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# Chapter- 1 Crop Production and Management

#### **Agricultural Practices**

We require food to carry out various metabolic functions of the body. In order to fulfill the demand of food for a large number of population regular production, proper management and distribution of food is necessary. Crop is a cultivated plant that is grown on a large scale commercially, especially a cereal, fruit, or vegetable. For example, crop of wheat means that all the plants grown in a field are that of wheat. Agriculture is the science, art, or practice of cultivating the soil, producing crops, and livestock and in varying raising degrees the preparation and marketing of the resulting products.



Crop field

According to the climatic conditions of a particular region the cropping patterns can be categorized into

- a. Kharif crops
- **b**. Rabi crop



Kharif crops - The crops which are sown in the rainy season are called kharif crops. Paddy, maize, soyabean, groundnut, cotton, etc., are kharif crops.

**Rabi crop** - The crops grown in the winter season are called rabi crops. Examples of rabi crops are wheat, gram, pea, mustard and linseed.

Kharif crop

#### **Basic Practices of Crop Production**

Soil may be defined as the upper thin layer of earth's crust, which serves as a natural medium for the growth of plants. Crop production involves a number of activities. These activities which a farmer performs to cultivate a crop are referred as agricultural practice.

These activities are listed below.



- Preparation of soil
- > Sowing
- Adding manure and fertilisers
- > Irrigation
- Protecting from weeds
- > Harvesting
- Storage

# **Preparation of Soil**

Preparation of soil is the first step in cultivating a crop for food production. The soil is prepared for sowing the seeds of the crop, by ploughing, leveling and manuring.

Before crops are planted, the soil must be prepared. It is done by turning and loosening the soil and this process is known as ploughing or tilling. Ploughing helps in easy penetration of the roots of seedlings. It aerates the soil thus the roots can thus breathe easily. It helps in the growth of earthworms and microbes present in the soil. These organisms further turn and loosen the soil and also add humus to the soil. The weeds are uprooted. This is done by using some devices known as agricultural implements.



Ploughing

## Agricultural Implements

The main tools used for this purpose are the plough, hoe, cultivator, and leveller.

**Plough**: It is a wooden or metal device drawn by a pair of bulls or other animals. It contains a strong triangular iron strip called ploughshare. The main part of the plough is a long log of wood which is called a ploughshaft. There is a handle at one end of the shaft. The other end is attached to a beam which is placed on the bull's necks.

Hoe: It is used for loosening the soil as well as for removing the weeds. It consists of a long rod of wood or iron. At one of the ends, a strong, broad and bent plate of iron is fixed. It has a long rod of wood or iron. A strong, broad and bent plate of iron is fixed to one of its ends and works like a blade.



**Cultivator**: These are driven by tractors. It is unlike the conventional plough. It saves time and labour. Cultivators stir and pulverize the soil before planting to aerate the soil and to prepare a smooth, loose seedbed.

Leveller: It is a large piece of wooden plank, which can also be driven by animals or a tractor.





#### Cultivator

Healthy seeds of good quality and good variety should be chosen to sow

There are different tools for this purpose.

**Traditional Tool**: In this tool, seeds are filled into a funnel, passed down through a pipe having sharp end. This end pierce into the soil and is placed there.

Seed Drill: This tool sows the seeds uniformly at proper distances and depths. It ensures that seeds get covered by the soil after sowing.

#### Selection of Seeds

The seeds that are not damaged will be hollow and thus would float on water unlike the healthy seeds. Healthy seeds can be selected and allowed to be sown.

## Adding Manure and Fertilizers

Manure is a natural substance obtained by the decomposition of cattle dung, human waste and plant residues. It is rich in nutrients and added to the soil for the healthy growth of plants.

## Functions of manure

- > They improve the texture of the soil.
- They increase the water holding capacity of the soil.
- They make the soil porous due to which exchange of gases in the soil improves.



Fertilizers added to soil

> It increases the number of friendly soil organisms like earthworms and microbes.

Another method of replenishing the soil with nutrients is through crop rotation. This can be done by growing different crops alternatively like growing legumes for one season then wheat for another. Thus the nitrogen is replenished back to the soil. This is done by the *Rhizobium* bacteria.

Fertilizers are inorganic nutrients that are added to the soil to make it fertile.

Difference between manure and fertilizers

Fertilizers	Manure
A fertilizer is prepared in factories.	Manure can be prepared in the fields.
A fertilizer does not provide any humus to	Manure provides a lot of humus to the
the soil.	soil.
Fertilizers are very rich in nutrients like	Manure is relatively less rich in plant
nitrogen phosphorus and potassium.	nutrients.

## Irrigation

Irrigation is the supply of water to the land from artificial channels to make plants grow. In many dry parts of the world where there is not enough rainfall, farmers irrigate their land to grow crops. Even in places where there is good rainfall, farmers often use irrigation to boost the growth of their crops. Irrigation makes agriculture possible in areas previously unsuitable for intensive crop production. Irrigation transports water to crops to increase yield, keep crops cool under excessive heat conditions and prevent freezing

The aim of irrigation is to spread the water evenly across the land so that each plant gets the same amount of water it needs. Many different methods of irrigation are now in use.

There are two ways of Irrigation

- Traditional ways
- Modern ways

## Traditional ways of Irrigation

Pumps are commonly used for lifting water. Diesel, biogas, electricity and solar energy is used to run these pumps.

Cattle or human labour is used in these methods. So these methods are cheaper, but less efficient.



- Moat (pulley-system) The water is filled in the pot from the well and poured on the crops.
- (ii) Chain pump The chain system involves irrigating fields with the help of water filled bucket.
- (iii) *Dhekli* The water is derived from the well and poured in the field.
- (iv) Rahat (Lever system) Rahat involves the use of an animal to irrigate the fields. The wheel turns and water filled buckets allow the water to spread over the field.



Rahat (Lever system)

#### Modern ways

n



**Drip irrigation** - Another method of irrigation is drip irrigation. Water is pumped through pipes and fed to plants near the roots, drop by drop. This is a very efficient method of watering plants because evaporation and run-off are kept to a minimum.

**Sprinklers** - Sprinklers are used in another kind of irrigation. Water is pumped to places in the fields where large sprinklers rotate and spray water at high pressure over the crops. When water is allowed to flow through the main pipe under pressure with the help of a pump, it escapes from the rotating nozzles. It gets sprinkled on the crop as if it is raining. Sprinkler is very useful for sandy soil.



**Sprinklers** 

#### **Protection from Weeds**

Weeds are the undesirable plants growing along with the crop plant. These weeds need to be removed as they would take up the nutrients from the soil that is required by the crops. The removal of weeds is called weeding. The best time for the removal of weeds is before they produce flowers and seeds.



It can be done

- By hands Mechanically removing the weeds with hands.
- By using trowel A hand tool with a short handle and a curved tapering blade used for removing weeds.
- By a tractor driven harrow A harrow is attached to the tractor that removes the weeds as the tractor moves.
- By Chemicals Weedicides are chemicals sprayed to the fields to kill the weeds.



Weeding

They are diluted with water and do not harm the crops. For example 2,4-D.

## Harvesting

The cutting of crop after it is mature is harvesting. Harvesting includes called several steps: gathering of the harvest, delivery for processing, transportation of the processed material for sale, and storage. The primary stage in crop harvesting consists of two groups of tasks: removal of the bulk plant material (cutting grains and grasses, digging up tubers, pulling flax, and gathering fruits and berries) and subsequent processing.



#### Harvesting of crops

The harvesting method used depends on the biological characteristics of the crop, climatic conditions, and the technical equipment available. Crops are pulled out or cut close to the ground by using sickle or machines. Then the seeds get separated from its chaff that is called Threshing. Farmers with small holdings of land do the separation of grain and chaff by winnowing.

#### Storage



If freshly harvested grains (seeds) are stored without drying, they may get spoilt or attacked by organisms, losing their germination capacity. Hence, before storing them, the grains are properly dried in the sun to reduce the moisture in them. This prevents the attack by insect pests, bacteria



and fungi. Then grains are sent to be stored in granaries after being dried in the sun. For storing large quantities of grains in big godowns, specific chemical treatments are required to protect them from pests and microorganisms. Large scale storage of grains is done in SILOS.

## Food from Animals

Like the crops the animals are also reared at home or in farms. They have to be provided with proper food, shelter and care. When this is done on a large scale, it is called **animal husbandry**.

# **Exercises**

#### 1.1 Fill in the blanks

- 1. Providing water to the crops is termed as .....
- 2. ..... are certain plants of the same kind grown on a large scale.
- 3. ..... is a machine used for cutting the matured crop.
- 4. ..... is a process of separating the grain from chaff. Enlist the differences between manures and fertilizers
- 1.2 Write short notes on
- (a) Preparation of soil
- (b) Sowing
- (c) Weeding
- 1.3 Give the modern methods of irrigating the crops.

1.4 Explain how soil gets affected by the continuous plantation of crops in a field.

1.5 Why is it essential toad manures and fertilizers to the soil time to time?



# Chapter- 2 Microorganisms: Friend and Foe

## Microorganisms

The invention of the microscope changed the way we see the world of microbes. In 1673, **Anton von Leeuwenhoek** put a couple of **lenses** together and was able to see a completely new world. He made the first microscope. It wasn't that impressive, but it started a whole history of exploration.

Microorganisms are very tiny one-celled organisms that are not visible by naked eye. Microorganisms can live in the air, on land and in fresh or salt water environments. Some of them may cause diseases while some may be beneficial for humans. The microbes cab be classified into



## Shapes of microbes

There are thousands of species of bacteria, but all of them are basically one of three different shapes.

Some are rod or stick-shaped and called bacilli. Examples of rod-shaped bacteria include *E.coli*, *Salmonella*, and *Bacillus anthracis* which is the bacterium that causes anthrax in cattle. Rodshaped bacteria include bent or curved rods; so Vibrio is a curved bacillus that causes cholera.





Others are shaped like little balls and called cocci. Examples of bacteria with round cells include *Staphylococcus*, *Streptococcus*, and *Neisseria* (causes *gonorrhea*).

Some others are twisted, helical or spiral in shape and called spirilla. These twisted cells can be flexible (*Treponema* which causes syphilis) or rigid corkscrew shape like *Campylobacter* (bacterium that causes food-borne illness).

# Habitat of Microorganisms

- Microbes are found in boiling hot springs and on frozen snowfields.
- Some microbes can survive temperatures about the boiling point.
- Other microbes live on snow and ice and die at room temperature. Some microbes "breathe" substances other than oxygen such as nitric acid, sulfuric acid, iron, arsenic or uranium to produce energy.



Hot springs

- > Some microbes live near roots of plants in symbiotic associations.
- Still other microbes flourish in chemical environments harmful to humans and remove toxins like oil and pesticides.
- Microbes live in overgrown slime, on pipes and in open oceans with few nutrients to support microbial life.
- In ponds there is a rich thriving ecosystem of microbial life including green and purple bacteria and algae, sulfate reducers, methane producers, and others.
- > Many microbes live in the bottom of lakes and rivers in sediments.
- Many animals have more microbe cells than they have animal cells living in or on them. Animals provide microbes with food and shelter.

## Microorganisms and Us

Microorganisms are both beneficial as well as harmful to the living organisms i.e. they may cause diseases. Microbes are much more of our friends than our enemies. Although some microbes cause health problems such as chickenpox and the common cold, most microbes make our lives better such as:



*Bacillus thuringiensis* is a common soil bacterium that is a natural pest-killer in gardens and on crops.

*Pseudomonas putida* - one of many microbes clean wastes from sewage water at water treatment plants.

*Escherichia coli* are one of many kinds of microbes that live in your digestive system to help you digest your food every day.

## Friendly Microorganisms

E.coli

We've been using microbes for thousands of years to make products we need and enjoy.

All the organic matter like the vegetable peels, remains of animals, faeces, etc. are decomposed and broken down into simpler substances with the help of microbes that feed on them and return the nutrients back to the soil. In this manner the soil fertility is increased.

## Making of Curd and Bread

*Lactobacillus acidophilus* is a bacterium that turns milk into yogurt. It multiplies in milk and converts it into curd. Cheese and bread are two microbe-made foods.

Yeast reproduces rapidly and produces carbon dioxide during respiration. Bubbles of the gas fill the dough and increase its volume this is the basis of the use of yeast in the baking industry for making breads, pastries and cakes.



Curd

#### **Commercial Use of Microorganisms**

Microbes are used on a large scale in industries for alcohol, wine and beer production. Yeasts are used for the production of alcohol. The process of conversion of sugars into alcohol is called as fermentation.



Alcohol production



## Medicinal Use of Microorganisms



Fungi and bacteria produce antibiotics such as penicillin and tetracycline. These are medicines we use to fight off harmful bacteria that cause sore throats, infections. diarrhea ear and other diseases. Antibiotics are even mixed with the feed of livestock and poultry to check microbial infection in animals. They are also used to control many plant diseases. They either kill bacteria or keep them from reproducing. Your body's natural defenses can usually take it from there.

#### **Antibiotics**

If you take antibiotics when not needed or in wrong doses, it may make the drug less effective when you might need it in future. Also antibiotics taken unnecessarily may kill the beneficial bacteria in the body. Antibiotics, however, are not effective against cold and flu as these are caused by viruses.

Although there are a number of different types of antibiotic they all work in one of two ways:

- A bactericidal antibiotic kills the bacteria. Penicillin is a bactericidal. A bactericidal usually either interferes with the formation of the bacterium's cell wall or its cell contents.
- A bacteriostatic antibiotic stops bacteria from multiplying.

## Vaccine

A vaccine is any preparation intended to produce immunity to a disease by stimulating the production of antibodies. Vaccines include, for example, suspensions of killed or attenuated microorganisms, or products or derivatives of microorganisms. The most common method of administering vaccines is by injection, but some are given by mouth or nasal spray.

When a person is inoculated with these preparations, the immune system confronts these harmless versions of the germs. The immune system quickly clears them from the body.

In turn the body remembers the germs so that later in life when it encounters the real live



Vaccines

virulent germs it may be able to fight it off with the retained memory against the particular germ.

## Increasing Soil Fertility

Population of microorganisms living in the soil derives its energy by oxidizing organic residues left behind by the plants growing on the soil or by the animals feeding on these plants. In return, the plants growing on the soil subsist on the products of microbial activity, for the microorganisms are continually oxidizing the dead plant remains and leaving behind, in a form available to the plant, the nitrogenous and mineral compounds needed by the plants for their growth.

## **Cleaning the Environment**

The microbes are capable of degrading the organic waste and converting it into manure. Microbes are nature's ultimate garbage disposal, devouring the dead, decomposing and inert material that litters Earth's surface. The concept is called bioremediation, and it involves using organisms that naturally love to eat contaminants.

## Harmful Microorganisms



Microorganism are not always helpful, some have deleterious effect also. They can harm human, animals and even the plants.

Some microorganisms are capable of causing diseases. These disease causing microorganisms are called pathogens. Like the polio virus causes polio and *Mycobacterium tuberculosis* is responsible for Tuberculosis. Microorganisms can cause disease in humans through air, water, direct contact or through a carrier.

Mycobacterium tuberculosis

Microbial diseases are of two types:-

Communicable

Non-communicable



Diseases that can spread from an infected person to a healthy person through air, water or direct contact are called **communicable diseases** like the common cold, chicken pox and tuberculosis while the diseases that cannot be transmitted from an infected person to a healthy person are called non-communicable diseases. Examples are cancer and diabetes.

#### Disease- causing Microorganisms in Humans

The microorganisms may get transmitted from an infected person to a healthy person through air while sneezing, by drinking infected water or by direct contact with the infected person.

## Carriers

Another mode of transmission of diseases is through the **carriers** or vectors. They are nothing but certain animals and insects that transfer the pathogens to cause disease.

The pathogens stick to the bodies of houseflies and get transferred to uncovered food. This food is now said to be contaminated. Consuming this food may cause disease.

Another well known example is of female anopheles mosquito that transfers the *Plasmodium*, protozoa causing malaria. These mosquitoes bites the infected person and sucks the blood, the parasite also gets transferred with the mosquito. When this mosquito bites a healthy person the *Plasmodium* also enters his/her body. Dengue is also transmitted similarly by the *Aedes* mosquito.



Female anopheles mosquito

Human Disease	Causative Microorganism	Mode of Transmission	Preventive measures (General)
Tuberculosis	Bacteria	Air	Keep the patient in complete
Measles	Virus	Air	isolation. Keep the personal
Chicken Pox	Virus	Air/Contact	belongings of the patient away
Polio	Virus	Air/Water	from those of the others. Vaccination to be given at suitable age.
Cholera	Bacteria	Water/Food	Maintain personal hygiene and good sanitary habits. Consume
Typhoid	Bacteria	Water	properly cooked food and boiled drinking water. Vaccination.



Hepatitis B	Virus	Water	Drink boiled drinking water.
			Vaccination.
Malaria	Protozoa	Mosquito	Use mosquito net and repellents.
			Spray insecticides and control
			breeding of mosquitoes by not
			allowing water to collect in the
			surroundings.

## Disease— causing Microorganisms in Animals

The pathogens also cause diseases in the animals. The *Bacillus anthracis* bacterium is responsible for causing anthrax disease in cattle as well as humans. The foot and mouth disease in cattle is caused by a virus.



## Disease- causing Microorganisms in Plants

#### Bacillus anthracis

The microbes also infect the plants. These cause diseases in them also and ultimately affect the crop yield. However they are be inhibited by the use of chemical that kill these microbes. The table shows the list of microbial diseases in plants.

Plant	Micro- organism	Mode of
Diseases		Transmission
Citrus canker	Bacteria	Air
Rust of wheat	Fungi	Air, seeds
Yellow vein mosaic of <i>bhindi</i> (Okra)	Virus	Insect

## Food Poisoning

Food poisoning occurs when you swallow food or water that contains bacteria, parasites, viruses, or toxins secreted by these germs. Most cases of food poisoning are from common bacteria such as Staphylococcus or *E. coli*.



Symptoms of the most common types of food poisoning usually start within 2 - 6 hours of eating the food. That time may be longer or shorter, depending on the cause of the food poisoning.

Possible symptoms include:

- Abdominal cramps
- Diarrhea (may be bloody)
- Fever and chills
- Headache
- Nausea and vomiting
- Weakness (may be serious)

# **Food Preservation**

Food preservation is the process of treating and handling food to prevent growth of microorganism to slow down Food spoilage, loss of quality, edibility or nutritional value and thus allow for longer food storage.

The objectives of food preservation are to:

- Preserve quality
- Preserve shelf life
- Ensure safety

## **Chemical Method**

Examples include some additives that inhibit growth of bacteria and molds, such as, sodium acetate and sodium benzoate. Sodium nitrite is used for cured meats, and specifically inhibits growth of *Clostridium* bacteria.

## Preservation by Common Salt

Salting is the addition of salt (sodium chloride or NaCl) to food for the purpose of preservation. The growth of microorganisms is inhibited by the salt, which has the effect of drawing water out of the bacterial cells so they become dehydrated and die. In this manner, salt, in combination with other measures, acts as a preservative in many foods such as butter, cabbage, cheese, cucumber, meat and fish. It also gives a desired flavour to the food. Salting can be done by rubbing adequate quantities of dry salt



Salting

into foods, or by immersion, where the food item is soaked in a concentrated salt solution (i.e. brine).

## Preservation by Sugar



Sugaring

**Sugaring** refers to the action of sugar in food preservation. It is similar to the action of salt that depends on the removal of water. In concentrations of at least 65%, sugar solution is widely used as a sweetening and preserving agent. However, care is needed because at low concentrations, sugar solution can support the growth of microorganisms. It has been found that microorganisms rarely survive in solutions above 20-25% sugar concentration.

## Preservation by Oil and Vinegar

Use of oil and vinegar prevents spoilage of pickles because bacteria cannot live in such an environment. Vegetables, fruits, fish and meat are often preserved by this method.

## Storage and Packing

## Canning and bottling

Canning involves the process of preserving foods in sealed containers by the application of heat. Primarily, it is based on the principle of sterilization. Firstly, all the micro-organisms present in the food are killed by the applications of heart at 275° to 350°F and then sealed in simultaneously sterilized air tight containers to prevent any further attack of micro organism.



**Canning and Bottling** 



Fruits, vegetables, fruit juices, pickles, cheese, butter, meat, fish etc. are generally canned or bottled.

#### Heat and Cold Treatments

This system has become one of the most popular methods of preserving food-stuffs in rural and urban areas of today. Many seasonal fruits and vegetables are stored in cold storages and according to the demand of the market are carried to the place of requirement. This method is based on the principle of refrigeration. Mostly, vegetables, fruits, eggs, meat, fish are kept in cold storages.

#### **Pasteurization**

This process is applicable to milk only. In this method milk is boiled at 160°F and then immediately cooled at 55°F. Normally, milk is pasteurized on a large scale to safeguard against any bacterial infection. The process aims at destroying the bacteria and inactivating the rest ones. The pasteurized milk is filled in sterilised bottles which are sealed. It could be preserved for five to six days and the colour and flavor of pasteurized



milk does not change in the process, as happens with the boiled milk.

#### **Nitrogen Fixation**

The growth of all organisms depend on the availability of minerals nutrients, and none is more important than nitrogen, which is required in large amounts as an essential component of proteins, nucleic acids and other cellular constituents. There is an abundant supply of nitrogen in the earth's atmosphere- nearly 79% in the form of  $N_2$  gas. However for the nitrogen to be used for growth of plants it must be fixed (combined) in the form of ammonium and nitrate ions.

*Rhizobium* lives in the root nodules of leguminous plants, such as beans and peas, with which it has a symbiotic relationship. Sometimes nitrogen gets fixed through the action of lightning.



## Nitrogen cycle

In soil, bacteria or fungi converts nitrogen gas or ammonium compound into ammonium ions. This process is called **ammonification**.

Nitrogen from fertilizer like urea or ammonium compounds, urea from urine decomposes to ammonia or ammonium ions. Ammonia dissolves in cytoplast to form ammonium ions. Ammonium ion is converted into  $NO_2^-$  to  $NO_3^-$  with help of bacteria. This process is known as nitrification.

Nitrate ion  $(NO_3)$  easily absorbed into plants through the roots. The plants then use the nitrogen to convert compounds of nitrogen.

Some plants have special root nodules like soyabean, pea plants. Bacteria in root nodules fix nitrogen and convert into compound of nitrogen. Animals eat the plants to get nitrogen.

When plants and animals die, bacteria and fungi present in the soil convert the nitrogenous wastes into nitrogenous compounds to be used by plants again. Certain other bacteria convert nitrate ion into nitrogen. This process is known as **denitrification**. The gas goes back into the atmosphere. As result, the percentage of nitrogen in the atmosphere remains more or less constant.





# **Exercises**

#### Fill in the blanks

- 1. Yeast is used in the production of
- 2. .... is the carrier of malaria-causing protozoan.
- 3. ..... bacteria is responsible for the formation of curd from milk...

### 2.1 Define fermentation

2.2 Give two advantages of microorganisms to us

## 2.3 What are vaccines? Explain their mode of action.

- 2.4 Name two chemical preservatives.
- 2.5 Sketch a diagram of nitrogen cycle.
- 2.6 Write a short paragraph on the harms caused by microorganisms
- 2.7 What are antibiotics? What precautions must be taken while taking antibiotics?



# **Chapter- 3 Synthetic Fibres and Plastics**

## Synthetic fibres

Synthesis means to make and synthetic means man-made, therefore man-made fibres are called synthetic fibres. A synthetic fibre is also a chain of small units joined together. Each small unit is actually a chemical substance. Many such small units combine to form a large single unit called a **polymer**.

## **Types of Synthetic Fibres**

#### Rayon

- Rayon is an artificial or synthetic fibre having properties similar to that of silk. Such a fibre was obtained by chemical treatment of wood pulp.
- This fibre was called rayon or artificial silk. Although rayon is obtained from a natural source, wood pulp, yet it is a man-made fibre.
- It is cheaper than silk and can be woven like silk fibres. It can also be dyed in a wide variety of colours. Rayon is mixed with cotton to make bed sheets or mixed with wool to make carpets.



Rayon

## Nylon

- Nylon is another man-made fibre made without using any natural raw material (from plant or animal).
- It was prepared from coal, water and air. It was the first fully synthetic fibre.
- Nylon fibre was strong, elastic and light. It was lustrous and easy to wash.
- We use many articles made from nylon, such as socks, ropes, tents, toothbrushes, car seat belts, sleeping bags, curtains etc.
- Nylon is also used for making parachutes and ropes for rock climbing. A nylon thread is actually stronger than a steel wire.



Nylon fibres used in ropes



## **Polyester and Acrylic**

- Polyester is a synthetic fibre. The fabric made from this fibre does not get wrinkled easily. It remains crisp and is easy to wash.
- Terylene is popular polyester. It can be drawn into very fine fibres that can be woven like any other yarn.
- PET or polyethylene terephalate is a very familiar form of polyester. It is used for making bottles, utensils, films, wires and many other useful products.
- We wear sweaters and use shawls or blankets in the winter. Many of these are actually not made from natural wool, though they appear to resemble wool.
- These are prepared from another type of synthetic fibre called acrylic.



Acrylic fibre

- The wool obtained from natural sources is quite expensive, whereas clothes made from acrylic are relatively cheap.
- They are available in a variety of colours. Synthetic fibres are more durable and affordable which makes them more popular than natural fibres.

# Characteristics of synthetic fibres

- They are non- reactive
- They dry up easily
- They are durable
- They are less expensive and readily available

## **Plastics**

Plastic is also a polymer like the synthetic fibre. All plastics do not have the same type of arrangement of units. In some it is linear, whereas in others it is cross linked. Plastic articles are available in all possible shapes and sizes. The fact is that plastic is easily moldable i.e. can be shaped in any form. Plastic can be recycled, reused, coloured, melted, rolled into sheets or made into wires.



Polymer



## Thermoplastics

Some plastic articles can bend easily while some break when forced to bend. When we add hot water to a plastic bottle, it gets deformed. Such plastic which gets deformed easily on heating and can be bent easily are known as thermoplastics. Polythene and PVC are some of the examples of thermoplastics. These are used for manufacturing toys, combs and various types of containers.



## Thermosetting plastics



On the other hand, there are some plastics which when molded once, cannot be softened by heating. These are called **thermosetting** plastics. Two examples are bakelite and melamine. Bakelite is a poor conductor of heat and electricity. It is used for making electrical switches, handles of various utensils, etc. Melamine is a versatile material. It resists fire and can tolerate heat better than other plastics. It is used for making floor tiles, kitchenware and fabrics which resist fire.

Thermosetting plastics

## **Characteristics of Plastics**

#### Plastic is non-reactive

We know that metals like iron get rusted when left exposed to moisture and air. But plastics do not react with water and air. They are not corroded easily. That is why they are used to store various kinds of material, including many chemicals.

## Plastic is light, strong and durable

Since plastic is very light, strong, and durable it can be molded into different shapes and sizes, it is used for various purposes. Plastics are generally cheaper than metals. They are widely used in industry and for household articles.



### Plastics are poor conductors

Plastics are poor conductors of heat and electricity. That is why electrical wires have plastic covering, and handles of screw drivers are made of plastic.

## Plastics and the Environment

A material which gets decomposed through natural processes, such as action by bacteria, is called **biodegradable**. A material which is not easily decomposed by natural processes is termed as **non-biodegradable**.

Since plastic takes several years to decompose, it is not environment friendly. It causes environmental pollution.



Plastic coating on electric wires

Besides, the burning process in the synthetic material is quite slow and it does not get completely burnt easily. In the process it releases lots of poisonous fumes into the atmosphere causing air pollution. The 4 R principles should be followed that is Reduce, Reuse, Recycle and Recover.

# Exercises

3.1 Give examples which indicate that nylon fibres are very strong.

3.2 Explain why plastic containers are favoured for storing food.

3.3 Enumerate the difference between the thermoplastic and thermosetting plastics.

3.4 Enlist the characteristics of plastics that make it material of choice

3.5 With the help of an activity show that thermoplastic is a poor conductor of electricity.

3.6 State whether the statements are true or false.

- 1. Synthetic fibres are also called manmade fibres.
- 2. Materials like plastics cannot be easily decomposed by natural processes and are called as non-biodegradable.
- 3. Plastics which when moulded once cannot be softened by heating are called thermoplastic.



# Chapter- 4 Materials: Metals and Non-metals

A metal is a chemical element whose atoms readily lose electrons to form positive ions (cations), and form metallic bonds between other metal atoms and ionic bonds between non-metal atoms.

# Physical properties of metals

- Metals in their pure state give a shiny appearance or metallic luster. Metals like gold, silver and platinum are used for making jewellery.
- Metals are usually hard except for sodium and potassium which are very soft and can be cut with a knife.





- > All metals are **solid** at room temperature except for mercury which is liquid at room temperature. It is used in thermometers.
- High melting and boiling points Metals have high melting and boiling point except for sodium, potassium, gallium and mercury which have low melting and boiling points. Tungsten has the highest melting point.
- Good conductors of heat and electricity Silver, copper and aluminium are good conductors of heat and used in making utensils.
- Good conductors of electricity Metals are good conductors because they have free electrons. Silver and copper are the two best conductors of heat and electricity. Lead is the poorest conductor of heat. Bismuth, mercury and iron are also poor conductors.
- Malleability: Metals have the ability to withstand hammering and can be made into thin sheets or foils.



Copper used in electric wires

Ductility: Metals can be drawn into wires. 100 gm of silver can be drawn into a thin wire about 200 meters long.



# **Physical Properties of Non-metals**

Elements which form negative ion by gaining electrons and are non malleable, non ductile, non sonorous and bad conductors of heat and electricity are called non-metals. For example sulphur, chlorine, nitrogen. Non-metals are quite abundant in nature. Nitrogen which is a non metal is the main constituent of atmosphere.

- > Oxygen, nitrogen and noble gases are present in the air.
- Nature: Non-metals are very brittle, and cannot be rolled into wires or pounded into sheets.
- > Reactivity: They generally form acidic or neutral oxides with oxygen.
- > Hydrogen and oxygen are present as water and chlorine as chlorides in oceans.
- They are bad conductors of heat and electricity except for graphite which is an allotrope of carbon.
- They are non-lustrous and non sonorous except for graphite and iodine which have lustre.
- Non metals are either solids or gases at room temperature excluding bromine which is liquid at room temperature.
- Non-metals are soft like phosphorus which can be easily cut with a knife. Diamond is an exceptional non-metal and the hardest substance known.



Black phosphorus

## **Chemical properties**

## Reaction with Oxygen

#### **Metals**

Most metals react with oxygen to metal oxide which is basic in nature. These basic oxides combine with water to form bases, which turns red litmus paper to blue. Sodium oxide is a basic oxide which reacts with water to form sodium hydroxide.

 $Na_2O + H_2O \rightarrow 2NaOH$ 

Sodium oxide water

Sodium hydroxide



Mg does not react with oxygen at room temperature. On heating, Mg burns in air with intense light and heat to form MgO.

 $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$   $Magnesium + Oxygen \qquad Magnesium oxide$ 

 $MgO + H_2O \longrightarrow Mg (OH)_2$ 

Magnesium Water

Magnesium hydroxide

oxide

Some metals like aluminium, zinc and tin form amphoteric oxides which are both acidic and basic in nature.

When a copper vessel is exposed to moist air for long, it acquires a dull green coating. The green material is a mixture of copper hydroxide (Cu (OH)<sub>2</sub>) and copper carbonate (CuCO<sub>3</sub>). The following is the reaction.



Green coating on copper

2Cu +	H <sub>2</sub> O +	CO <sub>2</sub> +	$O_2 \rightarrow$	Си (ОН)₂	+	CuCO <sub>3</sub>
Copper	Water	Carbon	Oxygen	Copper		Copper
		Dioxide		hydroxide		carbonate

# Non- metals

The name of the product formed in the reaction of sulphur and oxygen is sulphur dioxide gas. When sulphur dioxide is dissolved in water sulphurous acid is formed. The reaction can be given as follows:

SO <sub>2</sub>	+	$H_2O$	$\rightarrow$	(H <sub>2</sub> SO <sub>3</sub> )
Sulphur di	oxide	Water		Sulphurous acid

The sulphurous acid turns blue litmus paper red. Generally, oxides of non-metals are acidic in nature.



## Reaction with water

#### Metals

Sodium and potassium are highly reactive metals. They rapidly catch fire when exposed to air and hence kept in kerosene. Some other metals do not do so. For example, iron reacts with water slowly.

Na +	$H_2O \rightarrow$	NaOH +
Sodium	water	Sodium
		hydroxide

H<sub>2</sub> Hydrogen gas

Sodium reacts vigorously with cold water forming sodium hydroxide and hydrogen.

Generally, non-metals do not react with water though they may be very reactive in air. Such non-metals are stored in water. For example, phosphorus is a very reactive non-metal. It catches fire if exposed to air. To prevent the contact of phosphorus with atmospheric oxygen, it is stored in water.



Sodium in water

## Reaction with acids

## **Metals**

Potassium, sodium, lithium and calcium react violently with dilute  $H_2SO_4$  and dilute HCI, forming the metal salt (either sulphate or chloride) and hydrogen gas.

The reaction is similar to the reaction with water.

Zn	+	$2H_2SO_4 \rightarrow$	ZnSO <sub>4</sub> +	$H_2$
Zinc		Sulphuric acid	Zinc sulphate	Hydrogen
Fe	+	2HCI $\rightarrow$	FeCl <sub>2</sub> +	$H_2$
Iron		Hydrochloric acid	Iron chloride	Hydrogen



## **Reaction with bases**

Metals react with sodium hydroxide to produce hydrogen gas.

## Activity

Prepare a fresh solution of sodium hydroxide in a test tube by dissolving 3-4 pellets of it in 5 mL of water. Drop a piece of Aluminium foil into it. Bring a burning match stick near the mouth of the test tube. Observe carefully. The 'pop' sound indicates the presence of hydrogen gas.

Reactions of non-metals with bases are complex.

## **Displacement reaction**

The arrangement of metals in order of decreasing reactivity is called reactivity series

Reactivity series of metals is Potassium > Sodium > Barium > calcium > Magnesium > Aluminium > Zinc > Iron > Copper > Mercury > Silver > Gold

Zinc (Zn) replaces copper (Cu) from copper sulphate ( $CuSO_4$ ). The blue colour of copper sulphate disappears and a powdery red mass of copper is deposited at the bottom of the beaker.





*(CuSO4)* + Copper Sulphate (Blue) *(Zn)* → Zinc ZnSO<sub>4</sub> Zinc Sulphate (Colourless)

*(Cu)* Displacement reaction Copper (Red)

# Uses of metals

- Metals are used in every sphere of life. They are used in bridges, railways, aeroplans, electric mobile units and in daily use items like utensils, toys etc.
- Metals and their alloys have wide spread use in atomic energy, jet engines and high grade steel.
- Metals like gold and silver are used in jewellery making.





- > Copper and aluminum are used in electrical wires.
- Sodium:-compounds are used as common salt, chemicals etc.
- > Calcium :-compounds are used for making cement, glass etc.

## Uses of non metals

S

- Non-metal used in the purple coloured solution which is applied on wounds as an antiseptic,
- Non-metals used in crackers.
- Sulphur:-is used for making sulphuric acid, salts of metals etc.
- Oxygen:-is used for respiration by living things, burning of fuels etc.
- Nitrogen:-is used for making ammonia which is used for making fertilizers.



- Hydrogen:-is used for making ammonia which is used for making fertilizers, as fuel in rockets, for welding etc.
- > Chlorine:-is used to kill germs in water.
- > Iodine:-is used as tincture iodine which is an antiseptic

# **Exercises**

- 4.1 Give reasons for the following:
- (a) Aluminium foils are used to wrap food items.
- (b) Immersion rods for heating liquids are made up of metallic substances.
- (c) Copper cannot displace zinc from its salt solution.
- 4.2 Write true or false
- 1. Phosphorus is very reactive non-metal.
- 2. Metals are bad conductors of heat and electricity
- 3. Iron is a more reactive metal than copper.

4.3 You took a piece of burning charcoal and collected the gas evolved in a test tube.

- (a) How will she find the nature of the gas?
- (b) Write down word equations of all the reactions taking place in this process.
- 4.4 Give four uses of non-metals in everyday life.
- 4.5 With the help of an activity show the reaction between a metal and water.
- 4.6 Name the acid formed when sulphur dioxide reacts with water.



# Chapter- 5 Coal and Petroleum

Natural resources are materials and components that can be found within the environment. Natural resources are naturally occurring substances that are considered valuable in their relatively unmodified (natural) form. A natural resource's value rests in the amount of the material available and the demand for it.

#### Classification of Natural Resources

## Inexhaustible Natural Resources

These resources are present in unlimited quantity in nature and are not likely to be exhausted by human activities. Examples are: sunlight, air.

## **Exhaustible Natural Resources**

The amount of these resources in nature is limited. They can be exhausted by human activities. Examples of these resources are forests, wildlife, minerals, coal, petroleum, natural gas etc.

Coal, petroleum and natural gas are exhaustible natural resources. These were formed from the dead remains of living organisms (fossils). So, these are all known as fossil fuels.

## Coal

Coal is a combustible, sedimentary, organic rock, which is composed mainly of carbon, hydrogen and oxygen. It is formed from vegetation, which has been consolidated between other rock strata and altered by the combined effects of pressure and heat over millions of years to form coal steams.

The different amounts of conversion result in different types of coal. There are four main categories of coal: anthracite, bituminous, sub bituminous, and lignite.



Coal

These different varieties are rated upon the percentage of carbon in the coal and on their heating value (amount of energy released when burned), which are related to the heat and pressure that the coal underwent in being formed.



Coal is processed in industry to get some useful products such as coke, coal tar and coal gas.



**Coal tar** is a thick black liquid that is a byproduct of coke production. It works as an insulating agent, working with the wall insulation to help maintain a comfortable temperature inside the building, regardless of the outside weather.

Another use of this liquid has to do with fabric production. In order to create fabrics that will hold up to constant sunlight exposure and retain their colour, coal tar is added to the dye treatments that are

administered to the fabrics.

**Coke**, solid residue remaining after certain types of bituminous coals are heated to a high temperature out of contact with air until substantially all of the volatile constituents have been driven off. The residue is chiefly carbon, with minor amounts of hydrogen, nitrogen, sulfur, and oxygen. Also present in coke is the mineral matter in the original coal, chemically altered and decomposed during the coking process.



#### Coke

**Coal gas**, gaseous mixture—mainly hydrogen, methane, and carbon monoxide—formed by the destructive distillation (*i.e.*, heating in the absence of air) of bituminous coal and used as a fuel.

#### Petroleum

Petrol is used as a fuel in light automobiles such as motor cycles/ scooters and cars. Heavy motor vehicles like trucks and tractors run on diesel. Petrol and diesel are obtained from a natural resource called petroleum.



Petroleum



Petroleum was formed from organisms living in the sea. As these organisms died, their bodies settled at the bottom of the sea and got covered with layers of sand and clay. Over millions of years, absence of air, high temperature and high pressure transformed the dead organisms into petroleum and natural gas.

## **Refining of Petroleum**

Petroleum is a dark oily liquid. It has an unpleasant odour. It is a mixture of various constituents such as petroleum gas, petrol, diesel, lubricating oil, paraffin wax, etc. The process of separating the various constituents/ fractions of petroleum is known as refining. It is carried out in a petroleum refinery.



Petroleum extraction from oceans

S.	Constituents of petroleum	Uses
No		
1	Petroleum Gas in Liquid form (LPG)	Fuel for home and industry
2	Petrol	Motor fuel, aviation fuel, solvent for
		dry cleaning
3	Kerosene	Fuel for stoves, lamps and for jet aircrafts
4	Diesel	Fuel for heavy motor vehicles, electric
		generators
5	Lubricating oil	Lubrication
6	Paraffin wax	Ointments, candles, Vaseline etc.
7	Bitumen	Paints, road surfacing

## Various constituents of petroleum and their uses

## Natural Gas

Natural gas is a very important fossil Fuel. Natural gas is stored under high pressure as compressed natural gas (CNG). CNG is used for power generation. It is now being used as a fuel for transport vehicles because it is less polluting. It is a



Natural gas



#### cleaner fuel.

The great advantage of CNG is that it can be used directly for burning in homes and factories where it can be supplied through pipes. Natural gas is also used as a starting material for the manufacture of a number of chemicals and fertilizers.

## Uses of natural gas

- For cooking.
- To run central heating and cooling systems, and cloth dryers.
- For electricity generation through the use of gas turbines and steam turbines.
- In the manufacture of fabrics, glass, steel, plastics, paint and other products.

#### Some Natural Resources are Limited

Some natural resources are exhaustible like fossil fuels, forests, minerals etc. Coal and petroleum are fossil fuels. It required millions of years for the dead organisms to get converted into these fuels. On the other hand, the known reserves of these will last almost a few hundred years. Moreover, burning of these fuels is a major cause of air pollution. Their use is also linked to global warming.





It is therefore necessary that we use these fuels only when absolutely necessary. This will result in better environment, smaller risk of global warming and their availability for a longer period of time.

In India, the Petroleum Conservation Research Association (PCRA) advises people how to save petrol/diesel while driving. Their tips are:

- Drive at a constant and moderate speed as far as possible
- Switch off the engine at traffic lights or at a place where you have to wait,
- Ensure correct tyre pressure, and
- Ensure regular maintenance of vehicle.



# **Exercises**

5.1 Tick True/False against the following statements:

1. Paraffin wax, lubricating oil are obtained by refining petroleum

2. Coal, petroleum and natural gas are fossil fuels.

3. Bitumen is a constituent of coal.

5.2 Explain the process of refining of petroleum to obtain various its constituents.

5.3 Give two advantages of CNG

5.4 Write a detailed account of the products obtained by processing coal in industry.

5.5 Name the petroleum product used for surfacing of roads.

5.6 Why is there a need to switch from fossil fuels to alternative sources of energy? Explain



# Chapter- 6 Combustion and Flame

## Combustion

A chemical process in which a substance reacts with oxygen to give heat is called **combustion**. The substance that undergoes combustion is said to be combustible. It is also called **fuel** e.g. petrol, kerosene. The fuel may be solid, liquid or gas. Air is necessary for combustion to occur.

The lowest temperature at which a substance catches fire is called **ignition temperature**. A combustible substance cannot catch fire or burn as long as its temperature is lower than its ignition temperature.



#### Wood is a combustible substance

The substances which have very low ignition temperature and can easily catch fire with a flame are inflammable substances e.g. petrol, alcohol, LPG (Liquified petroleum gas) etc.



## Methods to control fire

When there is a fire, break out, the fire bridge pours water on the fire. Water cools the combustion material so that its temperature is brought below its ignition temperature thus, preventing the fire from spreading.


The job of the fire extinguisher is to the cut off the supply of the air, or to bring down the temperature of the fuel or both. The most common fire extinguisher is water but it is not suitable for fire involving oil and petrol. For fires involving electrical equipment and inflammable materials, carbon dioxide ( $CO_2$ ) is the best extinguisher, which is stored at the high pressure as a liquid in cylinders. Also, near the fire  $CO_2$  can be given off by using chemical like sodium bicarbonate, potassium bicarbonate etc.

The head of the safety match is made from antimony trisulphide and potassium chlorate. The rubbing surface has powdered glass and a little red phosphorous. When the matches is struck against the rubbing surface, some red phosphorous get converted into white phosphorous which reacts with the potassium chlorate in the match ignite antimony trisulphide and start the combustion.

# Types of Combustion

- Combustion in which gas burns rapidly and produces light and heat is known as rapid combustion e.g. burning of gas stove in kitchen.
- The type of combustion in which a material suddenly bursts in flames without application of any apparent is called spontaneous combustion e.g. spontaneous combustion of coal dust.
- Combustion in which a sudden reaction takes place with the evolution of heat, light and sound is known as explosion. For e.g. ignition of fire crackers



Burning of crackers

# Flame

Flame is the hot, glowing mixture of burning gases and tiny particles that arises from combustion. Flames get their light either from the fluorescence of molecules or ions that have become excited, or from the incandescence of solid particles involved in the combustion process, such as the carbon particles from a candle. The different zones of the candle flame are outer zone, middle zone and innermost zone.



# Zones of Flame



# Structure of a Flame

The substances which vapourise during burning, give flames. For example, kerosene oil and molten wax rise through the wick and are vapourised during burning and form flames.

Charcoal, on the other hand, does not vapourise and so does not produce a flame.

# Fuel

The substance that undergoes combustion is said to be combustible. It is also called a **fuel**. The fuel may be solid, liquid or gas.

Characteristics of an ideal fuel

- Cheap
- Readily available
- Burns easily in air at a moderate rate
- It produces a large amount of heat
- It does not leave behind any undesirable substances.

## **Fuel Efficiency**

The amount of the heat produced on complete combustion of 1 kg of the fuel is called its calorific value. It is expressed in kilo joule per kg. A good fuel has a high calorific value. The calorific value of a fuel is expressed in a unit called kilojoule per kg (kJ/kg).

## Burning of Fuels Leads to Harmful Products

- Carbon fuels like wood, coal, petroleum release unburnt carbon particles that cause respiratory diseases like asthma.
- Combustion of most fuels releases carbon dioxide in the environment leading to global warming.
- Burning of coal and diesel releases sulphur dioxide. Moreover, petrol engines give oxides of nitrogen. Oxides of nitrogen and sulphur dissolve in water of rain to form acids. Such rain is called



acid rain which is very harmful for crops, building and soil.

**Burning of fuels** 



# Exercises

6.1 Make a well labelled diagram of the various zones of a flame.

6.2 How does a fire extinguisher help in controlling fire?

6.3 Which zone of a flame does a goldsmith use for melting gold and silver and why?

6.4 You need to heat water in a beaker. Over which zone of the flame should you keep the beaker so that it gets heated at a faster rate?

6.5 Give reasons:

(a) Water is not used to control fires involving electrical equipment.

(b) LPG is a better domestic fuel than wood.

(c) Paper by itself catches fire easily whereas a piece of paper wrapped around an aluminium pipe does not.

6.6 In an experiment 5.5 kg of a fuel was completely burnt. The heat produced was measured to be 280,000 kJ. Calculate the calorific value of the fuel.

6.7 What are the essential conditions required for combustion to occur?



# Chapter- 7 Conservation of Plants and Animals

One of the most pressing environmental issues today is the conservation of biodiversity. Many factors threaten the world's biological heritage.

# Deforestation and Its Causes



Man has cut down trees since we first appeared, changing and adapting the environment to suit our needs in order to provide the things we require to live successfully. Deforestation is clearing Earth's forests on a massive scale, often resulting in damage to the quality of the land.

## **Reasons for deforestation**

- The world's rain forests could completely vanish in a hundred years at the current rate of deforestation.
- Forests are cut down for many reasons the biggest driver of deforestation is agriculture. Farmers cut forests to provide more room for planting crops or grazing livestock.
- Increasing demand for wood which are raw materials for industries has mounted the pressure on the forests and these are cut as a result of growing urban sprawl.



Deforestation

Sometimes deforestation is caused by a combination of human and natural factors like wildfires and subsequent overgrazing, which may prevent the growth of young trees.

#### **Consequences of deforestation**

Deforestation has many negative effects on the environment.

- The most dramatic impact is a loss of habitat for millions of species. Seventy percent of Earth's land animals and plants live in forests, and many cannot survive the deforestation that destroys their homes.
- Deforestation also drives climate change. Forest soils are moist, but without protection from sun-blocking tree cover they quickly dry out. Trees also help perpetuate the water cycle by returning water vapor back into the atmosphere. Without trees land may convert into deserts.



- Removing trees deprives the forest of portions of its canopy, which blocks the sun's rays during the day and holds in heat at night. This disruption leads to more extreme temperatures swings that can be harmful to plants and animals.
- With the loss of a protective cover of vegetation more soil is lost and eventually leads to soil erosion.





#### Water cycle

Trees also play a critical role in absorbing the greenhouse gases that fuel global warming. Fewer forests mean larger amounts of greenhouse gases entering the atmosphere—and increased speed and severity of global warming.

#### Droughts

> The increase in temperature on the earth disturbs the water cycle and may reduce rainfall. This could cause **droughts**.

## **Conservation of Forest and Wildlife**

To protect our flora and fauna and their habitats, **protected areas** called sanctuaries, national parks and biosphere reserves have been earmarked. Plantation, cultivation, grazing, felling trees, hunting and poaching are prohibited there. The government lays down rules, methods and policies to protect and conserve them. The protected areas are for conservation of plants and animals present in that area.

#### **Biosphere Reserve**

Biosphere reserves are the areas meant for conservation of biodiversity.

Biodiversity is the variety of plants, animals and microorganisms generally found in an area. The biosphere reserves help to maintain the biodiversity and culture of that area. A biosphere reserve may also contain other protected areas in it. The Pachmarhi Biosphere Reserve consists of one national park named Satpura and two wildlife sanctuaries named Bori and Pachmarhi.



#### Flora and Fauna

The plants and animals found in a particular area are termed **flora** and **fauna** of that area. *Sal*, teak, mango, *jamun*, silver ferns, *arjun*, etc are the flora and *chinkara*, blue-bull, barking deer, *cheetal*, leopard, wild dog, wolf, etc. are examples of the fauna of the Pachmarhi Biosphere Reserve

#### **Endemic Species**

Endemic species are those species of plants and animals which are found exclusively in a particular area. They are not naturally found anywhere else. A particular type of animal or plant may be endemic to a zone, a state or a country.

Sal and wild mango are two examples of the endemic flora. Bison, Indian giant squirrel and flying squirrel are endemic fauna. The destruction of their habitat, increasing population and introduction of new species may affect the natural habitat of endemic species and endanger their existence.

Animals whose numbers are diminishing to a level that they might face extinction are known as the endangered animals.

An ecosystem is made of all the plants, animals and microorganisms in an area along with non-living components such as climate, soil, river deltas, etc.

#### Wildlife Sanctuary

Some of the threatened wild animals like black buck, white eyed buck, elephant, golden cat, pink headed duck, *gharial*, marsh crocodile, python, rhinoceros, etc. are protected and preserved in our wild life sanctuaries. Indian sanctuaries have unique landscapes—broad level forests, mountain forests and bush lands in deltas of big rivers.







**Bison** 





## **National Park**



These reserves are large and diverse enough to protect whole sets of ecosystems. They preserve flora, fauna, landscape and historic objects of an area. Satpura National Park is the first Reserve Forest of India.

**Project Tiger** was launched by the government to protect the tigers in the country. The objective of this project was to ensure the survival and maintenance of the tiger population in the country.

#### **Red Data Book**

**Red Data Book** is the source book which keeps a record of all the endangered animals and plants.

#### Migration

Migration is critical in the life cycle of a bird, and without this annual journey many birds would not be able to raise their young. Birds migrate to find the richest, most abundant food sources that will provide adequate energy to nurture young birds. Siberian Cranes travel about 4000 km from Siberia to India every year in winter season.

#### **Recycling of Paper**

Paper can be recycled five to seven times for use. If each one saves at least one sheet of paper in a day, we can save many trees in a year. We should save, reuse used paper and recycle it. By this we not only save trees but also save energy and water needed for manufacturing paper. Moreover, the amount of harmful chemicals used in paper making will also be reduced. In India, we have some method of paper recycling by way of rag pickers and dealers of old and waste items.



**Recycling of Paper** 



## Reforestation



A more workable solution is to carefully manage forest resources by eliminating clear-cutting to make sure that forest environments remain intact. The cutting that does occur should be balanced by the planting of enough young trees to replace the older ones felled in any given forest. The number of new tree plantations is growing each year, but their total still equals a tiny fraction of the Earth's forested land.

Reforestation

# **Exercises**

#### 7.1 Give one word for the following

- 1. Species on the verge of extinction.
- 2. A book carrying information about endangered species.
- 3. Consequence of deforestation.
- 4. Species which have vanished.
- 5. Species found only in a particular habitat.
- 6. Variety of plants, animals and microorganisms found in an area.
- 7.2 Enumerate the consequences of deforestation.
- 7.3 Why is there a need to conserve the biodiversity?
- 7.4 What will happen if we remove the top layer of the soil?
- 7.5 Why do the birds migrate to a different habitat every year?
- 7.6 Differentiate between the following:
- (a) Wildlife sanctuary and biosphere reserve
- (b) Zoo and wildlife sanctuary



# Chapter- 8 Cell : Structure and Functions

# Discovery of the Cell

Robert Hooke in 1665 observed the slices of cork cells from the bark of the tree. These cells are non living. He observed them under a simple microscope and found many compartments separated from each other by a partition. He coined the term cell for each compartment.



Cork cells

# The Cell

- The cell is the basic structural and functional unit of life; all organisms are composed of cells.
- > All cells are produced by the division of preexisting cells through reproduction.
- > Each cell contains genetic material that is passed down during this process.
- All basic chemical and physiological functions for example, repair, growth, movement, immunity, communication, and digestion - are carried out inside of cells

## Organisms show Variety in Cell Number, Shape and Size

There are millions of living organisms and each differs in shapes and sizes. Their organs also vary in shape, size and number of cells. Different groups of cells perform a variety of functions.

## Number of Cells

An organism may be single cellular that is made up of one cell or multi cellular made of many cells. Amoeba and Paramecium for example are single celled. All the body processes like digestion, respiration, reproduction and excretion are carried out by that single cell while an elephant is multi celled and has complex organ system to carry out the body processes.



# Shape of Cells

Generally, cells are round, spherical or elongated. Some cells are long and pointed at both ends. They exhibit spindle shape. Cells sometimes are quite long.



Cells may be irregular in shape like the amoeba. The white blood cell also does not have any fixed shape.

A red blood cell is disc shaped and its function is transportation of gases in the human body.

Some are branched like the nerve cell or a neuron which transmits the signals from throughout the body. It helps in the control and coordination of the body.

Another example is the muscle cells which facilitate the movement of muscles.



Nerve cells

# Size of Cells

The cells also vary in their sizes. The smallest cell is that of a bacteria which is 0.1 to 0.5 micrometer while the largest is an ostrich egg measuring 170 mm  $\times$  130 mm.

## Cell Structure and Function

Our body has various organ system these contain specific organs. Each organ is made up a group of tissues and likewise each tissue is made of up several cells. A tissue is a group of similar cells performing a specific function. For example the function of the muscle tissues is the contraction and relaxation of muscles. There are two types of cells namely prokaryotic and eukaryotic cell.

Prokaryotic Cell	Eukaryotic Cell
The term pro means primitive and karyon means nucleus. It is devoid of well defined nucleus and also does not have the cell organelles like mitochondria, Golgi bodies and plastids. The genetic material is in form of nucleoid in the cytoplasm.	Eukaryotic cell on the other hand has a well defined nucleus with nuclear membranes and all the cell organelles.
The bacterial cell is an example of a	Nerve cell or muscle cell is an example of
prokaryotic cell.	eukaryotic cell.





## Parts of the Cell

The cell is made of up cell wall, membrane, nucleus, cytoplasm, vacuole and the plastids and the mitochondria. These are called as cell organelles. Each cell organelle has its own particular function to carry out. Like for example the plastids in plant cell have chloroplast that contains the green coloured pigment chlorophyll. This chlorophyll traps the light energy from sun and converts it into chemical energy.

## Cell Membrane

The cytoplasm and the other cellular components embedded in it are surrounded by the plasma membrane. The plasma membrane separates the cell from one another and also from the outside environment. It is semi-permeable that means it allows the movement of certain substances and restrict the movement of others.



Cell membrane structure

## Cell wall

The cell is protected by the cell wall. It is not present in the animal cell. This cell wall provides the shape and rigidity to the cell. Plant cell are non motile therefore to protect themselves from unfavourable conditions like high wind speed, increase or decrease in temperature they have cell wall.

## Cytoplasm

It is the jelly-like substance present between the cell membrane and the nucleus. Various other components, or **organelles**, of cells are present in the cytoplasm.

#### **Nucleus**



It is the dense round body at the centre of the cell. Like the brain in our body, the nucleus regulates all the functioning of the cell. The nucleus is separated from the cytoplasm by the nuclear membrane. The nucleus also has its cytoplasm called the **nucleoplasm**. Inside the nucleus you see another spherical body called the **nucleolus**. The nucleus contains thread like structures called the chromosomes. They have the genetic material or the genes that is transferred to the next generation. We appear similar to our parents; this is because we inherit genes from them. The entire content of a living cell is known as protoplasm. It includes the cytoplasm and the nucleus. Protoplasm is called the living substance of the cell.

#### Genes

These are the units of inheritance in living organisms. A gene is a segment of the chromosomes. It controls the transfer of a hereditary characteristic from parents to offspring. This means that your parents pass some of their characteristics on to you. If your mother has brown eyes, you may also have brown eyes. If your father has curly hair, you might also end up having However, curly hair. the different combination of genes from parents results in different characteristics.



Structural organization of cell

# Chloroplasts



Another cell organelle found only in the plant cell is the plastids. These contain coloured pigments. The green coloured plastid is called as chloroplast. They contain green colour pigment chlorophyll which is essential for the process of photosynthesis.

## Mitochondria

Mitochondria are the powerhouse of the cell. It is the. They are responsible for the generation of energy.



# Golgi bodies

These are membrane bound vesicle that package and transport macromolecules.

## Vacuoles

These are membrane bound sacs which help in intracellular digestion.



**Golgi bodies** 

## **Comparison of Plant and Animal Cells**

A plant cell varies from an animal cell as the animal cell is devoid of cell wall. Also the plant cell contain plastids which are absent in the animal cells. The vacuole occupies a larger portion in the plant cell unlike the animal cells that have vacuole scattered in the cell.



Plant cell

Animal cell

# **Exercises**

- 8.1 Which part of the cell contains organelles?
- 8.2 Enlist the differences between a plant cell and an animal cell. Also draw diagrams
- 8.3 Write the difference between eukaryotes and prokaryotes.
- 8.4 What are chromosomes? State their function.
- 8.5 'Cells are the basic structural units of all living organisms'. Justify.
- 8.6 Name the cell organelles present only in the plant cell.



# **Chapter- 9 Reproduction in Animals**

## Modes of Reproduction

Reproduction is a process in which an organism reproduces its same kind. The offspring produced are similar to the parents. Reproduction is essential for the continuation of a species.

Reproduction in animals takes place by two modes



# **Sexual Reproduction**

Sexual reproduction involves the participation of male and female reproductive system. Like plants, animals also produce male and female gametes which fuse to form a zygote. This zygote then develops into a baby.

# Male Reproductive Organs

The male reproductive organs include

- > A pair of testes
- Ejaculatory duct
- Seminal vesicle
- > Epididymis
- > Penis

The testes produce the male gametes called **sperms**. These are produces in millions. The sperm is a single cell with all cellular components. A single sperm is divided into, the head, middle piece and the tail. These sperms are motile and require a lot of energy for their



Male reproductive organs



passage. They have several mitochondria. These mitochondria are powerhouses which generate energy.

# Female Reproductive Organs

It includes

- > A pair of ovaries
- > Oviducts or the fallopian tubes
- Uterus

Like the testes in males the ovary produces female gametes called **ova or eggs**. In human beings, unlike male, the female produces a single matured egg into the oviduct by one of the ovaries every month. If it fuses with the sperm it becomes a zygote and if it doesn't fuses, it dies after one day.



Female reproductive organs

# **Fertilisation**

The male gamete that is the sperm and the female gamete that is the ovum fuse to form a zygote. This process is called as fertilisation. The zygote is a single cell formed by the fusion of one sperm and ovum.

The zygote then divides and develops into an embryo which later forms the foetus. The foetus has characteristics of both male as well as female parent.

Types of fertilisation

Fertilisation may occur inside the body of an organism or outside.

# Internal fertilisation

In mammals like cow, dog and humans the fertilization is internal that is the eggs are fertilized within the female reproductive tract. The sperm needs fluid to swim to the egg. The chances of fertilisation are much greater since the gametes are closer together when released.

# **External fertilisation**

In frogs, fishes and starfish the eggs are released outside the body. The female lays hundreds of eggs. In frogs these are coated with a layer of jelly which protects it. The sperms are motile, they swim and reach the egg and fertilizes it forming a zygote. This type of fertilization is called as external fertilisation.



## **Development of Embryo**

Fertilisation results the in formation of zygote which begins to develop into an embryo. The zygote divides repeatedly to give rise to a ball of cells. The cells then begin to form groups that develop into different tissues and organs of the body. This developing structure is termed an embryo. The embryo gets embedded in the wall of the uterus for development. further The



embryo continues to develop in the uterus.

**Development of Embryo** 

It gradually develops the body parts such as hands, legs, head, eyes, ears, etc. The stage of the embryo in which all the body parts can be identified is called a **foetus**. When the development of the foetus is complete, the mother gives birth to the baby.

## Viviparous and Oviparous Animals

In hens the fertilisation is internal but there is difference in the development of the embryo. The hen lays eggs unlike humans and cows. The eggs of the hen are shielded with a hard shell that protects it. After providing enough warmth by the hens the chick grows completely and the egg hatches. Such animals are called as **oviparous**.

Mammals like cows and humans which give birth to their young ones are called as viviparous. The foetus in mammals develops on the uterus wall. Such animals are called as viviparous.

## Young Ones to Adults

The transformation of the larva into an adult through drastic changes is called **metamorphosis**. There are three distinct stages in the life cycle of a frog, that is,

Egg  $\rightarrow$ Tadpole (larva)  $\rightarrow$  Young frog  $\rightarrow$ Adult



Metamorphosis in frog



# **Invitro Fertilisation**

When the sperm is not able to reach egg for fertilization, another technique is used where the fertilization is done under experimental conditions. Doctors collect freshly released egg and sperms and keep them together for a few hours for *IVF* or *in vitro fertilization*. In case fertilization occurs, the zygote is allowed to develop for about a week and then it is placed in the mother's uterus. Complete development takes place in the uterus and the baby is born like any other baby. Babies born through this technique are called test-tube babies.

# **Asexual Reproduction**

Reproduction which involves only a single parent is called asexual reproduction.

# Budding in Hydra

Hydra produces small bulges from the sides of its body. These bulges grow as buds and separate from the parent body. Since new individuals develop from the buds in hydra, this type of asexual reproduction is called budding.

## Binary fission in Amoeba

The amoeba which is a single celled organism divides by another method called binary fission. The nucleus of an amoeba cell divides into two nuclei after which the cytoplasm divides into two, each part receiving a nucleus. Finally, two amoebae are produced from one parent amoeba.



## Binary fission in Amoeba

# Cloning

Cloning is the production of an exact copy of a cell, any other living part, or a complete organism. The first organism that was produced by cloning was a sheep named dolly.

Mother amoeba



Daughter amoeba



During the process of cloning Dolly, a cell was collected from the mammary gland of a female Finn Dorsett sheep. An egg was obtained from a Scottish blackface ewe. The nucleus was removed from the egg. Then, the nucleus of the mammary gland cell from the Finn Dorsett sheep was inserted into the egg of the Scottish blackface ewe whose nucleus had been removed. The egg thus produced was implanted into the Scottish blackface ewe. Development of this egg followed normally and finally Dolly was born. Dolly was identical to the Finn Dorsett sheep from which the nucleus was taken.

Dolly

# **Exercises**

## 9.1 Fill in the blanks

- 1. an adult frog by the process of
- 2.
- occurs in ..... body.
- 3.
- develops from a cell called .....
- 4.

male gametes called .....

- 9.2 Explain the process of binary fission in amoeba
- 9.3 What is metamorphosis? Explain
- 9.4 Draw a well labeled diagram of a female reproductive system
- 9.4 Enumerate the difference between a zygote and a foetus.
- 9.5 Write true or false
- 1. Fertilization is the process of the fusion of the gametes.
- 2. Reproduction in hens takes place by external fertilization.
- 3. The spores are observed on the sides of the body of Hydra.
- 9.6 In which female reproductive organ does the embryo get embedded?

A tadpole develops into

Internal fertilization

A new human individual

The testes produce the



# Chapter- 10 Reaching the Age of Adolescence

## Adolescence and Puberty

The growth starts from the day we are born but there are sudden changes occurring in the body when we reach in our teens. These changes include change in voice, development of sex organs, increased activity of sweat and sebaceous glands, reaching mental, emotional and intellectual maturity and change in body shape.

The period of life, when the body undergoes changes, leading to reproductive maturity, is called **adolescence**. These changes mark the onset of **puberty**. The most important characteristics of puberty are that boys and girls become capable of reproduction.

## Changes at Puberty

There are several changes that occur at the onset of puberty.

## Increase in Height

The most prominent change at adolescent is the increase in height. Boys suddenly grow taller in comparison to girls.

## Change in Body Shape

In boys at puberty the shoulders broaden, muscles grow prominent and chest also widens whereas in girls the area below the waist broadens.

## Voice Change

As air passes by the vocal cords, they open and close rapidly, resulting in pressure changes that result in the production of sound. The growing voice box in boys can be seen as a protruding part of the throat called Adam's apple. In girls larynx is small and hardly visible externally. They have high pitched voice unlike boys who have deep voice.

## **Increased Activity of Sweat and Sebaceous Glands**

At puberty the secretions from sebaceous and sweat glands also increase due to which girls get acne and pimples on their faces.

# Reaching Mental, Intellectual and Emotional Maturity



It is the time in one's life when the brain has the greatest capacity for learning. Some feel insecure and difficult to adjust to certain changes. All these changes are natural and occur in all.

## **Development of Sex Organs**

The sex organs also develop fully. The boys start secreting sperms from mature testes while in girls the ovaries enlarge and egg begin to mature and release every month.

## Secondary Sexual Characters

Secondary sexual characters are the characters that distinguish male from female. Like in boys the facial hair grows, that is, moustaches and beard along with hairs on chest. In girls breast begins to develop. Apart from these both in boys as well as girls, hair grows under the arms and in the region above the thighs or the pubic region.

## Role of Hormones in Initiating Reproductive Function

Hormones are chemical messengers. These are secretions from **endocrine glands**, or endocrine system. Like the circulatory or reproductive system we also have endocrine system.

The endocrine glands secrete these hormones into the blood stream which reach the target site. This target site then further responds to the hormone. The endocrine glands secrete hormones directly into the bloodstream hence are called ductless glands whereas sweat glands and salivary glands produce their secretions through ducts.

At puberty, the ovaries and testes start secreting estrogen and testosterone respectively that is responsible for the secondary sexual character. Milk secreting glands called as the mammary glands develop inside the breasts. The production of these hormones is under the control of another hormone secreted from an endocrine gland called **pituitary gland**.

# Reproductive Phase of Life in Humans

From the onset of puberty the reproductive phase of an individual starts, that is he or she becomes capable of reproduction because the male or female gametes are secreted from their respective sex organs.

In girls during this time the uterus walls thicken and prepare itself to receive the egg. If the fertilization occurs the embryo gets embedded in the uterus wall and if no fertilization occurs then the released egg and the thickened lining of the uterus along with its blood vessels are shed off. This leads to bleeding or menstruation. The menstrual flow marking the beginning of the puberty is called as **menarche**. The reproductive phase last for 45-50 years of age after which it stops. This Stoppage of menstruation is termed **menopause**.



Menstrual cycle is also controlled by hormones. The cycle includes

- The maturation of the egg, its release,
- Thickening of uterine wall
- Breakdown if pregnancy does not occur.

#### How is the Sex of the Baby Determined?

## Boy or Girl?

Humans have 23 pairs of chromosomes. These chromosomes are thread like structures present in the nucleus of the cell. These contain DNA that posses the genetic information which is passed on to the next generation. Females have two X chromosomes while males have 1 X and 1 Y chromosomes. These are the sex chromosomes. The rest of the 44 chromosomes are called as **autosomes**.

# Human X and Y Chromosomes



#### Hormones other than Sex Hormones

There are other hormones also which are secreted by various glands of our body. The thyroid gland secretes **thyroxine** hormone which increases the rate of cell metabolism and regulates growth. It is caused due to deficiency of iodine in diet.

When the pancreas are not able to produce **insulin** in sufficient amounts the blood glucose level increases which causes diabetes.



#### Glands and hormones secreted by them



Adrenalin helps the body to adjust to stress when one is very angry, embarrassed or worried. These are secreted by adrenal glands. These glands also secrete hormones that maintain the salt balance in blood.

Pituitary also secretes growth hormone which is necessary for the normal growth of a person.

# Role of Hormones in completing the Life History of Insects and Frogs

This change from larva to adult is called **metamorphosis**. Metamorphosis in insects is controlled by **insect hormones**. The thyroxine hormone secreted by the thyroid gland is required for metamorphosis. Thyroxine production requires the presence of iodine in water. If it is not present in water, growth in tadpole stagnates.

# **Reproductive Health**

# Nutritional Needs of the Adolescents

For the proper development and well being, one should have a balanced diet which contains all the essential nutrients.

# Personal Hygiene

Adolescents should also take care of personal hygiene like bathing daily to avoid any bacterial infections.

Girls should be keeping extra cleanliness during menstrual flow and keeping extrack of their menstrual cycle.

# Physical exercise

Physical fitness is also essential hence boys and girls should exercise.

# Say "NO" to Drugs

Drugs are addictive. If you take them once, you feel like taking them again and again. They harm the body in the long run. They ruin health and happiness.

Another concern is HIV. This virus can spread by sharing the syringes used for injecting drugs. It can also be





transmitted to an infant from the infected mother through her milk. The virus can also be transmitted through sexual contact with a person infected with HIV.

# **Exercises**

10.1 Answer in one word for the following

- 1. Protruding voice box in boys
- 2. Glands without ducts
- 3. Endocrine gland attached to brain
- 4. Hormone reaches here through blood stream
- 10.2 Define adolescence.
- 10.3 What is menstruation? Explain.
- 10.4 List changes in the body that take place at puberty.
- 10.5 How is the sex of the baby determined?
- 10.6 Name the hormones that secrete
- a. Insulin
- b. Thyroxine
- c. Adrenalin



# Chapter- 11 Force and Pressure

## Force - A Push or a Pull

A push or a pull on an object is called a **force**. An applied force is a force that is applied to an object by a person or another object. If a person is pushing a desk across the room, then there is applied force acting upon the object. The applied force is the force exerted on the desk by the person.

## Forces are due to an Interaction

At least two objects must interact for a force to come into play. Thus, an interaction of one object with another object results in a force between the two objects.

It is clear from the picture that the man is pushing the car with his hands and applying force. There is interaction between the man and the car.



Force acting on the car by the man

# **Exploring Forces**

When two or more forces are applied in the same direction then the forces add up to give the net force and that's why they are able to push the box easily.

The strength of a force is usually expressed by its magnitude. If the direction or the magnitude of the applied forces changes, its effect also changes. In some cases it adds up where as in other it gets deducted.

# A Force can Change the State of Motion

Force can move a body which was initially at rest; it can bring a moving body to rest; it can change the direction of a moving object and it can change the speed of the moving objects.

# Activity

Take a ball of some soft material and do following tasks: Place the ball on the floor and give it a push. What do you observe? You observe that it starts moving. Now push the ball in the direction opposite to the ball. What will happen? It will stop. Now push the ball again so that it starts moving. Then give it a push at some angle. What happens to the motion of ball? Direction of motion of the ball changes at last take ball between your palms and try to push. What do you observe? You observe that the ball squeezes.



A change in either the speed of an object, or its direction of motion, or both, is described as a change in its state of motion.

Thus, a force may bring a change in the state of motion of an object.

# Force can Change the Shape of an Object

The force can change the size of an object. The shape of a deflated football can be changed by inflating it. When the football is inflated, force is applied on the pump.

## **Contact Forces**

Forces acting between two bodies can be classified into two broad categories: Contact force and non-contact force.

Contact forces act between two objects, which are in direct contact with each other. The two common examples of contact forces are muscular and frictional. When the trucks or cars apply brakes it stops. This happens due to the external force acting between the road and tyres of the vehicle. This force is known as the frictional force.

# **Frictional force**

Frictional force acts between all moving bodies and the surface on which they are moving.

It always acts opposite to the direction of motion and the magnitude of this force depends on the nature of the surface in contact.

## Muscular Force

The force applied by the action of muscles in our body is termed as *muscular force*.

Like humans, animals & birds also use muscular force to run and fly. For example, birds fly in the air by flapping their wings.

# Friction

#### Muscular force

The frictional force on an object in a fluid depends upon its speed with respect to the fluid. The frictional force also depends on the shape of the object and the nature of the fluid.



The friction between two surfaces depends on two factors:

The nature of two surfaces (smoothness or roughness of the two surfaces) More the roughness of a surface, larger is the number of irregularities on its surface & hence greater will be the friction.

> The force with which two surfaces are pressed together

Pressing together two surfaces of objects with a greater force will increase the interlocking in the two surfaces & hence increase the friction.

## Advantages of friction:

- It is the friction between the sole of our shoes & ground that enable us to walk without slipping.
- It is the friction between brake pad & rims that prevents the wheel from moving ahead. Due to this, the running bicycle slows down & finally stops.
- Friction enables us to write on paper.

# Disadvantages of friction:

- > Friction wears away the soles of our shoes.
- Due to friction between the surface of tyres & the surface of road, the tyres wear out gradually.
- Friction wears out the brake pads of vehicles gradually. As a result brake pads of cycles have to be replaced quite often.

# **Non-contact Forces**

Non-contact forces are those forces that act between two objects, such that objects are not in direct contact with each another.

Examples of non-contact forces include magnetic force, electrostatic force and gravitational force.

# Magnetic Force

A magnet is a substance which can attract certain objects like iron, cobalt, nickel etc. towards it. It has two poles namely: North Pole & South Pole. If you bring the South Pole of a bar magnet close to the North Pole of another bar magnet, the magnets will attract each other and if you bring the North Pole of both bar magnets close to each other, the bar magnets will repel each other.



Magnetic force



The force with which they attract and repel each other is known as magnetic force.

## Electrostatic Force

The comb acquires a charge and exerts a force called electrostatic force. Electrostatic force can also act from a distance and is therefore a non-contact force. A body with electrostatic charge can either attract or repel another charged body. Electrostatic force is used to separate solid pollutant particles from smoke given out from factories.

## **Gravitational Force**

The Earth attracts every object which is near or on its surface; towards its centre by a non-contact force known as gravitational force.

It is this gravitational force which makes an apple fall down from the tree and makes the water from a tap to flow down.

Gravitational force depends on the distance between the object and the Earth.

## Pressure

Pressure is the force that acts perpendicularly on a unit surface area. Thus, the formula for pressure is: F/A

The S.I. unit of pressure is Pascal which is equal to Newton per square meter. The force acting on a smaller area exerts a larger pressure as compared to the pressure it exerts on a larger area. This is the reason why drawing pins have pointed tips.



# Applications

- When you cut an apple with a knife, the shaper the knife, the smaller is the area of contact of the knife with the apple. Thus a sharper knife exerts a greater pressure making it easier to cut the apple.
- It is easier to pierce a piece of cardboard with a pin if the pin has a sharp point, as the area of contact is then smaller.
- School bags and shopping bags have broad belts or straps as handles. Narrow string-like handles cause severe pain in the hand because the weight of the bag acts on a small area and so the pressure is considerably higher.
- Porters wear turbans when they have to carry heavy loads on their heads, to increase the area of contact. This reduces the pressure on the head.



## Pressure exerted by Liquids and Gases

Friction exerted by fluids i.e. gases or liquid is termed as fluid friction or drag. The magnitude of drag (fluid friction) depends on

- Speed of the object
- Shape of the object
- Size of the object
- > Nature of fluid



Liquids exert equal pressure at the same depth



A liquid exerts pressure on the walls of the container



Pressure exerted by water at the bottom of the container depends on the height of its column.

When object moves through the fluids, they have to overcome friction acting on them. In this process they lose energy. Therefore efforts are being made to minimize energy by giving special shape to the objects called 'streamlined shape'. That's why cars, airplanes & rockets streamlined.

Pressure at the bottom of the ocean is very high. Deep sea divers wear steel diving suits to prevent their bodies from begin crushed by the tremendous pressure of water exerted on all sides.

Submarines are built of hard thick sheets of metal to withstand the high pressure under water. For the same reason dams are broader at the base than at the top.

An instrument called a monometer is used to measure liquid pressure.

## **Atmospheric Pressure**

Earth is covered with the envelope of gases known as atmosphere. The atmospheric air exists to height of about 1000 km. But beyond 100 km the air is very thin. The pressure exerted by the air present in the atmosphere is called atmospheric pressure. The pressure is equal to force divided by area. So if we assume a long cylinder having a base area equal to one and filled with air, then the weight of air inside it is equal to atmospheric pressure.



# **Exercises**

11.1 A blacksmith hammers a hot piece of iron while making a tool. How does the force due to hammering affect the piece of iron?

11.2 You rubbed an inflated balloon against a wall after it has been rubbed with a piece of synthetic cloth. What do you think would happen? What force might be responsible for the attraction between the balloon and the wall?

11.3 Name the forces acting on a plastic bucket containing water held above ground level in your hand. Why the forces acting on the bucket do do not bring a change in its state of motion.

11.4 A rocket has been fired upwards to launch a satellite in its orbit. Name the two forces acting on the rocket immediately after leaving the launching pad.11.5 Fill in the blanks in the following statements:

- 1. The pressure exerted by air around us is known as .....
- 2. Force has ..... as well as .....
- 3. The force exerted by a charged body on another charged or uncharged body is known as .....
- 4. The force exerted by a magnet to another magnet is an example of a ..... force.



# Chapter- 12 Friction

## **Force of Friction**

The force which always opposes the motion of one object over another object in contact with it is called **friction**.

The force of friction always acts in a direction opposite to the direction in which an object moves (or tends to move).

## Cause of friction

Friction is caused by the interlocking of irregularities in the surfaces of two objects which are in contact with each other. In order to move one object over the other, we have to apply force to overcome interlocking.

# Factors affecting Friction

The friction between two surfaces depends on two factors:

The nature of two surfaces (smoothness or roughness of the two surfaces) More the roughness of a surface, larger is the number of irregularities on its surface & hence greater will be the friction.

## The force with which two surfaces are pressed together

Pressing together two surfaces of objects with a greater force will increase the interlocking in the two surfaces & hence increase the friction.

# Activity

Make an inclined surface with the help of a wooden board. Mark a point on the upper end of the inclined surface. Now take a pencil and place it on the marked point. Slide the pencil from the marked point. Note down the distance travelled by the pencil as it slides on the table. Now place a cloth over the table. Slide the pencil again from the marked point. Note down the distance travelled by the pencil. Do you find any change in the distance travelled by the



pencil? Now put the some sand on the table. Again slide a pencil from the marked point. Note down the distance travelled by the pencil this time. Now as we compare the three readings of the distance covered by pencil in the three cases; we will see that when there was nothing on table pencil travelled maximum and when there was sand on table, pencil travelled minimum.



This indicates that the sand offered maximum friction to the pencil and hence it stopped after travelling a small distance only.

## Friction: A Necessary Evil

Friction is a necessary evil because in some cases, friction is useful but in other cases friction is harmful.

# Advantages of friction

- It is the friction between the sole of our shoes & ground that enable us to walk without slipping.
- It is the friction between brake pad & rims that prevents the wheel from moving ahead. Due to this, the running bicycle slows down & finally stops.
- It is due to the friction between tip of the pencil & paper that rubs off black graphite particles from the tip of the pencil which stick to the paper leave black marks on paper. In case of smooth surface friction is not sufficient to rub off that black
- graphite.
  Friction enables us to light a matchstick. When we rub the matchstick against a rough surface, then friction between the tip of matchstick & rough surface produces heat, as a result matchstick catches fire.

# Disadvantages of friction

- > Friction wears away the soles of our shoes.
- Due to friction between the surfaces of tyres & the surface of road, the tyres wear out gradually.
- Friction wears out the brake pads of vehicles gradually. As a result brake pads of cycles have to be replaced quite often.
- Friction wears out steps of staircases in foot overbridges.
- Friction produces unwanted heat which can damage & reduce the efficiency of machines.



Striking a match stick produces fire by friction



Wear and tear of machines are caused due to friction



## Friction is of three types:

(a) Static friction: The maximum frictional force present between two objects when one object just tends to move or slip over the surface of the other object. The object remains static in this case.

(b) Sliding friction: The frictional force present when one object slides over the surface of another object it is known as sliding friction.

When the object starts sliding, the contact point on its surface, do not get enough time to lock into the contact points on the other object. So sliding friction is always less than static friction.

(c) Rolling friction: When an object rolls over the surface of another object, then the frictional force that comes into picture is called rolling friction. Rolling friction is less than sliding friction.

## **Minimizing friction**

- By using a suitable lubricant, like oil (for light machinery) or grease (for heavy machinery). This helps because fluid friction is less than solid friction.
- By using wheels and ball bearings
- Use of wheels between surface moving over each other reduces friction. Ball bearings have small balls of steel between steel surfaces. Because of the balls the steel surfaces can easily moves over each other.
- By making the rubbing surfaces smooth by polishing them.



Oil is added to reduce friction

Friction due to air (air resistance) or water is reduced by using streamlined shapes in aeroplanes or ships. A streamlined shape is narrow in front and broader at the back. Birds and aquatic animals have streamlined shapes which held them in flying or swimming.







# **Increasing friction**

- By making the moving surfaces rough, e.g. tyres have designs and patterns with grooves on the surface to increase resistance with the road. This prevents slipping of the tyres on a wet road.
- Sand and gravel is strewn on slippery ground during the rainy season to increase friction. It is then easier to walk on the ground.
- To increase friction, spikes are provided in the soles of shoes used by players and athletes.

# **Fluid Friction**

Friction exerted by fluids i.e. gases or liquid is termed as fluid friction or drag.

The magnitude of drag (fluid friction) depends on



Spikes in shoes to increase friction

- Speed of the object
- Shape of the object
- Size of the object
- Nature of fluid

When object moves through the fluids, they have to overcome friction acting on them. In this process they lose energy. Therefore efforts are being made to minimize energy by giving special shape to the objects called 'streamlined shape'. Due to this the cars, airplanes & rockets are streamlined.

# Exercises

- 12.1 What kind of friction comes into play:
- (a) When a block of wood kept on table moves slowly?
- (b) When a block of wood kept on table just tends to move (or slip)
- 12.2 What is the cause of friction? Which type of surfaces produce:
  - a. least friction
  - b. too much friction

12.3 Why does a matchstick light when we strike it on a rough surface?

12.4 Why do brake pads of bicycles have to be replaced quite often?

12.5 What prevents you from slipping every time you take a step forward?

12.6 What happens when you rub your hands vigorously for a few seconds? Why does this happen?

12. 7 What enables us to fix a nail in a wall & knot to be tied?



# Chapter-13 Sound

## Sound is Produced by a Vibrating Body

Sound is a form of energy which produces a sensation of hearing in our ears. Sound is vibration transmitted through a solid, liquid, or gas, composed of frequencies within the range of hearing and of a level sufficiently strong to be heard, or the sensation stimulated in organs of hearing by such vibrations. The vibrating body can be a string on a violin or piano, a column of air in an organ pipe or clarinet, an animal skin or piece of plastic stretched over a drum, or the vocal cords in a person's throat.

#### Sound Produced by Humans

In humans, the sound is produced by the voice box or the larynx. Put your fingers on the throat, you find a hard hump that seems to move when you swallow. This part of the body is known as the voice box. This is at the upper end of the windpipe. Two vocal cords are stretched across the voice box or larynx in such a way that it leaves a narrow slit between them for the passage of air. When the lungs force air through the suit the vocal cords vibrate, producing sound.

The vocal cords in men are about 20mm long. In women these are about 5mm shorter. Children have very short vocal cords. This is the reason why the voices of men, women and children are different.

## Sound Needs a Medium for Propagation

Human voice originates from the vibrations of the vocal chords and the sound from the musical instruments is due to the vibrations of the air columns. Sound travels in the form of longitudinal wave and it requires a material medium for its propagation. This can be explained by following example



Vibrating strings produce sound



Larynx



## Electric bell suspended inside an airtight glass bell jar

An electric bell is suspended inside an airtight glass bell jar connected to a vacuum pump. As the electric bell circuit is completed, the sound is heard. Now if the air is slowly removed from the bell jar by using a vacuum pump, the intensity of sound goes on decreasing and finally no sound is heard when all the air is drawn out. We would be seeing the hammer striking the gong repeatedly. This clearly proves that sound requires a material for its propagation.

Sound can propagate not only through gases but also through solids and liquids. Some materials like air, water, iron etc can easily transmit sound energy from one place to another. On the other hand materials like blanket and thick curtains absorb most of the sound energy.

## We hear Sound through Our Ears

#### Structure of the Ear

#### The outer ear:

The outer ear consists of the pinna which collects the sound vibrations from the air. These sound vibrations reach to the ear drum through ear canal/auditory canal.

#### Middle ear:

It is air filled cavities which lies just beyond the ear drum and is surrounded by a bone.

There are three bones in the cavity. The hammer (malleus), anvil (incus) & stirrup (stapes).

These small bones help to amplify the vibrations.

#### Inner ear:

The inner ear is embedded in the bone of the skull and is filled with a liquid. It consists of main organ of hearing called Cochlea that carries the vibrations in the form of electrical impulses from the Auditory nerve to the brain.

#### Persistence of Hearing:-

The impression of sound heard by our ears persists in our mind for 1/10th of a second. Sound takes only 1/10th of a second to reach our ear when the sound producing body is 33 meter away from the ear.







Sound is always reflected back when it falls on the objects around them, these reflected sound reach to our ear in the time less than 1/10<sup>th</sup> of a second.

If the reflected sound and the direct sound reach to our ear in mingled form then it is slightly difficult to distinguish between them.

Reflected sound can only be heard when the reflecting surface is 17 meter away from the ear.

# Working of the Ear

Sound waves enter the external ear and strike on the eardrum causing it to vibrate.

These vibrations are amplified many times by three bones:

- (i) Hammer
- (ii) Anvil
- (iii) Stirrup, in the middle ear and transmitted to the inner ear by the hollow bones of the middle ear.

The inner ear has coiled tube called cochlea.

The tiny hairs present in it picks up the vibrations and sends the signals to the brain through auditory nerve to the brain, which interprets and make us hear sounds.

# Amplitude, Time Period and Frequency Of A Vibration

Amplitude:- The maximum displacement from the central position of vibrating body is called amplitude.

SI unit of amplitude is meter.

Frequency:-The number of cycles completed by a vibrating body in one second is called frequency.

Frequency is measured in number of cycle per second. Therefore the SI unit of frequency is Hertz.

Frequency = Number of cycle completed/second.

Time period: The time taken to complete one vibration is called time period SI unit of time period is seconds

# Loudness and Pitch

Loudness of sound: Loudness is the measure of the energy possess by the sound. It depends upon the amplitude.

More the amplitude more is the loudness and farther the sound will travel Unit of loudness is decibel.

Pitch: The shrillness of a sound is called pitch. It depends upon the Frequency.

# Audible and Inaudible Sounds

The sound that can be heard by human ears is called as audible sound. The range of audible sound is 20 Hz to 20,000 Hz.


Ultrasonic sounds are produced by dolphins, bats and tortoises.

Infrasonic sounds are produced by whales and elephants and they can observe the earthquake before the main shock waves.

Bat is able to locate any obstacle in its path due to the reflection of the ultrasonic waves from the object

#### Noise and Music

We hear different types of sounds around us. Some sounds are pleasant to the ear, whereas some are not. Do we enjoy the sounds produced by horns of buses and trucks? Such unpleasant sounds are called noise. In a classroom, if all the students speak together, it is unpleasant and called noise.

On the other hand we enjoy sounds from musical instruments. Musical sound is one which is pleasing to the ear. Sound produced by a harmonium is a musical sound.

The string of a sitar also gives out a musical sound.

### **Noise Pollution**

Noise pollution is unwanted human-created sound that disrupts the environment. The dominant form of noise pollution is from transportation sources, principally motor vehicles, referred to as environmental noise.

### Sources of noise pollution

The overarching cause of most noise worldwide is generated by transportation systems, principally motor vehicle noise, but also including aircraft noise and rail noise.

Hybrid vehicles for road use are the first widely sold automobiles in 100 years to achieve significant noise source reduction.

Poor urban planning may also give rise to noise pollution, since juxtaposition of industrial to residential land uses, for example, often results in

adverse consequences for the residential acoustic environment.

Besides transportation noise, other prominent sources are office equipment, factory machinery, appliances, power tools, lighting hum and audio entertainment systems. With the popularity of digital audio player devices, individuals in a noisy area might increase the volume in order to drown out ambient sounds. Construction equipment also produces noise pollution.



#### Source of noise pollution





### Measures to Limit Noise Pollution

- > To control noise, we must control the sources of noise.
- For this, silencing devices must be installed in air craft engines, transport vehicles, industrial machines and home appliances.
- > The noisy operations must be conducted away from any residential area.
- > Noise producing industries should be set up away from such areas.
- Use of automobile horns should be minimized.
- > TV and music systems should be run at low volumes.
- Trees must be planted along the roads and around buildings to cut down on the sounds reaching the residents, thus reducing the harmful effects of noise pollution.

# **Exercises**

13.1 On what factor loudness of sound deepens on?

- 13.2 What is the audible range of the frequency for human ear?
- 13.3 Why the voices of men, women and children are different.
- 13.4 Define oscillatory motion

13.5 The sound from a mosquito is produced when it vibrates its wings at an average rate of 300 vibrations per second. What is the time period of the vibration?

13.6 A pendulum oscillates 20 times in 8 seconds. Calculate its time period and frequency.



# Chapter- 14 Chemical Effects of Electric Current

### **Chemical Effects of Electric Current**

The materials, which allow electric current to pass through them, are good conductors of electricity. On the other hand, materials, which do not allow electric current to pass through them easily, are poor conductors of electricity.

Metals such as copper and aluminum conduct electricity whereas materials such as rubber, plastic and wood do not conduct electricity.



Metals are good conductors of electricity

When electric current flows through a bulb then due to heating effect of current, the filament of the bulb gets heated up to a high temperature and starts glowing. Now for a liquid having low electrical conductivity, the current flowing through the circuit is very weak due to which the filament does not get heated sufficiently & hence the bulb does not glow. Therefore LED is used in place of bulb because LED glows even when weak electric current flows in the circuit.

### **Conductivity of Liquid**

To test whether a liquid allows electric current to pass through it or not, we can use the tester. When the liquid between the two ends of the tester allows the electric current to pass, the circuit of the tester becomes complete. The current flows in the circuit and the bulb glows. When the liquid does not allow the electric current to pass, the circuit of the tester is not complete and the bulb does not glow.

In some situations even though the liquid is conducting, the bulb may not glow. Due to the heating effect of current, the filament of the bulb gets heated to a high temperature and it starts glowing. However, if the current through a circuit is too weak, the filament does not get heated sufficiently and it does not glow. Though a material may conduct electricity, it may not conduct it as easily as a metal. As a result, the circuit of the tester may be complete and yet the current through it may be too weak to make the bulb glow.



Most liquids that conduct electricity are solutions of acids, bases and salts.

# **Chemical Effects of Electric Current**

The passage of electric currents through liquids causes heating just as it does in solids. More importantly, chemical activity may occur in the liquids around the electrodes.

Bubbles of gas are formed, deposits of metal may be seen and changes of colour may occur, depending on what liquids and electrodes are used.

**Electrolysis:** The passage of an electric current through a liquid causes chemical changes. This process is known as electrolysis.

# Activity

Take out carbon rods carefully from two discarded cells. Clean their metal caps with sand paper. Wrap copper wires around the metal caps of the carbon rods and join them to a battery. We call these two rods **electrodes**. Pour a cupful of water in a glass/plastic bowl. Add a teaspoonful of salt or a few drops of lemon juice to water to make it more conducting. Now immerse the electrodes in this solution. Make sure that the metal caps of the carbon rods are outside the water. Wait for 3-4 minutes. Observe the electrodes carefully. The passage of an electric current through a conducting solution causes chemical reactions. As a result, bubbles of a gas may be formed on the electrodes.

# Electroplating

The process of depositing a layer of any desired metal on another material by means of electricity is called electroplating. It is one of the most common applications of chemical effects of electric current. Electroplating is a very useful process. It is widely used in industry for coating metal objects with a thin layer of a different metal. The layer of metal deposited has some desired property, which the metal of the object lacks. For example, chromium plating is done on many objects such as car parts, bath taps, kitchen gas burners, bicycle handlebars, wheel rims and many others.



However, chromium is expensive and it may not be economical to make the whole object out of chromium.

So the object is made from a cheaper metal and only a coating of chromium over it is deposited.



### Advantages of chromium

It has a shiny appearance. It does not corrode. It resists scratches.

Tin cans, used for storing food, are made by electroplating tin onto iron. Tin is less reactive than iron. Thus, food does not come into contact with iron and is protected from getting spoilt.

Cutlery and jewellery items are often silver plated - they have the appearance of silver but are much less expensive.



Chromium plating on vehicles

### Activity

Take two copper sulphate and two copper plates of size around 10 cm × 4 cm. Take 250 mL of distilled water in a clean and dry beaker. Dissolve two teaspoonfuls of copper sulphate in it. Add a few drops of dilute sulphuric acid to copper sulphate solution to make it more conducting. Clean copper plates with sand paper. Now rinse them with water and dry them. Connect the copper plates to the terminals of a battery and immerse them in copper sulphate solution. Allow the current to pass for about 15 minutes. Now remove the electrodes from the solution and look at them carefully.



**Electroplating of copper** 

When electric current is passed through the copper sulphate solution, copper sulphate dissociates into copper and sulphate. The free copper gets drawn to the electrode connected to the negative terminal of the battery and gets deposited on it. From the other electrode, a copper plate, an equal amount of copper gets dissolved in the solution. Thus, the loss of copper from the solution is restored and the process keeps going. This means that copper gets transferred from one electrode to the other.



# **Exercises**

14.1 Why does a magnetic needle shows deflection when free ends of a tester are dipped into a solution?

14.2 Fill in the blanks

1. The process of depositing a layer of any desired metal on another material, by means of electricity, is called \_\_\_\_\_

2. The passage of an electric current through a conducting solution causes \_\_\_\_\_

14.3 Why is it not safe for the electrician to carry out electrical repairs outdoors during heavy downpour? Give reasons

14.4 The compass needle deflects more in the case of seawater and less in case of rain water. Give reasons to support your answer.

14.5 Draw a simple circuit showing the electroplating of copper.



# Chapter- 15 Some Natural Phenomena

# Lightning

Lighting is the large electrical spark that usually occurs during thunderstorm. During thunder storm air currents move up while water droplets move down at very high speed.

# The Sparks that the Greeks Knew About

Around 600 B.C. Greek people have observed that if they rub a resin "Amber" with the animal fur, it can attract their hair because of the electric charges developed by rubbing.



Lightning

In 1972, Sir Benjamin Franklin proved that the spark of our hair rubbing with woolen clothes and that of Lighting are both same!

# Charging by rubbing

# Activity

Take a plastic ruler and some small paper pieces. Rub it with your dry hair. Now bring the ruler close to the paper pieces without touching them. We see that the paper pieces getting attracted towards the rubbed ruler. It is because as we rub two objects vigorously we actually charge them.

The charges acquired by rubbing are static charges. They do not move. When charges move, it is electric current.

Electric current is the motion of charges through a conductor.

# Types of Charges and their Interaction

There are two types of charges. They are positive charge (+) and negative charge (-).

Two charged bodies may attract or repel each other.

Like (similar) charges repel each other and unlike (dissimilar) charges attract each other.







# Like charges repel each other

Inflate two balloons and hang them in such a way that they do not touch each other. Rub both the balloons with a piece of woollen cloth and release them. They repel each other.

# Unlike charges attract each other

Charge a plastic refill by rubbing with polythene and keep it in a glass tumbler. Charge an inflated balloon by rubbing with a piece of woolen cloth and bring it near the charged plastic refill. They attract each other.



# Transfer of Charge

Static electric charges can be transferred using a metal conductor.

A device used to test whether an object is carrying charge or not is known as an electroscope. It is also used to detect charges. If foils move away then body is charged and if foils remain at the same position then body touched with the wire is not charged.

The process of transferring charges of a charged body to the ground or earth is called earthing.



### The Story of Lightning

When wind and droplets rub with each other they get charged. This causes the cloud to acquire electrical charge.

The upper part of cloud acquires positively charges and lower part of cloud acquires negative charges.



Accumulation of charges leading to lightning

There is accumulation of positive charges near the ground fall. As time passes, the accumulation of charges keep increase, at one point time, the accumulation of charges so high that air cannot restrict the charges through it.

It is at this point, charges carried by cloud discharged to the ground through the flash. This flash is called lighting.

### Lightning Safety

Hearing thunder is an alert to rush to a safer place. After hearing the last thunder, wait for some time before coming out of the safe place.

Open vehicles, like motorbikes, tractors, construction machinery and open cars are not safe. Open fields, tall trees, shelters in parks, elevated places do not protect us from lightning strokes. Carrying umbrella is not a good idea at all during thunderstorms. If in a forest, we should take shelter under shorter trees. If no shelter is available and we are in an open field, stay far away from all trees. We should stay away from poles or other metal objects. We should not lie on the ground. Instead, we should squat low on the ground.

**Inside the House:** Lightning can strike telephone cords, electrical wires and metal pipes. During a thunderstorm contact with these should be avoided. It is safer to use mobile phones and cordless phones. Bathing should be avoided during thunderstorms to avoid contact with running water. Electrical appliances like computers, TVs, etc., should be unplugged. Electrical lights can remain on. They do not cause any harm.

Lightning Conductors: Lightning Conductor is a device used to protect buildings from the effect of lightning. A metallic rod, taller than the building, is installed in the walls of the building during its construction. One end of the rod is kept out in the air and the other is buried deep in the ground. The rod provides easy route for the transfer of electric charge to the ground. The metal columns used during



construction, electrical wires and water pipes in the buildings also protect us to an extent. But do not touch them during a thunderstorm.

# Earthquakes

An earthquake is a sudden shaking or trembling of the earth lasting for a very short time. It is caused by a disturbance deep inside the earth's crust. Earthquakes occur all the time, all over the earth. They are not even noticed. Major earthquakes are much less frequent. They can cause immense damage to buildings, bridges, dams and people. There can be a great loss to life and property. The earthquakes can cause floods, landslides and tsunamis.

### Causes of Earthquake

The outermost layer of the earth is not in one piece. It is fragmented. Each fragment is called a tectonic plate. These plates are in continual motion. When they brush past one another, or a plate goes under another due to collision, they cause disturbance in the earth's crust. It is this disturbance that shows up as an earthquake on the surface of the earth.

Tremors on the earth can also be caused when a volcano erupts, or a meteor hits the earth, or an underground nuclear explosion is carried out. However, most earthquakes are caused by the movement of earth's plates.



Movement of earth plate during earthquake

Since earthquakes are caused by the movement of plates, the boundaries of the plates are the weak zones where earthquakes are more likely to occur. The weak zones are also known as seismic or fault zones. In India, the areas most threatened are Kashmir, Western and Central Himalayas, the whole of North East, Rann of Kutch, Rajasthan and the Indo - Gangetic Plane. Some areas of South India also fall in the danger zone.

# Seismograph

The tremors produce waves on the surface of the earth. These are called seismic waves. The waves are recorded by an instrument called the **seismograph**. The



instrument is simply a vibrating rod, or a pendulum, which starts vibrating when tremors occur. A pen is attached to the vibrating system. The pen records the seismic waves on a paper which moves under it.

### **Protection against Earthquakes**

It is, important that we take necessary precautions to protect ourselves all the time. People living in seismic zones, where the earthquakes are more likely to occur, have to be specially prepared. First of all, the buildings in these zones should be designed so that they can withstand major tremors. Modern building technology can make it possible. It is advisable to make the structure simple so that it is 'Quake Safe'.

• Consult qualified architects and structural engineers. In highly seismic areas, the use of mud or timber is better than the heavy construction material. Keep roofs as light as possible. In case the structure falls, the damage will not be heavy.

• It is better if the cupboards and shelves are fixed to the walls, so that they do not fall easily.

• Be careful where you hang wall clocks, photo-frames, water heaters etc., so that in the event of an earthquake, they do not fall on people.

• Since some buildings may catch fire due to an earthquake, it is necessary that all buildings, especially tall buildings, have fire fighting equipment in working order.

# Exercises

15.1 Does a charged body lose its charge if we touch it with our hand? Explain 15.2 How is the destructive energy of an earthquake measured? An earthquake measures 3 on this scale. Suggest three measures to protect ourselves from lightning. 15.3 Explain why a charged balloon is repelled by another charged balloon whereas an uncharged balloon is attracted by another charged balloon?

15.4 Name the instrument used to detect a charged body. Also draw its diagram.

15.5 What are the measures taken during lightening?

15.6 What is earthing done in building?



# Chapter- 16 Light

### What makes Things Visible

When beam of light strikes on the surface of medium and after striking it goes in same medium is called reflection.

The objects which shine in the light of other objects are called **illuminated** objects e.g. moon receives light from the sun and reflects it. That's how we see the moon. The objects which emit their own light are known as **luminous** objects. E.g. sun, fire, flame of a candle and an electric lamp.

### Laws of Reflection

The angle between the normal and incident ray is called **angle of incidence** ( $\angle$ i). The angle between the normal and reflected ray is known as the **angle of reflection** ( $\angle$ *r*) shown in figure.

There are the laws of reflection

The angle of incidence is always equal to the angle of reflection i.e.  $\angle i = \angle r$ . The incidence ray, the normal at the point of incidence and the reflected ray all lie in the same plane.

The image formed by a plane mirror is



virtual, exert and lateral inversion it is defined as, in an image formed by a mirror the left of the object appears on the right and the right appears on the left.

### **Regular and Diffused Reflection**

### Image formation by plane mirror

#### Irregular surfaces

When all the parallel rays reflected from a plane surface are not parallel, the reflection is known as **diffused or irregular reflection**. It is due to the irregularities in the reflecting surface as shown.



Irregular surfaces



### **Regular reflection**

The reflection from smooth surface like that of a mirror is called **regular reflection** as shown in figure. Images are formed by regular reflection.



### Multiple Reflected Rays

**Regular surfaces** 

The light reflected from one reflecting surface, if falls on another reflecting surface will get reflected again and this process can continue any number of times, according to the number of reflecting surfaces used and their orientation. Periscopes are used in submarines, tanks and also by soldiers in bunkers to see things outside.

### Multiple Images

A number of images formed by mirrors placed at an angle to one another. This is used in a kaleidoscope to make numerous beautiful patterns.

### Kaleidoscope

A kaleidoscope is a tube of mirrors containing loose coloured beads, pebbles or other small coloured objects. The viewer looks in one end and light enters the other end, reflecting off the mirrors. Typically there are two rectangular lengthwise mirrors. Setting of the mirrors at 45° creates eight duplicate images of the objects, six at 60°, and four at 90°. As the tube is rotated, the tumbling of the coloured objects presents the viewer with varying colours and patterns. A kaleidoscopic point is a point of intersection of two or more lines of reflection symmetry.

#### Sunlight – White or Coloured

Sunlight consists of several colours. White light is actually a mixture of all these colours, it can be separated by using a prism (similar process happens during the formation of rainbow, where water droplets act as prism). The process of scattering of sunlight is called dispersion.



**Dispersion through prism** 



### Sunlight - White or Coloured

Sunlight consists of several colours. White light is actually a mixture of all these colours, it can be separated by using a prism (similar process happens during the formation of rainbow, where water droplets act as prism). The process of scattering of sunlight is called dispersion.



**Dispersion through prism** 

### Activity

Take a bowl filled with water. Put a plane mirror strip in it lengthwise. This is our prism set up. Now take this set up at a place where plenty of Sun light is coming. Adjust the set up such that whatever is reflected by the mirror falls on the wall or some screen which should be white in color. What do you observe? We observe the seven colors instead of white light on the wall. Hence we have made a set up to see the dispersion of light on our own.

### Structure of Eye

Human eye has a roughly spherical shape. The outer coat of the eye is white. Its transparent front part is called cornea, behind the **cornea** is a dark muscular structure called **iris**. In the iris there is a small opening called the **pupil**. The size of the pupil is controlled by the iris. The iris is that part of eye which gives iris its distinctive colour.

The lens focuses light on the back of the eye, on a layer called **retina**. It is consist of nerve cells. There are two kinds of cells.

- Cones, which are sensitive to bright light
- Rods, which are sensitive to dim light





Cones sense colour. At the end of the optic nerve and retina, there are no sensory cells, so no vision is possible at that spot. This is called the **blind spot**.

The impression of an image does not vanish immediately from the retina. It persists there for about  $1/16^{th}$  of a second. So, if still images of a moving object are flashed on the eye at the rate faster than 16 per second, then the eye perceives this object as moving.

The minimum distance at which the eye can see objects distinctly varies with age. The most comfortable distance at which one can read with a normal eye is about 25 cm.

### Care of Eyes

It is necessary that we take proper care of our eyes. If there is any problem we should go to an eye specialist. Have a regular checkup. If advised, use suitable spectacles.

Too little or too much light is bad for eyes. Insufficient light causes eyestrain and headaches. Too much light, like that of the sun, a powerful lamp or a laser torch can injure the retina. Do not look at the sun or a powerful light directly.

Never rub eyes. If particles of dust go into eyes, wash eyes with clean water. If there is no improvement go to a doctor. Wash eyes frequently with clean water.

Always read at the normal distance for vision. Do not read by bringing book too close to eyes or keeping it too far.

Lack of vitamin A in foodstuff is responsible for many eye troubles. Most common amongst them is night blindness.

One should therefore include in the diet components which have vitamin A. Raw carrots, broccoli and green vegetables (such as spinach) and cod liver oil are rich in vitamin A. Eggs, milk, curd, cheese, butter and fruits such as papaya and mango are also rich in vitamin A.

### Visually Challenged Persons Can Read and Write

Some persons, including children, can be visually handicapped. They have very limited vision to see things. Some persons cannot see at all since birth. Some persons may lose their eyesight because of a disease. Such persons try to identify things by touching and listening to voices more carefully. They develop their other senses more sharply.

However, additional resources can enable them to develop their capabilities further.



### Braille System

The most popular resource for visually challenged persons is known as Braille. The present system was adopted in 1932. There is Braille code for common languages, mathematics and scientific notation. Many Indian languages can be read using the Braille system. Visually challenged people learn the Braille system by beginning with letters, then special characters and letter combinations. Methods depend upon recognition by touching. Each character has to be memorised. Braille texts can be produced by hand or by machine. Type writer - like devices and printing machines have now been developed.

# Exercises

16.1 With the help of a diagram draw the structure of an eye.

16.2 How many images of a candle will be formed if it is placed between two parallel plane mirrors separated by 40 cm?

16.3 Two mirrors meet at right angles. A ray of light is incident on one at an angle of 30° as shown in Fig. 16.19. Draw the reflected ray from the second mirror.



16.4 Differentiate between regular and diffused reflection. Does diffused reflection mean the failure of the laws of reflection?16.5 Enlist the two laws of reflection.



# Chapter- 17 Stars and the Solar System

### The Moon

Our solar system consists of an average star we call the Sun, the planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. It includes: the satellites of the planets; numerous comets, asteroids, and meteoroids; and the interplanetary medium.



#### The moon

The moon is the brightest object in the night sky. The stars, the planets, the moon and many other objects in the sky are called celestial objects. The various shapes of the bright part of the moon as seen during a month are called **phases of the moon**.

The Moon is Earth's only natural satellite and the fifth largest satellite in the Solar System. The average centre-to-centre distance from the Earth to the Moon is 384,403 km, about thirty times the diameter of the Earth. The Moon makes a complete orbit around the Earth every 27.3 days (the orbital period), and the periodic variations in the geometry of the Earth-Moon-Sun system are responsible for the lunar phases that repeat every 29.5 days.

The Moon is the only celestial body to which humans have travelled and upon which humans have performed a manned landing.

### The Moon's Surface

### **Eclipses**

Eclipses can occur only when the Sun, Earth, and Moon are all in a straight line. Solar eclipses occur near a new moon, when the Moon is between the Sun and Earth. In



contrast, lunar eclipses occur near a full moon, when the Earth is between the Sun and Moon.

Because the Moon's orbit around the Earth is inclined by about 5° with respect to the orbit of the Earth around the Sun, eclipses do not occur at every full and new moon.



For an eclipse to occur, the Moon must be near the intersection of the two orbital planes.

The periodicity and recurrence of eclipses of the Sun by the Moon, and of the Moon by the Earth, is described by the soars cycle, which has a period of approximately 6 585.3 days (18 years 11 days 8 hours).

### The Stars

A star is a massive, luminous ball of plasma that is held together by gravity. The nearest star to Earth is the Sun, which is the source of most of the energy on Earth. Other stars are visible in the night sky, when they are not outshone by the Sun.

For most of its life, a star shines due to thermonuclear fusion in its core releasing energy that traverses the star's interior and then radiates into outer space. Almost all elements heavier than hydrogen and helium were created by fusion processes in stars. The total mass of a star is the principal determinant in its evolution and eventual fate. Other characteristics of a star are determined by its evolutionary history, including the diameter, rotation, movement and temperature.

# Constellations

Constellation is what astronomers call an asterism: a group of celestial bodies (usually stars) that appear to form a pattern in the sky or appear visibly related to each other. Examples are Orion (which appears like a human figure with a belt, often referred to as "The Hunter"), Leo (which contains bright stars that outline the form of a lion), Scorpius (which can seem reminiscent of a scorpion), and Crux (a cross).

Constellations are names for groups of stars that appear to form shapes in the sky. They were given their names many hundreds of years ago to help us remember the stars. We use constellations to divide up the sky; finding one can help us find another because constellations move so slowly that, in our lifetime, they will always be found in about the same place.

*Ursa Major* or **Big Dipper** or **Great** Bear or **Saptarshi** is a very famous constellation which is seen in the summers during early night time in the Northern Hemisphere.

It has seven bright stars and looks like a big inverted spoon or a question mark in the sky. This constellation helps us locating Pole Star.

There is another prominent constellation which can be seen easily in the winters during late even



Ursa Major



'nt sky in the

Northern hemisphere. It is **Orion** the Hunter. There are around eight stars which are arranged in a shape of a Man. There is one face star, two shoulder stars, three belt stars and two knee stars. Orion can be used to locate the brightest star in the night sky "SIRIUS".

There is another constellation "Cassiopeia - the princess". It depicts a princess sitting on a chair. It looks like a distorted W or M in the sky. It can be seen in the winters during early part of night in the Northern Hemisphere.

"Leo - The Lion" is another prominent constellation in the night sky. It is visible in springs during early night time in the Northern Hemisphere.

# The Solar System

The Sun and the celestial bodies which revolve around it form the solar system. It consists of large number of bodies such as planets, comets, asteroids and meteors. The gravitational attraction between the Sun and these objects keeps them revolving around it. The Earth also revolves around the Sun. It is a member of the solar system.



The Solar system

It is a planet. There are seven other planets that revolve around the Sun. The eight planets in their order of distance from the Sun are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

# The Planets

The planets look like stars, but they do not have light of their own. They merely reflect the sunlight that falls on them. The simplest method of identifying planets from stars is that stars twinkle, whereas planets do not. Also the planets keep changing their positions with respect to the stars. A planet has a definite path in which it revolves around the Sun. This path is called an **orbit**. The time taken by a planet to complete one revolution is called its period of **revolution**. The period of revolution increases as the distance of the planet increases from the sun.

Some planets are known to have moons/satellites revolving round them. Any celestial body revolving around another celestial body is called its satellite.



### **Planets Vs Stars**

- 1. Planets do not have their own light but stars have their own light.
- 2. Planets do not twinkle but stars twinkle.
- 3. Planets revolve around star but stars do not revolve around planets.
- 4. Planets could be rocky or gaseous but stars are only made up of gases.

### The Sun

- 1. Like all stars it is a big ball of gas and fire.
- 2. It is the nearest star to Earth.
- 3. Light from sun reaches us in approximately 8 minutes. That is why we say sun is 8 Light minutes away from us.
- 4. It is the major source of energy on the Earth.

# Mercury (Budh)

- 1. It is a rocky planet.
- 2. It is the nearest to the Sun and smallest planet of the Solar system.
- 3. It has no satellite or moon.
- 4. Since it is very close to Sun so it is difficult to observe it from the Earth; it can be observed from the places where trees or buildings do not obstruct the view of Horizon.

### Venus (Shukra)

- 1. It is a rocky planet.
- 2. It has a very thick atmosphere having sulphur which traps heat and hence makes it hottest planet of the Solar system.
- 3. It has thick clouds which reflect big amount of light and hence make Venus the brightest planet in the night sky.
- 4. It has no moon of its own.
- 5. It rotates on its axis from east to west which is opposite to that of Earth's rotation.



Venus



- 6. It is either seen before Sunrise or after Sunset. So it is often called Morning or Evening star.
- 7. It shows phases like moon as seen from the Earth with the help of Telescope.

# The Earth

- 1. It is a rocky planet.
- It is the only planet having Life on it because of optimum distance, atmosphere, water and ozone layer.
- 3. It is tilted about its axis because of which we observe different seasons on the Earth.
- 4. It has one moon called 'Luna'.
- 5. Because of greenery and water it is called Blue-Green planet.



Earth

# Mars (Mangal)

- 1. It is also a Rocky planet.
- 2. It is red in color because of presence of iron on its surface. So it is called red planet.
- 3. It has two moons phobos and deimos.

# Jupiter (Brihaspati)

- 1. It is a gaseous planet.
- 2. It is the largest planet of the solar system. 1300 Earths can accommodate in it!
- 3. It has rings around it.
- 4. It has more than 60 moons. 4 moons can be seen from the Earth with the help of telescope.

# Saturn (Shani)

- 1. It is a gaseous planet.
- 2. It has rings of ice around it which can be seen with the help of telescope.



- 3. It is yellowish in color.
- 4. It is less dense than water which means if it is thrown in water, it will float in water.
- 5. It also has more than 60 moons.

### Uranus and Neptune:

- 1. Both are gaseous planets.
- 2. Both have rings around them.
- 3. Uranus rotates from East to West.
- 4. Uranus appears to roll on its side.

# Some Other Members of the Solar System

### Asteroids:

- 1. Mini planets revolving around sun.
- 2. These reside in asteroid belt between the orbit of Mars and Jupiter.
- 3. These are the pieces of planets.
- 4. These are big threat to Earth, as if collide with Earth; can cause major destruction.

#### Comets:

- 1. These are made of ice and mud.
- These revolve around sun in large and highly elliptical orbit.
- 3. These acquire a bright tail as they come near the Sun.



- 4. Tail is always directed away from the Sun.
- 5. Size of tail decreases as comet moves away from the Sun.





6. Comets appear periodically. Like Halley's Comet which comes after every 76 years.

#### Meteors:

- 1. These are the small rocks or the left out pieces of Comet.
- 2. As these enter Earth's atmosphere at very high speed they burn up due to friction.
- 3. It's burning results in a bright streak of light which lasts for few seconds.



**Meteors** 

### Meteorites:

- 1. Bigger meteors which do not get burnt completely.
- 2. These unburnt pieces reach Earth.
- 3. These are studied by scientists to study the composition of meteor and the nature of material from which Solar System was formed.
- 4. If these are very big in size, then may cause destruction.

# **Artificial Satellites**

- 1. Man made machines which revolve around Earth.
- 2. These revolve at a closer distance as compared to natural satellite Luna.
- 3. First Indian Satellite was Aryabhatta.
- 4. These are used for Communication, Weather Forecasting, Remote Sensing and Signal Transmission.



# **Exercises**

17.1 Why is the distance between stars expressed in light years? What do you understand by the statement that a star is eight light years away from the Earth? Why we can see only that part of the moon which reflects light towards us?

17.2 The radius of Jupiter is 11 times the radius of the Earth. Calculate the ratio of the volumes of Jupiter and the Earth. How many Earths can Jupiter accommodate?

17.3 Name two objects other than planets which are members of the solar system.

17. 4 In which part of the sky can you find Venus if it is visible as an evening star?

17.5 Fill in the blanks

- 1. \_\_\_\_\_ is the smallest planet of the solar system.
- 2. \_\_\_\_\_\_is the farthest planet in the solar system.
- 3. \_\_\_\_\_ is an artificial satellite.

Give one word for the following

- 1. The planet which appears reddish in colour
- 2. A group of stars that appear to form a pattern in the sky
- 3. A prominent constellation looks like a distorted letter W or M



# Chapter- 18 Pollution of Air and Water

### **Air Pollution**

Air supplies us with *oxygen* which is essential for our bodies to live. Air is 99.9% nitrogen, oxygen, water vapor and inert gases. Human activities can release substances into the air, some of which can cause problems for humans, plants, and animals. The presence in the atmosphere of one or more contaminants is injurious, or tends to be injurious to human health or welfare animal or plant life is called air pollution.



Air pollution

### **Sources of Air Pollution**

The substances which contaminate the air are called **air pollutants**. It may be through natural sources like smoke and dust arising from forest fires or volcanic eruptions.

Other pollutants and their effects are explained below.

- Carbon dioxide (CO<sub>2</sub>) is the principle greenhouse gas emitted as a result of human activities such as the burning of coal, oil, and natural gases.
- Chlorofluorocarbons (CFC) are gases that are released mainly from airconditioning systems and refrigeration. When released into the air, CFCs rise to the stratosphere, where they come in contact

with few other gases, which lead to a reduction of the ozone layer that protects the earth from the harmful ultraviolet rays of the sun.

Lead is present in petrol, diesel, lead batteries, paints, hair dye products, etc. Lead can cause nervous system damage and digestive problems and, in some cases, cause cancer.



Nitrogen oxide (Nox) causes smog and acid rain. It is produced from burning fuels including petrol, diesel, and coal.

Air Pollutants

Nitrogen oxides can make children susceptible to respirator

:ers.

Suspended particulate matter (SPM) consists of solids in the air in the form of smoke, dust, and vapour that can remain suspended for extended periods and is also the main source of haze which reduces visibility. These finer particles, when



breathed in can lodge in our lungs and cause lung damage and respiratory problems.

Sulphur dioxide (SO<sub>2</sub>) is a gas produced from burning coal, mainly in thermal power plants. Some industrial processes, such as production of paper and smelting of metals, produce sulphur dioxide. It is a major contributor to smog and acid rain. Sulfur dioxide can lead to lung diseases.

### Acid rain



Another effect of air pollution is acid rain. The phenomenon occurs when sulphur dioxide and nitrogen oxides from the burning of fossil fuels such as, petrol, diesel, and coal combine with water vapour in the atmosphere and fall as rain, snow or fog. These gases can also be emitted from natural sources like volcanoes. Acid rain causes extensive damage to water, forest, soil resources and even human health. Many lakes and streams have been contaminated and this has led to the disappearance of some species of fishes. Acid rain corrodes the marble of the Taj Mahal.

Taj Mahal affected due to acid rain

The phenomenon is also called "Marble cancer". Suspended particulate matter, such as the soot particles emitted by Mathura oil refinery, has contributed towards yellowing of the marble.

### **Greenhouse Effect**

The greenhouse effect refers to circumstances where the short wavelengths of visible light from the sun pass through a transparent medium and are absorbed, but the longer wavelengths of infrared re-radiation from the heated objects are unable to pass through that medium. The trapping of the long wavelength radiation leads to more heating and a higher resultant temperature.



#### Greenhouse effect

Besides the heating of an automobile by sunlight through the windshield and the namesake example of heating the greenhouse by sunlight passing through sealed, transparent windows, the greenhouse effect has being widely used to describe the trapping of excess heat by the raising concentration of carbon dioxide in the atmosphere. The carbon dioxide strongly absorbs infrared and does not allow as much



of it to escape into space. As a result, the average temperature of the earth's atmosphere is gradually increasing. This is called global warming.

**Global warming** can cause sea levels to rise dramatically. In many places, coastal areas have already been flooded. Global warming could result in wide ranging effects on rainfall patterns, agriculture, forests, plants and animals.

### Measures to Control Air Pollution

- ➢ Fuels like CNG and unleaded petrol can be used which don't pollute the environment and are much cheaper and efficient fuel.
- There is a need to switch over to alternative fuels instead of the fossil fuels for our energy requirements like the solar energy, hydropower and wind energy.
- > Plant trees and nurture the ones already present in the neighbourhood.
- Instead of burning leaves better option is to put them in a compost pit rather than burning.

# Water Pollution



Whenever harmful substances such as sewage, toxic chemicals, silt, etc get mixed with water, the water becomes polluted. The substances that pollute water are called water pollutants.

Water pollution

#### **Sources of Water Pollution**

Dirty water is the world's biggest health risk, and continues to threaten both quality of life and public health

- Many industries discharge harmful chemicals into rivers and streams, causing the pollution of water. Examples are oil refineries, paper factories and chemical factories. The chemicals released lead to toxicity in plants and animals.
- If the pesticides and weedicides dissolve in water and are washed into





Indus

water bodies from the fields and polluting them. They also seep into the ground to pollute ground water.

- The excessive quantities of chemicals getting washed from the fields act as nutrients for algae to flourish. Once these algae die, they serve as food for decomposers like bacteria. A lot of oxygen in the water body gets used up. This results in a decrease in the oxygen level which may kill aquatic organisms.
- Hot water from power plants and industries is released into the rivers. It raises the temperature of the water bodies, adversely affecting the animals and plants living in it.

### **Potable Water**

Water which looks clean may still have disease carrying microorganisms and dissolved impurities. Therefore such water is unfit for drinking. Water which is suitable for drinking is called **potable water**.

### Water Purification

Water is filtered. This is a physical method of removing impurities.

Boiling kills the germs present in the water and hence is a method for obtaining safe drinking.

Chlorination is a commonly used chemical method for purifying water. It is done by adding chlorine tablets or bleaching powder to the water.

### **Conservation of Water**

- We should save water by not wasting it. Reduce, reuse and recycle water.
- Make sure to dispose of toxic products, such as paints, solvents, and polishes, in the proper area. Don't pour them down your drain. Better yet, avoid toxic products altogether and use environmentally friendly products instead.



#### Septic tank

Have a proper system in place that will allow for proper methods of garbage disposal so that it does not find its way into the water bodies. Same is the case with maintaining a proper septic tank and keeping it clean.



# **Exercises**

18.1 Write short notes on

a. The Green House Effect

b. Global warming

18.2 How is acid rain caused? What are its consequences?

18.3 What are the measures taken to control air pollution?

18.4 What are the different ways in which water gets contaminated?

18.5 How does the increased level of nutrients in the water affect the survival of aquatic organisms?

18.6 State whether the statements are true or false.

- 1. Water which is purified and fit for drinking is known as potable water.
- 2. Increasing levels of greenhouse gases like O<sub>2</sub> are leading to global warming
- 3. Pollutants are the substances which contaminate only air.

