-oxide is transported to lung again through blood.

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

Flowchart of Respiratory system is given below:

Nostril $\rightleftarrows$ Nasal passage $\rightleftarrows$ Nasopharynx $\rightleftarrows$ Trachea

Bronchus $\rightleftarrows$ Branchiole $\underset{O_2}{\overset{CO_2}{\rightleftarrows}}$ 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 younger 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 or 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 learned from this chapter

Respiration is indispensible 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 into 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 –

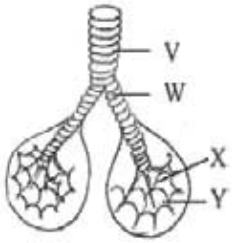
   i. gills and skin ii. skin and trachea iii. lungs and gills

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 no. 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 $O_2$ and $CO_2$ occur?

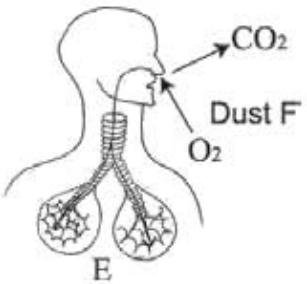
a. V b. W c. X d. Y

5. Name the disease produced by the infection of part 'V'

a. Asthma b. Bronchitis c. Pneumonia d. Tuberculosis

**Creative questions:**

1.



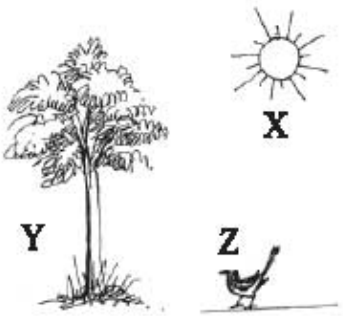

a. What is pleura?

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 into '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'? Explain.

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 studying this chapter, we will 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 blood circulatory system.
- 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 the 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 absorb. Undigested and useless materials are expelled as fecal matter. We do not have any control on the changes that occur 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 biscuits and 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.

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

## Lesson – 2: Saliva and Enzymes

You like sweets very much and one plate of Rasogolla (sweetmeat) is kept in front of you. Could you feel any change in your mouth? Could you feel the 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 taking 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? Enzyme is:

- Such a material that mixes with food and 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 is called oesophagus. Food and water reach the stomach through this pipe line.

How the foods get into the stomach:

**Do yourself:**

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 to 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:

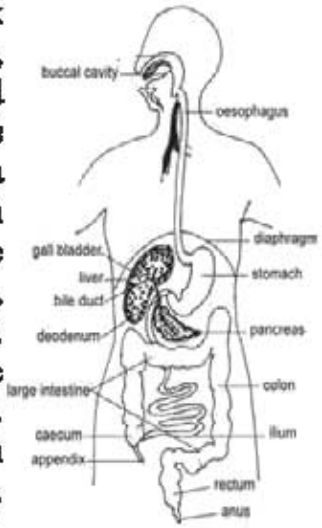

Fig- 5.1: Digestive System

1. **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.

2. **Buccal Cavity:** Next to mouth is the buccal cavity. The buccal cavity is surrounded by two jaws and teeth en the frent siae. Above this, there is palate and beneath, there 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 sends food under tooth for chewing. Saliva from salivary glands make foods slimy and help

Fig-5.2: Types of Teeth

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 i) Incisor teeth that cut food particles into small pieces. ii) Canine teeth cut and tear hard parts like meat. iii) Premolar teeth chew and grind food materials. iv) Molar teeth help chewing and grinding of food substances. Besides, after growing other teeth, the wisdom teeth grow.

3. **Pharynx**: Next to buccal cavity is the pharynx through which food materials move from buccal cavity to oesophagus.
4. **Oesophagus**: Its location is in between pharynx and stomach. Food materials pass through it from pharynx to stomach.
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, chimotripsin and lipase. Tripsin and chimotripsin 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 into 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 them.

## 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 dental caries. One should not take too much sweets. Sweets are responsible for dental 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 regularly. 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 is the blood? 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

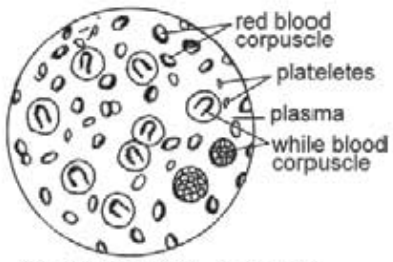

Fig- 5.3 : Constituents of Blood

**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.

**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 carries 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

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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? A vessel through which blood flows is called blood vessel. Our body has three types of blood vessels. They are :

a)Artery b) Vein c) Blood capillary

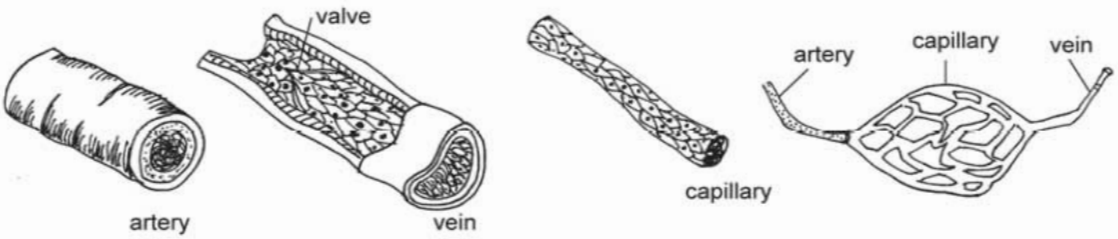



Fig- 5.4: Artery, Vein & Capillary

a) **Arteries**: Blood carrying vessels originating from the heart, 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 having divided into branches and branchletes, 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

| | **Artery** | **Vein** |
|---|---|---|
| Valves | | |
| Cavity | | |
| Wall | | |
| Amount of oxygen | | |
| Amount 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 Epicardium 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.

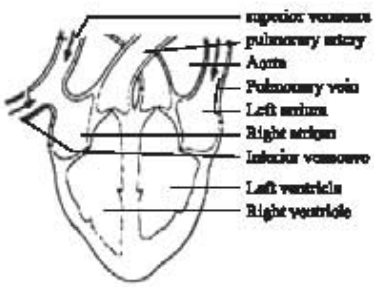


Fig- 5.5 : Structure of Heart (L.S)

Blood can enter ventricles through these apurtures. Similarly, valves are present in between left atrium and left ventricle. Here also blood from left atrium can enter into 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.

**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 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? His elder brother told him that he was examining father's pulse. What is a pulse? Beats created in the artery by alternate expansion and contraction of heart are 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 labour 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 the 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 the 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, meat and oily foods. He is a smoker. He works continuously from morning to night. With mental labour he smokes too much. He scarcely goes for walks or takes any physical exercise. One day after 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.
- Not taking 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. Developing the habit of doing regular physical labour, such as playing, walking, taking physical exercise.

3. Taking balanced foods regularly.
4. Giving up the habit of smoking.
5. Trying to avoid too much heavy mental labour, too much mental pressure and remain anxiety free.
6. Developing the habit of taking fresh fruits and vegetables.
7. Not allowing body weight to increase much. Overweight enhances blood pressure of the heart. As a result heart is affected.

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

## What we learned from this chapter-

**Artery:** Originating from the heart, artery usually transports 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:

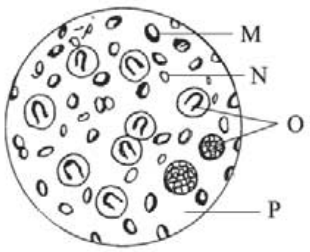
1. Which one is the largest gland of the body?

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 and 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 we should take care of the organ in the stem to keep it healthy .

## Do yourself:

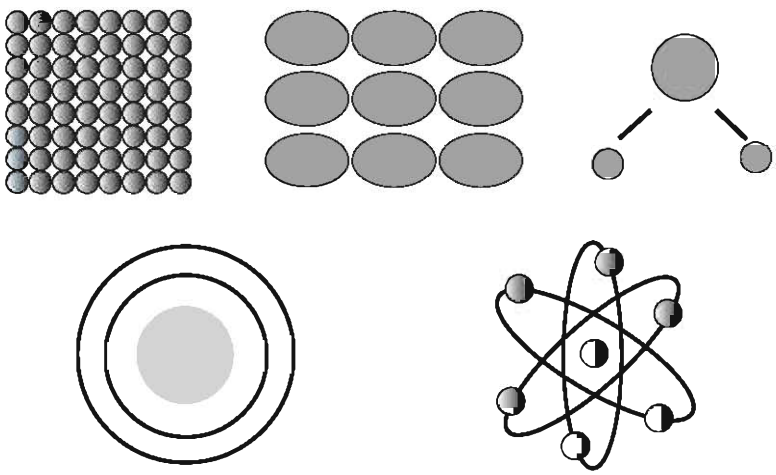
1. How would you examine your friend's pulse? Examine your friend's pulse after physical exercise. Can you find any change ? Explain the causes of these changes.

2. In a group, prepare a chart of the human digestive system and write down the functions against each organ.

## 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 by what a matter is composed of or what the structures of those matter are and how they are made of ?



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

- to explain the structure of matter.
- to differentiate between atom and molecule.
- to differentiate among elements, compounds and mixtures.
- to identify the selected elements and compounds by using symbol and formula.
- to demonstrate the use of water as universal solvent.

## Lesson 1-2 : Structure of Matter

In our surrounding we can see different types of matter. We use them 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. What are these matters made of?

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

The reason of variation of 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. The iron we use in various works is mainly made of some small iron particles. 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.

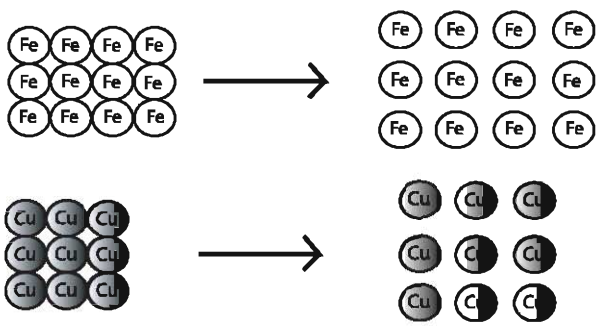



Fig- 6.1 : Iron and Copper.

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

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

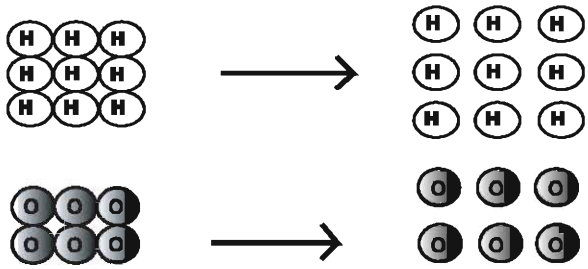



Fig- 6.2 : Hydrogen and Oxygen.

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 chlorine Sugar is made of three different components named carbon, hydrogen and oxygen.

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.

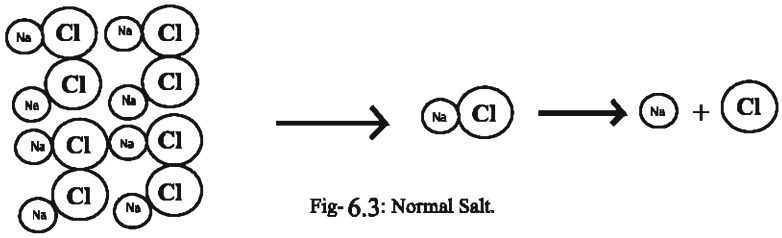



Fig- 6.3: Normal Salt.

Similarly, if sugar breaks, three different components will be found.
The matter that is made of more than one component of different properties like salt and sugar is called compounds.

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, red/brown 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: 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 be broken anymore). He called such small particles 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 Dalton's 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 of an element 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 they are joined with and separated from each other.

## Lesson 4 and 5

We have learnt from the Dalton's atomic theroy that matters consist of small particles. These small particles are known as atoms. Atoms cannot stay free or independent. They form molecules by combining each other. A molecule can stay free or independent.

In case of elements, only atoms of the same substance combine together and form molecules. For example, two Oxygen atoms combine to form an Oxygen molecule.

Oxygen atoms Fig- 6.4 Oxygen molecule

In other words, an element named Oxygen is made up of small molecules. If we break down an oxygen molecule, we will get two oxygen atoms.

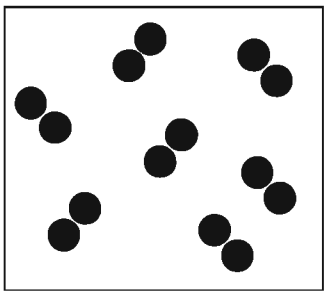


Fig : 6.5 : Oxygen gas in a container. Individual Oxygen molecules are staying free from each others.

Now, let us consider a compound named water. Take some water in a container. Divide them into small parts. Assume that we now have a single drop of water. This single drop of water, in fact, consists of numerous small particles. If we continue to break down the single drop, we will get a single particle which can stay alone and free. Such a particle contains all the properties of water. This particle is a molecule of water.

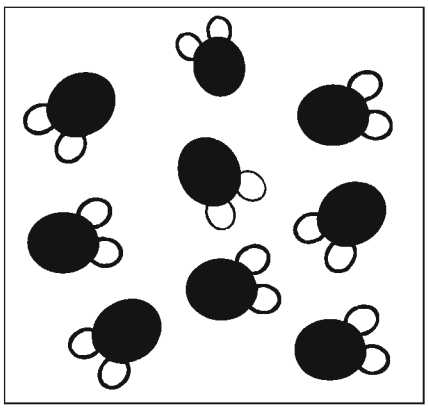


Fig- 6.6 : water is in fact an aggregate of water molecules.

If we breakdown a water molecule, we will get smaller particles. However, they cannot stay free or independent. They do not contain any properties of water. They, in fact, are no longer water particles. They are atoms of two different elements- one oxygen atom and two hydrogen atoms. In other words, one oxygen atom and two hydrogen atoms combine to form a water molecule.

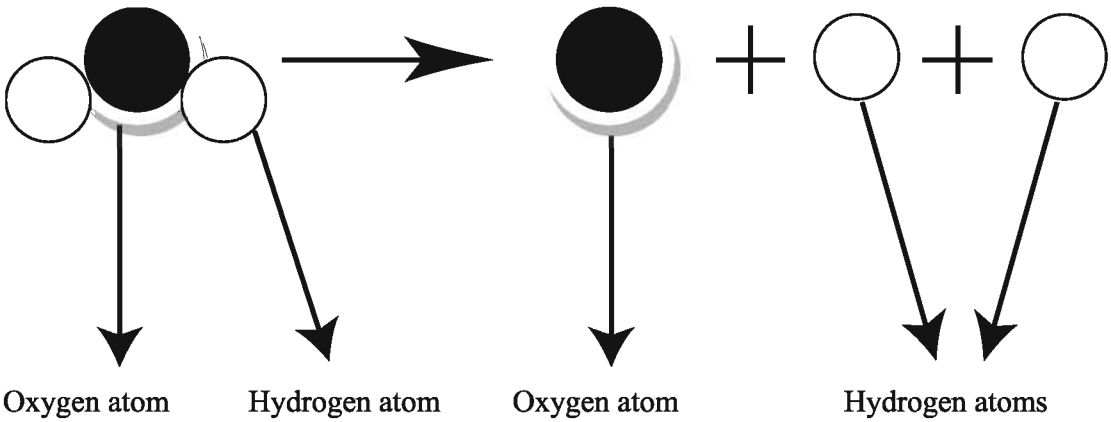



Fig- 6.7

**Work** : Find some objects of spherical shape. Make models of water and oxygen molecues from these objects with the help of sticks.

So, did you understand the relationship and differences between atoms and molecules?

Matters, consist of small particles, named atoms. They cannot stay free or independent. Two or more atoms form molecules by combining with each other. Two or more identical atoms combine and form a molecule of an element. Atoms of two or more elements combine to form a molecule of a compound. A molecule can remain free or independent.

## Lesson 6: 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. Every element has a name. 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, Greek 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 English, Greek or Latin names are given below.

| Atom | Symbol | English, Greek or Latin name |
|---|---|---|
| Hydrogen | H | Hydrogen |
| Helium | He | Helium |
| Lithium | Li | Lithium |
| Beryllium | Be | Beryllium |
| Boron | B | Boron |
| Carbon | C | Carbon |
| Nitrogen | N | Nitrogen |
| Oxygen | O | Oxygen |
| Fluorine | F | Florine |
| Iron | Fe | Ferrum |

## Lesson 7 and 8: Molecule and Formula:

We have learned that molecules are made of combining two or more atoms. From the formulae it can be learnt which atoms a molecule contains.

A formula is, in fact, a short expression of a molecule. A formula is written with the symbols of the atoms that form the molecule. Now we will know about the rules of writing formulae and what a formula tells us. Note that the term 'formulae' is the plural form of formula.

**Formulae for elements:** Generally, numerous atoms in solid and liquid elements stay together; they do not form any molecules. Therefore, there are no formulae for such elements, such as sodium, copper and iron. For most of the gaseous elements, two elements combine together to form a molecule. Therefore, the formulae of such elements are written by writing their symbols with 2 as subscript. For example, the formula of oxygen is $O_2$ and the formula of nitrogen is $N_2$. Two atoms form molecules in some liquid and solid elements as well. Their formulae are also written by writing their symbols with 2 as subscript. For example, the formula of bromine (liquid) is $Br_2$. Formulae of some elements are given in the following table:

| Element | Symbol | Formulae |
|---|---|---|
| Hydrogen | H | $H_2$ |
| Nitrogen | N | $N_2$ |
| Oxygen | O | $O_2$ |
| Fluorine | F | $F_2$ |
| Chlorine | CI | $Cl_2$ |
| Bromine | Br | $Br_2$ |
| Iodine | I | $I_2$ |

## Formulae of Compounds

From a formula of a compound we know which elements or group of atoms and their ratio the compound is made of from. For example, $H_2O$ tells us that a molecule of water is formed from two hydrogen atoms and one oxygen atom. From the following table, we will see how formulae of compounds tell us about the atoms and group of atoms that form molecules of the compounds.

| Characteristics of Compounds' name | Formulae | Name | Atoms and group of atoms that form the molecule |
|---|---|---|---|
| Compounds' name ends with -ide when it is formed from a metal (sometimes a nonmetal) and a nonmetal. | NaCl<br>CaO<br>KI<br>$SO_2$<br>$CO_2$ | Sodium chloride<br>Calcium oxide<br>Potassium iodide<br>Sulfur dioxide<br>Carbon dioxide | Sodium and Chlorine<br>Calcium and Oxygen<br>Potassium and Iodine<br>Sulfur and Oxygen<br>Carbon and Oxygen |
| Sometimes a nonmetal and a number of oxygen atoms form a group of atoms which acts like a single atom. When such group of atoms forms a compound with a metal, the compound's name ends with-ite or-ate. | $CaSO_4$<br>$CaSO_3$<br>$KNO_3$<br>$KNO_2$<br>$Na_2(CO_3)$<br>$AlPO_4$ | Calcium Sulfate<br>Calcium Sulfite<br>Potassium Nitrate<br>Potassium Nitrite<br>Sodium Carbonate<br>Aluminium Phosphate | Calcium and Sulfate<br>Calcium and Sulfite<br>Potassium and Nitrate<br>Potassium and Nitrite<br>Sodium and Carbonate<br>Aluminium and Phosphate |

you will learn the rules how to write the formulae of compounds in the next class.

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## Lesson 9: 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 modem research it has been proved that neutron and proton exist in the centre of atoms and electron moves around the centre 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 centre and eight electrons outside of the atom of oxygen.

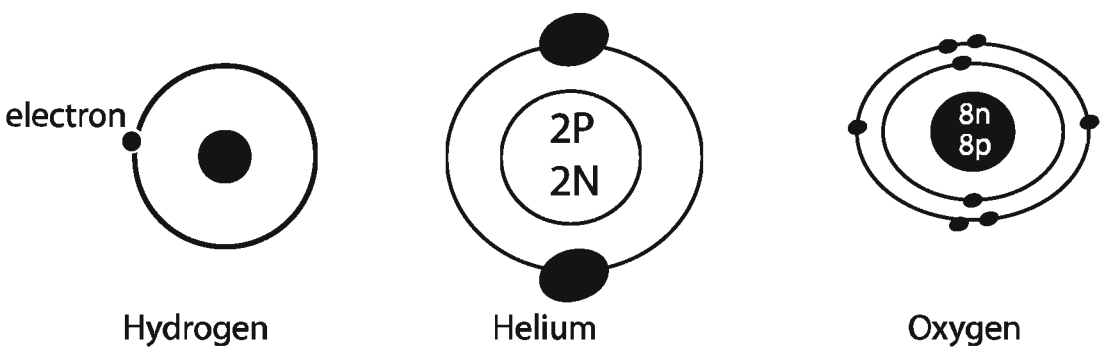



Fig- 6.8 : Structure of atom

## Lesson 10 – 11: 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.

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

**Necessary Equipment**: water, test-tube, different types of matter (for example: common 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 normal salt, eating soda, testing salt, bit salt, copper sulphate are the in-organic substance but sugar, vinegar, spirit, vitamin C tablet, glucose are organic substance. So it is proved that water can dissolve organic and innorganic 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.

**What we learned from this 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.

# 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. $N_2$ d. NO

Give the answer to the question no. 2 and 3 according to the following stem:

| Matter | Symbol | Formula |
|---|---|---|
| 1 | | $Cl_2$ |
| 2 | Al | |
| 3 | | $O_3$ |
| 4 | F | |
| 5 | | $NH_3$ |
| 6 | | NaOH |
| 7 | Cu | |

2. 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. 2,6

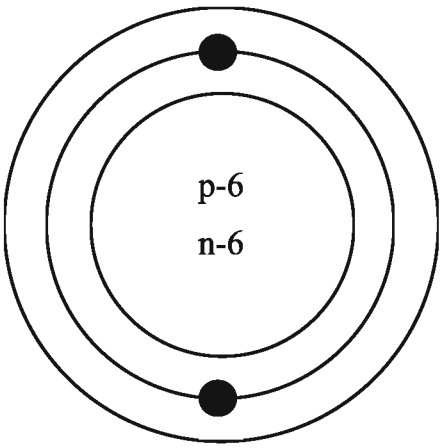
3. Which substances have equal atomic number?
   a. 2,3
   b. 3,4
   c. 4,5
   d. 3,6

**Creative question:**

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

| Matter | Number of atoms |
|---|---|
| 1 | Na - 1<br><br>CI-1 |
| 2 | F - 2 |
| 3 | C - 1<br>O - 2 |

   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. Number 2 of the table is an element and Number 3 is a compound. Explain.




2.

a. What is atom?

b. What is the difference between O and $O_2$.

c. Putting the required electron in the second orbit, draw a diagram.

d. Give reasons in favour of the diagram that you have drawn.

## Chapter Seven

# The Use of Energy

In our daily life, we are involved in many works. Work is related to energy and power. Besides, there are different types of energy and its process from one state to another. In addition, 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.

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

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

# Lesson 1: Work, Power and Energy

Let's take a look at the following pictures.

Fig- 7.1: A student is reading

Fig-7.2: A boy is playing football

Fig-7.3: Person standing bearing load over head

What are you thinking after seeing the above pictures? In the first picture, the student is reading. Is she really doing any work? In the second picture, someone is playing football. Is he working? And in the third picture: Is the man, standing with load over his head doing some work? 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 is taking place in these two cases. Here he, who is playing football, has changed his position, so he is working. 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. In The language of science, work is the multiplication of force and distance passed by the object.

A rickshaw puller has to work in order to go from one place to another. In other case, a rickshaw pullar needs 10 minutes to go from one place to another and another 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 takes less time to go to a place, has more power 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 students decided to move around the playground of the school for five times. After some times of starting, it is found that 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 was 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 are 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 is 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 release a brick from top to down or are 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 are 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. We get necessary heat and kinetic energy required for our body from chemical energy stored in food through respiration. Petrol, Gas, Wood and Coal all of them have chemical

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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. The sun is the main source or light energy. We get light energy by burning fire and switching the electrical light on.

### 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 vibration 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.

### 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.

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## Lesson 4 and 5: Transformation of Energy

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

Pic 1 Pic 2 Pic 3 Pic 4

Fig- 7.4

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- 7.5: Swinging

## Conversion of Thermal 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-7.6: Railway Engine

## Conversion of Light Energy

Thermal energy turns into chemical energy when it works on photographic paper. The sun light is converted into electrical energy through solar pannel. Besides, various kinds of electronic machines such as pocket calculator, radio, electric watch use solar energy by converting it into electricity.

Fig-7.7: Digital Camera

Fig-7.8: Calculator

Fig-7.9: Solar Panel

## Conversion of Sound Energy

Clothes are cleaned by using 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.

Fig-7.10: Telephone Conversation

## Conversion of Magnetic Energy

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

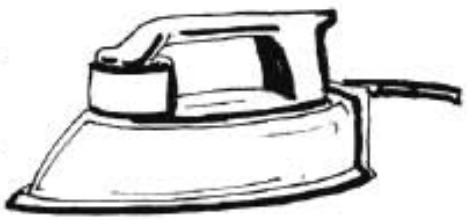

Fig-7.11: Electric Iron

### 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. We get electrical light from the electrical 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-7.12: Gas Stove

### Conversion of Atomic Energy

Atomic energy transforms into light electrical energy in the atomic electricity plant.

## 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

We get energy from the various sources of energy. There are two types of sources: renewable and non-renewable. 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 flow, ebb and flow tide of water etc. are mentionable.

We will get an idea about biogas, solar energy, ebb and flow tide of water and the production of renewable energy form the airflow from 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 Flow

Aboriginal people were afraid of air. People are using the flow of 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 the flow of 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. Electricity is being produced in many countries by using windmill.

## 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-days, 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.

**Work:** Solar Energy production

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

**Procedure**: At first take a magnifying glass. Usually magnifying glass has convex lens. Focus sunray on a piece of paper using the lens. You will find fire flame up, if you focus the lens correctly.

Fig-7.13

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 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. Example : Solar cell is used to supply electricity in satellite.

## 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. 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 flow and the sun are unlimited source of energy because they always exist.
- 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 increase $CO_2$ in the air.

This energy is very much necessary in our country and it is available also. There are many areas in our country 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 as we have limited amount of 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:

- Electricity getting from biogas is limited quantity.
- Sources of air and water flow for renewable energy are limited. Because the plant needs suitable place to develop. The main problem of producing energy from wind is that air flow does not exist always.
- 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.

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## 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 etc. are some examples among them.

### Merits of non-renewable Energy

It may consider the merits of renewable energy from two sides, price and availabity. 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: solar 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.
- It pollutes environment at large scale.
- Carbon di oxide spread out by its burning that causes global warming .

## Lesson - 11: The Use and 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.
- 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.

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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 160 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 have 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 biogas technology is very important.

## Lesson 13: The Effect of Energy in Our Life and Its Cost Effective Use

We have almost 160 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

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every state in our life. Energy is needed in order live as well as to develop the standard of our life. We have cannot move without energy. Therefore, energy is very close to our life. We have 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 of energy 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.

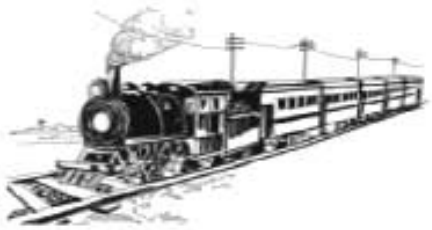
**New words from this chapter:**

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

**What we learned 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 _____ constituent.

**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 stem:**

A gymnast lifts the weight of 200 kg and keeps it down. Then after taking some rest she/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 Samiha's village named Bijoynagar. That is why many of the villagers use solar electricity. she went to Kaptai with her 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 Samiha at Kaptai.
d) Discuss the suitability of the energy as mentioned in the stem used in Samiha's village.

2. Now a days Mr. Mumin 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 importance of activities of Mr. Mumin 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 a kind of an energy which helps us to hear. How is sound produced? How is sound circulated? How can we recognize different sounds? We shall discuss in this chapter.

**After studying this chapter, we will be able-**

- to describe the characteristics of sound.
- to explain the circulations of sound.
- to compare the velocity of sound through solid, liquid and gaseous.
- to explain how animal can hear sound.
- to explain the limit of audibility and noise.
- to explain the ways of producing sound by the sound making machine.
- to conscious and to make other conscious about the bad effect of making sound (noise and pollution) in our daily life.
- to hear from our team mate in group work, to 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 the 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 is 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 that produces the feeling of hearing. Now, we will do some works from which we can understand that how sound is produced. When your school bell rings, 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-8.1: 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.

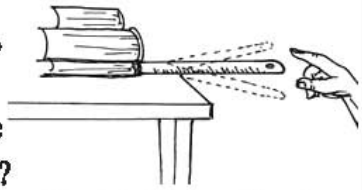


Fig- 8.2: Origin of Sound

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.

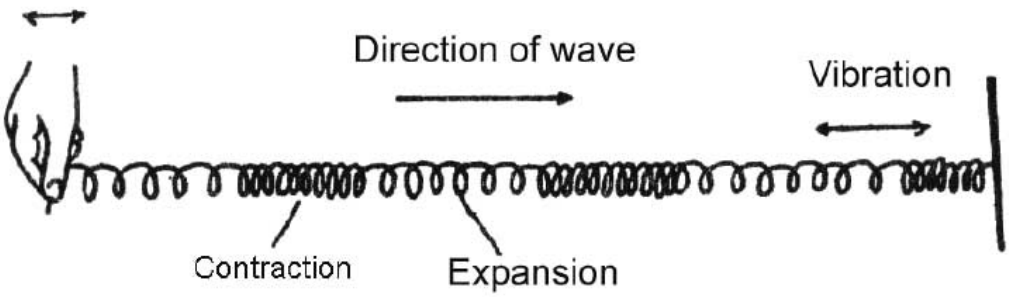



Fig- 8.3: Circulation of Sound

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.

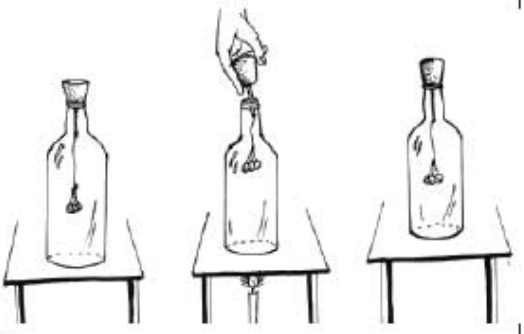


Fig-8.4 : Sound does not circulate without medium

## 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-8.5: 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:**. Circulation of sound through solid.
**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- 8.6 : 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.

Table : Comparison among the velocity of sound in the air, liquid and solid medium

| |
|---|
| The velocity of sound in the air = 343 meter/second |
| The velocity of sound in the water = 1496 meter/second |
| The velocity of sound in aluminium = 6420 meter/second |

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, 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?

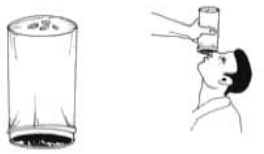


Fig-8.7: Vibration of Sound Vibrate on Tympanum

The vibration of sound created by your friend vibrates the balloon. That's why wheat or rice was jumping.

## 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 limit of 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. This 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.

**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. The main causes of pollution are: horn of vehicles, explosion, 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 to do the work.

**What harms does sound pollution causes?**

You know the excessive sound all around creates health hazards. The problems are insomnia, 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, 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 bicycle or 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 open 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.

Fig- 8.8: Change of intensity of sound with the length of tube

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.

### 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- 8.9: Mono chord and two stringed musical instruments

**Bell of a bicycle or rickshaw:** We are familiar with the sound of bell of a bicycle or rickshaw a (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.

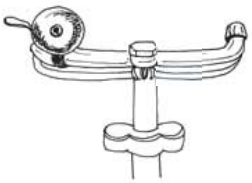


Fig-8.10: Bell of a bicycle

**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 learned 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 Htz.
- Dog can hear the sound which has frequency more than 20000 Htz.
- 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 act of hearing-pre sound and act of hearing-post sound?
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 medium b. Solid medium c. Gaseous medium d. Liquid 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 on the surface of the moon 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 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?

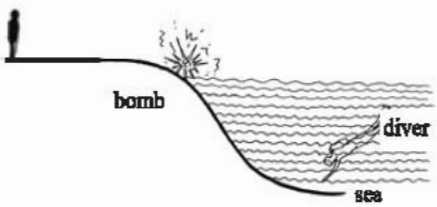
a. The sound of gun fire b. The light produced by gun fire c. The sound of explosion d. The light of explosion

4. Which instrument produces sound with the help of its inside vibration?

a. Sitar b. Monochord instrument c. Guitar d. Flute

## 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 and the diver are 3300 meters away from the place 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. After how much time will the man standing on the shore hear the sound from the place of the bomb explosion?

d. Will the diver hear the sound of the explosion of the bomb at the same time as well? Give reason in favour of your answer.

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 house.

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 house? explain 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.

### After studying this chapter we will be able—

- to distinguish between heat and temperature.
- to make relationship between Fahrenheit scale and Celsius scale.
- to measure the temperature precisely using thermometer.
- to explain the pressure of air and humidit.
- to analyze the effect of change of temperature over the pressure and huminity of air.
- to explain the process of heat transportation.
- to explain the thermal expansion of substance.
- to explain the transfer of heat which causes different incidents all around.
- to distinguish between radiatior 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.

**Work:** 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 do 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 work.

**Work:** Touch a steel glass with your hand. Whether it is hot or cold, keep it in your mind. Now fill the steel glass with hot water. Now touch the glass after two minutes. You will feel that 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 that 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, 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 if you touch the glass after every two minutes. 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.

Fig: 9.1

You will learn very clearly in the next lessons that when temperature changes, 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:

### Mercury thermometer

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° Fahrenheit. It is called fever when temperature goes beyond that. Measure the temperature of five learners of your class using clinical thermometer and write down them. Decide from this whether anyone feels feverish.

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## Measuring Scale of Temperatuse

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° and the boiling point is marked 100°. The interval between two points is divided into 100 equal divisions. Each division is called one degree Celsius (1 ° 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, it is also called centigrade ( centi means one hundred and grade means divisions) scale.

**Fahrenheit Scale:** In this scale the freezing point is marked 32 degree (32°) and the boiling point is marked 212 degree (212° ). The interval between the two points is divided into 180 equal divisions. Each division is called one degree Fahrenheit (1 ° 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.

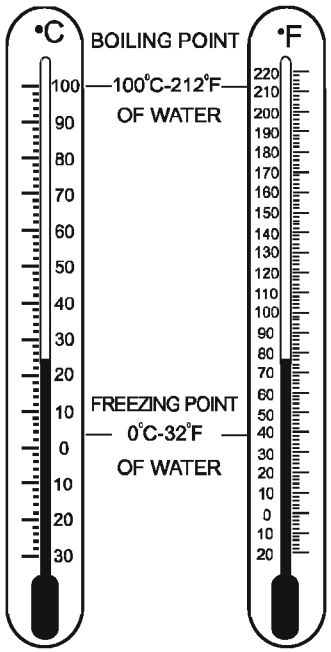

Fig-9.2 : Celsius and Fahrenheit Scale

## Relation between Celsius and Fahrenheit Scales:

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

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

Where, C = the temperature in Celsius Scale,

F = the temperature in Fahrenheit Scale

**Now let us look at an example.**

Example: A player of the Bangladesh Cricket Team fell sick while playing in Australia. An Australian doctor measured his temperature and found it 38°C. What was the body temperature of that player in Fahrenheit scale?

Solution :

We know, $\frac{C}{5} = \frac{F-32}{9}$

Here, C = 38

Therefore, $\frac{38}{5} = \frac{F-32}{9}$

Or, $5 \times (F-32) = 9 \times 38$

Or, $F-32 = 342/5$

Or, $F = 68.4+32$

$\therefore F = 100.4$

The body temperature of that player in Fahrenheit scale is $100.4^0$F.

**Work:** 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 so 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:

**Work:** 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. 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.

**Caution :** Be careful while working with the hot matters/objects.

Fig-9.3 : 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.

**Work:** 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?

**Caution:** Be careful in using boiling water.

The gas expands a great while it is heated. If we dip the bottle in hot water, the gas inside of 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 more when temperature increases. On the other hand, air contains 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 vapur floats and comes 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 flows 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 tum 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. So, the utensils made of metals are used to cook. 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 higher 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

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and gets cold. You will know in the chapter. Climate Change that 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 learned 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 in 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. Characteristic of temperature is that it-

a. Can be felt b. Can be measured
c. Is 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 $32^0$F
(ii) Fundamental division $200^0$ F
(iii) Melting point $232^0$ F

Which one of the following is correct?

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

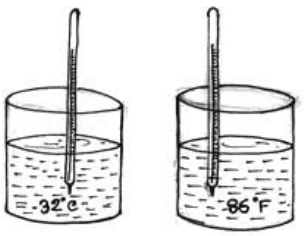



Fig. 1 Fig. 2

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. The temperature measured in Celsius Scale is 37°C. Sharmin can understand Fahrenheit Scale temperature instead of Centigrade Scale. Being anxious she goes to a doctor to measure the temperature. The doctor measuring thermometer and finds 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. Explain with reason whether Sharmin would go to the doctor 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 she noticed some gaps in their door in winter season where he found no gap in the summer. Both the incidents made her 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 helps to run 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.

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

- to explain the property of charge.
- to explain conductor, non-conductor and semi-conductor.
- to demonstrate the properties of charge through creating static electricity.
- to explain how current electricity is produced form static electricity.
- to prepare a simple circuit.
- to explain the use of electricity in daily used machine.
- to differentiate between magnetic and non magnetic substance through. demonstrating the property of magnets.
- to demonstrate the process of preparing magnets from non magnetic substance.
- to explain electric magnets.
- to 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.

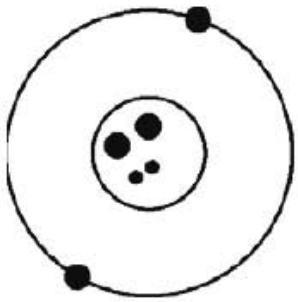


Fig-10.1

But it is interesting that the atom itself behaves neutral. Atom is neither positive nor negative. There is no charge 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 works.

**Work:** Knowing the properties of charge.
**Necessary equipments:** two combs, woolen cloth.
**Method:** Hang a small comb by tying it with a ribbon on a dry stick. It should be hung in such a way that it cannot touch any other things. Now hang 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.

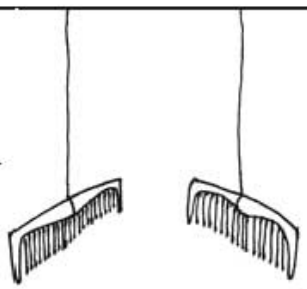


Fig-10.2: Knowing the properties of charge

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

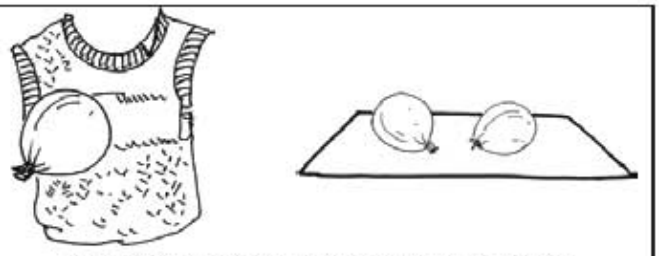


Fig- 10.3 : Demonstrating Properties of charge

**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 work? Yes, two decisions can be made from this:

a. Charges of same nature repel each other (in terms of two balloons and two combs).
b. 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.

**Work :** Proving the existence of charge.
**Necessary equipments:** A plastic comb, a piece of news paper.

Fig-10.4 : 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 negatively charged by receiving electron from woolen cloth during rubbing which leads to the attraction towards the pieces of paper.

## 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.

## 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 of it later on.

## 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.

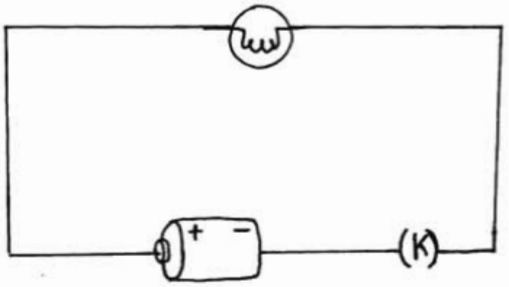



Fig-10.5 : Simple circuit

# Lesson – 7 and 8

## Use of 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 as examples.

### Electric Bulb

We all are familiar with 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.

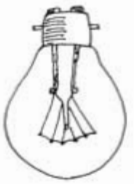


Fig-10.6 : Electric Blub

### Torch Light

We all are familiar with 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.

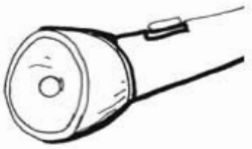


Fig-10.7: Torch Light

### 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.

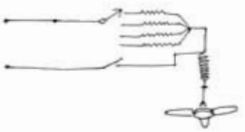


Fig-10.8: Electric Fan

### Electric Heater

Many of us are familiar with 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.

### 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-10.9: Electric Iron

## Lesson – 9 and 10: What is Magnet?

There is a story in ancient Greece that 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

**Work:** 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

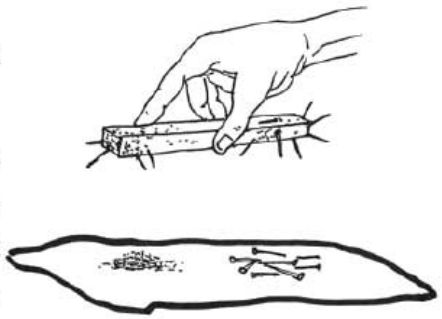


Fig-10.10

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.

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-10.11: Properties of Magnet

Now let us mention north and south poles of magnets respectively by N and 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 attract 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, wood, silver, plastic etc. These are non magnetic substances.

**Work** : 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 one 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 are 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.

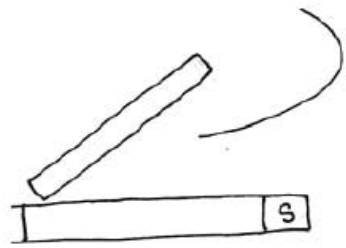



Fig-10.12: Method of Rubbing

### 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.

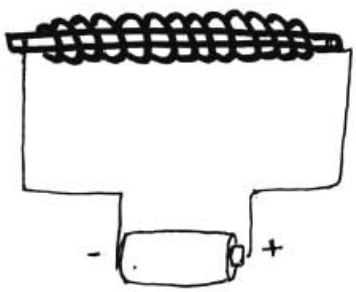



Fig-10.13 : Electrical Mathod

### Terrestrial Magnetic Field

If a bar magnet in hung by tying it with a thread at the middle, the magnet practically lies 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 hanging 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 semi-conductor, simple circuit, magnetic substance, non-magnetic substance and Earth's magnet

### What we learned from this chapter

- 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 can magnetic substance 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.

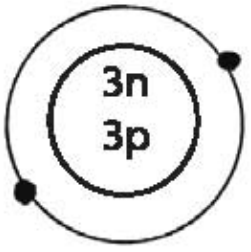



Fig: A

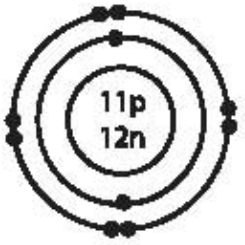



Fig: B

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 attraction  d. A and B have 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 magnet.

   d. "The second type of magnet is strong though temporary"- analyze the quotation.

2.

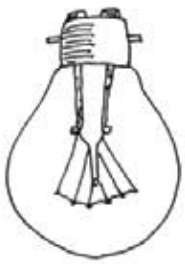


Fig.1

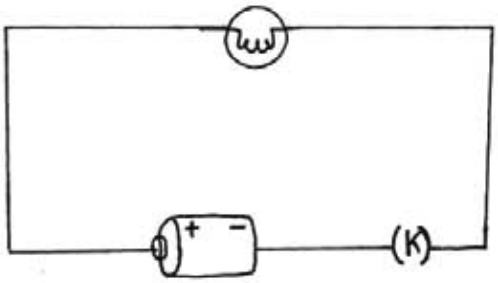



Fig. 2

   a. What is called static electricity?

   b. Why metals are conductor of electricity? Explain.

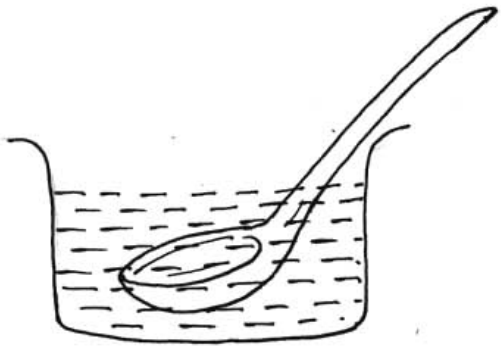
   c. Explain the function of the figure 1 ?

   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.



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

- to explain physical and chemical change of various incidents of nature;
- to realize the importance of preserving metal;
- to show some practical application of chemical reaction and change;
- to be conscious in taking necessary safety measures in experimental activities and to make others conscious; and
- to use the equipments appropriately in experimental activities.

## Lesson 1: Melting and Boiling

**Wrok** : Wait for sometimes after keeping some ice cubes in a small pot. What is happening? The ice is turning into 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 form of water, it is liquid and while it is in the shape of ice, it is solid.

Fig- 11.1 : Glass with ice

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

What happen 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 into 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 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.

Fig- 11.2 : Paper sheet and pieces of paper

Thus the changes 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.

## 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?

**Work:** Take a pot containing half of 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 decay if they are 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.

**Work :** Take two third of water in a pot and dive a spoon made of stainless steel and a nail 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. But nail creates rust on it because it is made of iron.

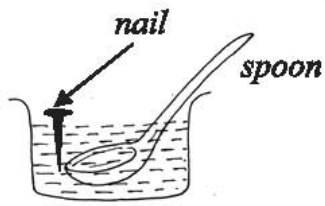


Fig- 11.3

Prepare a list of metalic 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, they will be unable to use. But if we are conscious of using those with proper care, then it will be possible to prevent

the deecay. 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, 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 ironic stuff is called galvanizing. The layer of zinc protects iron from oxygen and water of the air. 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 made food pots, cycle etc.

## Lesson 4: Combustion

**Work:** 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?

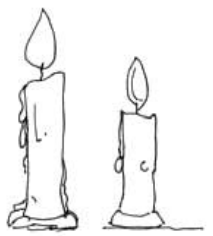


Fig-11.4 : Combustion of candle

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

Do you know from where and how we get the energy to do different works?

The various foods we eat become stored in stomach. After being digested nutrients are absorbed is the body. A huge amount of heat is produced by breaking these foods in the bodycell. 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 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:** You 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 woks in the growth of plants and oxygen helps us in breathing.

$$\text{Carbon dioxide} + \text{Water} \xrightarrow[\text{Chlorophyll}]{\text{light}} \text{Glucose} + \text{Oxygen}$$

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. What would happen of photosynthesis did not occur? We did not get enough oxygen for our inhalation. So, we can say that photosynthesis is such a chemical change that is essential for our survival.

**Water Cycle:** 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 Vapour. Water vapour 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 vapours 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.

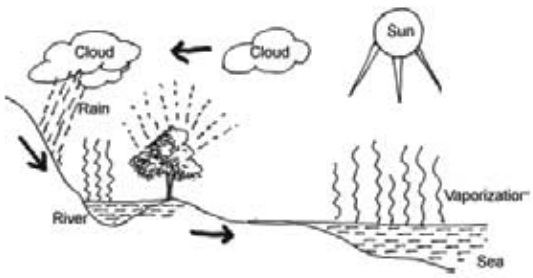



Fig- 11.5 : Water cycle

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 above diagram.

Some important changes related to water cycle is vaporization, condensation, solidification. Let us see which of them occurs what type of change.

**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 vapour 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.

**Solidification:** In the water cycle, water drops of clouds get freezed and turns into ice. Then this ice is stored on the peak of the mountains and comes down on earth as hailstone. What types of change does it occur when water turns into ice? Do the properties of water change because of it? If he properties of water do not change, it is a physical change.

**Carbon Cycle:** In carbon cycle, we mainly see how carbon dioxide moves from one state or medium 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. 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

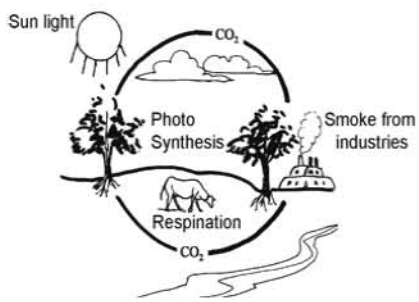


Fig-11.6: Carbon Cycle

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 patrol are 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. 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. Is there any other process where carbon dioxides are being absorbed from atmosphere except plants?

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.

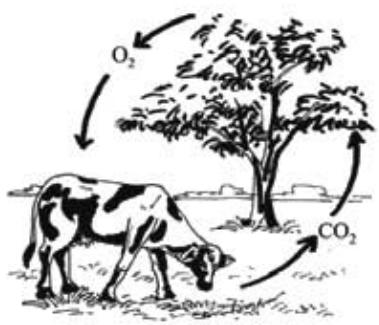


Fig- 11.7: Oxygen Cycle

**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 combustion 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.

## Lesson 7, 8:

**Work :** 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 withforceps. 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-11.8: 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.

**Work :** 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.

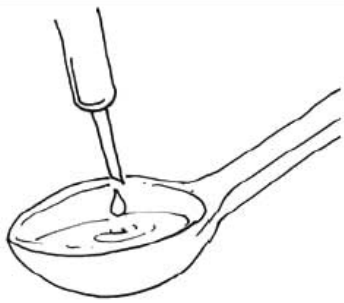


Fig-11.9: Reaction of carbonate compound and acid

What is the reason? The reason behind this is chalk, which is mainly Calcium carbonate ($CaCO_3$). 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 is it? 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:

**Work :** 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 is it? 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 that 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 was transformed into cool hard rock and it is called igneous rock. That means igneous rock is made of cooling hot mixture mainly rather creating a new substance. Thus, the process of formation of 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 tum into small pieces. Water or air takes these pieces to the ocean through rivers and is stored at the 8 lower level of the ocean as alluvium. Dead remains 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.

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, it 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 learned from this chapter**

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.

Fig- 11.10 : Rocks

- 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

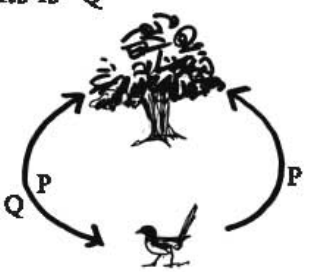
   ii. The major respiratory element of animals and plants is 'Q'

   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 stem: 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.

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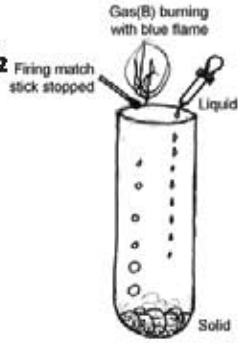
3. Which of the following gas will be produced if acid is applied to the metamorphic rock mentioned in the stem?

   a. $O_2$ b. $CO_2$ c. $N_2$ d. $H_2$




4. What type of granite has been mentioned in the stem?

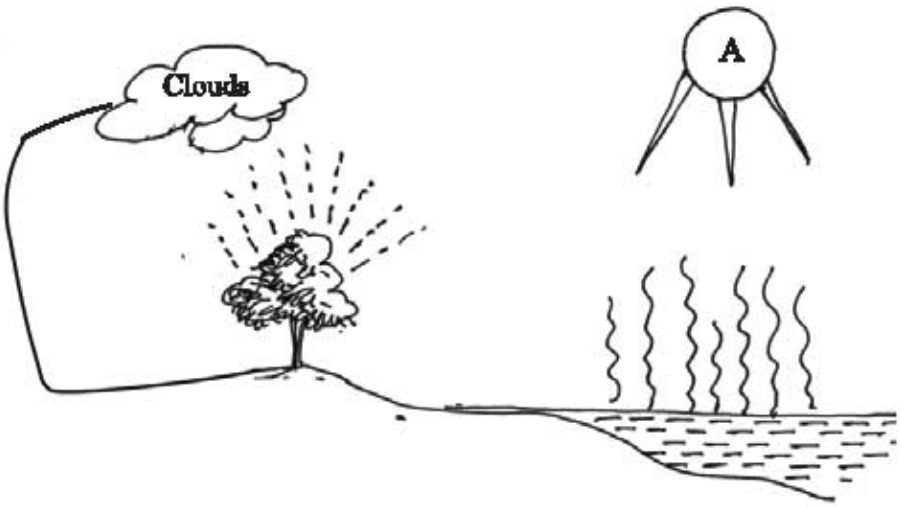
   a. Igneous b. Alluvial c. Metamorphic d. Fossil

**Creative question**

1. Carbon-di-oxide+water $\xrightarrow[\text{Chlorophyll}]{\text{Sun}}$ [A] + [B]

a) What is rust?
b) What do you understand by " Electroplating"?
c) Explain what type of change occurs in the reaction as mentioned in the above stem.
d) Between A and B of the stem which one appears in cyclic order in the environment - analyze.

2.

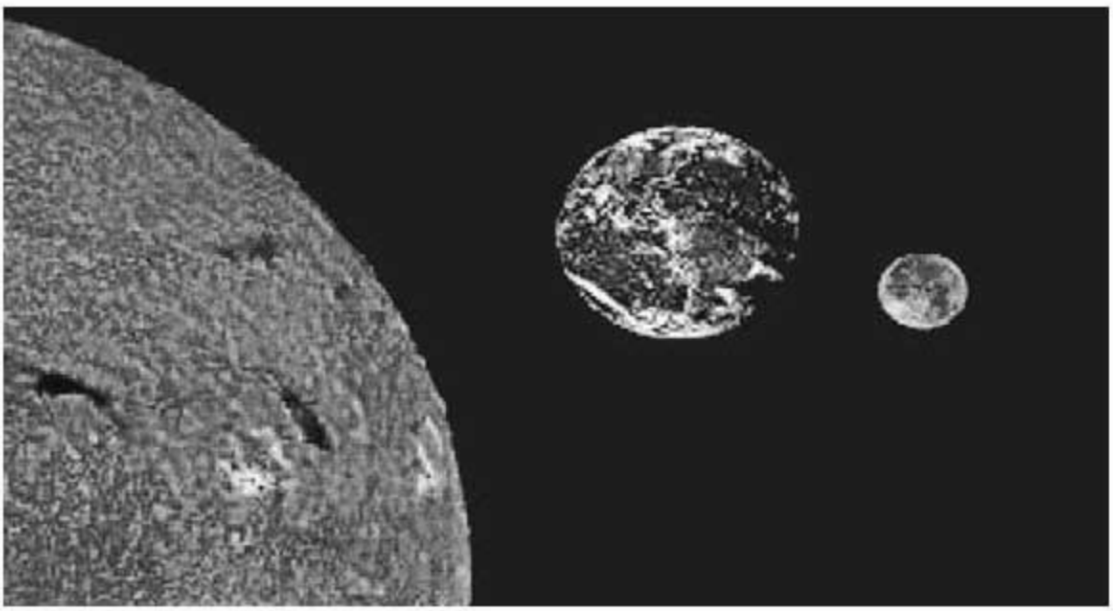



a) What is the above picture about?
b) How is alluvial rock created?
c) Explain the process mentioned in the above picture.
d) Analyze the role of 'A' in the process shown in the picture.

## 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 moving luminaries and the huge space, centring 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.



**After studying this chapter 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: The Earth Moves Round the Sun

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 but 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 and 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.

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 of solar system.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 process. This energy spreads in the solar system as heat and light.

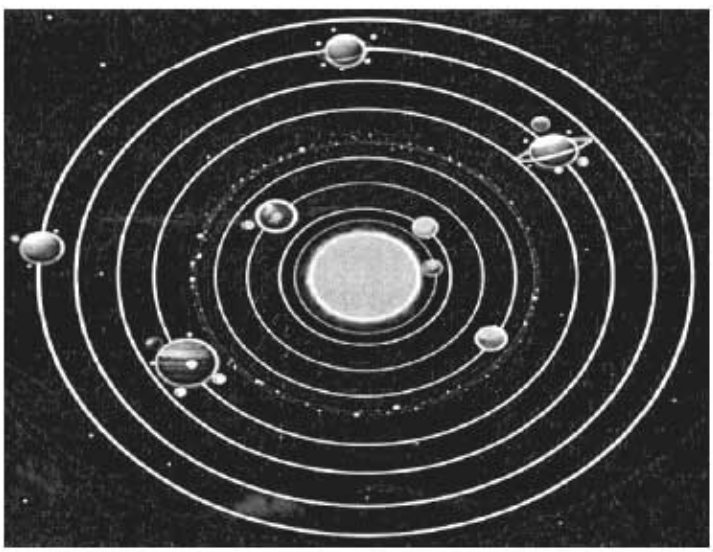


Fig-12.1: The solar system

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. So, we see the sun so small.

**Introduction of the Planets:** The eight planets are moving round the sun. The 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. Introduction of the planets in brief is:

**Mercury:** Mercury is the nearest to the sun. There is no atmosphere in mercury.

**Venus:** From the earth we find a star in the western sky as the morning star and the evening star which 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.

**Earth:** Perhaps you know that the earth is the only planet in which there is atmosphere and temperature necessary elements 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 may be present 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.

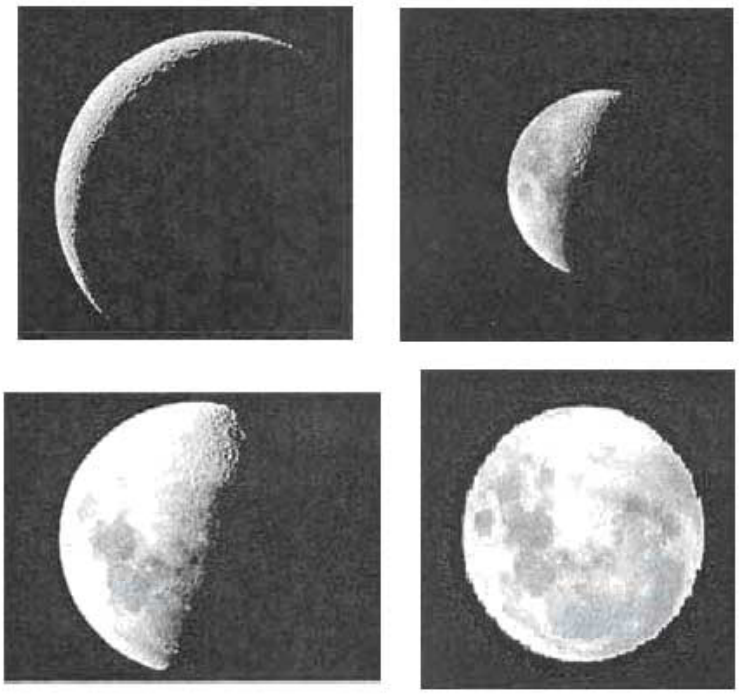


Fig- 12.2: New moon and full moon

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, rocky or metallic objects and 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, 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. It appeared in 1911 and 1986. It will be appeared again in 2062.

Have you seen a fireball flying all on a sudden at night? These are called meteors. Meteors are the smallest luminaries which revolve round the sun. This solid small piece when comes in contact of atmosphere bums out.

Fig- 12.3 : Comet

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 totally . 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- 12.4: 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 centring the earth. In ancient 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 one place to another on the soil.

Fig-12.5: 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.

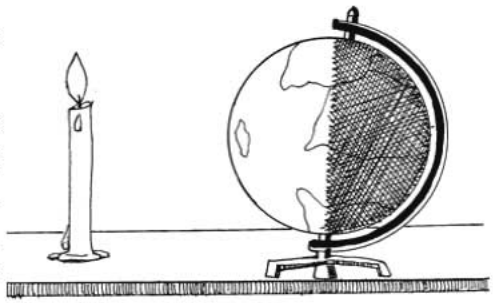


Fig- 12.6 : Experiment of the earth's diurnal motion

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. 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 move around the sun in its orbit. The period the earth takes to complete the revolve is known as the solar year or simply year. Fluctuation of day or night length 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 Srabon. 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 earth changes its inclined position after 21st June. The northern hemisphere including Bangladesh moves a bit distance. At the same time the southern hemisphere advances a bit towards the sun. In this way on 23rd September the equator of the earth faces the sun and at that time the sun remains in equal

distance from the north and the south pole. So, on the 23rd September, the duration of the day and night is equal in both hemispheres of the earth. Then over the equator, the sun shines vertically and it is hot in the equator As the duration of the day and night is equal in Bangladesh, it is neither hot nor cold in here. Then in the southern hemisphere the winter departs and the summer is coming, i.e. it is spring there.

On the 22nd December, a part of southern hemisphere remains facing the sun. Then Bangladesh is far away from the sun. So, in Bangladesh, the day is short and the night is long. The sun shines inclined at the south. The heat of the sun is less and due to inclination Bangladesh then it is winter. On the other hand, in Australia of southern hemisphere, the day is long and the night is short. 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 the 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 this rotation

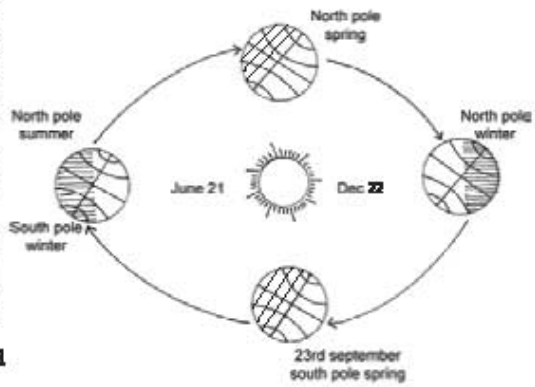


Fig-12.7: Rotation of the earth round the sun

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 croup 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 grows. When summer comes, 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 learned from this chapter-**

- The earth moves round the sun.
- The solar system is composed of the sun and the luminaries revolving round it and the huge space. The huge universe beyond our vision is called the spece.
- 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 get 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.
- 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 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 centred model?
3. Explain how the sun and the other stars produce heat and light.
4. What is comet? How is its tail created? 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

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 of the following is correct?

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

Answer the question no. 3 and 4 from the table below:

| Planet | Distance from the sun (Crore km) | Time of one rotation around the sun |
|---|---|---|
| Venus | 10.80 | 225 days |
| Earth | 14.96 | 365 days |
| Jupiter | 77.85 | Approx. 12 years |
| Saturn | 142.70 | 29.5 years |
| Uranus | 287.1 | – |
| 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?

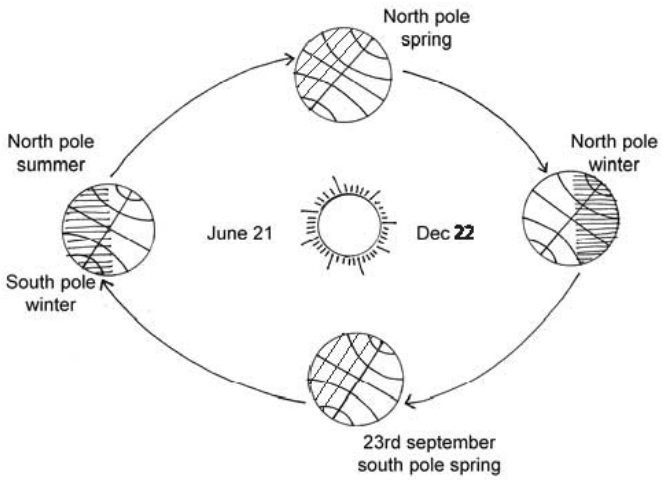
a) In between Earth and Venus
b) In between Jupiter and Saturn
c) In between Saturn and Neptune
d) In between Earth and Jupiter

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.**



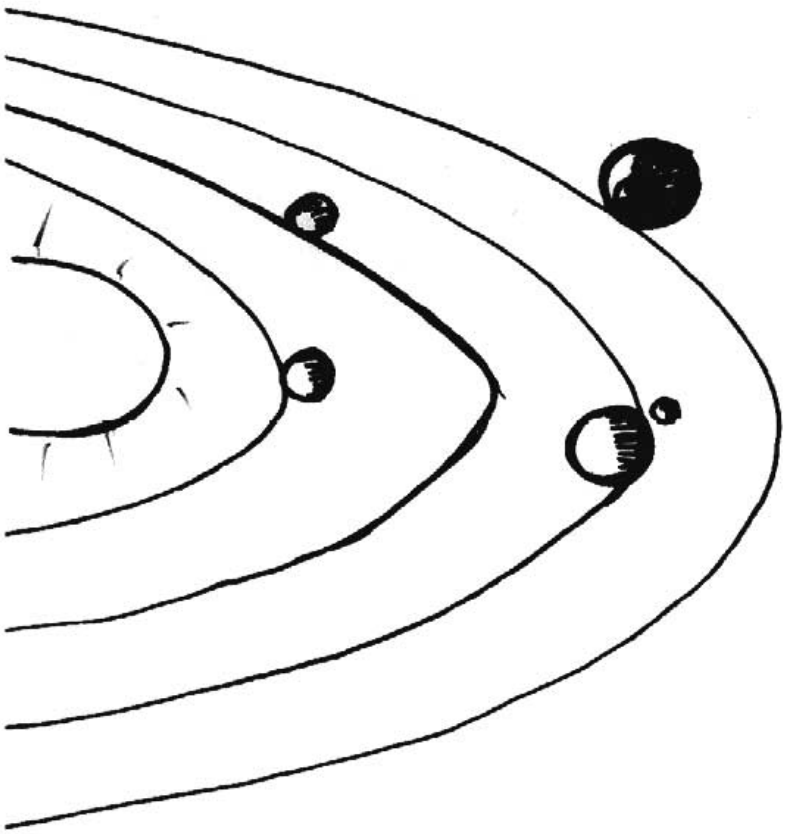

a) What is diurnal motion?

2021 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 Moon to move round the earth?

b) Why is Pluto not the member of the solar system?

c) Which one of the planet between number 3 and 4 remains dark? Explain.

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.

2021

## 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 his existence on earth, man uses various materials from the natural sources to fulfill their needs. For this, people are engaged in some activities involving the environment. So, such activities have few effect on some factors of the environment.

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

- to explain what pollution is.
- to explain the causes of environmental pollution.
- to explain the effect of pollution on environment.
- to explain the ways of preventing environmental pollution.
- to take initiative to create awareness in the society for. conservation of environment.
- to publish posters containing environmental pollution and its 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 and the environmental balance is lost. As a result, life of human beings, plants and other animals are affected. Discomfort prevails in the environment for organisms. We term this condition as environmental pollution.

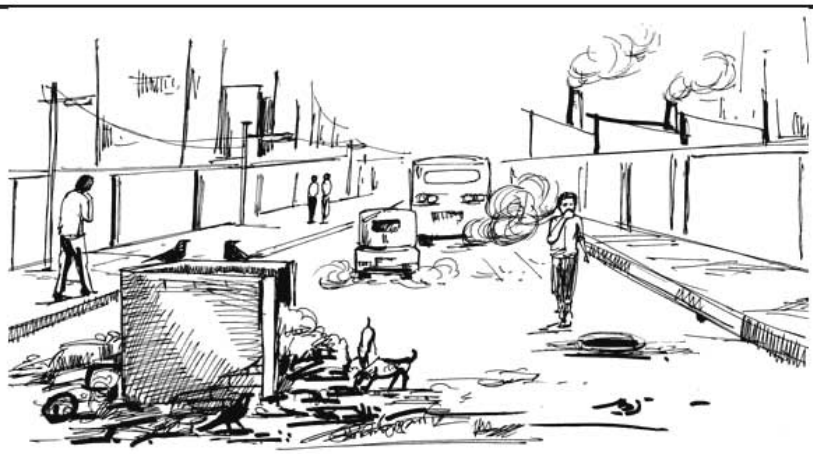


Fig-13.1: Polluted environment

**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 is 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 Components: living and non-living component. 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 non-living 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.

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 of increased carbon dioxide gas, temperature of the earth is increasing. Besides, CFC (Chloro Fluro Carbon ) 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.

## 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. 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 discussion.

**Causes and Sources of Soil Pollution:** The garbage and wastes that we throw, bacteria help them to decay. 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. Besides these materials, we pollute soil in various ways. Among these pollutants, there are different forms of garbage, fertilizers, fungicides used in agricultural land and industrial wastes etc.

Fig-13.2 : 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 discussion.

**Causes and Sources of Water Pollution**

Water may be polluted by various means. Human activities are the main cause among other causes of water pollution. Due to urbanization and industrialization sewage and industrial wastes have increased. As a result, water is being polluted.

Besides, for increased agricultural production 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 immerged in ponds. Cows, Buffalos, and goats are washed in ponds. Some unsafe latrines erected over different water bodies, are responsible for 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. The leftover foods, filths, wastes, the decomposed bodies of animals, various degradable substances used in domestic work are thrown here and there. These waste products get mixed with the water of ponds, lakes and rivers.

Fig- 13.3 : 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 vanous ways.

**Work:** To know the causes and sources of air pollution.

**Procedure:** Observe the sources and causes of air pollution of your area. Write down the man made and natural causes on a separate poster paper. Present it in the class and take part in discussion.

### 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 there 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, dust released form construction work and various kinds of waste materials etc. make air polluted. One of the causes of air pollution is injudicious deforestation. As a result, carbon-di-oxide which is absorbed by plants, increases in the air.

Fig-13.4 : 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. The groups will make an observation of environment of your school and adjacent areas. 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. 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. Insecticides and chemical fertilizers used in agricultural lands are harmful for all organisms. These chemicals mixing up with food stuffs through plants may cause fatal diseases like cancer.

### Effect of Water Pollution

You have learned that we pollute water in various ways. Drinking such water people suffer from diseases like dysentery, diarrhoea , 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. 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 damages the balance of aquatic environment.

Besides these, due to air pollution temperature of the earth rose much higher than before. 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. Consequently, the earth will face problems from all sides.

## Lesson-10: Prevention of Pollution and Conservation of Environment

You have learned the causes of pollution of soil, water and air 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 create awareness among the people.

**Work:** To know the 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, measure 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 reduced. 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 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 is water supplied to the residential houses in urban areas?
   a. Tube well b. Pond c. River d. Beel

2. Causes of soil pollution are -
   i. polythene and insecticide
   ii. Garbage and dead bodies of organisms
   iii Chemical fertilizers and glasses

Which one of the following is correct?

a. i and ii b. i and iii

c. ii and iii d. i, ii and iii

Observe the scene and answer question no. 3 and 4 :

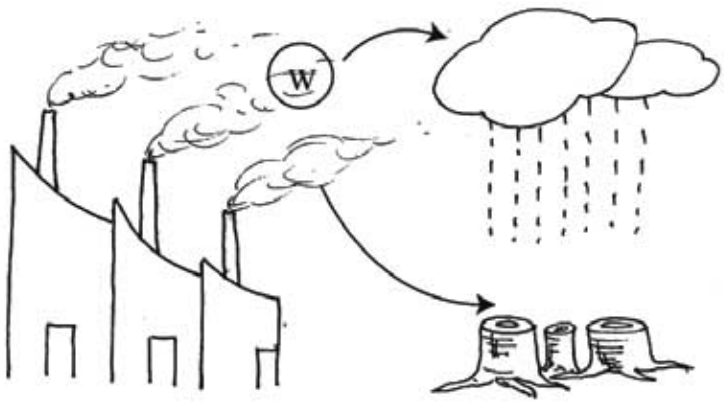



Fig: Smoke from the industries and deforestation

3. Which one is absent in part W of the imaginary scene ?

   a. Carbon dioxide  b. Oxygen

   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.

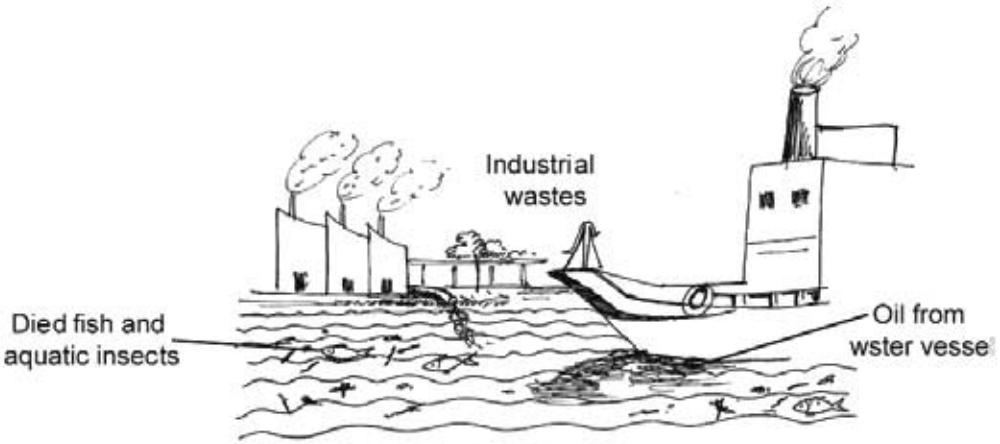



Fig: River

a. What is acid rain?
b. Why is plastic harmful for soil? Explain.
c. What are the problems faced by the animals shown in the stem? Explain.
d. What steps should be taken to balance the environment as shown in the stem?

2.

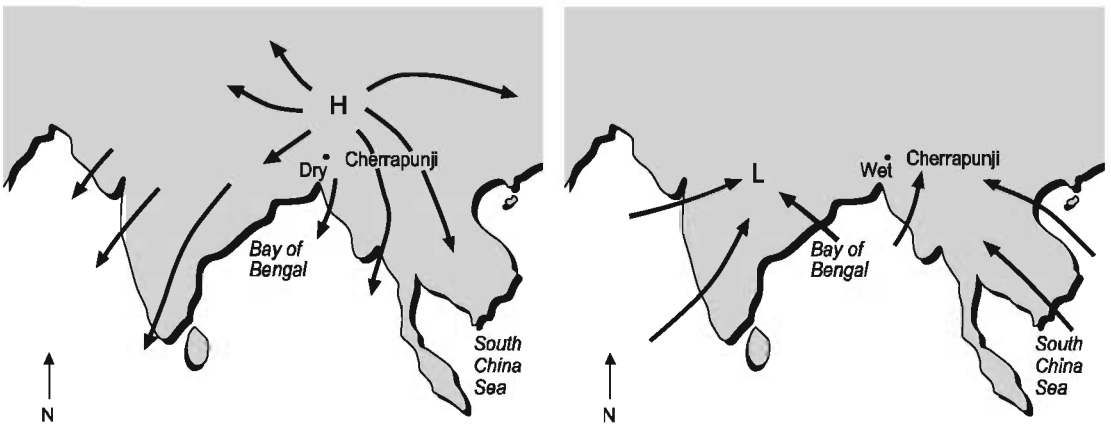
Fig: Car

a. What is pollution?
b. Why is water pollution harmful?
c. What problem will P of the stem create? Explain.
d. 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.




(a) Winter Monsoon (b) Summer Monsoon

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

- to describe different layers of the atmosphere.
- to explain importance of water cycle, oxygen cycle and carbon cycle.
- to explain weather and climate.
- to 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 at the first stage of creation. 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.

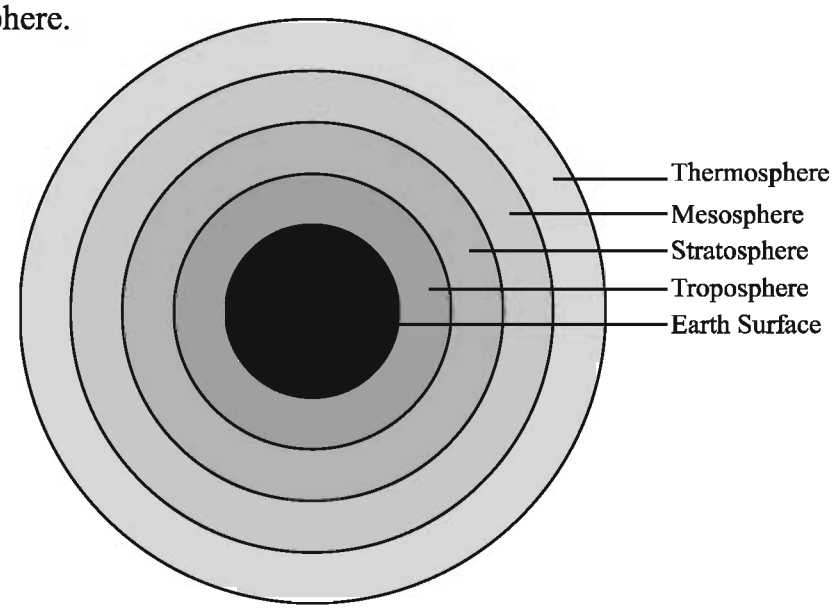



Fig- 14.1: Different layers of atmosphere

**Troposphere:** Up to eleven kilometers from the earth surface forms the troposphere. This layer contains most of the essential gases, like oxygen, nitrogen, carbon dioxide and water vapour. 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 stratosphere starts. 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 have learnt water cycle in chapter eleven. Water cycle is very important for the environment. Say if surface water including the sea water does not evaporate and remains 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

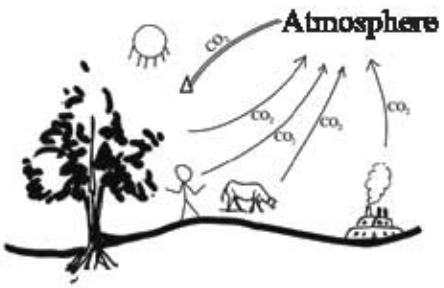


Fig-14.2: Balance of Co2 and O2

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.

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. Due to these imbalance of nature the climate has been changed. We will learn it in this chapter.

## Lesson-5: Weather and Climate

Gusty wind may blow tomorrow from the north-west side of Dhaka and its surroundings. Troughout 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 in Sylhet.

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 vapours 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, 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. And climate is the average result of many years weather of an area.

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 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 vapour, 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 vapour. 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 vapour from the Bay of Bengal. This water vapour 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.

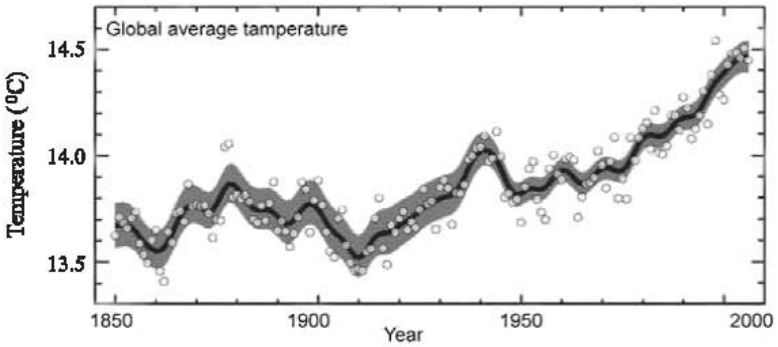



Fig-14.3 : Rise of global temperature

**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 various 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? If not, explain the reason.

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.

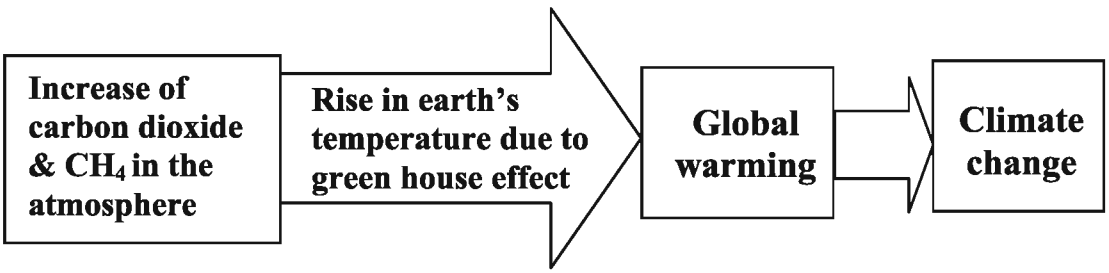
Fig-14.4 : Green house

The earth may be compared with a green house. The earth is surrounded by the atmosphere. The atmosphere contains carbon dioxide, methane and water vapour, 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 vapour 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 discussion.




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 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 concern 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 learned from this chapter**

- Atmosphere is extended few hundred kilometers from the earth's surface. Atmosphere is divided into few layers. Main 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 vapour; from water vapour 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. During 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. Balance of oxygen and carbon dioxide 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. 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. Ice of the mountain peak and polar region are melting due to the rise of temperature. 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 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 maintained 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.

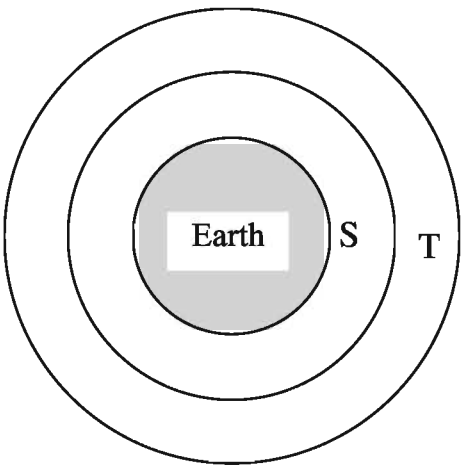
ii. climates of Bangladesh and West Bengal are almost the same.

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 the 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. i and 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

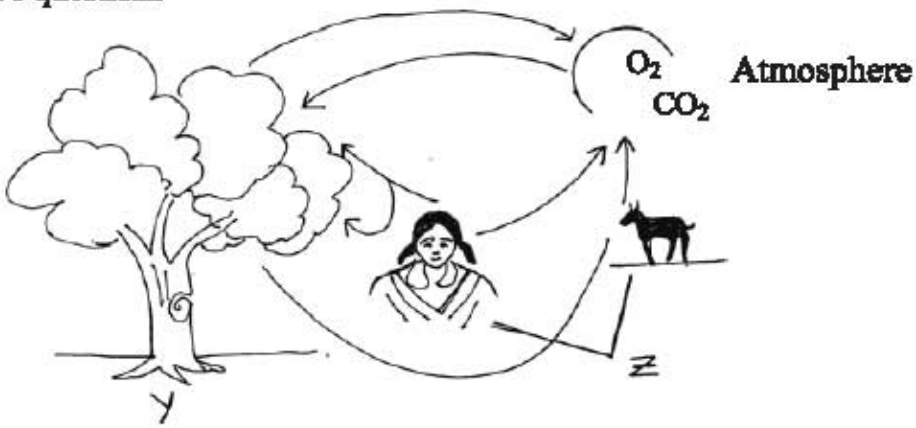
iii. Air pressure will decrease

Which one of the following is correct?

a. i and ii b. i and iii

c.ii and iii d. i, ii and iii

1. Creative questions



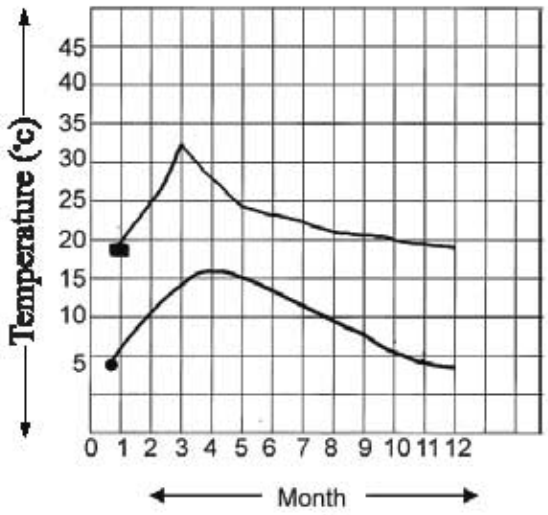

a. What is underground water ?

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 :




graph

■ Highest temperature

● Lowest temperature

a. What are the factors of weather ?

b. Why is the atmosphere in March in Bangladesh soothing?

c. As per the graph, in which month air pressure in Dhaka was the highest? Explain.

d. In which month was there highest possibility of storm in Dhaka? Explain it in the light of the graph.

## The End

স্বাধীনতার সুবর্ণ জয়ন্তী

স্বাধীনতার
৫০
বছর
উন্নয়ন আমারও

## শেখ হাসিনার নেতৃত্বে খাদ্যে স্বয়ংসম্পূর্ণ বাংলাদেশ

মাননীয় প্রধানমন্ত্রী শেখ হাসিনার যোগ্য নেতৃত্বে বাংলাদেশ আজ খাদ্যে স্বয়ংসম্পূর্ণ। বিভিন্ন খাদ্য উৎপাদনে বিশ্বে বাংলাদেশের অবস্থান আজ ঈর্ষণীয়। যেমন- বিশ্বে বাংলাদেশের অবস্থান ধান উৎপাদনে- ৩য়, প্রাকৃতিক উৎস হতে মাছ উৎপাদনে- ৩য়, সবজি উৎপাদনে- ৩য়, আলু উৎপাদনে- ৭ম, চা উৎপাদনে- ৯ম এবং পাট উৎপাদনে- ২য়।

**2021**

**Academic Year**

**7- Science**

সমৃদ্ধ বাংলাদেশ গড়ে তোলার জন্য যোগ্যতা অর্জন কর

- মাননীয় প্রধানমন্ত্রী শেখ হাসিনা

বিনয়ীকে সবাই পছন্দ করে

তথ্য, সেবা ও সামাজিক সমস্যা প্রতিকারের জন্য **'৩৩৩'** কলসেন্টারে ফোন করুন

নারী ও শিশু নির্যাতনের ঘটনা ঘটলে প্রতিকার ও প্রতিরোধের জন্য ন্যাশনাল হেল্পলাইন সেন্টারে ১০৯ নম্বর-এ (টোল ফ্রি, ২৪ ঘণ্টা সার্ভিস) ফোন করুন

শিক্ষা নিয়ে গড়ব দেশ শেখ হাসিনার বাংলাদেশ

**Ministry of Education**

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