

PART - 3

TEXT BOOK FOR  
SECONDARY COURSE

# SCIENCE AND TECHNOLOGY



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## AIR AND WATER

You have already learnt that air is a mixture of gases and is one of the main abiotic components of the environment. Air is an extremely important natural resource, as living organisms breathe in air. A human being breathes about 22,000 times in a day and, takes about 16 kg of air into the body during this process.

Like air, water is another abiotic component of the environment, which is also essential for all living beings. Water is the most abundant and **renewable** natural resource. It covers about three quarters of earth's surface. Water occurs in nature in the free state as well as **in the combined state**. The different properties of water make it useful and essential in our daily life. We shall learn about air and water in this lesson.



### OBJECTIVES

After completing this lesson, you will be able to:

- *tabulate various components of air and their amount;*
- *explain the importance and utility of various components ( $O_2$ ,  $N_2$ ,  $CO_2$ ) of air and give a brief account of air pressure and its use to us;*
- *list various pollutants of air, its consequences and means of control of these pollutants in air;*
- *identify different sources of water and state its properties;*
- *distinguish between potable and non-potable water and describe simple methods for making water potable;*
- *state various sources of water pollution, its consequences and means of control of water pollution;*
- *recognize the urgency of water conservation and rain water harvesting.*



## Notes

## 26.1 COMPOSITION OF AIR

Ancient philosophers considered air as a most vital element. **Mayow** in 1674 proved that air is not an element but is a mixture of two substances, one of which is active and the other is non-active. Lavoisier in 1789 named the active element as oxygen and said that it is  $1/5^{\text{th}}$  of the total volume of air. The non-active element in air is nitrogen and it is about  $4/5^{\text{th}}$  of the total volume of air. The ratio of oxygen and nitrogen in the air is about 1:4 by volume.

Air is a mixture of gases. The composition of dry air at sea level is given in table 26.1.

Table 26.1: Composition of air

Gas	Composition (% by volume)
Nitrogen ( $\text{N}_2$ )	78.03
Oxygen ( $\text{O}_2$ )	20.09
Argon (Ar)	0.94
Carbon dioxide ( $\text{CO}_2$ )	0.033
Inert gases (Neon, Helium, Crypton, Xenon: Ne, He, Kr, Xe)	0.0020

Water is excluded from this table because its concentration in air varies drastically from location to location.

Which of the gases mentioned above is important for the following:

- (a) Photosynthesis      (b) Breathing

Yes, you are right: (a) carbon dioxide      (b) oxygen



## ACTIVITY 26.1

Let us perform a simple activity to study the presence of carbon dioxide in air.

**Aim :** To show the presence of carbon dioxide in air

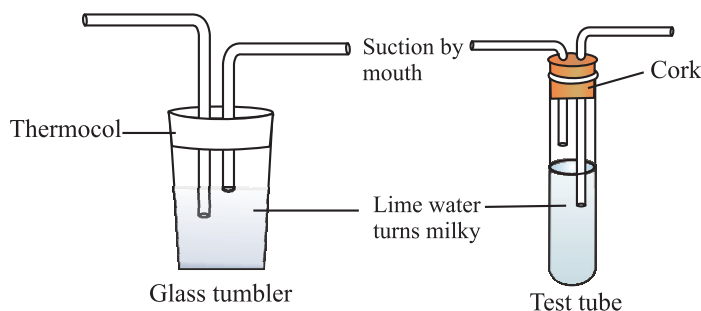
**What is required?** A test tube/glass tumbler, freshly prepared lime water, a cork/thermocool with two holes, two glass tubes/straw pipes bent at right angles;

**What to do?**

- Take about 4 ml freshly- prepared lime water in a test tube/glass tumbler.



- Fix a cork/thermocool (having two holes) in the mouth of the test tube/glass tumbler so that it is air tight. You may use vaseline.
- Fix the two tubes in two holes in such a way that only one is dipped in lime water while the other remains above the lime water as shown in figure. 26.1.



*Fig. 26.1 To show that air contains carbon dioxide*

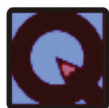
- Suck the air through the tube, which is not dipping in limewater.

**Note:** Fresh lime water can be made by soaking lime (Chuna) in water overnight. The supernatant is the lime water.

### What do you observe?

Due to suction the air pressure within the test tube falls. To compensate this fall in pressure, the air from outside enters into the tube dipping in limewater and bubbles through it.

You will see that after a minute the limewater turns milky. Can you explain why? Yes you are right. Carbon dioxide can turn limewater milky. What does this prove? It shows the presence of carbon dioxide in the air. Will the small concentration of  $\text{CO}_2$  in air be able to turn lime water milky? Please check from your elders/books.



### INTEXT QUESTIONS 26.1

1. A chemical substance may occur as an element, mixture or compound. To which category does air belong?  
\_\_\_\_\_
2. Name the major constituents of air. Which constituents are inevitable for survival of plants and animals?  
\_\_\_\_\_
3. If you were to compare the relative amounts of nitrogen and oxygen in the atmosphere. Which will be four times the other?  
\_\_\_\_\_



Notes



4. Air also contains water vapour. But is its percentage in air the same at all places?
- 

## 26.2 IMPORTANCE OF VARIOUS COMPONENTS OF AIR

Oxygen, nitrogen and carbon dioxide are directly or indirectly useful for human beings, other animals and plants. Without oxygen and nitrogen it is impossible for living beings to survive. Water vapour also plays a very important role in our life.

### 26.2.1 Oxygen

We live on the surface of the earth, and we are surrounded by air, which contains oxygen. Oxygen is one of the major components of air and life is not possible without oxygen. The importance and utility of oxygen is given below:

#### (a) General uses

- Oxygen is necessary for respiration in almost all living beings.
- It is the supporter of combustion and therefore materials burn easily in the presence of oxygen.
- Liquid  $O_2$  called as LOX (Liquid oxidant) is used as oxidant in rockets to burn the fuel.
- Oxygen from air gets dissolved in water which keeps the water and aquatic life fresh.
- Oxygen cylinders are carried by climbers, during high altitude climbing, by aviators during high altitude flying and firemen during fire fighting.
- Rusting of iron takes place in the presence of oxygen and water.

#### (b) Medical uses

- Oxygen is given to the patients suffering from asthma or gas poisoning and for artificial respiration in hospitals.
- A mixture of oxygen and nitrous oxide is used as anesthesia in surgical operations.

#### (c) Industrial use

- **In steel industry:** Impurities present in iron are removed by burning in presence of oxygen.
- **For cutting and welding purposes:** Oxygen is mixed with hydrogen (hydrogen torch) or acetylene (oxyacetylene torch). These mixtures are

burnt to produce very high temperatures and are used for cutting metals and for welding.

- Oxygen is also used for the manufacture of sulphuric acid from sulphur and nitric acid from ammonia ( $\text{NH}_3$ ).

### Harmful effects of Oxygen

- Corrosion means deterioration of metals by an **electrochemical process**. The most common example of corrosion is the rusting of iron. Oxygen gas and water must be present for iron to rust. Similarly, articles made of other metals like aluminum and copper also corrode slowly in the presence of oxygen. Can you list any two rusted items that you have seen. Write them in the space provided 1. \_\_\_\_\_ 2. \_\_\_\_\_
- Oxygen combines with almost all elements to form oxides

### 26.2.2 Nitrogen

Nitrogen is the main constituent of proteins. A number of amino acids containing nitrogen join together to form a protein. Proteins build the body. Enzymes which act as catalyst in biochemical reactions occurring in the body are mostly proteins. Main uses of nitrogen are as follows:

- Nitrogen subdues the activity of oxygen. If concentration of oxygen in air is increased, processes like metabolism, combustion and corrosion are speeded up and this shall have a harmful effect. Hence, due to the presence of nitrogen, oxidation of food and combustion of fuel occur at a moderate rate.
- The compounds of nitrogen are of vital importance to plants as they help them to manufacture proteins. Animals and humans obtain proteins from plants. Recollect the functions of proteins and name one protein deficiency disorder in growing children.

### 26.2.3 Carbon dioxide

The percentage of carbon dioxide in air varies from place to place. Which two human activities are responsible for increase in atmospheric carbon dioxide.

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Main uses or carbon dioxide are:

- During photosynthesis, plants absorb carbon dioxide and water vapour from atmosphere and convert into carbohydrates (Sugars) in the presence of chlorophyll and sunlight.



Notes



## Notes

- Carbon dioxide dissolves in water to form carbonic acid  $\text{H}_2\text{CO}_3$  which reacts with rocks that contain calcium carbonate ( $\text{CaCO}_3$ ) or magnesium carbonate ( $\text{MgCO}_3$ ) to form  $\text{Ca}(\text{HCO}_3)_2$  and  $\text{Mg}(\text{HCO}_3)_2$  salts. These salts give the taste of natural water and also supply  $\text{Ca}_2+$  and  $\text{Mg}_2+$  ions to the plants which are necessary for their growth.
- It is also used in food preservation. When stored in an atmosphere of  $\text{CO}_2$ , the grains are prevented from being destroyed by insects. Can you give a reason?
- Solid  $\text{CO}_2$  which is known as dry ice, is used as refrigerant.
- Dissolved in water,  $\text{CO}_2$  is used in the preparation of soft drinks. The effervescence that comes out when we open a soft drink bottle is carbon dioxide.
- $\text{CO}_2$  is used in fire extinguishers.

### Harmful effects of $\text{CO}_2$

$\text{CO}_2$  is a greenhouse gas. It traps infrared radiation which raises the atmospheric temperature and results in global warming. You will read about global warming in more details in lesson-30, section 30.8)

### 26.2.4 Water vapour

We know that air contains water vapour. Its amount in the air is not the same everywhere. It is the maximum in low latitudes and over oceans and is low in the atmosphere over polar regions. It is also more in summers than in winters.

Though water vapour comprises a very small part of the atmosphere, it plays an important role in heating and cooling of the atmosphere and in the day to day change in weather. In fact clouds, rain, snow, fog, frost and dew that we experience, all result from water vapour present in the atmosphere.

But how does water vapour come into the atmosphere? It comes into the atmosphere through a process called **evaporation**. Evaporation is a process in which water from any source change into vapour state 'due to heat'. Water evaporates from water bodies due to heat of the sun forms clouds and then falls as rain upon condensation.

### Cloud formation

Condensation of water vapour in the atmosphere leads to the formation of clouds. Clouds are formed when moist air rises upwards. When dew point is reached, condensation of water vapour occurs resulting in the formation of very tiny droplets of water. They cling to the dust particles in the air. These millions of very minute water droplets or tiny ice crystals almost hang in the air rather than fall.

They are blown as clouds by the wind. Clouds are of different types according to their shapes and height. You can observe the different types of clouds, if you watch the sky carefully.

**Dew point** : the temperature at which the water vapour begins to change into water drops.

### Rain

When clouds rise up, they are cooled when blown into cooler regions of the atmosphere. The small droplets of water in them become still cooler and they, come closer to each other. A number of small droplets combine to form a big drop of water. These drops are so big that they can no longer float in the air and they fall down on the earth as rain. As they fall, they pick up more and more small drops of water on their way down. The falling of these big drops of water from the clouds is known as **rain** and the process is called **precipitation**.

The instrument used to measure rainfall is called **rain gauge**. Rainfall is measured in centimeters.



#### Do you know

The maximum rainfall occurs in the countries- near equatorial regions and South-East Asia. In these regions, annual rainfall is 200 cm or even more. The lowest rainfall occurs in Tundra, central Asia and hot deserts, where it is less than 25 cm. The medium rainfall (between 25 cm to 200 cm) occurs in west European countries, Taiga regions and China.

### 26.2.5 Relative humidity

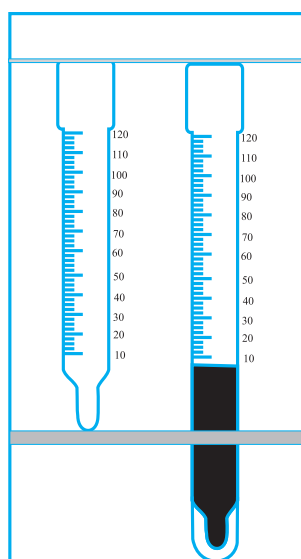


Fig. 26.2 Hygrometer

The presence of water vapour in the atmosphere is known as humidity. Humidity of the air is related to its temperature. For example, during summer, you must have experienced days when both the temperature and humidity are high.

**Relative humidity is the ratio of the mass of water vapour actually present in a certain volume of air at room temperature to the mass of water vapour required to saturate the same volume of air at that temperature.**

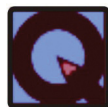
While mentioning the relative humidity, it is necessary to mention the temperature. The instrument used to measure relative humidity is called hygrometer. (figure 26.2)



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## INTEXT QUESTIONS 26.2

1. Why is oxygen essential for life? What would happen if there is no oxygen in air?  
\_\_\_\_\_
2. Carbon dioxide acts as food for plants. Name the process in which it is utilized for making food.  
\_\_\_\_\_
3. What is dry ice and what is it used for?  
\_\_\_\_\_
4. If you were to analyse all proteins, you would find a particular element common to all. Which one is it?  
\_\_\_\_\_

## 26.2.6 The air and its pressure

We know that air is a mixture of gases and molecules of these gases have weight due to gravity. Anything that has weight, pushes and presses against other objects. The envelop of air that surrounds earth (atmosphere) exerts a force which acts downwards on the surface of the earth.

The force of air column acting per unit area of a surface results in a pressure exerted by atmosphere. This pressure is called **atmospheric pressure**. The atmospheric pressure is about  $1 \text{ kg cm}^{-2}$  or  $10 \text{ ton m}^{-2}$



## ACTIVITY 26.2

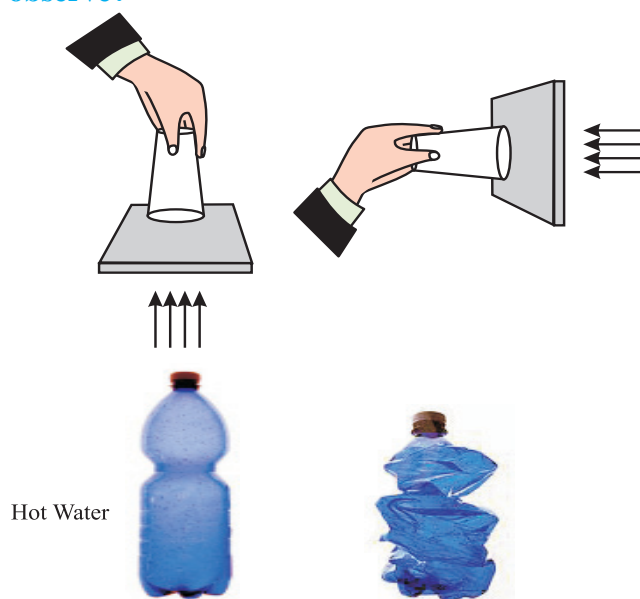
**Aim:** To show that air exerts pressure

What is required?

An empty polythene bottle of mineral water and some hot water.

**What to do?**

- Take an empty bottle of mineral water.
- Take some hot water in it and tightly screw its cap in order to make it airtight.
- Pour cold water on the bottle.

**What do you observe?***Fig. 26.3 Air exerts pressure*

You will find that bottle collapses and becomes misshapen when the water vapor inside cools and condenses into water.

**Why is it so?**

When hot water is taken in the empty bottle, air present in it becomes hot and expands. Also some air comes out of it. On cooling, the air inside the closed bottle contracts. This creates a partial vacuum inside the bottle. The atmospheric pressure acts from outside, presses the bottle and causes the bottle to collapse. This shows that air exerts pressure.

In our everyday life, atmospheric pressure plays an important role in the working of many things, for example, working of a straw, working of a syringe or ink dropper, working of a water pump etc. Think and try to explain how atmospheric pressure helps in the working of these above mentioned devices?

**26.2.7 Variation of air pressure with height**

The atoms and molecules of the gases in the atmosphere like those of all other matter are subject to earth's gravitational pull. As a consequence, the atmosphere is much denser near the surface of earth than at higher altitudes. In fact, the density of air decreases very rapidly with increasing distance from earth. Therefore, atmospheric pressure also decreases with altitude. Often at higher altitudes, people find their nose bleeding because blood pressure of the body is much more than the pressure outside (i.e. atmospheric pressure).

Air pressure is measured by the instrument known as barometer.



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26.2.8 Atmosphere

The region of air around earth is called atmosphere. Atmosphere protects us and all living organism from harmful radiations of the sun like ultraviolet rays etc. We can divide the atmosphere into different layers according to temperature, pressure variation and composition. The main layers of the atmosphere (figure 26.4) from the surface of earth upward are troposphere (0-10 km), stratosphere (10-50 km), mesosphere (50-85 km) and thermosphere (85-500 km).

The most active region of the atmosphere is the troposphere, the layer of the atmosphere, which contains about 18% of the total mass of air and practically all the atmosphere's water vapour. It is the thinnest layer of atmosphere and all the dramatic events of weather (such as rain) occur here

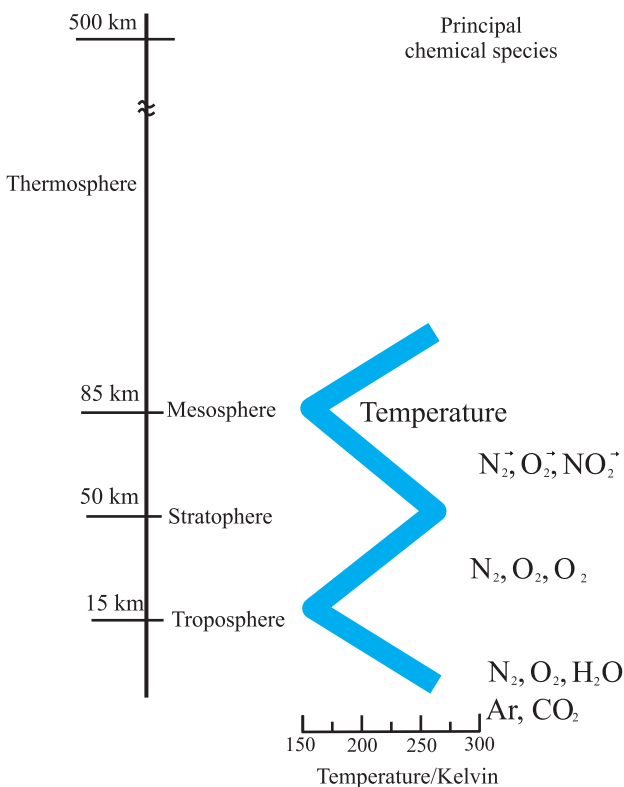


Fig. 26.4 Layers of the atmosphere

26.3 AIR POLLUTION

You must have observed the black soot deposition on the plants growing in areas with heavy vehicular traffic. Have you wondered why? It is because of pollutants present in the air. These pollutants are one of the causes of air pollution. Air pollution is the introduction of harmful chemicals, biological wastes, and particulate matter into the atmosphere. Pollution has harmful effects on humans as well as on all other living beings.

Pollutants can be classified into two main categories:

- A. **Primary pollutants** which are directly emitted into the atmosphere such as carbon monoxide from exhaust of a motor vehicle
- B. **Secondary pollutants** which are not emitted directly into atmosphere but are formed in air when primary pollutants interact.



Major Primary pollutants include:

**Carbon monoxide (CO)** is produced by incomplete combustion of fuels like petrol, natural gas, coal or wood. It is a colourless and odourless gas but very poisonous in nature.

**Carbon dioxide (CO<sub>2</sub>)** is produced by complete combustion of fuels in motor vehicles and various industries. It is a colourless, odourless and non-toxic gas. (A person dies in atmosphere of carbon dioxide due to lack of oxygen and not due to its toxic nature). (Read details in lesson 30, section 30.8.2)

**Sulphur oxides (SO<sub>x</sub>)** (mainly sulphur dioxide, SO<sub>2</sub>) are produced by combustion of coal and petroleum and also produced in volcanoes. It is also produced in various industrial processes. Oxidation of sulphur dioxide (SO<sub>2</sub>) to sulphur trioxide (SO<sub>3</sub>) results in formation of sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) which causes **acid rain**. (See Lesson-30, Section 30.8.4)

**Nitrogen oxides (NO<sub>x</sub>)** especially nitrogen dioxide, NO<sub>2</sub> is a reddish brown gas with pungent smell. It catalyses the oxidation of SO<sub>2</sub> to SO<sub>3</sub> and indirectly causes acid rain.

**Volatile organic compounds (VOCs)** include methane, benzene, toluene and xylene. While methane is a major green house gas, others are suspected to be carcinogens (cancer inducing).

**Particulate matter** consists of tiny particles of solids or liquids suspended in air. These are also called ‘suspended particulate matter (SPM)’. The major sources for these include volcanoes, dust storms and burning of fuels. These can cause heart and lung diseases and breathing disorders.

**Chloro-fluorocarbons (CFCs)** are used as refrigerants in air conditioners and refrigerators and are harmful to the ozone layer which protect us from harmful ultraviolet rays. You shall read about the ozone hole in Lesson30, Section 30.8.1)

**Major secondary pollutants include :**

**Photochemical smog** (smoke + fog) formed by the action of ultraviolet light from the sun on particulate matter or formed due to burning of coal and petrol in an atmosphere containing SO<sub>2</sub>. It prevents dissipation of pollutants and causes breathing disorders. Read in detail from Lesson-30, Section 30.8.3

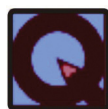
**Ground level ozone (O<sub>3</sub>)** is formed from NO<sub>x</sub> and VOCs. It is a constituent of smog. Normally ozone occurs in stratosphere and prevents UV radiations from reaching earth’s surface. At ground level, when inhaled, it is harmful for health of humans and animals.



Notes



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### INTEXT QUESTIONS 26.3

1. What happens to atmospheric pressure as we climb a mountain?  
\_\_\_\_\_
2. At high altitude the people find their nose bleeding. Why?  
\_\_\_\_\_
3. Which layer of atmosphere is the closest to the earth's surface and which is the farthest from earth's surface?  
\_\_\_\_\_
4. In which layer of atmosphere is ozone layer present?  
\_\_\_\_\_
5. Name (i) a green house gas (ii) gas responsible for acid rain (ii) chemicals causing ozone hole  
\_\_\_\_\_

## 26.4 WATER - ITS SOURCES AND PROPERTIES

Next to air, water is the most important substance needed for survival of living beings. Living beings cannot live long without water. Water is available in plenty on earth. More than three-fourth of the earth's surface is covered with water in the form of seas, rivers and lakes. It is also found inside the earth's crust. Most of the water that we get from the wells comes from this source.

### 26.4.1 Sources of water

The natural sources of water are rain, springs, wells, rivers and seas.

**(a) Rain water:** Rain water is considered to be the purest form of natural water (distilled water) free from impurities. Water from sea and rivers get evaporated into water vapour by the heat of sun. During this process of evaporation, impurities are left behind. When the water vapours go high up in the air they condense to form clouds. The water drops come down as rain.

**(b) Spring water:** Springs are formed by percolation of rain water into soil. Springs supply water to wells and lakes.

**(c) Well water:** The rain water seeps through the soil and goes down and is stored over rocks or hard earth crust. On digging the well this underground water

becomes available to us. This is known as well water. This water may not be pure and may contain impurities such as suspended particles, bacteria and other microorganisms.

**(d) River water:** Rivers are formed by melting of snow on the mountain, and also sometimes from the rain water. River water is also not pure and is not fit for drinking.

**(e) Sea water:** Out of all the sources, sea water is the largest natural source of water. However, it is also the source of common salt and other important chemicals. It is the most impure form of water. All the impurities dissolved in river water are carried into the sea. As such, sea water cannot be used for drinking purpose because of high salinity and impurities.

### 26.4.2 Potable and Non-potable water

Potable water means water which is fit for drinking by humans and other animals. It can be consumed with low risk of immediate or long term harm. Non-potable water is that which is not safe for drinking. It may carry disease causing microbes, and high levels of dissolved salts and minerals, heavy metals and suspended solids. Drinking or using such water for cooking leads to illnesses and may even cause death.

Contaminated or non-potable water can be treated to turn it into potable or drinking water. Let us learn about simple methods of purifying water.

### 26.4.3 Purification of water to make it suitable for drinking

- **By decantation,** insoluble impurities can be removed. Decantation is the process of separation of solid from the liquid by allowing the former to settle down and pouring off the latter. Water is kept in a vessel for some time. The suspended insoluble impurities settle down at the bottom. Clean water can now be carefully poured into another clean vessel without disturbing the settled impurities which are left behind. But, this water has to be made fit for drinking through further treatment.
- **By filtration** also, the insoluble impurities can be removed. It is a more effective method than decantation and can remove even very fine particles of insoluble impurities. A piece of clean and very fine cloth can be used as a cheap and easily available filter. When water is poured through it, the insoluble impurities are stopped by the filter and clean water passes through it.

Commercially available water filters use 'candles' made of porous material (figure 26.5). Pure water passes through it leaving the impurities on its outer surface. These candles must be cleaned and washed periodically to maintain their effectiveness.



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Accordingly, we can say that,

- Water which forms lather with soap is called **soft water**.
- Water which does not form lather is called **hard water**.
- The hardness of water is due to the presence of salts of magnesium and calcium in water.

### 26.5.4c Conversion of hard water into soft water

Hard water does not form lather with soap. Can this hard water be converted into soft water? Yes, hard water can be converted into soft water, by removal of Ca and Mg ions which are responsible for hardness. This is called softening of water.

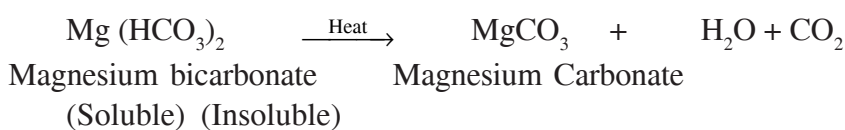
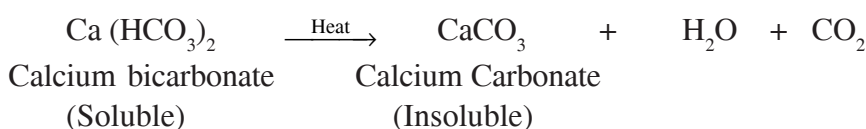
Hardness of water is of two types :

- Temporary hardness
- Permanent hardness

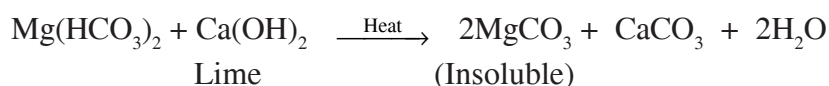
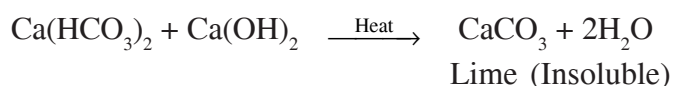
#### a) Temporary hardness

**Temporary hardness** of water is due to the presence of soluble bicarbonates of calcium and magnesium. It is also called **carbonate hardness**. It can be removed by boiling and by soda lime process.

**(i) By boiling:** Upon boiling hard water, calcium or magnesium bicarbonate present in it are decomposed to give magnesium or calcium carbonate. These carbonate salts are insoluble in water. They settle down easily and water can be decanted.



**(ii) By soda lime process (Clark's method):** When a calculated amount of lime is added to hard water, then the soluble bicarbonates are converted to insoluble carbonates as follows:





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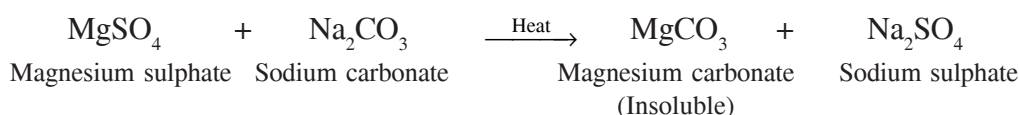
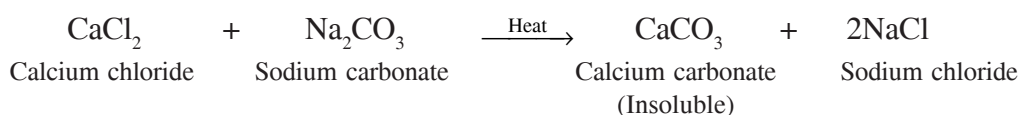
**b) Permanent hardness**

Permanent hardness of water is due to the presence of soluble chlorides and sulphates of calcium and magnesium. It is also known as **non-carbonate hardness**.

It can be removed by addition of washing soda or by the ion exchange method.

**(i) By addition of washing soda:** The hard water is treated with the 'calculated' quantity of washing soda (sodium carbonate). Washing soda reacts with chloride and sulphate of calcium and magnesium to form precipitate of calcium and magnesium carbonate.

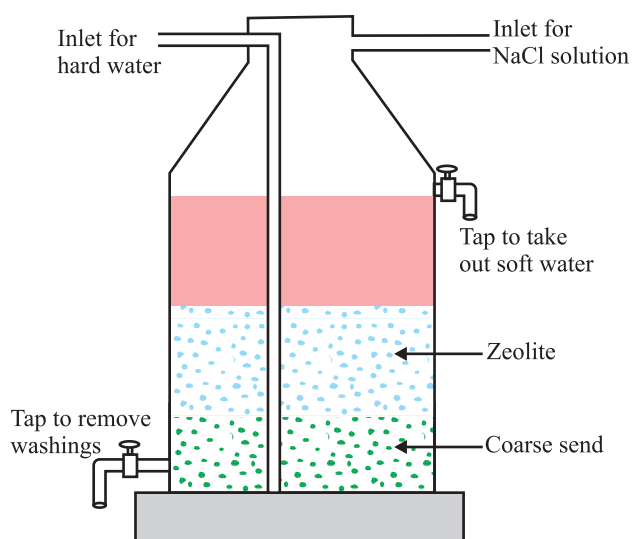
The reactions are as follows.



The precipitate settles down and can be removed by decantation.

**(ii) By ion. exchange method:** Two types of ion exchangers can be used, namely, inorganic ion exchanger and organic ion exchanger. In **inorganic ion exchange** process, complex compounds known as Zeolite are used to soften the hard water. The salts causing hardness of water are precipitated as insoluble zeolite of calcium and magnesium and are replaced by soluble sodium salts. On the large scale, this process is carried out in tanks as shown in figure 26.6. After using it for sometime the zeolite is regenerated by soaking it in 10% solution of NaCl (brine) and then washing away chlorides. The washings are removed and are replaced by soluble sodium salts.

By using organic ion exchanger, water obtained is free from cations and anions and is known as **deionized water or demineralized water**.



**Fig. 26.6** Obtaining soft water on a large scale using tanks

## 26.5.4d Polar nature of water

Water is a very effective solvent for ionic compounds. Although water is an electrically neutral molecule, it has a small positive charge (on the H atoms) and a negative charge (on the O atom), Therefore, it is polar in nature and can dissolve ionic compounds.

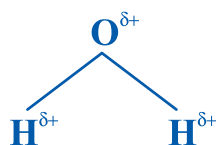


Fig 26.7 Structure of water

Let us perform an activity, which proves the polar nature of water



## ACTIVITY 26.3

**Aim:** To study the polar nature of water

**What is required?** Burette, water, ebonite rod (negatively charged), glass rod (positively charge) and burette stand.

## What to do?

- Take a burette or a bottle with a fine opening and fill it with water.
- Fix the burette vertically in a burette stand/hold the put a clip a little above the fine opening to regulate the water flow bottle in a suitable stand.
- Open the stopcock of the burette/clip of the bottle and allow the water to flow.
- Take an ebonite rod/ordinary straw (negatively charged by rubbing one end with fur) near the water

## What to observe?

You will see that the stream of water is attracted towards negatively charged rod (figure 26.8a). Why? Because one end of water molecule has positive charge.

Similarly, now we take a glass rod/glass tumbler rubbed with fur near water, which is positively charged. You will see the rod again attracts the stream of water. This indicates that one end of water molecule also has negative charge (figure 26.8b). This proves the polar nature of water.



Notes





Notes

### 26.4.4e Surface tension

Surface tension is the property of all the liquids. Due to this tension water drops try to occupy a minimum surface area. Hence, water droplets always tend to take the shape of a sphere.

The tension exerted by molecules of water present on the surface layer is called **surface tension**.

To understand this let us perform an activity.



#### ACTIVITY 26.4

**Aim:** To study surface tension

**What is required?** Glass and razor blade.

**What to do?**

Take a glass full of water. Put a safety razor blade (having a coating of very thin layer of wax), gently on the surface of water

**What to observe?**

You will find that the blade remains on the surface of water though it is heavier than water.

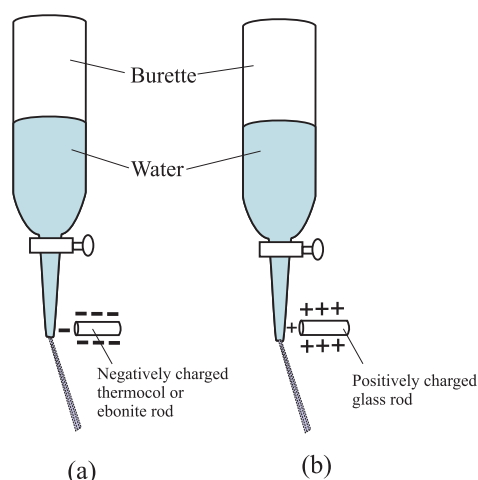
**Why is it so?**

The upper layer of water acts like a tight sheet and holds the blade. Why is the sheet tight? Due to intermolecular forces i.e. attractive forces between the molecules on water surface and there is a tension or force acting on the surface of the thin film of the liquid which behaves like a tight sheet.

### 26.4.4f Capillarity - Rise of water

When a capillary tube with a fine bore is dipped in water, water rises in the capillary. The extent to which water rises depends on the diameter of the capillary. The smaller the diameter of the capillary, the higher will be the rise of water in the capillary tube.

This property of rise of water inside a capillary is called **capillarity** or **capillary action**.



**Fig. 26.8 a and b** To show that water is polar in nature



This is the property, by which water from the soil enters the leaves and branches of the plants through the stems.

When a piece of cloth or blotting paper is placed in water, it soaks the water by this process of capillary action. The thread strands in the cloth and cellulose of the blotting paper serves like very fine capillaries for the water to rise.



Notes

### 26.4.4g Density of water

Water behaves in an unusual way when it is heated from 0°C. As the temperature rises from 0°C to 4°C it actually contracts. However, from 4°C upwards it expands like any other liquid. This means that water takes up the least space at 4°C. It has the highest density at this temperature and will sink through warmer or colder water around it. The density of water at 4°C is 1g/m<sup>3</sup>

Because of this property of water, we can explain why it takes months for a lake to freeze while a small bucket of water can freeze overnight on a bitterly cold day. The surface water cools down to 4°C and sinks to the bottom of the lake due to its high density and hotter water comes up to the surface. Gradually the whole water cools down to 4°C. Further cooling decreases the temperature of surface water which finally freezes. Ice being lighter than water keeps floating on the surface. It acts as an insulator and slows down the cooling and freezing of the lower layers of water. This explains why aquatic animals living in water bodies of very cold regions do not die in severe winter.

## 26.5 WATER POLLUTION

Water pollution is the contamination of water bodies like lakes, rivers, ground water and oceans. It occurs due to the discharge of untreated pollutants into water bodies. It not only affects plants and organisms living near the location of discharge but also travels to other locations through transportation of polluted water.

### Various sources of water pollution

Various sources of water pollution are:

- Factories and industries which release various toxins, untreated effluents and heavy metals and industrial solvents into natural water bodies.
- Agricultural farms releases fertilizers and pesticides which leads to eutrophication and biomagnification. (See lesson 30- Section 30.6 .3 b and 30.6.3c for details)
- Mining exposes heavy metals and sulphur which were buried deep in the earth into water bodies.

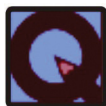


**Notes**

- Sewage pipe and storm water drains release various pathogens, disinfectants and detergents
- Air pollution releases pollutants like sulphur dioxide, oxides of nitrogen etc. which are washed down by rains.
- Food processing units and their waste includes fats and greases.

Based on their origin, sources of water pollution are generally grouped into two categories:

- **Point source pollution** refers to contaminants that enter a water body from a single identifiable source such as a pipe or a ditch.
- **Non-point source pollution** refers to diffused contamination that does not originate from a single discrete source but is the cumulative effect of contaminants gathered from a large area such as leaching of fertilizers and pesticides from agricultural land.



**INTEXT QUESTIONS 26.4**

1. It is said that more of earth is water than land. How much of the earth's surface is covered by water?  
\_\_\_\_\_
2. Name any two sources of water.  
\_\_\_\_\_
3. Is rainwater pure or impure? Give one reason to support your answer.  
\_\_\_\_\_
4. What does chlorination do to water in order to purify it?  
\_\_\_\_\_
5. I could not form lather with soap while washing my hands, which type of water was it?  
\_\_\_\_\_
6. Name the type of hardness caused to water due to presence of bicarbonates of  $Ca_2+$  or  $Mg_2+$ .  
\_\_\_\_\_
7. Name the type of hardness caused to due to presence-of chloride or sulphate of  $Ca_2+$  or  $Mg_2+$ .  
\_\_\_\_\_

8. Which type of hardness is removed by the following:
- (i) boiling \_\_\_\_\_
- (ii) ion exchange method. \_\_\_\_\_
9. Is water a polar or a non polar solvent? Why do you think so?
- \_\_\_\_\_
10. At what temperature does water take up least space?
- \_\_\_\_\_



Notes

## 26.6 UTILITY OF WATER

Water is used for many purposes, including growing crops, metallurgical operations to obtain metals such as copper, generating electricity, watering lawns, cleaning; drinking and recreation. We can say that water is essential for our life and for all living beings. Without water, plants and animal cells cannot function and they ultimately die. Let us discuss the role of water for domestic use, agricultural use, industrial use and for the generation of electricity.

### 26.6.1 Domestic uses of water

Water plays an important role in our domestic life. For example: it is used for cooking food, to wash utensils and clothes and clean the floor of houses. It is also used for white washing. It is used to take bath. Water provides a good medium for extracting the body waste such as urine, stool or perspiration. The salts and the nutrients of the food dissolve in water. Therefore these nutrients are easily absorbed by our body. Thus, water helps in assimilation of many nutrients present in food. Please recall the role of water as universal solvent. (Section 26.5.4a)

### 26.6.2 Agricultural uses of water

In agriculture sector, water is used for the irrigation of crops. It helps in the germination of seeds and growth of plants. The nutrients provided by fertilizers to the soil are soluble in water. These dissolved nutrients/fertilizers are easily absorbed by the plants. Water is also required (along with carbon dioxide) for preparation of food by plants (photosynthesis). It also acts as medium for the transportation of nutrients and minerals from one part of the plant to other. Water provides home for aquatic plants and animals.

### 26.6.3 Industrial uses of water

Water is used as a coolant in automobiles as well as in industries. It is also used in production of ice. It is used for the production of steam in industrial boilers and



## Notes

in steam engines. It is used as solvent in many industrial processes. Water is used to prepare many chemical compounds, for example  $\text{H}_2\text{SO}_4$  is prepared by dissolving  $\text{SO}_3$  in water and  $\text{HNO}_3$  is prepared by dissolving  $\text{NO}_2$  in water. Water is also used to prepare fuels like hydrogen gas and water gas.

### 26.6.4 Uses of water to generate electricity

There are many different ways to harness the energy from water. The most common way of capturing this energy is hydroelectric power. Electricity is generated by using the water falling from a height to rotate the turbines.

Water is used in thermal and nuclear power stations to produce steam for the generation of electricity.

## 26.7 CONSERVATION OF WATER AND RAIN WATER HARVESTING

Over the years, the ever increasing population, growth in industrialization and expanding agricultural needs have pushed up the demand for water. On other hand, water resources like ground water and river water are fast drying up. Wise conservation of water has become the need for our survival and attempts are being made in many different directions such as collection of water by making dams and reservoirs, creating ground water structures such as wells, recycling of used water and desalination of water. **Recharging of ground water has become necessary.** This is being done through **rain water harvesting.**

Rainwater harvesting essentially means collecting rain water on the roofs of building and storing it underground. Not only does this recharging arrest the underground depletion of water but also raises the declining water level.

While many people may not realize it, but a few centimeters of annual rainfall is a valuable resource. Harvesting rainwater not only helps reduce the possibility of flooding, but it also decreases the community's dependence on ground water for domestic uses. Rain water is perfectly suited for landscape irrigation growing vegetables and flowers, use in room coolers, washing and many other applications. Being soft water, rain water is used for washing purposes. While using rain water, hardness deposits do not accumulate and there is no problem of soap scum. Harvested water may also be used for personal consumption, but it must be filtered and treated prior to use. By reducing runoff of the rain water that falls on your house or field, you can put a valuable water resource to work around your house.

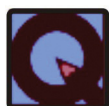
The benefits of harvesting rain water can be summarized as follows.

- Conserves valuable ground water.

- Reduces local flooding and drainage problems.
- Decreases landscaping and property maintenance needs. .
- Provides excellent quality water for many household uses.
- It can be used for domestic purposes such as for growing vegetables, flowers, trees and shrubs and seedling in a green house etc.



Notes



### INTEXT QUESTIONS 26.5

1. State any two uses of harvesting rain water?  
\_\_\_\_\_
2. How would industries and agriculture suffer in the event of acute scarcity of water?  
\_\_\_\_\_
3. What does rainwater do to ground water?  
\_\_\_\_\_
4. Why does rain water prove to be suitable for washing with soap?  
\_\_\_\_\_



### WHAT YOU HAVE LEARNT

- The major components of air are nitrogen and oxygen. Air also contains argon, carbon dioxide and some trace gases like neon, helium, krypton and xenon. It also contains water vapour.
- The weight of air column acting per unit area results in a pressure exerted by atmosphere called the atmospheric pressure.
- Atmospheric pressure plays an important role in our everyday life-in-the working of common devices like ink dropper, to water pumps, etc.
- The state of atmosphere in relation to the amount of water vapour present in it is known as **humidity**.
- Next to air, water is the most abundant substance available to us. The natural sources of water are rain, spring, wells, rivers and sea. Sea water is a rich source of several minerals.



## Notes

- The following properties of water make it suitable for use in our everyday life:
  - i. ability to dissolve many things i.e. to behave as a universal solvent.
  - ii. lather formation.
  - iii. surface tension.
  - iv. capillarity.
  - v. Density of water at 4°C being 1 g/ cm<sup>3</sup>.
- Water resources in a country is managed for proper and judicious use by constructing dams, canals, reservoir; wells and tube wells. Water collected in dams is not only used for irrigation but also to generate electricity.
- Water pollution and air pollution are due to human activities.
- Rain water can be conserved by recharging it to ground or using it for various other purposes. This is known as **rainwater harvesting**.



## TERMINAL EXERCISES

1. Multiple choice type questions.
  - i. Air is
    - a) compound
    - b) element
    - c) mixture
    - d) non of these
  - ii. Major components of air are
    - a) CO<sub>2</sub> and H<sub>2</sub>O
    - b) N<sub>2</sub> and O<sub>2</sub>
    - c) CO<sub>2</sub> and He
    - d) H<sub>2</sub>O and Xe
  - iii. The instrument used to measure humidity is
    - a) barometer
    - b) hygrometer
    - c) lactometer
    - d) thermometer
  - iv. Water has maximum density at
    - a) 0°C
    - b) 10 °C



Notes

- c) 5°C  
d) 4 °C
- List the utility of oxygen and nitrogen in our lives.
  - What is atmospheric pressure?
  - How does the atmospheric pressure depend on altitude?
  - Give an activity, which proves that air exerts pressure.
  - What is relative humidity?
  - What is the different source of water? Mention any two.
  - Why is water called as universal solvent?
  - What are the different ways to purify drinking water? What is the role of chlorination?
  - What do you mean by hard and soft water? Explain the types of hardness in water.
  - How are the temporary and permanent hardness removed from water?
  - Explain the following properties of water
    - Surface tension
    - Density
  - What is rainwater harvesting? How is it beneficial for everyday life?
  - Why is the presence of carbon dioxide in atmosphere essential? Give two reasons.
  - Give any two medical uses of oxygen.
  - What are primary and secondary air pollutants? Give one example of each.
  - What are the sources of the following pollutants : (i) Chlorofluorocarbons (ii) Nitrogen oxides (iii) Particulate matter
  - Why are the following substances considered air pollutants: (i) Carbon monoxide (ii) Carbon dioxide (iii) Sulphur oxides (iv) Volatile organic compounds
  - What are (i) photochemical smog and (ii) ground level ozone.
  - What are (i) point source pollution and (ii) non-point source pollution? Give one example of each.

**Notes**

22. Give any two of water for each of the following purposes (i) domestic (ii) industrial and (iii) agricultural
23. What do you mean by conservation of water? How is it useful?
24. You are incharge of the residents welfare association./ prepare two slogans to make residents aware of need for conservation of water.
25. The atmospheric envelop around living beings is the provider of the gases essential for their survival which are these gases, what is their proportion in air and how are they responsible for survival?
26. How does rain water pollute water bodies with the air pollutants/
27. Recall five properties of water and write a paragraph justifying that water is an indispensable resource.
28. How does boiling of hard water convert it such that it can be used for washing clothes?

**ANSWERS TO INTEXT QUESTIONS****26.1**

1. Mixture
2. Nitrogen and oxygen; oxygen
3. Nitrogen
4. It varies from place to place.

**26.2**

1. Needed for respiration by plants and animals; animals would die.
2. Photosynthesis
3. Solid CO<sub>2</sub> , used as a refrigerant
4. Nitrogen

**26.3**

1. it decreases with altitude
2. It is because the blood pressure in blood vessels of the body is much more than the air pressure at high altitude, so the capillaries burst and bleeding occurs.



3. i) Troposphere (ii) Thermosphere
4. Stratosphere
5. (i) Methane (ii) Sulphur oxide (SO<sub>x</sub>) (iii) Chloro fluoro carbons (CFCs)

### 26.4

1. Three fourth
2. Rain and sea (or any other)
3. Pure/ Distilled
4. Kill microorganisms
5. Hard water
6. Temporary hardness
7. Permanent hardness
8. (i) Temporary, (ii) permanent
9. Polar—reasons to be given
10. 4°C

### 26.5

1. i. It conserves valuable ground water. ii. It reduces local flooding and drainage problems, iii. It decreases landscaping and property maintenance needs iv. It provides quality water for many household needs; v. It can be used for domestic purposes (Any two)
2. Industries: coolant purpose, production of steam, use as solvent for many chemical would be affected  
Agriculture: irrigation of crops, germination of seeds and growth of plants would be affected.
3. Raises the declined water level.
4. Because rain water is in the form of soft water.



Notes



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## METALS AND NON-METALS

At home, in school, in the street or in office, we are surrounded by metals and non- metals. In the kitchen, we use both metals and non-metals. Cooking utensils are made of metals like iron, aluminium, zinc and copper. Our storage containers could be made of non-metals such as plastics and glass. **Thus metals and non-metals are an integral part of our lives.**

You have already read about metal and non-metals in the chapter of **periodic classification of elements**. You also know the criteria for classifying metals and non-metals which are basically based on electronic configuration of the elements.

Apart from day-to-day life situations, metal and non-metal are industrially very important. They play an important role in our national economy. You might have heard about various iron and steel plants, zinc and copper plants and aluminium plants (factories) established in our country. Have you seen any one of these so far?. There are basically metal based industries. Apart from these, you also must have heard acid plants and fertilizer factories. These are basically non-metal based industries. All these metals and non-metals are obtained from **minerals**. You are lucky that our mineral resources are very rich. You will study about all these in your higher classes. In this Chapter we will discuss certain relevant properties of metal and non-metals which will be quite meaningful for you.



### OBJECTIVES

After completing this lesson, you will be able to :

- *differentiate between metals and non-metals on the basis of their physical properties;*
- *describe the reactions of metals with oxygen, water and some common acids and bases;*
- *distinguish between mineral and ores;*

- recognize various metallurgical processes in the extraction of common metals;
- explain the phenomenon of corrosion and list various methods to prevent it;
- describe the reactions of non-metals with oxygen;
- arrange the metals in order of their reactivity and construct reactivity series;
- list some of the important uses of metals and non-metals.



Notes

## 27.1 PHYSICAL PROPERTIES OF METALS AND NON-METALS

Elements can be broadly divided into two categories: metals and non-metals. They differ both in physical and chemical properties. The characteristic physical properties of metals and non-metals are listed in Table 27.1

**Table 27.1**

Physical Properties	Metals	Non-Metals
Malleability and Ductility	Metals are malleable. They can be beaten into thin sheets. They are also ductile and can be drawn into wire (except a few metals like Na, K etc.)	Non-metals are neither malleable nor ductile. For e.g. coal, (carbon) and sulphur
Metallic Lusture	All the metals show metallic lusture.	They do not show any metallic lusture.
Hardness	Metals are generally hard	Non-metals are soft in comparison to metals
Physical state	They exist in solid and liquid states	Non-metals exist in solid, liquid and gaseous states.
Sonorous	Metals are sonorous and produce characteristic metallic sound when struck (e.g school bell )	They are non sonorous
Density	High density	Low density
Electrical conductivity	Good conductor of electricity	Bad conductor of electricity

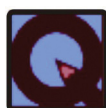


## Notes



## Do you know

- Mercury is the only metal and bromine is the only non-metal which exist in liquid state at room temperature.
- Graphite and iodine possess metallic lusture though they are non-metals
- Sodium metal is soft like wax and it can be cut with a knife.
- Gallium metal would melt if kept on our palm
- Gold and silver are the most malleable and ductile metals .
- Diamond is a better conductor of heat than copper but poor conductor of electricity.
- Graphite is the only non-metal which is a good conductor of electricity but poor conductor of heat.
- Gold, silver, platinum and copper are found in the free state. This is because of their poor reactivity as compared to other metals.



## INTEXT QUESTIONS 27.1

1. Which properties of gold allows it to make ornaments?
2. Name a few metals which are found in free state?
3. Metals are generally very hard. Name the metal which is soft like wax?
4. Name a non-metal which is a good conductor of electricity.
5. Name two metals which show malleability and ductility.



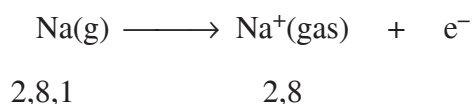
## ACTIVITY 27.1

- Collect samples of iron, copper and aluminium and note down the colour of each sample.
- Clean the surface of all the samples of the metals with sand paper and compare the appearance before and after cleaning the surfaces.

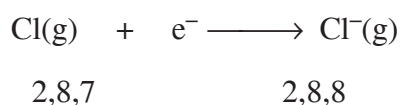
## 27.2 CHEMICAL PROPERTIES OF METALS AND NON-METALS

Metals are electropositive in nature. They generally have 1, 2 or 3 electrons in their valence shells and readily lose these electrons to form positively charged ions

(cations). These cations are stable as they acquire noble gas configuration after losing the valence shell electrons. You must have learnt in the lesson on chemical bonding.



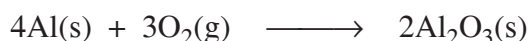
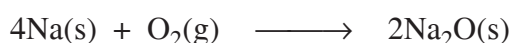
During electrolysis of their aqueous solutions they are discharged at the cathode. On the other hand non-metals are electronegative in nature. They generally have 5,6 or 7 electrons in their valence shells. They have tendency to form anion by gaining electrons.



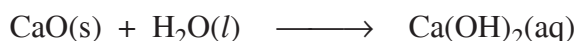
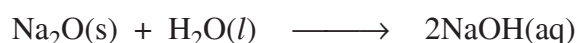
### 27.2.1 Chemical Properties of Metals

Let us now understand some common chemical reactions of metals.

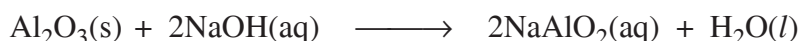
**1. Reaction of metals with Oxygen:** - Most of the metals react with oxygen and form oxides. The reaction may take place without heating as in sodium, calcium or potassium, while some metals react with oxygen on heating to form oxides.



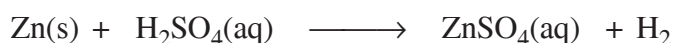
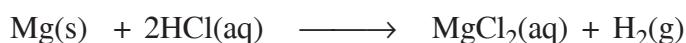
Oxides of metals are **basic** in nature as they react with water and form bases .e.g.  $\text{Na}_2\text{O}$ ,  $\text{CaO}$ ,  $\text{MgO}$ ,  $\text{K}_2\text{O}$  etc.



Oxides of aluminium ( $\text{Al}_2\text{O}_3$ ), zinc ( $\text{ZnO}$ ), tin ( $\text{SnO}$ ) and iron ( $\text{Fe}_2\text{O}_3$ ) are amphoteric in nature as they react with acids as well as with bases.



**2. Reaction of metals with acids:** - Metals react with common acids like dilute  $\text{HCl}$  and dilute  $\text{H}_2\text{SO}_4$  with evolution of  $\text{H}_2$ . The reaction of  $\text{Mg}$  ribbon with dil.  $\text{HCl}$  is represented in Fig. 27.1 below.



Notes



Notes

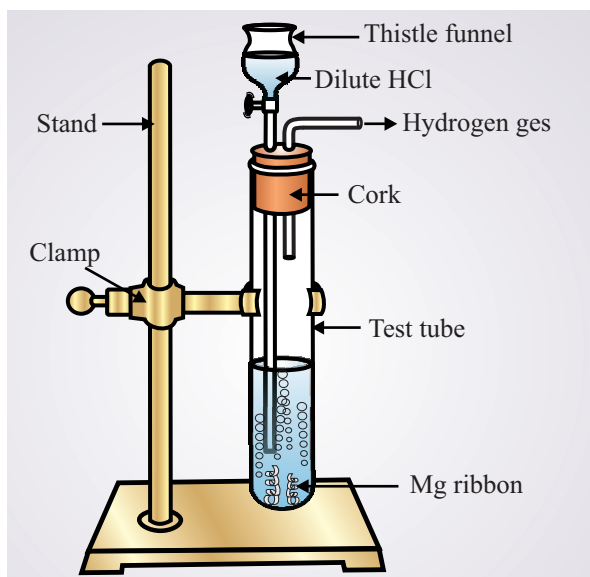
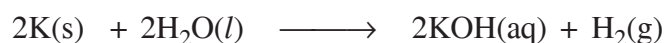
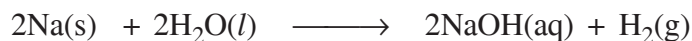
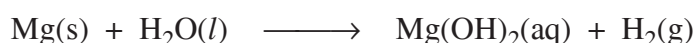


Fig. 27.1 Reaction between Mg and dil HCl

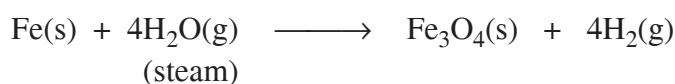
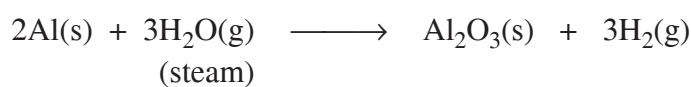
**3. Reaction of Metals with Water:** Many metals react with water to form hydroxides. Hydroxides are basic in nature. Sodium and potassium react with cold water.



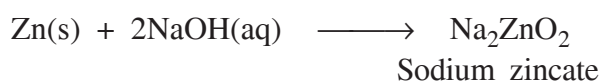
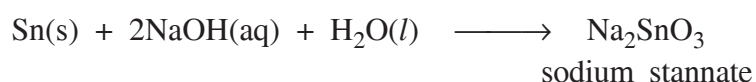
Magnesium reacts with hot water



- Metals like Al or Fe react on heating with water or with steam. In these conditions metals form metal oxides.



**4. Reaction of metals with Common bases:** Some metals like aluminum and zinc react with common bases.



## 27.2.2 Corrosion

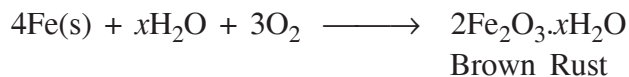
As you know that metals react with air and form their oxides. This oxide formation tendency of metals affects their physical and chemical properties. Can you guess one example in your day to day observation? You have already studied corrosion in Chapter No. 4. You might have observed the rusted nails at your home, rusted iron grills or gate in your garden due to oxidation of iron. You just bring a rusted nail and fresh nail if you have and compare their physical properties. You might have observed a green layer over old copper coin. This green layer is due to oxidation leading to formation of copper oxide which is finally converted to basic copper carbonate on its surface due to its oxidation. All these processes of oxidation of metals are known as **Corrosion**. Let us one again learn more about corrosion and various methods to prevent it.

Corrosion leads to the destruction of metal surface by the action of air and moisture.

Generally the corrosion word is used for oxidation of different metals but in case of corrosion of iron we use specifically term rusting. Let us see how rusting takes place in term of chemical reaction. When iron reacts with oxygen it produce brown powder called **rust** which is chemically hydrated ferric oxide.



Fig. 27.2 Rusted nut-bolt



You might have observed that in rainy season maximum rusting takes place due to increased moisture in the air.

For **rusting** of iron, two important conditions are required:

- (i) Presence of moisture
- (ii) Presence of oxygen

Let us do **activity 27.2** to see if this conditions of rusting is true



## ACTIVITY 27.2

You can do this activity in the lab of your study centre to find out if the above specified conditions for rusting hold true.

- Take three test tubes or small glass bottles (Clean & dry) and three clean iron nails.

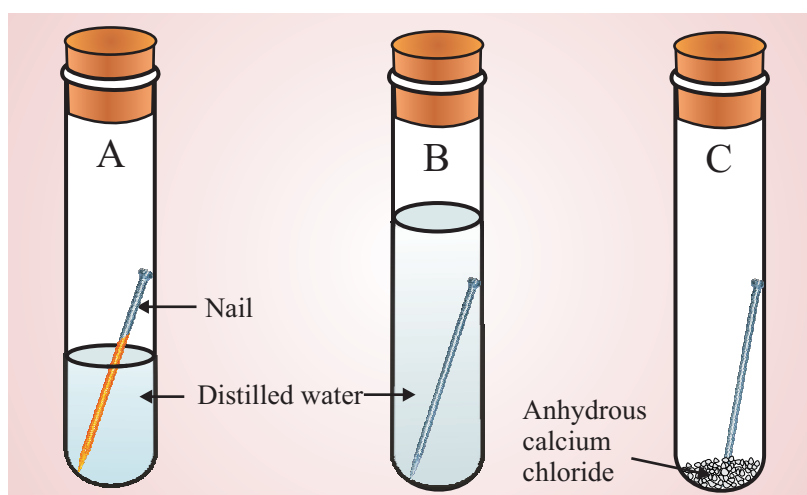


Notes



#### Notes

- Label these test tubes or small glass bottles as **A, B & C** and put one iron nail into each test tube.
- In test tube **A** take distilled water so that half of the nail is immersed in water and cover the mouth of the test tube with a cork.
- In test tube **B** take distilled water in excess so that nail is completely immersed in the water. Cover the mouth of the test tube with cork so that no air comes in contact with the nails.
- Test tube **C** should be dry and must contains anhydrous calcium chloride with iron nail.



**Fig. 27.3** Activity to study the condition for rusting

#### What do you observe?

You will find that maximum rusting has happened on the nail put inside the test tube **A**, but they do not rust in test tube **B** and **C**. Have a look on the nails in the test tube **A** and touch the surface of rusted nail. You will find a flaky reddish brown powder on its surface and it is known as rust.

#### Why does this happen?

In test tube **A** both oxygen as well as moisture (water) are present. Hence maximum rusting has happened. But in case of test tube **B** only moisture is present but not air and in test tube **C** only air is present not moisture. Hence rusting did not happen.

From the above activity it is clear that for rusting both oxygen and moisture are required. Now, can you tell me what you generally do to prevent your bicycle wheels or iron gate in your garden from rusting? Yes, we generally paint or put grease over the iron objects to prevent it from rusting. Let us know other various methods of prevention of rusting/corrosion.



### Methods of Prevention of Corrosion

There are various methods of preventing corrosion and rusting of iron. Our main concern is to know the various methods to prevent the rusting of iron because iron is a strategic metal as it plays a very important role in the development of a nation. Some of the important methods of prevention of corrosion are as follows:

#### 1. Painting

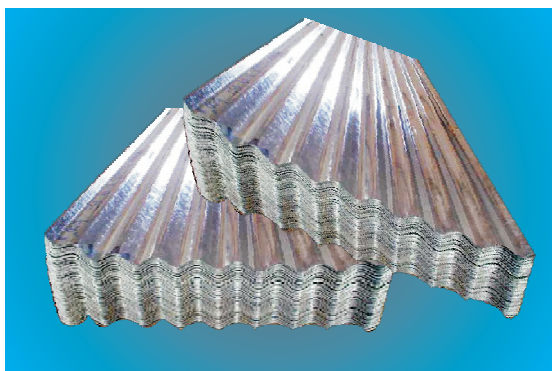
This is a common method of preventing iron from rusting. You might have observed that your parents paint iron gate in the garden and iron grills in your house. This painting prevents rusting by providing a coating over iron objects.

#### 2. Oiling and greasing

To put a layer of oil and grease on the iron objects also prevents them from rusting. Iron parts of various machines and vehicles are oiled and greased to prevent rusting and to minimize friction.

#### 3. Galvanization

In this method we put a layer of zinc metal on the iron objects and this process is known as **galvanization**. This method is used on large scale for making galvanized iron sheets for making boxes and for roof covering. You might have seen large boxes and containers sold in the market. Do you know that these iron sheets do not rust even if small zinc coating is removed from the sheet. Can you find the reason why such sheets do not rust? Galvanised iron sheets are used to make drum, trunks and other iron containers. Galvanised iron sheets are also used for building roofs and manhole covers. In brief, galvanization prevents rusting in a big way.



**Fig. 20.4** Galvanized sheets

#### 4. Alloying

This is a very good method for improving the quality of different metals. In this method a particular metal with other metal or non-metal is mixed in a fixed proportion

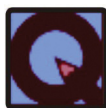


Notes



## Notes

to improve its quality like resistance towards corrosion, strength, hardness, shining and high tensile strength. For example iron metal can not be used for making utensils because it will rust but when it is mixed with nickel and chromium metal it becomes **stainless steel**. Now it becomes very useful and we are using this steel on a large scale for making kitchenwares and so many other things for our day to day uses. You just ask your father or mother about the carats of gold used for making the jewelry. You also can see the purity in terms of carat printed on the back of any gold jewelry. You will see that 22c is printed. It means it is of 22 carats. Pure Gold is actually 24 carats. Just think that why jewelers do not use 24 carat gold which is for making jewelry? This is because 24 carat gold is very soft and it can not be easily converted into fine wire or sheets.

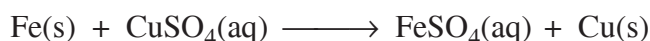


## INTEXT QUESTIONS 27.2

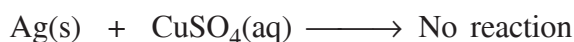
1. Under what conditions there are more chances for iron to be rusted?
2. Why metals are electropositive but non-metals are electronegative in nature?
3. Name a metal oxide which reacts with an acid as well as with a bases?
4. When zinc reacts with sodium hydroxide what is the product? Write the equation.
5. Write the formula of rust.

## 27.3 REACTIVITY OF METALS AND THE ACTIVITY SERIES OF METALS

You have already seen that when Fe is placed in a solution of  $\text{CuSO}_4$  it replaces Cu from the solution according to the following reaction (Chapter 4).



On the other hand when we place a silver wire in a solution of  $\text{CuSO}_4$ , no reaction occurs because silver is less reactive than copper.



However when a copper wire is dipped in  $\text{AgNO}_3$  solution, silver is replaced and deposited on copper wire. Reaction is as following



This indicates that copper is more reactive than silver.

In general, a more reactive metal displaces a less reactive metal from its salt solution.

By observing these reactions we will say that Fe is more reactive than Cu and copper is more reactive than silver. If we take solution of different metals and place other metals in these solutions, we can compare the reactivity of metals with respect to each other. The arrangement of metals in the decreasing order of their activity is known as **activity** or **reactivity series**. It is also known as **electrochemical series**. A portion of this series is given below. In this series only few metals are shown.

K	Most reactive metal	
Na	Decreasing Reactivity	
Ca		
Mg		
Al		
Zn		
Fe		
Pb		
H		
Cu		
Hg		
Ag		
Au		Least reactive metal



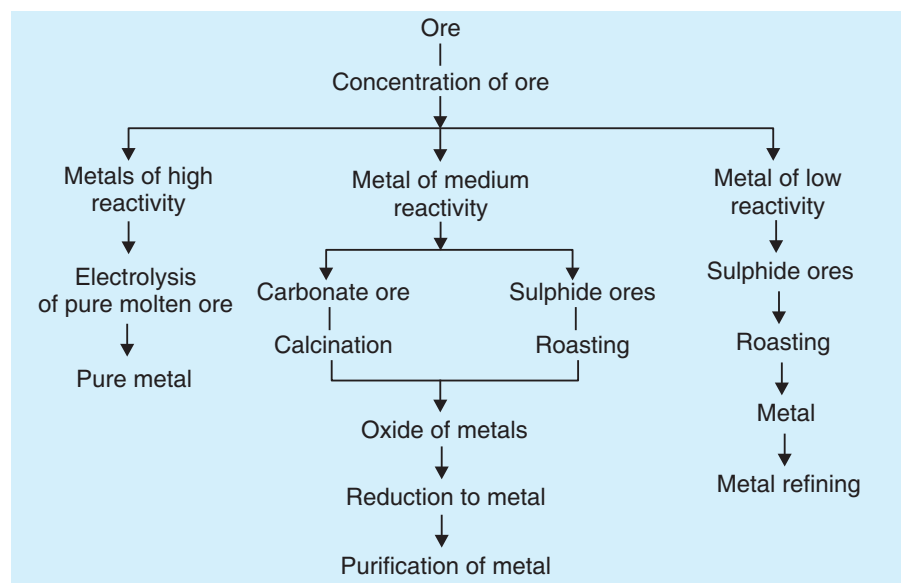
Notes

## 27.4 WHAT IS THE SOURCE OF METALS AND HOW DO WE OBTAIN THEM

After learning some interesting properties of metals and being aware of their day-to-day importance you will be definitely motivated to know the source of metals. You will be delighted to learn that earth crust is the major source of metals. Some metal salts are also present in sea. These salts are also source of certain metals like sodium, magnesium etc. The constituents of earth crust which contain these metals or their compounds are known as **minerals**. At some places minerals contain a high percentage of a particular metals and the metal can be profitably extracted from it, such minerals are called **ores**. An ore taken out from the earth contains a lot of impurities in form of sand and other undesirable materials. In fact, metal is present in these ores in form of a compound. Now getting pure compound of a metal from its ore and finally getting the metal from it pure compound is called **metallurgy**. Several steps involved in the extraction of metals from their ore are provided in the following chart.



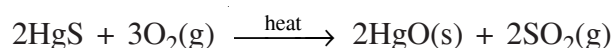
Notes



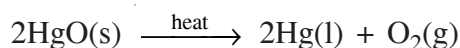
After understanding the activity series you can broadly consider metals in three categories

- (i) lower part of activity series (i.e. metal of low reactivity)
- (ii) the middle part of activity series (metals of medium reactivity)
- (iii) top part of activity series (metal of high reactivity)

Metals in the lower part of the activity series are very unreactive. For example mercury which is obtained as HgS (cinnabar) can be extracted easily



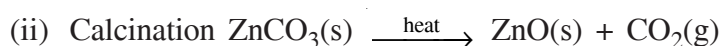
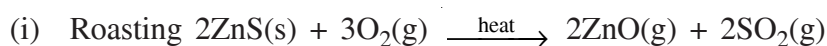
On further heating HgO is decomposed in mercury and oxygen



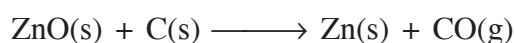
Metals in the bottom of activity series like Ag, Au etc are least reactive and are found in native state. No doubt some of them are also found in combined state.

The metals in the middle of the activity series such as iron, zinc lead etc are moderately reactive. They are present usually as sulphide or carbonate in nature. Prior to reduction these ores are converted into oxides as it is easy to reduce metal oxides.

For example, in case of zinc we get following reaction,



Metal oxides are reduced to corresponding metal using carbon.



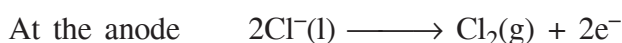
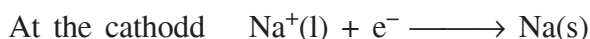
Here ZnO is reduced to Zn, you are already familiar with process of oxidation-reduction (chapter 4). Obtaining metal from their compounds is always a reduction process.

We also use displacement reaction for reduction of metal oxide. For example



This type of reaction is also known as **thermite process** and is very useful in welding of rail tracks or other heavy machineries.

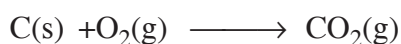
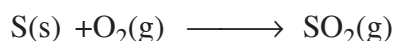
Metal at the top of activity series are highly reactive. These metals have high affinity for oxygen and therefore can not be obtained by reduction with carbon. These metals (such as Na, K, Mg) are obtained by the process of electrolysis of their molten salt. Even Al is also obtained by electrolysis of its oxide ( $\text{Al}_2\text{O}_3$ ). Sodium is obtained by electrolysis of its **molten salt**, NaCl.



## 27.5 CHEMICAL REACTION OF NON-METALS

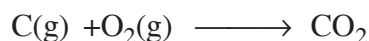
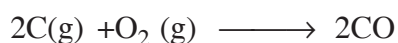
### 1. Reaction of non-metals with Oxygen, Water and some common acids and

**bases:** Non-metals react with oxygen on heating or burning to form their oxides



Many non metals form more than one oxide.

- Carbon with limited supply of oxygen on burning forms CO which is a neutral oxide. However in ample supply of air carbon forms  $\text{CO}_2$  which is an acidic oxide



- Nitrogen forms a series of oxides with oxygen
  - Nitrous oxide or laughing gas  $\text{N}_2\text{O}$  (neutral)
  - Nitric oxide, NO (neutral)
  - Dinitrogen trioxide,  $\text{N}_2\text{O}_3$  (acidic)



Notes



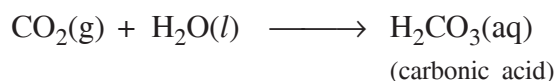
## Notes

- (iv) Nitrogen dioxide  $\text{NO}_2$  (acidic)
- (v) Dinitrogen tetroxide,  $\text{N}_2\text{O}_4$  (acidic)
- (vi) Dinitrogen pentoxide,  $\text{N}_2\text{O}_5$  (acidic)

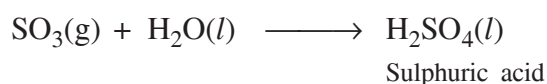
**Nature of oxides of non- metals**

In general oxides of non-metals are acidic in nature or after dissolving in water they form acids

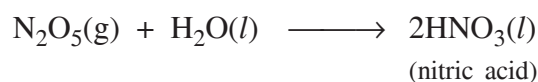
Carbon dioxide forms carbonic acid with water



Sulphur trioxide forms sulphuric acid with water

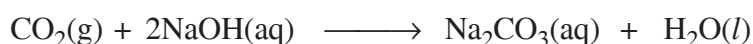
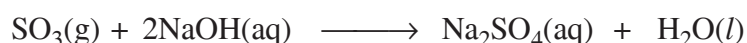


Dinitrogen pentoxide forms nitric acid with water

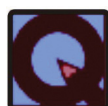


$\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$  are very important acids and play very important role in industries.

Due to their acidic nature, many non-metal oxides directly react with bases to form salts.



Halogens (F, Cl, Br, I) are also non-metals and they react with metals to form halides. For example, NaCl, NaBr, KCl, KBr, KI. Important source of these halides is sea. Oxides of halogens are not very important as compared to their salts. NaCl which is obtained from sea, is used as a raw materials for the manufacture of many important chemicals.

**INTEXT QUESTIONS 27.3**

1. What will happen if you keep a solution of copper (II) sulphate in an iron vessel? Explain the observation and give suitable explanation.
2. What will happen if you keep a solution of silver nitrate in a copper vessel? Explain the observation



Notes

3. An element reacts with oxygen to form an oxide which dissolves in water to form a solution that turns red litmus blue. The oxide dissolves in dil. HCl. Identify the element as metal or non-metal.
4. Give an example of a metal which
  - (a) is a liquid at room temperature.
  - (b) can be easily cut with a knife.
  - (c) is the best conductor of electricity.
  - (d) poorest conductor of electricity.
5. Write the formula of the oxide of magnesium formed on burning of magnesium ribbon in oxygen?
6. Name the hydroxide of magnesium formed when magnesium oxide reacts with hot water?
7. What happens when sodium metal reacts with water in cold? Write the reaction for the same?
8. Define activity series of metals? Write a reaction when zinc granules are added to copper sulphate solution?
9. What is the difference between 'mineral' and 'ore'?

## 27.6 SOME IMPORTANT USE OF METALS AND NON-METALS

Metals and non-metals are put to many uses which are based upon their properties.

### Uses of metals

- (i) Many metals like iron, copper and aluminium are used to make containers.
- (ii) Metals like copper, aluminium, iron and stainless steel are used to make utensils and fry pans.
- (iii) Ductile metals like copper and aluminium are used for making electrical wires. Steel ropes are used in cranes to lift heavy objects in making bridges.
- (iv) Iron and steel are used to make machines.
- (v) Zinc, lead, mercury, lithium are used to make cells and batteries.
- (vi) Malleable metals like iron and aluminium are used to make sheets which are used for various construction purposes.
- (vii) Gold, silver and platinum metals are used to make jewellery due to their luster, high malleability and inert nature.
- (viii) Alloys of different metals and non-metals are used for various purposes e.g. Stainless steel for making utensils.





## Notes

## Uses of non-metals

- (i) Hydrogen is used in manufacturing of ammonia gas which is further used in the manufacturing of urea (fertilizer).
- (ii) Hydrogen is a constituent of many industrial fuels like water gas ( $\text{CO} + \text{H}_2$ ) and coal gas ( $\text{H}_2 + \text{CH}_4$ ).
- (iii) Silicon is used in making transistors, chips for computers and photovoltaic cells.
- (iv) Silicon is used in steel industry to deoxidize steel and it produces high quality corrosion resistant steel.
- (v) Most of the phosphorous is used for making phosphoric acid  $\text{H}_3\text{PO}_4$  which is used in the manufacturing of phosphate fertilizers.
- (vi) White phosphorous as ( $\text{P}_4\text{S}_3$ ) is used in the match industry.
- (vii) Phosphates are added to the detergents as they help in the removal of dirt from soiled cloths.
- (viii) Sulphur is used in agriculture to control fungus and pests.
- (ix) Sulphur is used in the manufacturing of gun powder which is an intimate mixture of sulphur, charcoal and potassium nitrate.
- (x) Most of sulphur is converted into sulphuric acid which is called the **king of chemicals** and is used to make variety of other chemicals.



## WHAT YOU HAVE LEARNT

- Metals and non-metals are inseparable part of human life. Elements are broadly classified as metals non-metals.
- Metals can be distinguished from non-metal on the basis of their physical properties like malleability ductility, lusture etc.
- Metals have tendency to lose electrons whereas non-metal have tendency to gain electrons. Thus metals show electron positive character whereas non-metals show electronegative character.
- Metals are arranged in an activity or reactivity series based on their reactivity. More reactive metal replace less reactive metal from their solutions (e.g.  $\text{Zn(s)} + \text{CuSO}_4(\text{aq}) \longrightarrow \text{Cu(s)} + \text{ZnSO}_4(\text{aq})$ ). Most of the metals are found in nature in combined form as minerals. There are also less or least reactive metals like gold, platinum and silver which are found in nature or in free states. Metal are obtained from their ores by the process of **reduction**.
- An ore is a mineral from which a metal can be profitably extracted from it.
- Metallurgy is the branch of science which deals with extraction of metals from its ores.



- Some of the non-metals also are found in free state in nature for example sulphur and carbon (as coal, graphite, diamond).
- Metals mix with metal and non-metals and form **alloys** of desired properties like hardness, tensile strength colour etc. Bronze, stainless steel brass and duralamine are some common examples of alloys.
- Chemical properties of metals and non-metal are different. Metal and non-metal both react with oxygen (air), water and acids.
- Metals on combination with oxygen normally form basic oxides like  $\text{Na}_2\text{O}$ ,  $\text{MgO}$  and  $\text{CaO}$  whereas non-metals normally form acidic oxides like  $\text{CO}_2$ ,  $\text{SO}_2$ ,  $\text{NO}_2$  etc. Some non-metal oxides are neutral like  $\text{CO}$ ,  $\text{N}_2\text{O}$  and  $\text{H}_2\text{O}$ .
- Certain oxides of metals show both the properties acidic as well as basic e.g.  $\text{ZnO}$  and  $\text{Al}_2\text{O}_3$ .
- Reactive metals replace hydrogen from dilute solution of acids like ( $\text{H}_2\text{SO}_4$ ,  $\text{HCl}$  etc.)



Notes

**TERMINAL EXERCISES**

1. Name two precious metals used in making ornaments and write names of two important properties of these metals.
2. Name two non-metals which are commonly available and name their two important properties.
3. Write four physical properties of metals.
4. Write four physical properties of non-metals.
5. How would you differentiate between a metals and a non-metal.
6. Write reaction of metals with the following:  
(a) water                      (b) air or oxygen      (c) acids
7. What are three types of oxides of metals?
8. Name four uses of metals.
9. Write four uses of non-metals.
10. Define the following:  
(a) Brittleness              (b) Sonorous nature.
11. Name two metals which are most malleable and ductile. Also define:  
(a) Malleability              (b) Ductility  
(c) brittleness              (d) Tensile nature





## ANSWER TO INTEXT QUESTIONS



Notes

## 27.1

1. Malleability and ductility
2. Gold, silver and platinum
3. Sodium
4. Graphite (an allotropic form of carbon)
5. Gold and aluminium

## 27.2

1. Iron will be rusted if there is oxygen (air) and water.
2. Metals have tendency to lose electrons and get converted into a positive ion and therefore are electropositive. Non-metals have tendency to take electron and get converted into a negatively charged ion and therefore are electronegative.
3.  $\text{Al}_2\text{O}_3$  and  $\text{ZnO}$  are amphoteric in nature and react with acid and base.
4. Sodium zincate is formed  

$$\text{Zn(s)} + 2\text{NaOH(aq)} \longrightarrow \text{Na}_2\text{ZnO}_2\text{(aq)}$$
5.  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$

## 27.3

1. Iron will react with copper (II) sulphate and after sometimes a hole will be formed in the bottom of iron vessel. Reaction will be as following  

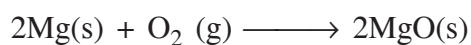
$$\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \longrightarrow \text{FeSO}_4\text{(aq)} + \text{Cu(s)}$$
2. When silver nitrate is kept in copper vessel, copper will replace silver as copper is above silver in the activity series and a hole is expected in the bottom of copper vessel. Reaction will be as following:  

$$\text{Cu(s)} + 2\text{AgNO}_3\text{(aq)} \longrightarrow 2\text{Ag(s)} + \text{Cu(NO}_3)_2\text{(aq)}$$
3. Since oxide of the element turn red litmus blue therefore that must be a basic oxide. This is further supported by dissolution of oxide in HCl. Basic oxide will be formed by a metal. Therefore element must be a metal
4. (a) Hg (mercury) is metal which is liquid at room temperature  
 (b) Sodium metal can be cut easily with knife  
 (c) Silver is best conductor of electricity  
 (d) Iron is poorest conductor of electricity



## Notes

5. When magnesium burns it forms magnesium oxide



6.  $\text{MgO(s)} + \text{H}_2\text{O(l)} \text{ (hot)} \longrightarrow 2\text{Mg(OH)}_2\text{(aq)}$

7.  $2\text{Na(s)} + \text{H}_2\text{O(l)} \longrightarrow 2\text{NaOH(aq)}$

8. When the metals are arranged in the decreasing order of their reactivity, a series is obtained, this series is called activity series. Metals in the upper position of the series can replace the metal in lower position from their aqueous solution.

When zinc granules are added to copper sulphate solution, reaction will be as following.



Zn is above copper in activity series therefore it (Zn) will replace copper from the solution.

9. Naturally occurring homogeneous inorganic substances are called minerals. But those minerals from which metals can be extracted profitably are called ores. every ore is a mineral but every mineral cannot be an ore.



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## CARBON AND ITS COMPOUNDS

In lesson 27, you have studied about the metals and non-metals. Carbon is an important non-metallic element. The chemistry of carbon and its compounds is an equally important field about which you will learn in this lesson. Carbon is the sixth most abundant element in the universe. It can exist in the free state or in the form of its compounds. It is the major chemical constituent of most organic matter. Carbon is the second most common element in the human body after oxygen. Carbon is present in coal, oil and natural gas. Main natural sources of carbon and its compound which are industrially important are coal, petroleum and natural gas which contribute to our national economy in a big way. Carbon also occurs in a number of minerals. You might have seen that when kerosene oil lamp burns it produces black soot which contains carbon particles. You might have also seen that when any some materials like wood, paper are burnt, a black residue is left which contains carbon.

Carbon atoms can form compounds by combining with other carbon atoms as well as atoms of other elements. Carbon has the unique property of forming long chains of carbon atoms. These long chains serve as a backbone on which various groups can attach to give a large variety of compounds. These compounds have a variety of structures, properties and uses in our life. You will study about some such compounds like alcohol, acetic acid, acetone etc. in this lesson.

We will begin this lesson with the discussion on the properties of carbon. Then, various allotropic forms of carbon-viz. *diamond*, *graphite* and *fullerenes* will be explained. We will also study about *hydrocarbons* which are compounds containing carbon and hydrogen. Here, we will cover various aspects of hydrocarbons such as their *classification*, *homologous series*, *isomerism* etc.

We will also give you a brief idea about some simple functional groups which can attach onto the hydrocarbon backbone to yield a large number of compounds. Further, the rules for naming the hydrocarbons and their derivatives will be explained. Finally, some compounds of daily use will be discussed.



Notes



## OBJECTIVES

After completing this lesson, you will be able to:

- recognize carbon as a constituent of all living matter and physical world;
- appreciate the existence of large number of carbon compounds;
- identify various sources of carbon compounds;
- explain various allotropes of carbon and compare their properties;
- describe the preparation of oxides of carbon and mention their properties;
- recognize catenation as the unique property of carbon i.e. its ability to form chains, branches and rings leading to the formation of large number of compounds of carbon;
- classify the hydrocarbons as saturated and unsaturated;
- describe various homologous series and identify various homologues;
- recognize different functional groups (alcohol, aldehyde, keto, carboxylic acid, halogen, double bond (alkene) and triple bond (alkyne) present in common organic compounds;
- appreciate that organic compounds have unique names as per IUPAC nomenclature;
- name simple organic compounds; and
- describe the nature, properties and uses of some useful organic compounds of daily uses i.e. ethanol and acetic acid.

## 28.1 CARBON AND ITS PROPERTIES

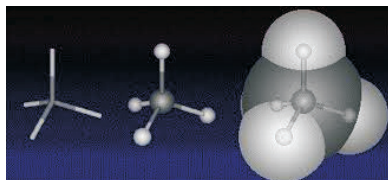
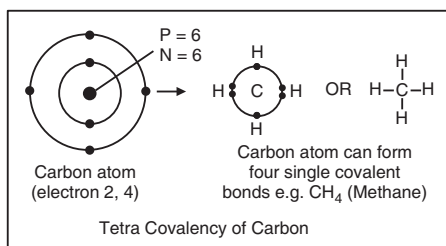
You have studied in lesson 6 that carbon belongs to Group 14 of the periodic table.

Group →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
↓ Period																		
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo
			<b>Lanthanoids</b>	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
			<b>Actinoids</b>	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

Carbon is abundant in the universe i.e. in Sun, planets, and atmosphere of the Earth. It is present in carbonate rocks i.e. limestone, dolomite, marble etc. It is also a major constituent of fossil fuels such as coal, petroleum and natural gas. It is present in the form of its compounds in all living organisms. Some such compounds are carbohydrates, proteins, fats etc. In combination with oxygen, it occurs as carbon monoxide and carbon dioxide. You are quite familiar with these compounds. Our atmosphere also contains some pollutants arising from these carbon compounds.

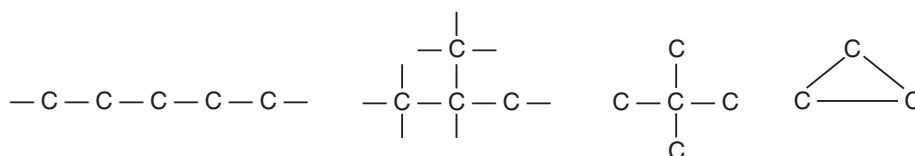
In the structure of a carbon atom, there are 4 electrons in the second shell. The electronic configuration of carbon is 2,4. To complete its octet, carbon requires four more electrons. But due to unfavorable energy considerations, it cannot gain four more electrons by ion formation and hence attain the electronic configuration of neon. Due to the same reason, it is also not possible for carbon to lose these four electrons and attain the noble gas configuration of helium. However, it can form covalent bonds by sharing these four electrons.

There are three naturally occurring isotopes of carbon –  $^{12}\text{C}$ ,  $^{13}\text{C}$ ,  $^{14}\text{C}$ .  $^{14}\text{C}$  is a radioactive and its half life is 5730 years. It is used in radio carbon -dating to determine the age of formerly living things.



It can form four covalent bonds, *i.e.* it is tetravalent in nature. It has a valency of four which is according to the rule you have learnt in lesson 5 i.e. Group No.14 – 10 = 4. The sharing of four more electrons from other atoms completes the octet of carbon atom and it attains the stability by forming four covalent bonds.

Carbon can form bonds with atoms of other elements such as hydrogen (H), nitrogen (N), oxygen (O), sulphur(S) and halogens etc. It also has the property of self combination i.e. bond formation with the other carbon atoms. Thus, carbon can form long chains of carbon atoms. This unique property of forming long chains is known as **catenation**.



Notes

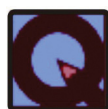




## Notes

The carbon-carbon covalent bond is strong in nature. As you will study later in this lesson, the long carbon chains can act as a backbone to which various groups can attach and give a large number of compounds. The total number of compounds formed by carbon exceeds the total number of compounds formed by all other elements of the periodic table. In addition to the single covalent bonds, carbon can also form multiple bonds, i.e. double or triple bonds with other carbon, oxygen or nitrogen atoms to give a large variety of compounds. The number of compounds formed is so large that a separate branch of chemistry, called **organic chemistry**, is devoted to the study of these compounds.

Before proceeding further, you can check your progress by answering the following questions.



## INTEXT QUESTIONS 28.1

1. What is the valency of carbon?
2. What is the nature of bonds formed by carbon?
3. Why carbon forms a large number of compounds?
4. Name the branch of chemistry which is devoted to the study of carbon compounds.
5. How many electrons are needed by a carbon atom to complete its octet?

## 28.2 ALLOTROPES OF CARBON

Carbon occurs in free state (*i.e.* not combined with any other element) in three allotropic forms. Allotropes are different forms of the same element in the same physical state, earlier only two allotropic forms *i.e.* *graphite* and *diamond* were known. Another allotropic form – fullerene – has, been discovered few years back. Let us now study about them in detail.

## 28.2.1 Diamond

Diamonds are formed inside the earth under the conditions of high temperature (about 1500°C) and high pressure (about 70,000 atmospheres).

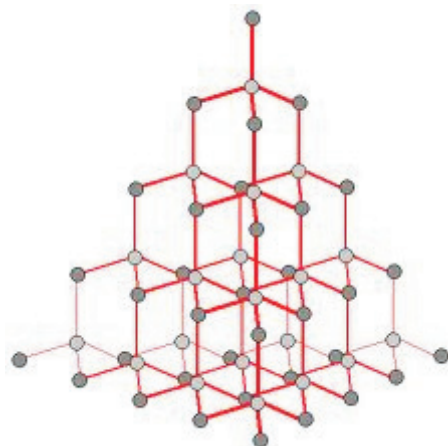
South Africa is the leading producer of natural diamonds. In India, diamonds are found in Panna in Madhya Pradesh and in Wajrakarur in Andhra Pradesh.

In a diamond crystal, each carbon atom is linked to four other carbon atoms by covalent bonds in a tetrahedral fashion. This results in a three dimensional arrangement as shown in Fig. 28.1





Notes



**Fig. 28.1** Three dimensional network of carbon atoms in diamond

The three-dimensional network of covalently bonded carbon atoms provides a rigid structure to diamonds. This rigidity makes diamond a very hard substance. It is, in fact, the hardest natural substance known. The only other substance harder than diamond is silicon carbide which is also known as carborandum but note that diamond is a natural substance whereas carborandum is a synthetic one.

Diamonds are basically colourless. However, some impurities impart colour to them.

The density of diamond is high. It has a value of  $3.51 \text{ g cm}^{-3}$ . The melting point of diamond (in vacuum) is also very high, i.e.  $3500^\circ\text{C}$  because a large amount of heat energy is required to break the three-dimensional network of covalent bonds.

Since all the four electrons are covalently bonded and there are no *free electrons* in diamond, hence it does not conduct electricity. But diamond is a good conductor of heat. Its thermal conductivity is five times that of copper. Thus, it can easily dissipate the heat energy released by friction when it is used as an abrasive.

Because of its above-mentioned properties, diamond has the following uses:

- (i) It is used in cutting and grinding of other hard materials.
- (ii) It is also employed in instruments used for cutting of glass and drilling of rocks.
- (iii) It is used in jewellery. Beautiful ornaments are made with diamonds. The high refractive index of diamond (2.5) makes it very brilliant when it is properly cut and polished.

### Synthetic Diamonds

Because of their importance diamonds worth millions of dollars are synthesized. In 1950's diamonds were synthesized by the scientist at General Electric in New York. They heated graphite to  $1500^\circ\text{C}$  in the presence of a metal such as



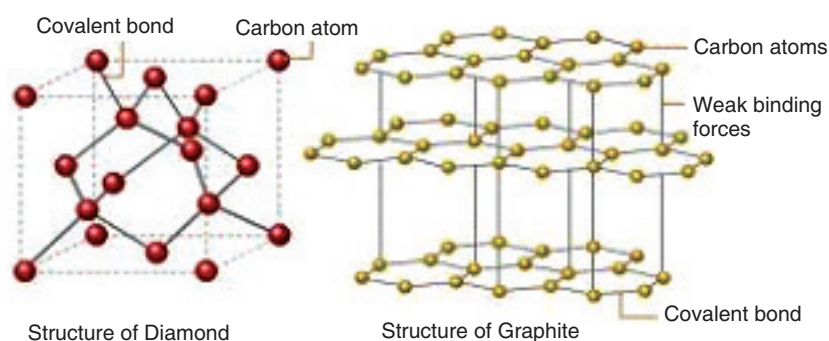
nickel and iron under a pressure of 50000 to 65000 atmospheres. Most of the diamonds so produced are used as abrasives and for making diamond coated cutting tools used for drilling.

Most synthetic diamonds lack the size and clarity of natural diamonds and are generally not used in jewellery. Gem quality diamonds can be produced but they are costly.

### 28.2.2 Graphite

In contrast to diamond, graphite is soft, black and slippery solid. It has a metallic luster. It is also a good conductor of electricity and heat.

Both graphite and diamond contain only carbon atoms, then why do they exhibit such different properties? We can find an answer to this question if we look at the structure of graphite as given below in Fig.28.2.



**Fig.28.2** Structures of Diamond and graphite

You can see that in contrast to diamond, which has a three-dimensional tetrahedral arrangement of carbon atoms, graphite contains layers of carbon atoms. In each layer, a particular carbon atom is linked to three other carbon atoms in a trigonal planar arrangement with a bond angle of  $120^\circ$ . Thus, three electrons of carbon are covalently bonded to the other three carbon atoms. The fourth electron, which does not participate in bonding, is free. These electrons of various carbon atoms are free to move along between the layers and hence are able to conduct electricity.

The bonding between these layers of carbon atoms is weak. Hence, these layers can slide one over the other. This property makes graphite a good solid lubricant. The density of graphite is less than that of diamond. It has a value of  $2.2\text{g cm}^{-3}$ . The melting point of graphite (in vacuum) is about  $3700^\circ\text{C}$ . Graphite can be converted to diamond by applying very higher atmospheric pressure and temperature.

Because of the above properties, graphite has the following uses:

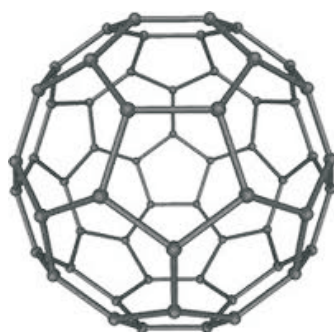
- (i) It is used as a dry lubricant for moving machine parts which operate at a high temperature and where other ordinary oil lubricants cannot be used.
- (ii) It is used for making electrodes in dry cells and in electric arcs.
- (iii) It is used for making pencil leads. Because of its soft nature and layered structure, it leaves black marks on paper. Hence, it is used for writing as leads in pencils.
- (iv) It is used for making containers which are used for melting metals.



Notes

### 28.2.3 Fullerenes

Fullerenes were discovered in 1985 by Robert F. Curl, Harold W. Kroto and Richard E. Smalley. They were awarded the Nobel Prize in Chemistry in 1996 for this discovery. Fullerenes have closed structures like a football. A typical fullerene, named as buckminsterfullerene has 60 carbon atoms. Its structure is shown below in Fig. 28.3.



**Fig. 28.3** *Buckminsterfullerene, C<sub>60</sub>*

Fullerenes are formed when vaporized carbon condenses in an atmosphere of an inert gas. The discovery of fullerenes has opened up a new field in Chemistry. Fullerenes of various other sizes are being synthesized and their properties and uses are being studied. New materials, which contain metals enclosed in the fullerenes are being synthesized. It is hoped that these materials would find uses as superconducting materials, new catalysts, polymers etc.

In addition to the above three allotropic forms, carbon also exists in three microcrystalline or amorphous forms of graphite. They are **charcoal, coke** and **carbon black**.



- *Charcoal* is formed when wood is heated strongly in the absence of air. It has a large surface area. Activated charcoal is a pulverized form whose surface has been made free from any adsorbed materials by heating with steam. It is widely used for adsorbing coloured impurities and bad odours from water and other substances.



- *Coke* is an impure form of carbon. It is formed when coal is strongly heated in the absence of air. It is used as a reducing agent in metallurgy.



Coke

**ACTIVITY 28.1**

Take samples of graphite, coal, charcoal and compare their properties.

- *Carbon black* is formed by heating hydrocarbons in limited supply of oxygen. For example,





## ACTIVITY 28.2

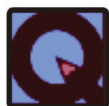
Find out places in India which have rich resources of coal, petroleum and natural gas.

Mark these places on the map of India.



Carbon black

It is used as a pigment in black inks. It is also used in making rubber tyres for automobiles.



## INTEXT QUESTIONS 28.2

1. Which allotropic form of carbon has been discovered few years back?
2. Each carbon atom is linked to how many carbon atoms in
  - (i) Diamond
  - (ii) Graphite
3. Why diamond has high melting point?
4. Is diamond a conductor of electricity? Give reason for your answer.
5. Why is graphite a good lubricant?
6. Give two uses of graphite.
7. What kind of structure is possessed by fullerenes?
8. Name the three microcrystalline forms of carbon and give their use.

## 28.3 COMPOUNDS OF CARBON

The compounds of carbon can be classified as *organic* and *inorganic* compounds.

Earlier the **organic compounds** were defined as those compounds which originated from living organisms but it is now possible to synthesize organic compounds in the laboratory, therefore, they are now defined as compounds of carbon.

The compounds of carbon, which are not organic compounds, are called **inorganic compounds**. Most of the inorganic compounds are obtained from various



Notes



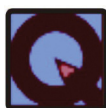
## Notes

minerals. For example, limestone, marble and dolomite contain carbon as *carbonates*. The other inorganic compounds are carbides of metal (e.g.  $\text{CaC}_2$ , calcium carbide),  $\text{HCN}$ ,  $\text{CS}_2$  and oxides of carbon such as  $\text{CO}_2$  and  $\text{CO}$ .

The organic compounds are obtained from natural sources such as *plants* and *animals*, *coal* and *petroleum*. You have studied in lesson \*\* that plants and animals are sources of complex organic compounds such as carbohydrates, starch, oils, proteins, drugs etc. Coal gives us benzene, phenol, naphthalene etc. whereas petroleum is source of petrol, diesel, kerosene, lubricating oils, wax and other compounds. In addition, a large variety of synthetic organic compounds exists and their number is increasing daily. Thus, the number of organic compounds as compared to the inorganic ones is very large.

The properties of organic and inorganic compounds are different from each other. Organic compounds are generally low melting solids or liquids. They dissolve in organic solvents such as benzene, alcohol, chloroform etc. but are generally insoluble in water. The inorganic compounds are generally solids which have high melting and boiling points. They generally dissolve in water but are insoluble in organic solvents.

After having a general idea about the nature of compounds, let us now study the oxides of carbon. But before that why don't you answer the following questions to check your understanding.



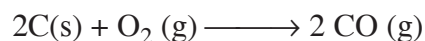
## INTEXT QUESTIONS 28.3

- Classify the following compounds as organic or inorganic:
  - Sugar
  - calcium carbide
  - kerosene
  - carbon dioxide
  - carbon disulphide
- Give two differences between organic and inorganic compounds.

## 28.4 OXIDES OF CARBON

The two important oxides of carbon are carbon monoxide ( $\text{CO}$ ) and carbon dioxide ( $\text{CO}_2$ ).

**Carbon monoxide** is formed when carbon or hydrocarbons are burned in a limited supply of oxygen.



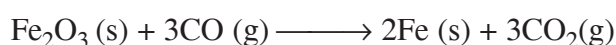


It is a colourless and odourless gas. It has a melting point of  $-199^{\circ}\text{C}$  and boiling point of  $-192^{\circ}\text{C}$ .

It is a major air pollutant and is released in large quantities from automobile engines. Its low level poisoning causes headache and drowsiness whereas its large amounts can cause even death. It is toxic because it reduces the oxygen carrying capacity of blood by binding with haemoglobin, the red pigment of blood.

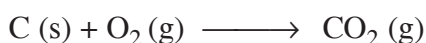
Carbon monoxide has many uses which are given below:

- (i) It is used as a reducing agent in metallurgical processes to reduce metal oxides. For example, in the blast furnace, it is used to reduce iron oxide to iron.

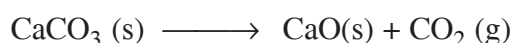


- (ii) In the presence of a catalyst, it can combine with hydrogen to give methanol ( $\text{CH}_3\text{OH}$ ).
- (iii) It forms carbonyl compounds. The nickel carbonyl  $\text{Ni}(\text{CO})_4$  is used in the refinement of nickel.
- (iv) It is used as a fuel.
- (v) It is used in the synthesis of several organic compounds.

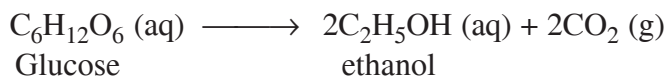
**Carbon dioxide** is formed when carbon containing substances are burnt in excess of oxygen.



It is also produced by heating of carbonates.



It is also released as a by product in the fermentation of sugar to produce alcohol (ethanol).



Carbon dioxide is colourless and odourless gas. It is present in very small amount (0.03%) in the atmosphere. It is a major contributor to the green house effect about which you will study in lesson —.

The main uses of carbon dioxide are as follows:

- (i) Solid carbon dioxide also called *dry ice* is used as a refrigerant because when it is cooled at atmospheric pressure, it condenses into a solid rather than as a liquid. This solid sublimates at  $-78^{\circ}\text{C}$

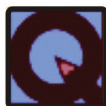


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- (ii) It is used in the production of *carbonated drinks*.
- (iii) It is used in the production of washing soda ( $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ ) and baking soda ( $\text{NaHCO}_3$ ).



### INTEXT QUESTIONS 28.4

1. What is dry ice?
2. Which gas, carbon monoxide or carbon dioxide, is a major air pollutant?
3. Which gas is used in carbonated drinks?
4. Name the gas which is a major contributor to the green house effect.
5. Name the products obtained by the fermentation of sugar.

### 28.5 HYDROCARBONS

As the name suggests, hydrocarbons are compounds which contain only carbon and hydrogen. As you have studied in lesson — the main source of hydrocarbons is petroleum.

Hydrocarbons can be divided into various classes as show in Fig. 28.4.

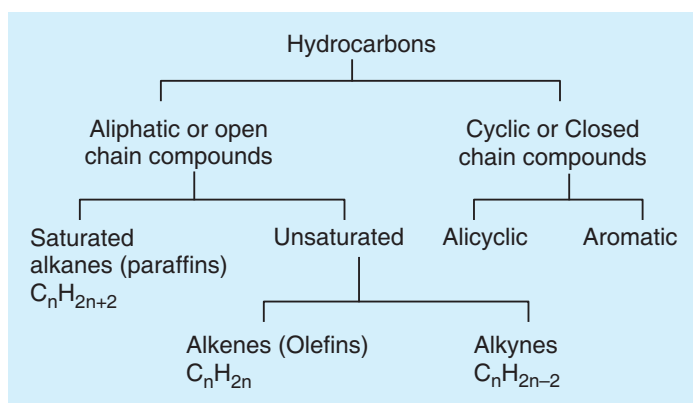


Fig.28.4 Classification of hydrocarbons



### ACTIVITY 28.3

Why are sources of hydrocarbons getting scarce? What should be done to save these resources?



**Aliphatic hydrocarbons:** The word aliphatic is derived from the Greek word aleiphar meaning fat. Aliphatic hydrocarbons were named so because they were derived from fats and oils.

Hydrocarbons can be *acyclic* compounds, which are straight chain compounds, or cyclic compounds, which have rings of carbon atoms.

**Aromatic hydrocarbons:** The word aromatic is derived from the word *aroma* meaning fragrance. The aromatic compounds have a characteristic smell. Structurally, they include benzene and its derivative.

The *aliphatic hydrocarbons* can be divided into two categories: **saturated hydrocarbons** and **unsaturated hydrocarbons**. In *saturated hydrocarbons*, carbon atoms are linked to each other by single bonds whereas in *unsaturated hydrocarbons*, multiple bond (double and triple bonds) are present between carbon atoms.

Let us now study about them in details.

### 28.5.1 Saturated hydrocarbons (Alkanes)

Methane ( $\text{CH}_4$ ) is the simplest alkane in which four hydrogen atoms are linked to the carbon atom in a tetrahedral fashion as shown in Fig.28.5.



Fig.28.5 Structure of methane

If instead of a hydrogen atom, the carbon atom is further linked to another carbon atom, we get another alkane, namely ethane ( $\text{C}_2\text{H}_6$ ), Fig 28.6.



Fig.28.6 Structure of Ethane

Similarly, more carbon atoms can link with each other and the carbon chain can further extend to give a variety of hydrocarbons.



Notes



Notes

The general formula of alkanes is  $C_nH_{2n+2}$  where  $n$  is the number of carbon atoms in the alkane molecule. First ten alkanes corresponding to  $n = 1$  to  $n = 10$  are given in Table 28.1.

**Table 28 .1 Some alkanes and their physical properties**

No. of Carbon atoms	Name	Molecular formula	Molecular Mass (u)	Melting point ( $^{\circ}C$ )	Boiling point( $^{\circ}C$ )	No. of structural isomers
1	Methane	$CH_4$	16	-183	-162	1
2	Ethane	$C_2H_6$	30	-172	-89	1
3	Propane	$C_3H_8$	44	-187	-42	1
4	Butane	$C_4H_{10}$	58	-138	0	2
5	Pentane	$C_5H_{12}$	72	-130	36	3
6	Hexane	$C_6H_{14}$	86	-95	68	5
7	Heptanes	$C_7H_{16}$	100	-91	98	9
8	Octane	$C_8H_{18}$	114	-57	126	18
9	Nonane	$C_9H_{20}$	128	-54	151	35
10	decane	$C_{10}H_{22}$	142	-30	174	75

Alkanes are colourless and odorless compounds. They have very low reactivity. Many of these compounds are gases or liquids as shown in Table 28.1.

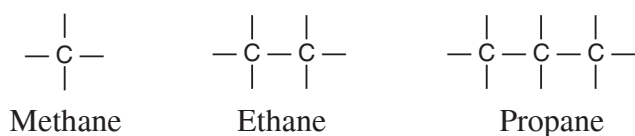
You can also see in Table 28.1 that each compound differs from the previous one by a  $-CH_2$  unit. Such a series of compounds is known as **homologous series**. Each homologous series has a general formula. We have mentioned above the general formula for alkanes as  $C_nH_{2n+2}$  which is the general formula for the homologous series of alkanes, i.e. all the compounds of the homologous series of alkanes can be represented by this general formula.

You will see later that similar homologous series also exist for the unsaturated hydrocarbons and derivatives of hydrocarbons.

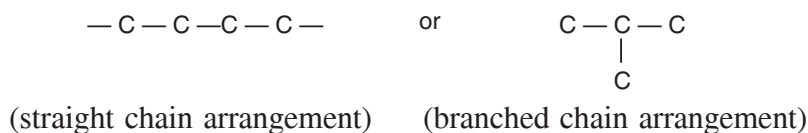
### 28.5.1a Isomerism in alkanes

So far we have not mentioned anything about the last column of Table 28.1. It mentions the number of isomers for various alkanes. **Isomers are compounds which have the same molecular formula but have different structures.**

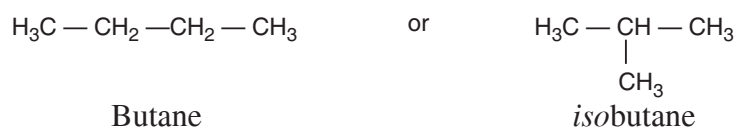
The first three hydrocarbons have only one isomer because there is only one way in which one, two or three carbon atoms can link to each other i.e.



But when there are four carbon atoms, they can join in two different ways as follows:



Corresponding to the above two carbon skeletons, there are two hydrocarbons— butane and *isobutane* as shown below:



They are the isomers of butane as they have the same molecular formula ( $\text{C}_4\text{H}_{10}$ ) but have different structures.

The number of possible structures in which different carbon atoms can link to each other increases with the increase in number of carbon atoms in the alkane molecules. Hence, the number of isomers of alkanes increases with the increase in the number of carbon atoms as is shown in Table 28.1.

After knowing about the structures of alkanes, let us now study how they are named.

### 20.5.1b IUPAC Nomenclature of Alkanes

Earlier organic compounds were known by their popular or common names which mostly originated from the sources of these compounds. But as the number of these compounds increased, it became difficult to correlate the structure and name of the compound. This led to the need of a systematic nomenclature of compounds.

In 1892, ‘International Union of Chemists’ met in Geneva, Switzerland and framed the rules for nomenclature. Later, this organization was named as International Union of Pure and Applied Chemistry (IUPAC) and the names approved by it are called IUPAC names of compounds.

The systematic names are called IUPAC names. For IUPAC naming, we must have idea about **word root** of carbon skeleton. The word root for different carbon skeletons are given below:

No. of Carbon atom	Word root	No. of Carbon atom	Word root
1	meth	5	pent
2	eth	6	hex
3	prop	7	hept
4	but	8	oct



Notes



Notes

The rules for the IUPAC nomenclature of alkanes are as follows:

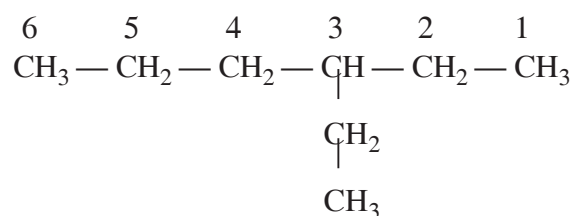
1. Upto butane, the common names are listed in Table 28.1, have been adopted by IUPAC. For straight chain alkanes higher than butane, the suffix *-ane* is added to the Greek root for the number of carbon atoms, *i.e.* *pent* – for five, *hex* – for six and so on.

For example  $\text{CH}_4$ , word root + ane  $\longrightarrow$  Meth + ane  $\longrightarrow$  Methane

$\text{C}_3\text{H}_8$ , word root + ane  $\longrightarrow$  Prop + ane  $\longrightarrow$  Propane, and so on.

The names of alkanes so obtained are listed in Table 28.1.

2. For branch chain alkanes, the longest continuous chain of carbon atoms is selected as the main chain which gives the root name of the hydrocarbon. For example, in the following compounds the longest chain consists of 6 carbon atoms.



Hence, this compound is a hexane derivative.

3. Then, the substituent alkyl groups are identified and named. The alkyl groups are named by replacing *-ane* suffix of the alkane with *-yl* suffix. Some examples of the names of alkyl groups so obtained are given below.

**Table 28.2 : Naming of alkyl groups**

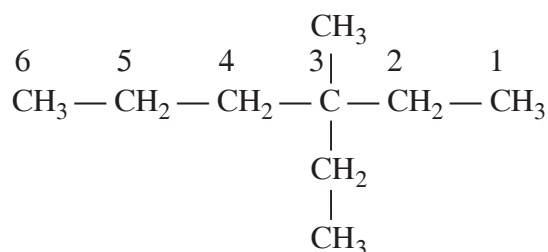
Alkyl group	Derived from Alkane	Name of Alkyl group
$-\text{CH}_3$	methane	methyl
$-\text{C}_2\text{H}_5$	ethane	ethyl
$-\text{C}_3\text{H}_7$	propane	propyl
and so on		

You can see that in the above compound, the substituent alkyl group is an ethyl group.

4. The location of the substituent alkyl group on the main chain is specified by counting its number from that end of the carbon chain which gives it the lowest possible number. If we count from the end as shown in point No.2, we see that the ethyl group is attached to the third carbon atom of the main chain. Hence, we write the IUPAC name of the above alkane as 3-ethylhexane.

Note that the number and alphabets are separated by a hyphen (-) and there is no space between the substituent and the root name.

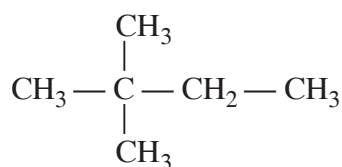
5. When more than one substituent is present on the carbon chain, then they are listed in alphabetical order.



3-ethyl-3-methylhexane

6. The identical substituents are indicated by the prefixes *di* (two), *tri* (three), *tetra* (four) etc.

The prefixes *di*, *tri*, *tetra* etc. are not considered while arranging the substituent's in the alphabetical order.



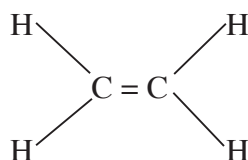
2,2-dimethylbutane

### 28.5.2 Unsaturated Hydrocarbons

Unsaturated hydrocarbons contain carbon-carbon double or triple bonds. Unsaturated hydrocarbons having carbon-carbon double bonds ( $\text{—C}=\text{C—}$ ) are called alkenes whereas those having carbon-carbon triple bonds ( $\text{—C}\equiv\text{C—}$ ) are known as **alkynes**.

#### (a) Alkenes

The simplest alkene, ethene has two carbon atoms joined by a double bond. Its molecular formula is  $\text{C}_2\text{H}_4$ . Its structure is as shown below:



Ethene

Similar to alkanes, alkenes also form a homologous series of compounds in which each member differs from the next one by a  $\text{—CH}_2$  unit. The homologous series of alkenes is shown below in Table 28.3.



Notes

Table 28.3 Homologous series of alkenes

No. of carbon atoms	Name of the Alkene	Molecular formula
2	ethene	C <sub>2</sub> H <sub>4</sub>
3	propene	C <sub>3</sub> H <sub>6</sub>
4	butene	C <sub>4</sub> H <sub>8</sub>
5	pentene	C <sub>5</sub> H <sub>10</sub>
And so on		

You can see that the homologous series of alkenes can be represented by the general formula C<sub>n</sub>H<sub>2n</sub> where *n* represents the number of carbon atoms in the alkene molecule.

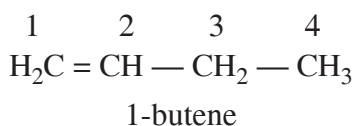
IUPAC name of an alkene can be given as

Ex C<sub>2</sub>H<sub>4</sub>, Word root + ene = eth + ene = Ethene

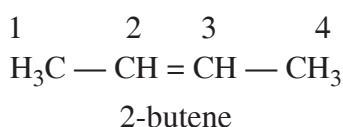
The names of alkenes are given by replacing the *-ane* suffix of alkanes by *-ene*.

The other rules for the nomenclature of alkenes are same as those of alkanes.

However, the position of the double bond is indicated by the smaller number of the two carbon atoms forming the double bond. For example, in the following alkene



The double bond is between the carbon atoms numbered as 1 and 2 and hence, it is called 1-butene. Similarly, in another alkene shown below,



The double bond is between the carbon atoms numbered as 2 and 3 and hence it is called 2-butene.

Note that these two butenes *i.e.* 1-butene and 2-butene are *isomeric* in nature.

### (b) Alkynes

The simplest alkyne is *ethyne* and it has molecular formula C<sub>2</sub>H<sub>2</sub>. Its common name is acetylene. It is used to ripen the fruits such as banana, mango etc. It is also used along with oxygen in oxy-acetylene torch which is used for welding purposes. Its structure is as shown below:



Notes

The homologous series of alkynes is shown below in table 28.4

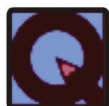
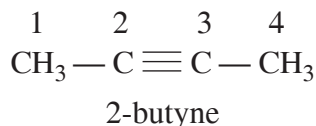
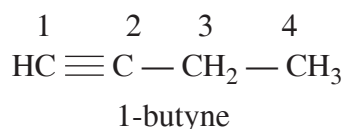
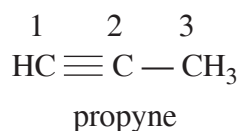
**Table 28.4 : Homologous series of alkynes**

No. of carbon atoms	Name of the Alkyne	Molecular formula
2	ethyne	C <sub>2</sub> H <sub>2</sub>
3	propyne	C <sub>3</sub> H <sub>4</sub>
4	butyne	C <sub>4</sub> H <sub>6</sub>
5	pentyne	C <sub>5</sub> H <sub>8</sub>

You can see from the above table that the general formula for the homologous series of alkynes is C<sub>n</sub>H<sub>2n-2</sub> where *n* is the number of carbon atoms in the alkyne molecule.

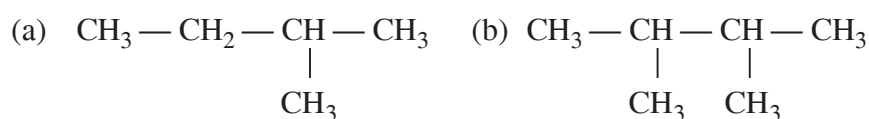
IUPAC Name of alkyne = Word root + yne, eg C<sub>2</sub>H<sub>2</sub> = eth + yne = Ethyne

Alkynes are named by replacing *-ane* suffix of alkanes by *-yne* suffix. The other rules of nomenclature of alkynes are similar to those of alkanes. The names of some simple alkynes are given below:



### INTEXT QUESTIONS 28.5

- What is the difference between saturated and unsaturated compounds?
- Give two examples each of (i) saturated compounds and (ii) unsaturated compounds.
- Name the alkane which has three carbon atoms.
- Define isomers.
- What is the full form of IUPAC?
- Name the following alkyl groups:
  - CH<sub>3</sub>
  - C<sub>2</sub>H<sub>5</sub>
- Give IUPAC name of these compounds



Notes



Notes

28.6 FUNCTIONAL DERIVATIVES OF HYDROCARBONS

Functional derivatives of hydrocarbons are those compounds which are derived from hydrocarbons by replacing one or more hydrogen atoms with the *functional groups*.

A **functional group** is an atom or a group of atoms which is responsible for characteristic properties of a compound. The double and triple bonds which respectively give the alkenes and alkynes their characteristic properties are functional groups. The other examples of functional groups are halogens (— F, — Cl, — Br, — I etc.), — OH (hydroxyl group and > C = O (carbonyl group).

Since each of these functional groups exhibits the characteristic properties and reactions, all the compounds having the same functional group show the same chemical reactions and constitute one class of compounds. For example, *haloalkanes* such as chloromethane, chloroethane, chloropropane which have the *halo* (chloro) functional group show the characteristic reactions of the halo (chloro) group and hence, constitute the class of compounds known as *haloalkanes*.

CH <sub>3</sub> Cl	Chloromethane
C <sub>2</sub> H <sub>5</sub> Cl	Chloroethane
C <sub>3</sub> H <sub>7</sub> Cl	Chloropropane

Similarly, the *alcohols* – methanol, ethanol, propanol *etc.* which have — OH functional group show characteristic properties and reactions due to the — OH group and they constitute another class called alcohols which is different from that of haloalkanes.

CH <sub>3</sub> OH	Methanol
CH <sub>3</sub> CH <sub>2</sub> OH	Ethanol
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> OH	Propanol

Table 28.5 shows the common functional groups and their classes.

Table 28.5 : Some common functional groups

Functional group	Class	General formula	Example
>C = C<	alkene	C <sub>n</sub> H <sub>2n</sub>	H <sub>2</sub> C = CH <sub>2</sub>
—C ≡ C—	alkyne	C <sub>n</sub> H <sub>2n-2</sub>	HC ≡ CH
— X (F, Cl, Br, I)	haloalkanes	R — X	CH <sub>3</sub> -Cl
— OH	alcohols	R — OH	CH <sub>3</sub> OH
$\begin{array}{c} \text{O} \\    \\ \text{—C—H} \end{array}$	aldehydes	$\begin{array}{c} \text{O} \\    \\ \text{R—C—H} \end{array}$	CH <sub>3</sub> CHO



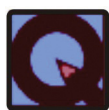
$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}- \end{array}$	ketones	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{R} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3-\text{C}-\text{C}_2\text{H}_5 \end{array}$
$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{OH} \end{array}$	carboxylic acids	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{OH} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3-\text{C}-\text{OH} \\ \text{acetic acid} \end{array}$
$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{O}- \end{array}$	esters	$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{OR} \end{array}$	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3-\text{C}-\text{O}-\text{CH}_3 \end{array}$



Notes

**ACTIVITY 28.4**

Take some simple organic compounds available around you which contain the simple functional groups and study their properties. You can take help of your teacher for this activity.

**INTEXT QUESTIONS 28.6**

1. Identify the functional groups present in the following compounds:

- (i)  $\text{CH}_3\text{CH}_2\text{OH}$  (ii)  $\text{CH}_3\text{Cl}$  (iii)  $\text{C}_2\text{H}_2$  (iv)  $\text{CH}_3-\text{COOH}$

In the next section, you will study about some simple compounds which contain some of the above mentioned functional groups.

**28.7 COMPOUNDS OF DAILY USE**

We daily use many organic compounds such as alcohol, vinegar, vanillin, acetone etc. Let us now study about some of them in more details.

**28.7.1 Alcohols**

You have read earlier that alcohols contain the hydroxyl ( $-\text{OH}$ ) functional group. They are named by replacing final *e* of the parent alkane by *ol*. Some examples of alcohols are given below:

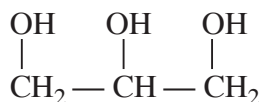
$\text{CH}_3\text{OH}$   
Methanol

$\text{C}_2\text{H}_5\text{OH}$   
Ethanol

$$\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3-\text{CH}-\text{CH}_3 \end{array}$$
 2-propanol (rubbing alcohol)



Notes

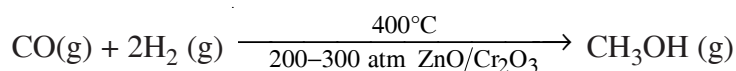


1, 2, 3-propanetriol (Glycerin)

Alcohols are soluble in water because they can form hydrogen bonds with water molecules.

**(a) Methanol (CH<sub>3</sub>OH)**

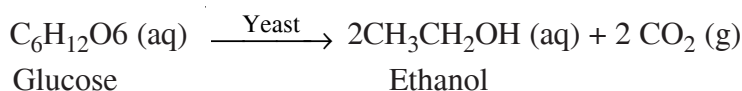
Methanol is also called wood alcohol because it was earlier obtained by heating wood in the absence of air. It is prepared by heating carbon monoxide and hydrogen under pressure and by using a catalyst.



It has many industrial uses. It is used in the synthesis of acetic acid and many adhesives, fibers and plastics. It is also used as an additive to petrol and also as a fuel.

**(b) Ethanol (C<sub>2</sub>H<sub>5</sub>OH)**

Ethanol is present in beer, wine and medicines. It is produced by the fermentation of carbohydrates such as glucose and starch present in grapes, barley etc. The reaction is catalyzed by the enzymes present in yeast.



It is used as solvent for organic compounds. It is also used as sprit (95% Ethanol)

**28.7.2 Aldehydes and Ketones**

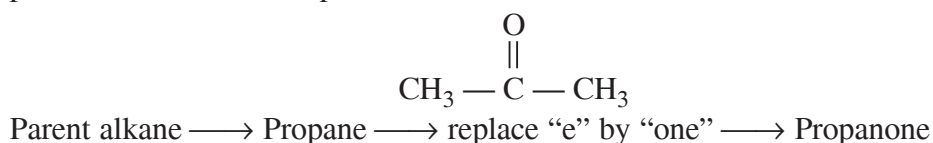
**IUPAC name of aldehyde-** Suffix “al” is added by replacing “e” from the parent alkane. For example

For HCHO, parent alkane → Methane → replace “e” by “al” → Methanal

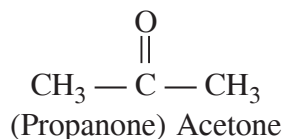
For CH<sub>3</sub>CHO, parent alkane → Ethane → replace “e” by “al” → Ethanal



**IUPAC naming of ketone -** Suffix “one” is added by replacing “e” from the parent alkane. For example



In ketones, the carbonyl group is attached to two carbon atoms as given below:



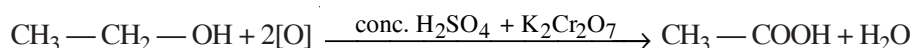
An aqueous solution of formaldehyde, called *formalin* is used to preserve biological specimens in the laboratories. Vanillin which is used as a flavour, also has the aldehyde functional group.

Acetone is used as a solvent and also in nail polish removers.

### 28.7.3 Carboxylic Acids

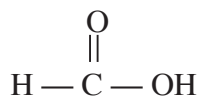
Carboxylic acids contain the carboxyl ( $\text{—C(=O)—OH}$ ) functional group. Their general formula is  $\text{R—COOH}$ . Vinegar which is also called acetic acid has the formula  $\text{CH}_3\text{COOH}$ .

It is obtained by the oxidation of ethanol in the presence of conc.  $\text{H}_2\text{SO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$

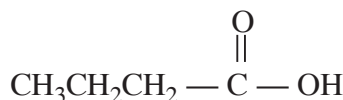


It is soluble in water as it forms hydrogen bond with water molecule. It is used as preservative .

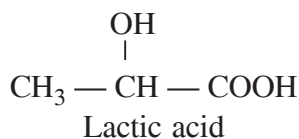
Some common carboxylic acids are given below:



Formic acid (from ants)  
'In Latin *formica* means ant'

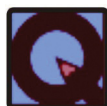


Butyric acid  
(present in rancid butter)



(present in sour milk, also produced in muscles during heavy exercise)

Similarly, citric acid present in citrus fruits and ascorbic acid present in Vitamin C are carboxylic acids.



### INTEXT QUESTIONS 28.7

1. What is wood alcohol?
2. What is glycerin? Which functional group is present in it.
3. How is ethanol produced?



Notes



## Notes

4. Give two examples of compounds having aldehyde functional group.
5. What is the use of acetone?
6. Which acid is present in vinegar?
7. Name the compound which has an aldehyde group and is used as a flavour.
8. Give IUPAC Name of the following compounds
 

(a) $C_2H_5OH$	(b) $CH_3COOH$
(c) $HCHO$	(d) $CH_3 - CO - CH_3$
9. Name the functional group present in the following compounds
 

(a) $C_2H_5OH$	(b) $CH_3COOH$
(c) $HCHO$	(d) $CH_3-CO-CH_3$



## WHAT YOU HAVE LEARNT

- In this lesson, you have learnt that carbon is tetravalent in nature and has the unique property of catenation,
- The number of compounds formed by carbon is very large.
- The allotropic forms of carbon are diamond, graphite and fullerene.
- Diamond has a three-dimensional network of covalently bonded carbon atom. It is hard and colourless. It has high melting and boiling point and is a good conductor of heat but poor conductor of electricity.
- Graphite is soft, black, and slippery in nature and has a layered structure. It is a good conductor of electricity.
- Fullerenes contain carbon atoms arranged in closed structures similar to football.
- Charcoal, coke and carbon black are micro-crystalline forms of carbon.
- The compounds of carbon can be classified as organic and inorganic.
- Carbon monoxide and carbon dioxide are two important inorganic compounds of carbon.
- Organic compounds of carbon are hydrocarbons and their derivatives.
- The hydrocarbons can be classified as saturated and unsaturated. The saturated hydrocarbons contain carbon-carbon single bonds whereas the unsaturated hydrocarbons contain carbon-carbon multiple bonds.
- Isomers have same molecular formula but different structure.

- Organic compounds are systematically named according to IUPAC system of nomenclature.
- Some simple functional groups include halo-, hydroxyl-, carbonyl, carboxylic acid etc.
- Compounds containing the above functional groups exhibit characteristic properties and have important uses in our daily life.



Notes

**TERMINAL EXERCISES**

1. Why carbon cannot form ionic bonds?
2. What is catenation?
3. What types of bonds are formed by the carbon atom?
4. Name the three allotropic forms of carbon.
5. How do natural diamonds form?
6. Name two places where diamonds are found.
7. Why is diamond hard?
8. Give two uses of diamond.
9. Compare the physical properties of diamond and graphite.
10. How can graphite be converted into diamond?
11. Create a flow chart as shown below to compare the various allotropes of carbon

C			
G.....	D.....	F.....	
1. Names of Allotropes	.....	.....	.....
2. Place where found	.....	.....	.....
3. One use	.....	.....	.....
4. Appearance	.....	.....	.....
5. Arrangement of C atoms	.....	.....	.....

12. What is activated charcoal? How is it prepared?
13. Given below are pictures of three microcrystalline or amorphous form of graphite. Name them and write one use of each.



Notes

Picture of Charcoal  
from book

A

Name .....

Use .....

Picture of Coke  
from Book

B

Picture of Carbon  
Black from book

C

14. Name the products formed when
  - (i) Wood is strongly heated in absence of air.
  - (ii) Coal is strongly heated in the absence of air.
  - (iii) Hydrocarbons are heated in limited supply of oxygen.
15. Why is CO toxic in nature?
16. Give two uses of CO and CO<sub>2</sub>.
17. For the following state one point of differences between the following pairs of terms
  - (i) Organic compounds and inorganic compounds
  - (ii) Carbon Monoxide and carbon dioxide
  - (iii) Aliphatic and aromatic compounds
18. What is a homologous series?
19. Name 10 carbon compounds of a homologous series. Write their molecular formula and derive a general formula for the series.
20. What is general formula for the homologous series of
  - (i) alkanes
  - (ii) alkenes
  - (iii) alkynes?
21. What is the molecular formula for ethane?
22. Give here four prefixes: But- , Eth- , Meth- , Prop- , and Suffix -ane to develop the names of alkanes. How many carbon atoms do each of these alkanes contain?
23. Draw the Chemical Structure of Butane and Isobutane and based on it justify that they are isomers.
24. Give IUPAC name of the following compounds:
  - (i) CH<sub>3</sub> — CH = CH<sub>2</sub>
  - (ii) CH<sub>3</sub> — HC = CH — CH<sub>3</sub>
  - (iii) CH<sub>3</sub> — OH
25. Give an example of a compound which has carboxylic (-COOH) functional group.
26. (a) Of the following which has single bond, double bonds and triple bonds between C, C atoms? Alkynes, alkane, alkene
  - (b) Name their simplest compounds and write the molecular formula.

27. Give one use of each of the following:  
(i) Methanol      (ii) ethanol      (iii) glycerin
28. What is the difference between the structure of an aldehyde and a ketone?
29. What is (i) dry ice (ii) wood alcohol (iii) formalin (iv) vinegar
30. To which group of carbon compounds do each of the carbon compounds used for the following belong?  
(i) To ripen fruits  
(ii) In oxy-acetylene torch
31. Name the carboxylic acid present in vitamin C.
32. Which acid is present in citrus fruits?
33. Your teacher has asked you to procure sources of formic acid and butyric acid. Which two sources will you collect and bring?
34. Name the carboxylic acids found in :  
(i) Lemon      (ii) Vitamin C      (iii) Sour milk  
(iv) Rancid butter      (v) Ants



Notes



## ANSWERS TO INTEXT QUESTIONS

**28.1**

- 4
- Covalent
- Because of catenation, possibility of existence of isomers and presence of various functional groups.
- Organic chemistry
- 4

**28.2**

- Fullerenes
- (i) 4      (ii) 3
- Because a large amount of heat energy is required to break the three – dimensional network of covalent bonds.
- No. Because there are no free electrons.
- Because of weak bonding forces between layers of carbon atoms in graphite, they can slide over each other.



## Notes

6. As electrodes, lubricant, pencil leads, vessels for melting metals (any two).
7. Closed structure similar to foot ball.
8. Charcoal, coke and carbon black

Uses: Charcoal – absorption of coloured impurities

Coke – reducing agent in metallurgy

Carbon black – pigment in inks or in automobile tyres

**28.3**

1. (i), (iii) – Organic  
(ii), (iv) – inorganic
2. (i) Organic compounds have low melting and boiling points whereas inorganic compounds have high melting and boiling points.  
(ii) Organic compounds dissolve in organic solvents whereas inorganic compounds dissolve in water and not in organic solvents.

**28.4**

1. Carbon dioxide
2. Carbon monoxide
3. Carbon dioxide
4. Carbon dioxide
5. Carbon dioxide and ethanol

**28.5**

1. In saturated compounds, single bonds are present between carbon atoms whereas in unsaturated compounds double or triple bonds are present between carbon atoms.
2. Saturated: methane, ethane    Unsaturated: ethene, propyne
3. Propane.
4. Isomers are compounds which have the same molecular formula but have different structures.
5. International Union of Pure and Applied Chemistry.
6. (i) methyl    (ii) ethyl
7. (a) 2-methylbutane    (b) 2,3-dimethylbutane



## 28.6

1. (i) hydroxyl ( $\text{— OH}$ )    (ii)  $\text{— Cl}$     (iii) Alkyne    (iv) Carboxylic

## 28.7

1. Methanol
2. Glycerin is 1,2,3-propanetriol. It contains the hydroxyl functional group
3. It is produced by the fermentation of carbohydrates such as glucose and starch present in grapes, barley etc.
4. Formaldehyde, acetaldehyde
5. It is used as a solvent.
6. Acetic acid
7. Vanillin
8. (a) Ethanol    (b) Ethanoic acid    (c) Methanal    (d) Propanone
9. (a) Alcohol    (b) Carboxylic    (c) Aldehyde    (d) Ketone



Notes



**MODULE - 7**  
**HUMANS AND ENVIRONMENT**

- |           |                             |
|-----------|-----------------------------|
| Lesson 29 | Natural Environment         |
| Lesson 30 | Human Impact on Environment |
| Lesson 31 | Food Production             |
| Lesson 32 | Health and Hygiene          |



29



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## NATURAL ENVIRONMENT

The environment means everything that surrounds us—our house, garden, town, shops, hills, rivers, ocean, the air, soil, sunlight etc. and also the plants and animals around us.

All living and non-living things that occur naturally on earth constitute the **natural environment**. We also know that all living organisms are dependent on the environment for their survival. Their life is regulated by the environment and in turn they influence the environment. Thus, the environment with all its components is a vibrant and intricate entity. We need to think twice before doing anything that would disturb the delicate balance between the environment and its various components. But how do we know what affect our activities have on the environment? In order to nurture our environment we need to understand its various components and their relationship.



*(Graphic to show natural environment)*

**OBJECTIVES**

After completing this lesson, the learner will be able to:

- *define ecosystem and give examples of interdependence of aquatic and terrestrial ecosystems;*
- *establish relationship between biotic and abiotic component of an ecosystem;*
- *explain the interdependence of autotrophs, heterotrophs and saprophytes in a biotic community;*
- *explain the importance of food chain, food web, different trophic levels and energy flow in an ecosystem;*
- *highlight the importance of cycling of minerals citing the example of carbon, nitrogen and water and the role played by humans in maintaining the cycles;*
- *recognise the various services provided by the ecosystem;*
- *justify the role of adaptation in the living world;*
- *correlate the benefits of cooperation in the various types of association such as mutualism, commensalism and symbiosis.*
- *identify the factors which lead to population growth.*

**29.1 ECOSYSTEM AND ITS COMPONENTS**

Living organisms draw their nutrition and oxygen for survival from the environment. In the process, plants and animals interact with each other and also their physical environment. Thus, an ecosystem may be defined as **“a biological environment consisting of all organisms living in a particular area, as well as the non-living physical components of the environment with which the organisms interact”**.

A.G.Tansley in 1935 put forward the concept of ecosystem. The word ecosystem is derived from the greek word **“oikos meaning home and systema meaning system”**.

An ecosystem can either be natural or human-designed. How are these two different from each other?

All ecosystems that exist in nature are **Natural ecosystem**. They can either be terrestrial or aquatic. Grasslands and deserts constitute the terrestrial ecosystem while rivers, ponds and oceans form the aquatic ecosystem. On the other hand, **man-made or human designed ecosystem** is an artificial ecosystem e.g. gardens, aquarium, crop fields etc.



## 29.2 COMPONENTS OF AN ECOSYSTEM AND THEIR RELATIONSHIP

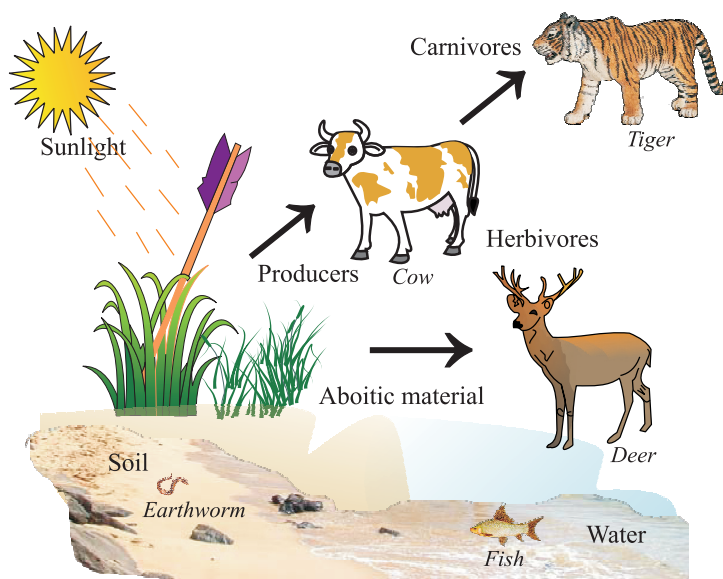
Both, non- living and living things constitute an ecosystem. Accordingly they are termed as abiotic and biotic components.

- **Abiotic:** Abiotic components are the non-living physical and chemical factors in the environment of an ecosystem.
- **Biotic:** Biotic components are the organisms which include plants, animals and micro-organisms in an ecosystem.

**Table 29.1 Components of the ecosystem**

Abiotic Components	Biotic Components
Sunlight	Primary producers
Temperature	Herbivores
Precipitation	Carnivores
Water or moisture	Omnivores
Soil	Detritivores etc.
Air etc.	

**All of these components vary over space and time.** You must have observed that plants of coastal regions, hilly areas and deserts are distinctly different from each other. Do you know why? It is because each one has different abiotic components like temperature, soil and moisture. Thus, we see that the abiotic components affect the various organisms in the environment.



**Fig. 29.1 Components of an ecosystem.**



ACTIVITY 29.1

List the biotic and abiotic components shown in figure 29.1

S. No.	BIOTIC	ABIOTIC

If you have five biotic and three abiotic components correct, then your score is excellent

Four biotic and three abiotic components correct, then it is good

Anything below this, you need to revise.

These environmental factors-”biotic” and “abiotic” are important in all the ecosystems. Can you now think how all living beings are totally dependent on the abiotic components of the environment? Yes, you are right. The green plants manufacture their food with the help of sunlight, CO<sub>2</sub> and chlorophyll (the green pigment present in the leaves of the plants). The herbivores and carnivores including humans are dependent on the food produced by the plants. Plants, animals and other organisms release back carbon dioxide, oxygen, water and other nutrients into the environment. This not only enriches the soil but also replenishes the atmosphere. You will read about this in the subsequent section. Thus, we can say that we all eat a bit of sunlight every day.

**29.3 BIOTIC COMMUNITY**

Biotic community refers to populations of various kinds of organisms living together and sharing the same habitat. An ecosystem houses several biotic communities which interact with each other. For example, one can observe populations of different kinds of birds, insects and many other animals on a tree, living in the same environment, mutually sustaining and interdependent. This assembly of different organisms constitutes a biotic community. Depending on the mode of nutrition, members of a biotic community are categorised into **autotrophs**, **heterotrophs** and **saprotrophs**.

**Autotrophs** (Gr. Auto- self; trophos-feeder): You know that all plants (except for a few parasitic plants) can manufacture their own food by the process of photosynthesis, but do you know that there are certain organisms that do not utilize sunlight yet can manufacture their food by the process of chemosynthesis. Certain



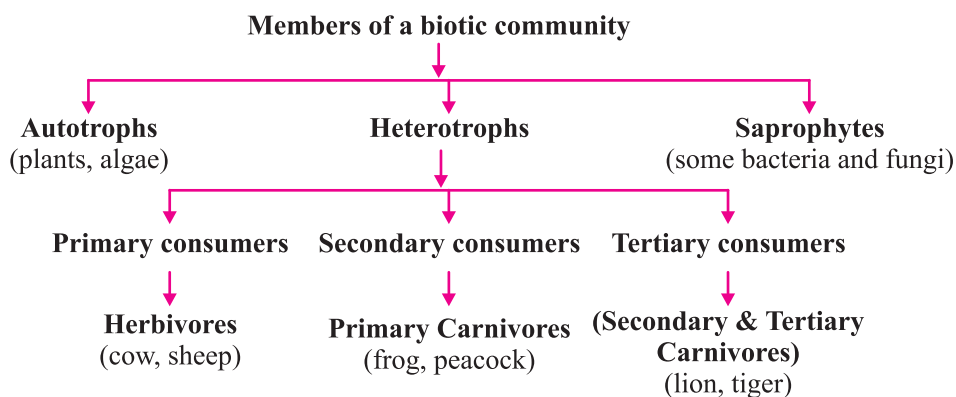
bacteria belong to this category. Since the plants provide food to all the animals directly or indirectly they are also called **producers**.

Autotrophs form the basis of any biotic system as they trap solar energy to manufacture food for all.

In terrestrial ecosystems, the autotrophs are mainly the rooted plants while in aquatic ecosystem, floating plants called phytoplankton and shallow water rooted plants called macrophytes are the examples of autotrophs.

**Heterotrophs** (Gr: heteros - other; trophs - feeder) are called **consumers** which feed on plants and animals. Consumers include **herbivores** (that eat plant material) and **carnivores** (which eat other animals).

**Saprotrophs** (Gr: sapos - rotten; trophos - feeder) also called **decomposers** feed on dead and decaying matter. They break down the complex organic compounds of dead plants and animals into simpler forms and return them back into the environment. **Decomposers form an important link between the living and non-living component of the ecosystem.** Some bacteria and fungi belong to this category.



You can name many more examples of primary consumers, secondary consumers and tertiary consumers. List some of them in the space provided.

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Pond is a good example of an ecosystem to understand the concept of abiotic and biotic components and their relationship. A pond has three different layers: top, middle and bottom. All the three layers differ greatly from each other in terms of temperature, light conditions, oxygen content and other factors that affect the lives of the biotic components living in it. If you have taken a dip in a pond then you must have experienced that the temperature of the water at the top is different from its deeper layers.





Fig. 29.2 shows the biotic and abiotic components of an ecosystem. Water, dissolved oxygen, carbon dioxide, minerals, soil and stones are the abiotic components. A natural pond also has thousands of different species of plants and animals living together. Some are microscopic, that is, these are too small to be seen with the naked eye while some others are macroscopic. These constitute the biotic component. Greater the number of species present in the pond, the stronger and healthier it is. Here, living things are born, they live, breathe, feed, excrete, move, grow, reproduce, become food for others and die within the pond.

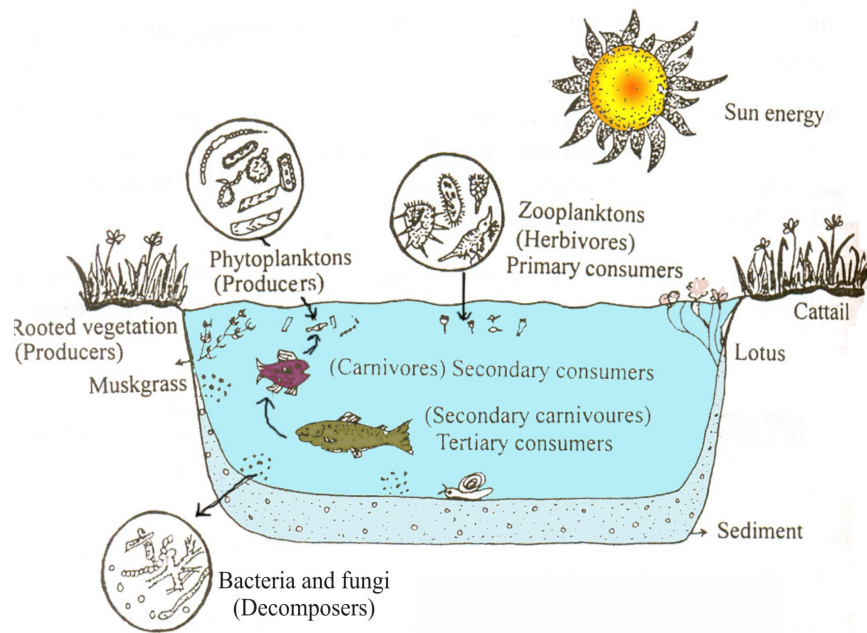


Fig. 29.2 The pond ecosystem showing the biotic and abiotic components

### 29.4 FOOD CHAIN AND FOOD WEB

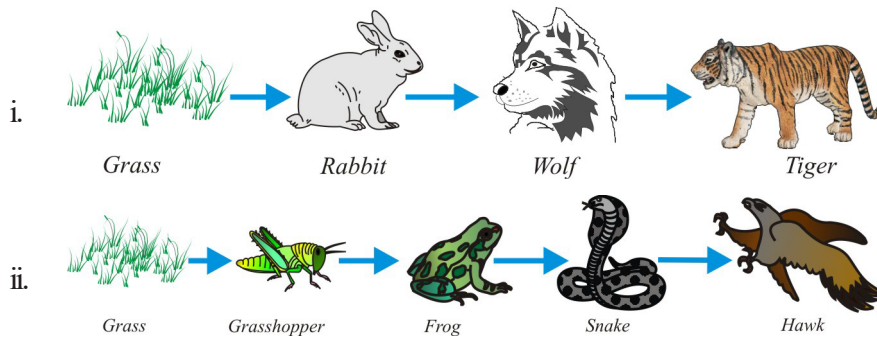
Observe figure 29.2. You can make out that organisms form a chain of ‘eating’ and ‘being eaten’. In the fig. you can see that small fish is feeding on phytoplanktons which in turn is being eaten by a bigger fish. This constitutes the food chain. A simple food chain basically consists of producers, herbivores and carnivores. Just like the pond, a simple food chain in a terrestrial ecosystem links the trees and shrubs (producers), the giraffes (herbivores that eat trees and shrubs) and the lions (carnivores that eat the herbivores). Each link in this chain is food for the next level and is said to be at a particular trophic level (trophos means feeding). In the example, trees and shrubs are the producers and occupy trophic level I, giraffe comes at trophic level II, while lion occupies the third trophic level. As food provides energy, food chain may be defined as “**succession of organisms in an ecological community that constitutes a passing on of food energy from one organism to another as each consumes a lower member and in turn is preyed upon by a higher member of the food chain.**”



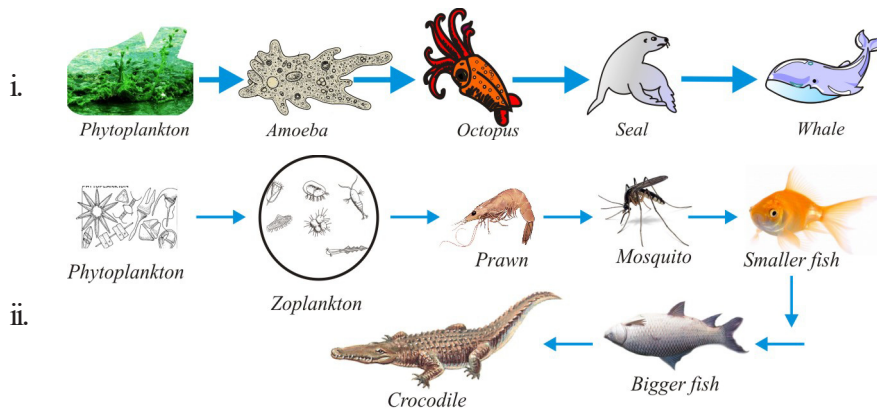
Different types of food chain can exist in an ecosystem. The examples given below will help you to understand the various food chains.

1. **Grazing food chain** is found both in aquatic as well as grassland ecosystem. It is the most common food chain found in the terrestrial ecosystem.

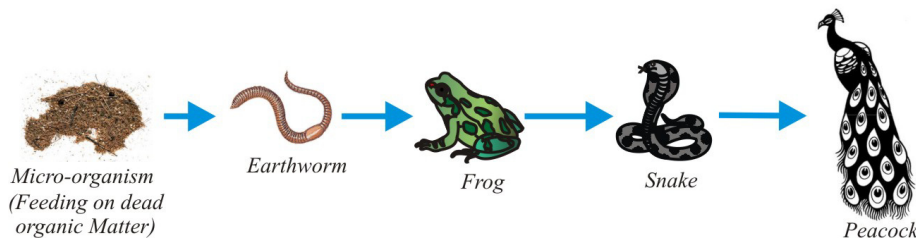
- Food chain in a terrestrial ecosystem:



- Food chain in an aquatic ecosystem:



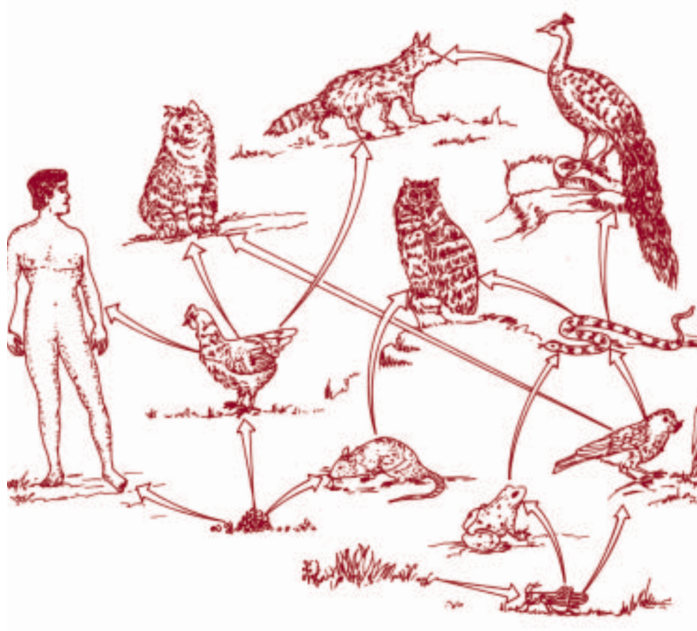
2. **Detritus food chain:** This type of food chain starts from dead organic matter. The dead organic matter is broken down into simple nutrients by micro-organisms like fungi and bacteria. These simple nutrients and decomposers are then consumed by smaller carnivores which in turn become food for larger carnivores.



A similar detritus food chain also exist in an aquatic ecosystem



However, most animals form a part of more than one food chain and eat more than one kind of food in order to meet their food and energy requirements. These interconnected food chains form a **food web**. (figure 29.3)



*Fig. 29.3 A food web*

Significance of food chain and food web:

1. They help to maintain ecological balance.
2. They help in understanding the feeding relations among organisms.
3. Energy flow and nutrient cycle takes place through them.



**ACTIVITY 29.2**

- Go for a walk in a nearby park or field or riverside or sea beach.
- Note down the various abiotic and biotic factors.
- On a chart paper make a collage of these biotic and abiotic factors. You can draw and paste pictures of these. With the help of arrows you can show how the biotic factors are dependent on the abiotic factors.
- Mention the food chain that you have observed yourself. Which trophic level of the food chain you represent? Do you represent more than one? You can draw the food web in the space provided.

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Notes

**29.4. ENERGY FLOW IN AN ECOSYSTEM**

We know that food provides energy and thus in a food chain, energy is passed from one link to another. This energy flow is unidirectional i.e. the energy which is transferred from one trophic level to the next does not come back (figure 29.4). When a herbivore eats, only a fraction of the energy (that it gets from the plant food) becomes new body mass; the rest of the energy is lost as heat or is used up by the herbivore to carry out its life processes (e.g., movement, digestion, respiration, reproduction). Therefore, when the herbivore is eaten by a carnivore, only a small amount of total energy is received by the carnivore. Of the energy transferred from the herbivore to the carnivore, some energy will be lost as heat or “used up” by the carnivore. The carnivore then has to eat many herbivores to get enough energy to grow. Because of the large amount of energy that is lost at each link, the amount of energy that is transferred gets lesser and lesser as we go up the food chain (figure 29.5).

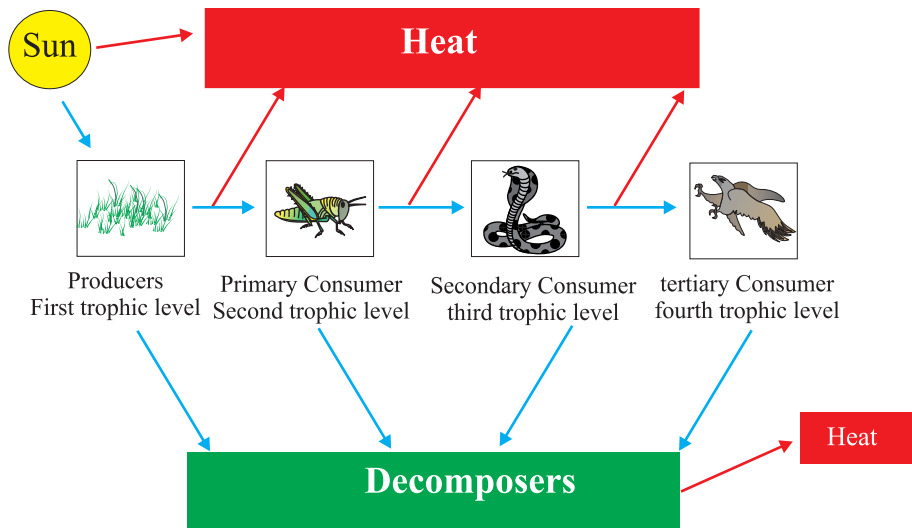


Fig. 29.4 Energy Flow

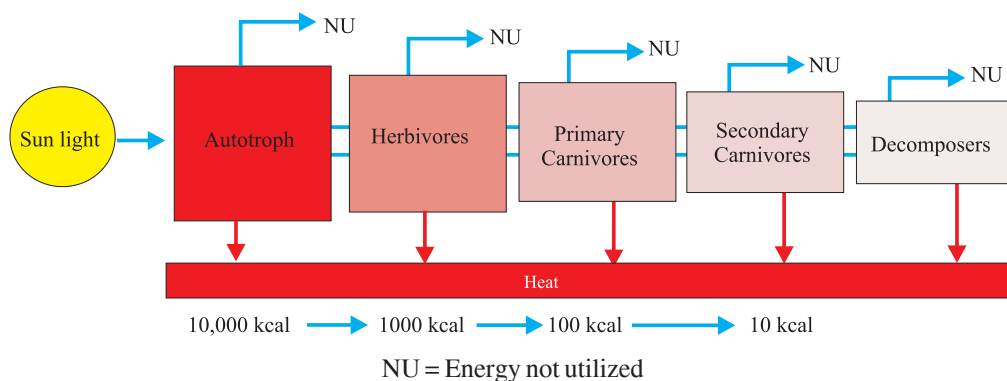


Fig. 29.5 Energy Flow at different trophic levels in an ecosystem. Boxes indicate the standing crop biomass and pipes (=) indicate the energy flowing



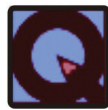
ACTIVITY 29.3

From the fig. 29.3, name a herbivore, collectively name the animals that are at trophic level 1, and mention the animal that gets the least energy.

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INTEXT QUESTIONS 29.1

1. Sunlight forms the abiotic component of ecosystem, name one biotic component.  
\_\_\_\_\_
2. Why are plants called producers? Which trophic level do they occupy in an ecosystem?  
\_\_\_\_\_
3. Give one reason in support of the statement that “food web is a jumble of food chains”.  
\_\_\_\_\_
4. Construct one food chain and one food web from the following :  
Tiger, grains, vulture, frog, snake, grass, cat, sheep, peacock, wolf, rabbit, phytoplankton, small fish, rat, large fish.  
\_\_\_\_\_

29.6 BIOGEOCHEMICAL OR NUTRIENT CYCLES

There is a constant need of nutrients by the biotic community for their survival and they take these from the environment. Nutrients in the form of oxygen, carbon dioxide, nitrogen, phosphorus, sulphur or water exists in a definite amount in the environment. The amount of these nutrients however varies in different parts of an ecosystem at a given time. But these elements are never lost and nature has its own method of replenishing them in a cyclic manner. The movement of these nutrients in a cyclic manner in the environment constitutes the biogeochemical cycles. Thus, a **“biogeochemical cycle is the cycle in which nitrogen, carbon, and other inorganic elements of the soil, atmosphere, etc. of a region are converted into the organic substances of animals or plants and released back into the environment.”**



It is a cyclic pathway by which a chemical element or molecule moves through the environment unlike energy flow which is unidirectional.

Let us now study a few of the biogeochemical cycles.

### A. Carbon cycle

The carbon cycle is the biogeochemical cycle by which carbon is exchanged between soil, water and atmosphere (air) of the earth. It is the most important cycle of the earth and allows for carbon to be recycled by all of its organisms (figure 29.6).

It justifies the saying “what goes around comes around”

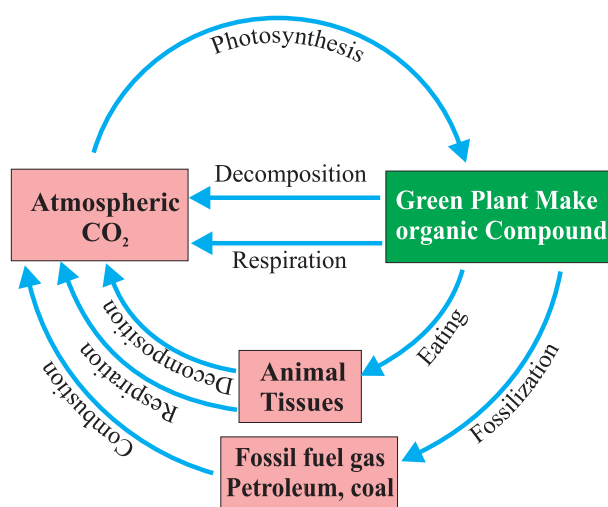


Fig. 29.6 Carbon Cycle

After studying the carbon cycle, can you think of any two ways by which human activities have been interfering with nature’s carbon cycle. Write them down in the space provided below.

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### B. Nitrogen cycle

#### What is nitrogen cycle

Nitrogen cycle is the biogeochemical cycle that describes the transformation of nitrogen and nitrogen-containing compounds in nature. Atmospheric nitrogen is the biggest source of nitrogen. Green plants absorb nitrogen in the form of nitrates and nitrites from the soil and water. Animals get nitrogen when they feed upon plants. Nitrogen is an essential component of proteins and nucleic acids in living organisms (figure 29.7).



## MODULE - 7

### Humans and Environment



Notes

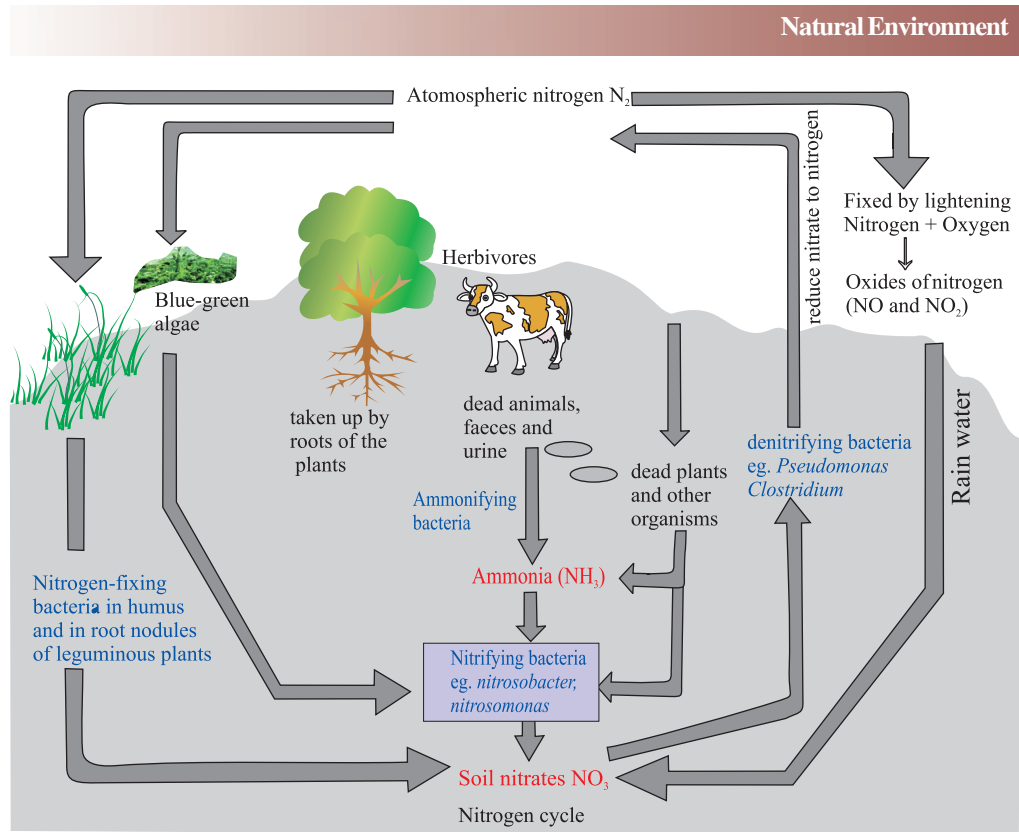


Fig. 29.7 Nitrogen Cycle

The nitrogen cycle can be studied in five steps:

- i. **Nitrogen fixation:** As we can see in the figure, above, nitrogen can be fixed in two ways:
  - a. Lightening during cloud formation: Nitrogen and oxygen combine with each other to form oxides of nitrogen in the atmosphere by lightening. These nitrogen oxides then dissolve in rain water and on reaching the earth's surface becomes a part of the soil and water.
  - b. Free living micro-organisms present in the soil and by the symbiotic bacteria in the root nodules of certain leguminous plants: Microbes like the blue green algae and bacteria fix the atmospheric nitrogen into nitrites and nitrates. These nitrogenous compounds are then released into the soil.
- ii. **Nitrogen assimilation:** Plants absorb nitrogen in the form of nitrates to prepare amino acids. This nitrogen is then taken up by the animals in the form of proteins through the food chain.
- iii. **Ammonification:** The proteins in the body of the animals are broken down into simpler form like urea and ammonia. These are then removed from the body along with urine and excreta. Dead plants and animals also return nitrogen to the soil as ammonium compounds. These ammonium compounds are then converted to ammonia by ammonifying bacteria.





**INTEXT QUESTIONS 29.2**

1. Name any two ways which are responsible for adding carbon dioxide in the atmosphere.  
\_\_\_\_\_
2. Name the bacteria which live in the roots of the leguminous plants and are responsible for nitrogen fixation.  
\_\_\_\_\_
3. What is the process of conversion of free atmospheric nitrogen into nitrites and nitrates called?  
\_\_\_\_\_
4. What is the role played by denitrifying bacteria and nitrifying bacteria in the nitrogen cycle? Give the name of one denitrifying bacteria and one for nitrifying bacteria.  
\_\_\_\_\_
5. Mention any one role that you play in the (i) nitrogen cycle and (ii) carbon cycle.  
\_\_\_\_\_
6. Nitrogen is an essential component of the proteins and nucleic acids in living beings. Mention any one way by which you obtain nitrogen for your growth.  
\_\_\_\_\_
7. Mention one way in which increasing deforestation by humans is influencing the carbon cycle.  
\_\_\_\_\_

**29.7 ECOSYSTEM SERVICES**

Have you ever given a thought how the ecosystems are valuable to us? We gain benefit from some of the resources of our natural ecosystem free of cost e.g.

We take in oxygen (plants take in carbon dioxide) from the environment. The forests, rivers and oceans control the climate. There is also a natural check on the pests by the predators and parasites thus keeping the diseases under control.

Can you live without taking food or water? No!! Where do you get them from? Right!!! Plants and algae trap solar energy for photosynthesis and produce food for all organisms. Water, minerals, biomass fuels, wood (for fuel and for constructing houses) required for our daily needs are all provided by the

environment. Think of many more services that are provided by our environment and list them below

Ecosystem Services
1.
2.
3.
4.
5.

Although our environment provides us with so many valuable resources free of cost, the need of the hour is to appreciate its value and judiciously utilize the services so that we can leave them for our future generation.



Notes

## 29.8 ADAPTATIONS IN ORGANISMS

We walk with our legs, birds fly with their wings while whales swim with flippers. Why are the limbs different in them? You will say, we walk on land, birds soar in air and whales live and move in water. You are right. The limbs are adapted to the environment in which they live. **Adaptations are special features that allow a plant or animal to live in a particular place or habitat.** Can you tell how the frog is adapted to jump on land and swim in water? Limbs help them to jump and web helps in swimming. The living things adapt themselves so that they can:

- successfully compete for food
- defend themselves from attack by other organisms
- find favourable conditions to reproduce
- respond efficiently to the change in environment.

### 29.8.1 Aquatic adaptations in plants:

Aquatic plants are called **hydrophytes** (hydro: water; phyte: plant). For a life in water:

- Hydrophytes have reduced root system as water is easily available.
- Floating leaves have stomata only on their upper surface while the submerged ones have no stomata at all.
- The leaves are thin and narrow for example *Hydrilla*, or long, flat, ribbon shaped for example *Vallisneria*. These adaptations protect the plant body from any damage due to water currents.

## MODULE - 7

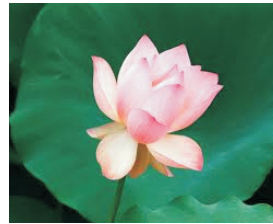
### Humans and Environment



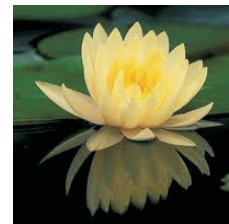
Notes

## Natural Environment

- The stem may be long, slender and spongy, to prevent them from getting carried away by water current e.g. lotus
- Flat leaves on surface plants are for floatation. The broad upper surface is coated with wax which acts as water repellent, for example lotus, waterlily.
- Examples: water lily, *Hydrilla*, *Vallisneria*, *Pistia*, waterhyacinth (*Eichhornia*).



*Lotus*



*Water lily*



*Vallisneria*



*Hydrilla*

**Fig. 29.9** Some Aquatic Plants



### ACTIVITY 29.4

Identify any one adaptive feature in each of these aquatic plants

#### Aquatic plant



#### Adaptive feature

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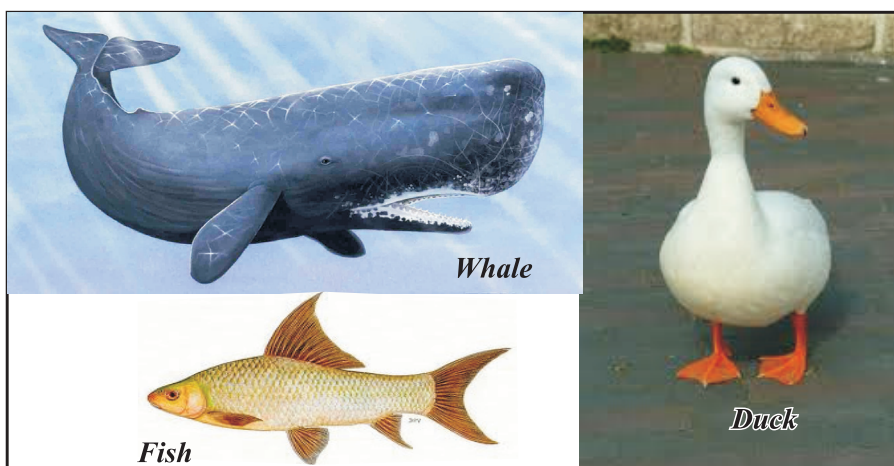
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### 29.8.2 Aquatic adaptations in animals:

The animals that live in water show the following characteristics:



1. Streamlined body (pointed at both ends) that reduces friction when the animal moves through the water.
2. Smooth, almost hairless body helps aquatic mammals move through the water with little friction.
3. Webbed feet in ducks, (formed from thin skin between the toes), work like paddles for swimming.
4. Flattened tail that serve as oar.
5. Fins of fish help to swim, steer and maintain balance. A whale has flippers for swimming.
6. Long legs and necks in cranes keep the bodies of wading birds out of the water. The long neck helps the birds to reach the water, or below it, for food.
7. Blubber of whale, a thick layer of fat or oil stored between the skin and muscles of the body, provides insulation.
8. Eyes are positioned on top of the head which allows animals to hide in water and still detect predators or prey above the water.
9. Transparent eyelids cover the eyes water of animals swimming underwater.
10. Nostrils positioned near the top of the head allow animals to come to the surface to breathe in air. Nostrils close when the animal goes under the water e.g. whales, dolphins.
11. Some fish have swim bladder which is filled with air to help maintain buoyancy.
12. Fish and aquatic invertebrates like prawns have gills for respiration.



*Fig. 29.10 Aquatic Animals*



### 29.8.3 Terrestrial adaptations in plants:

Terrestrial plants include mesophytes (meso =moderate) and xerophytes (xero =scarce water).

#### Mesophytic adaptations:

**Mesophytes** are terrestrial plants which are adapted to neither a particularly dry nor particularly wet environment. Mesophytes include the majority of terrestrial plants which have the following adaptations:

- Mesophytes generally require a continuous water supply and have large, thin and broad leaves with a large number of stomata on the undersides of leaves.
- The roots of mesophytes are well developed, branched and provided with a root cap.
- The shoot system is well organised.



Fig. 29.11 Mesophytes

#### Xerophytic adaptations :

Xerophytes are desert plants, well adapted to high temperature and water shortages. They are adapted to store and conserve water. The adaptations that xerophytes may exhibit are:

- Succulent leaves and stems to store water e.g. cacti. Succulent: soft, fleshy, water storing structures.
- They have few or no leaves which reduce transpiration.
- Many desert trees and shrubs have thorns for protection from enemies.
- Fewer stomata to reduce water loss.
- Deep widespread root system caters to maximum water uptake.



Fig. 29.12 Some Xerophytes (Cacti, Casuarina etc.)

### 29.8.4 Adaptations in desert animals:

- Most of the desert animals avoid being out in the sun during the day. Many desert mammals, reptiles, and amphibians live in burrows to escape the



intense desert heat. They come out during the night when the temperatures are low.

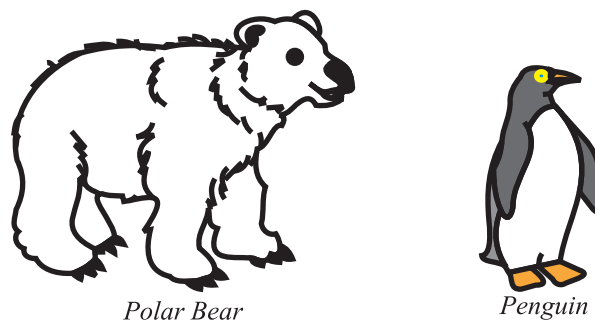
- Due to constant exposure to high temperatures, desert animals need to maintain their body temperatures at an optimum level for which some of them have developed long body parts that provide greater body surface to dissipate heat.
- These animals have scaly skin, resistant to drying.
- Camels have a hump to store fat.
- A camel can drink very large amounts of water in one day or survive for a relatively long time without drinking any water. They can excrete concentrated urine when there is water scarcities and thus reduce loss of water.
- Desert animals like reptiles have minimised loss of water by excreting urine in the form of insoluble uric acid. This ensures very little wastage of water.



*Fig. 29.13 Desert Animal (Camel)*

### 9.7.5 Adaptations to survive in extreme cold and scarcity of water

- The animals which live in cold climates have very thick fur over the body to trap air and insulate it.
- They also have a layer of stored fat under the skin to give additional insulation.
- The body shape and size of many cold climate mammals is well adapted to the cold climate. They are round and bulky with short legs, ears and tail. These adaptations help to conserve heat.
- Penguins have a thick layer of densely packed feathers to reduce heat loss. Its flippers and legs are also adapted to reduce heat loss.



*Fig. 29.14 Polar bear and penguin*





Notes

29.7.6 Aerial adaptations in animals:

Aerial animals include a small number of animals that are able to fly in air. These animals come to the trees or land or water for safety or shelter. These are called **arboreal animals (which dwell on trees)**. They may walk or run on land or glide in air for a short while to land on the tree or ground. Flying squirrel, flying lizard, tree frogs, lemurs and monkeys belong to this group. True aerial animals are birds and bats. These animals exhibit adaptations to balance themselves and stay in air, soaring or flying. These adaptations include:

- **Streamlined body** to steer through the air.
- **Wings** - Forelimbs are modified into wings to help them to fly.
- Birds have wings that are covered with **feathers** which trap air to keep the body warm and help the bird to fly. Bats have an extension of the skin between fingers of forelimb which help them to fly.
- **Bones** - Bones are hollow to make them light.
- **Flight muscles** - Very strong flight muscles are attached from the body to the wings.



Fig.29.15 Bat



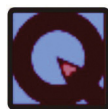
ACTIVITY 29.5

- Visit a nearby pond or a lake and observe the various plants that you can see. Try to find their common and scientific names.
- Make a list of :
  1. Plants that were floating on the surface of the water
  2. Remain on the surface but had roots or stem in water
- Now study the adaptations that help them to float or remain on the surface of water.

**Name of the plant**

**Special features**

- |   |     |  |      |  |
|---|-----|--|------|--|
| 1 | (i) |  | (ii) |  |
| 2 | (i) |  | (ii) |  |



INTEXT QUESTIONS 29.3

1. Why are leaves of water lily coated with wax on the upper surface?

---



2. Name two tree dwellers.  
\_\_\_\_\_
3. Enumerate the adaptations of birds that enable them to fly so easily (Any two).  
\_\_\_\_\_
4. How are penguins able to survive in the extreme cold conditions?(Any two adaptations)  
\_\_\_\_\_
5. Why do the desert plants have fewer stomata?  
\_\_\_\_\_
6. Humans are not adapted for aquatic life. List any two challenges that you would face when you go for swimming in a pond/lake and the ways by which you would overcome them and become an effective swimmer.  
\_\_\_\_\_

## 29.9 POPULATION INTERACTION

You have learnt that all living organisms are interdependent, otherwise it would be difficult to live together in a population.

### What is population?

Population is a group of similar individuals living in a particular geographical area. Populations of different species of organisms live in the same ecosystem. When organisms encounter one another in their habitats, they can influence each other in a number of ways. Some interactions are harmful to one or both of the organisms. Others are beneficial.

Such relationships can be characterised into different types depending on the interaction and the extent to which they associate.

**1. Mutualism:** Mutualism is an interaction between individuals belonging to two different species, that benefit both members. Lichen is a complete entity formed by the association of an alga and a fungus. The main body of the lichen is formed by fungus. The alga manufactures food for itself as well as for the fungus, while the fungus provides water, minerals and shelter to the alga.

**2. Commensalism:** Commensalism is an interspecific interaction where one species benefits and the other is unaffected (neither harmed nor benefitted). Commensal relationships may involve one organism using another for transportation or for housing. For example, hermit crab lives in gastropod shell to





protect their body. Sucker fish attaches itself to the under surface of shark and gets a free ride. It is thus protected from its predators and is also widely dispersed in this way.

**3. Parasitism:** It includes one organism living in or on the body of another living organism from which it derives nourishment and in the process harms its host. For example: tapeworm living in the intestine of man.

**4. Symbiosis:** A close interaction between two or more different organisms of different species living in close physical association. You are quite familiar with pollination of flowers where the flowering plants are cross pollinated by the bees which benefit by getting nectar from the plants. Plants pollinated in this manner produce less pollen than do plants that rely on the wind to transfer pollen. This is an example of symbiotic association.

This is the term that relates to parasitism, commensalism and mutualism. Literally the word symbiosis means living together. More important for us to understand is that emphasis is on the interactions that involve a close relationship between two kind of organisms.



**INTEXT QUESTIONS 29.4**

1. How is the sucker fish benefitted by attaching itself to the shark’s body? What type of association is it?  
\_\_\_\_\_
2. If alga provides food to the fungus that lives on it, what does the fungus do for the alga?  
\_\_\_\_\_

**29.10 POPULATION GROWTH**

Population is an aggregate of individuals belonging to the same species.

Population of any species does not remain static. It undergoes changes. Now the question arises as to why does the population keeps changing? Let us try to find an answer to this question.

Population growth is the change in the number of individuals of any species in a population at a given time. The size of the population depends upon the density, natality (birth rate), mortality (death rate), population dispersal, age distribution, and environmental resistance that the population has to face.



### 29.10.1 Population growth:

The provisions for life in a geographical area where a population lives is limited. Only certain number of organisms can live comfortably in the area. When this number gets exceeded it is termed as “population growth”.

Growth rate of a population is the difference between the birth rate and the death rate. When the birth rate is more than the death rate, then the population density increases.

**Birth rate or natality:** It is defined as the number of live births per thousand per unit time.

**Mortality rate:** The mortality rate of a population is the number of individuals dying per thousand per unit time.

### 29.10.2 Population dispersal

It is the movement of individuals or groups of living organisms by which they expand the space or range within which they live. Dispersal operates when organisms leave the space that they have previously occupied, or in which they were born and settle in new areas. It affects the size of the population. Population dispersal can be of two types:

- 1. Emigration:** It is the permanent outward movement of the organisms from a given population. It decreases the size of the local population.
- 2. Immigration:** It is the permanent inward movement of the organisms from outside into a given population. It increases the size of the local population.

### 29.10.3 Environmental resistance

It is the resistance presented by the environmental conditions to prevent the species from reproducing at maximum rate and thus limiting a species from growing out of control. Environmental resistance includes both abiotic factors like temperature, space etc. and biotic factors like natural enemies. Environment keeps a check on the rise in the population size.

The physical and biological factors that together prevent a species from reproducing at its maximum rate is called environmental resistance.

**Carrying Capacity:** It is the maximum population that the environment can sustain indefinitely.

### 29.10.4 Growth curves:

The growth of a population can be expressed in the form of a mathematical expression called the growth curve. If the number of organisms is plotted against



time, we get a curve which is called the **population growth curve**. Population growth curve has a characteristic shape.

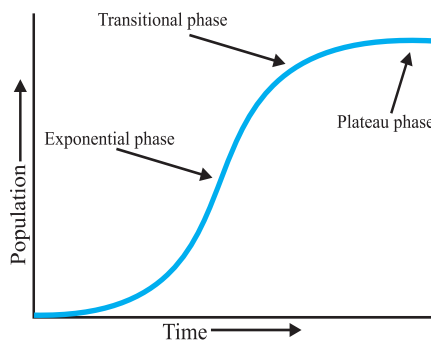
There are two forms of growth curves, namely, **J-shaped growth curve** and **S-shaped or sigmoidal growth curve**.

**29.10.5 S-shaped growth curve:**

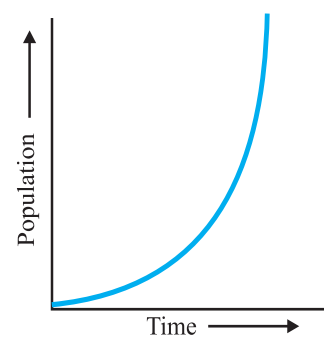
When a small number of organisms first enter a previously unoccupied area, the growth is slow at first as it adapts to new conditions and establishes itself. Reproduction in these organisms takes place after a certain period of time. This is called the **lag phase**. During this phase, both natality and mortality remain small and relatively constant. Gradually, the growth becomes rapid and the population increases rapidly. Now, the natality rate increases while the mortality remains low. This is called **growth phase**. The rapid rise in population is because of the availability of plenty of food and also because there is no competition between the biotic potential and the natural resources. But the number of organisms cannot continue to increase at a faster and faster rate because eventually something in the environment will become limiting and cause an increase in the number of deaths. For animals, food, water or resting sites may be in short supply, or predators or disease may kill many individuals. Plants may lack water, soil nutrients or sunlight. Eventually, the number of individuals entering the population will become equal to the number of individuals leaving it by death or migration and the population size becomes stable. This part of the population growth curve is called **stable phase** where the natality rate and mortality rate are approximately equal. The graph so obtained is S-shaped and is called the **sigmoid curve**.

**29.10.6 J-shaped growth curve:**

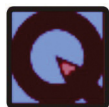
The J-shaped growth curve describes a situation in which the population growth continues in an exponential form until the environmental resistance becomes effective. As the environmental resistance becomes effective, there is a stiff competition for survival and the growth rate stops abruptly. There is a sudden increase in mortality (population crash).



*Fig. 29.16 S-shaped curve*



*Fig. 29.17 J-shaped curve*

**INTEXT QUESTIONS 29.5**

1. When does the population density increase?  
\_\_\_\_\_
2. What is the difference between Emigration and Immigration?  
\_\_\_\_\_
3. What is lag phase?  
\_\_\_\_\_

**WHAT YOU HAVE LEARNT**

- An ecosystem is a functionally independent unit of biotic and abiotic components of an ecosystem.
- Physical and chemical factors, plants, animals and micro-organisms are the structural component of an ecosystem.
- Biotic community is the living together and sharing of the same habitat by different organisms which are classified as autotrophs, heterotrophs and saprophytes on the basis of their mode of nutrition.
- All the living organisms are interdependent through food chains and food webs. An ecological imbalance is caused if any single species of the community is removed.
- Source of energy for all the ecosystems is solar radiation which is absorbed by autotrophs and passed on to the consumers in the form of food (organic substances).
- The energy flow in an ecosystem is unidirectional and the amount of energy that is transferred from one trophic level to another gets lesser and lesser as we go farther along the food chain.
- The nutrients move from the non-living to the living and back to the non-living component of the ecosystem in a more or less circular manner. These nutrient cycles are known as biogeochemical cycles.
- Biosphere, geosphere, hydrosphere, and atmosphere are the main components of the biogeochemical cycles.
- Adaptations are special features that allow a plant or an animal to live in a particular habitat.



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#### Natural Environment

- Population of different species of organisms have evolved certain features that help them to live together in close association.
- On the basis of the interaction and the extent to which the organisms associate with each other, the association can be called as mutualism, commensalism or symbiosis.
- Population does not remain static.
- Population growth is the change in the number of individuals of any species in a population at a given time.
- Size of the population depends upon the natality, mortality, immigration and emigration.
- Environmental resistance prevents a species from reproducing at its maximum rate.
- Population growth curves are either J-shaped or S-shaped.



#### TERMINAL EXERCISES

1. What is an ecosystem? Name the various components of an ecosystem.
2. Is detritus a biotic component or is it an abiotic component of an ecosystem?
3. What is the function of *Nitrosomonas* in nitrogen cycle?
4. With the help of suitable examples differentiate between the detritus and grazing food chain.
5. What is the significance of food chain and food web?
6. Why does the energy decrease as we go along the food chain from producers to tertiary consumers?
7. What will happen if all the animals are removed from a pond?
8. Why is the number of trophic level restricted to four or five in a food chain?
9. What is the difference between energy flow and biogeochemical cycle in an ecosystem?
10. How are camels able to survive in extreme heat?
11. Why do polar bear have thick fur over their body?
12. Compare the S-shaped pattern of population growth with the J-shaped pattern of population growth.



13. What is population dispersal? What are the two types of population dispersal?
14. What is the main cause of population explosion?
15. Do you think population remains static? Support your answer with suitable explanation.
16. Try to complete the table given below

	Feature	How is the feature advantageous to the organism?	Name of the plant/animal if is found
1.	Nostrils positioned near the top of the head of animals		
2.		To store water	Cacti
3.	Loss of water by excreting uric acid in water		
4.	Hollow bone		Birds
5.		Trap air to keep the body warm and help the bird to fly	Birds
6.	Presence of flippers and legs		
7.	Thin, bread leaves with a large number of stomata on the underside of leaves		
8.		Acts as a water repellent and allows them to remain afloat on the surface of water	Water lily

17. Extensive poaching and hunting has reduced the tiger population in Asia to a dangerous level.
  - (a) What are they hunted for (2 points)
  - (b) Draw a food web with tiger as the top level carnivore (At least 2 food chain to be shown)
  - (c) What effect will removal of the tiger have on (i) the herbivore (ii) producer?  
(You can answer this question by making a food chain)



## ANSWER TO INTEXT QUESTIONS

## 29.1

1. Plants, animals and microorganisms (any one).

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#### Natural Environment

2. They produce the food for all the animals either directly or indirectly; first trophic level
3. Animals eat more than one kind of food in order to meet their food and energy requirements
4. Refer to text

### 29.2

1. Factories, vehicles, burning wood, living organisms (respiration) (any two)
2. *Rhizobium*
3. Ammonification
4. Denitrifying bacteria reduces nitrate to nitrogen.
  - Nitrifying bacteria converts ammonia to nitrate.
  - Example: denitrifying bacteria – *Pseudomonas*, *Clostridium* (any one)
  - Nitrifying bacteria *Nitrosobacter*, *Nitrosomonas*
5. (i) Release/excrete  $N_2$  as nitrogen compounds in the urine/excreta) (ii) Release  $CO_2$  to the atmosphere
6. As food/as vegetables/meat (Any other)
7. Lead to increase in the level of atmospheric carbon dioxide

### 29.3

1. Wax acts as a water repellent.
2. Flying squirrel/flying lizard/tree frogs/lemurs/monkeys (any two)
3. Streamlined body, hollow bones, strong flight muscles, wings covered with feathers, forelimbs modified into wings.
4. Presence of thick layer of densely packed feathers, flippers and legs are adapted to reduce heat loss.
5. To reduce water loss.
6. Challenges: Keeping afloat, breathing, eyes getting affected (Any two)

How to overcome: Try to move hands and feet so as to swim/keep the nose above water to breathe air; wear water mask (any two)

### 29.4

1. It is protected from its predators; can be widely dispersed. Commensalism

2. Fungus provides water, shelter and minerals to the alga.

### 29.5

1. When birth rate is more than the death rate.
2. Emigration
  - (i) It is the permanent outward movement of the organisms from a given population.
  - (ii) Decrease the size of the population.

#### Immigration

- (i) It is the permanent inward movement of the organisms from outside into a given population.
  - (ii) Increases the size of the local population.
3. When the individuals enter a previously unoccupied area, the growth is slow at first as it adapts to the new conditions and establishes itself.



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### Humans and Environment



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# HUMAN IMPACT ON ENVIRONMENT

While there are many reasons for appreciating nature's bounty, there are also reasons for expressing concern regarding environmental problems. Environmental problems arise both due to natural processes and human activities. These problems adversely affect human and other forms of life.

In this lesson, you will learn about some natural and man-made environmental problems, their causes, effects and control. We will first explain the issues related to human activities and then discuss the natural disasters. But even before that it would be worthwhile to consider how the growing population can affect the environment



## OBJECTIVES

After completing this lesson, you will be able to:

- *express concern regarding environmental problems;*
- *categorise environmental problems into natural and human made and cite examples;*
- *state meaning of the term natural disaster and briefly explain some of them along with their management methods;*
- *establish relationship between large human population and its impact on the environment;*
- *define the term biodegradable and non-biodegradable wastes and suggest methods of waste management.*
- *discuss certain global environmental problems like ozone hole, global warming, photochemical smog and acid rain.*



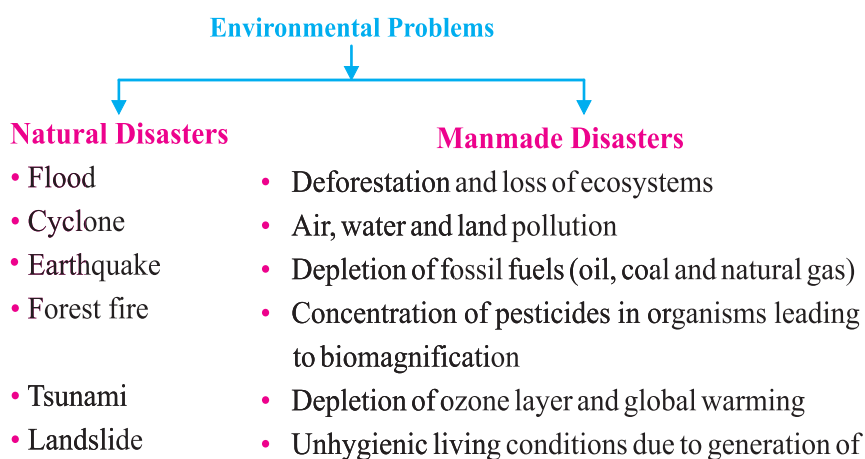
### 30.1 ENVIRONMENTAL PROBLEMS-CAUSE FOR CONCERN

You have already learnt about the natural environment and its components in the previous lesson. You must have realized the importance of maintaining a clean environment for supporting life. But developmental activities carried out by humans have degraded and polluted the environment. It has become necessary, therefore, to keep a close watch on their impact on the environment. Human population of our country has crossed the one billion mark. The large population world over, technological advancement in recent years and lack of respect for our environment has added to the list of problems, especially pollution and depletion of natural resources.

Although natural phenomena such as earthquakes, floods, tsunamis, cyclones and fires affect the environment on a large scale, nature has the capacity of recovering. It is however, high time that each citizen becomes aware of these issues in order to contribute towards saving the environment.

### 30.2 ENVIRONMENTAL PROBLEMS

Environmental problems may occur due to natural disasters and/or degradation caused by human activities. A disaster whether it is natural or manmade results in large scale damage to life and property. The effect of these disasters can be felt either locally or at the global level. They are categorized into natural and man-made environmental problems.



### 30.3 NATURAL DISASTERS AND THEIR IMPACT ON ENVIRONMENT



#### Do you know

Following are the Nodal agencies in the Government of India mandated for early warning of different natural hazards:



Disasters	Agencies
Cyclone	— Indian Meteorological Department
Tsunami	— Indian National Centre for Oceanic Information Services
Floods	— Central Water Commission
Landslides	— Geological Survey of India
Avalanches	— Snow and Avalanche Study Establishment
Heat & Cold Waves	— Indian Meteorological Department

These agencies shall be responsible for keeping track of developments in respect of specific hazards assigned to them and inform the designated authorities/agencies at National, State and District levels about the impending disasters. All these agencies have developed guidelines for early warning of disasters.

Let us discuss some such disasters and their impact on humans and other living beings.

**30.3.1 Floods**

India being a country of many rivers and with tropical climate is one of the most flood-prone countries of the world. We regularly learn about the damage caused due to floods. Floods are frequent because most of the rivers are full of water during monsoons. Flooding is caused by the inadequate capacity within the banks of the rivers to contain the high flow of water due to heavy rainfall. Areas having poor drainage get flooded by accumulation of water. Do you know that even humans contribute to flooding by blocking the natural flow of a river?



*Fig. 30.1 (a) Floods blocks roads*

*(b) Human lives and property affected by floods*

Almost all Indian states have been affected by serious floods. Apart from loss of lives of humans and cattle, on an average, every year 75 lakh hectares of land area is affected by the floods annually, accompanied by damage to the crops, houses

and public utilities. Interestingly, while on one hand floods cause large scale losses on the other hand it helps agriculture by improving the soil quality.

### Preventive Measures and Management

The following steps may be taken to prevent damage due to floods:

- No construction should be allowed in the river beds
- Timely cleaning and desilting of water channels and reservoirs by civic agencies;
- Safe disposal of surplus run-off water from river to river and drain to drain to ensure easy flow of water;
- Buildings like public institutes, schools, offices, telephone exchange, power supply stations, railway tracks and stations, roads and residential areas etc. need to be built above levels that correspond to floods occurring in the past few years;
- Constructing flood proof buildings;
- Local community as well as authorities needs to have a ready plan for evacuation. It is important to identify an evacuation center in the flood-prone area and give it publicity so that people can move there in emergency. Adequate supply of food and drinking water may also be considered;

Floods can also cause epidemics. Can you suggest any two possible way of preventing the epidemics? Yes you are right: 1. Drinking boiled water 2. Eating properly cooked food.

Epidemics: an outbreak of a contagious disease that spreads rapidly and widely

### 30.3.2 Cyclones

India has a long coastline, which is vulnerable to the tropical cyclones in the Bay of Bengal and the Arabian Sea. The Bay of Bengal region is frequently battered by storms and cyclones. Cyclones are intense low-pressure areas in the form of depressions or cyclone storms. Severe cyclones are associated with hurricane, winds etc.

There are two cyclone seasons in India, the pre-monsoon season (April-May) and the post-monsoon season (October-December). The states of Orissa, Andhra Pradesh, Tamil Nadu and West Bengal are the most affected states due to cyclones.

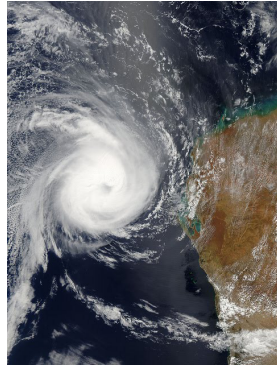
Balasore district in Orissa is the most vulnerable district for cyclone landfall. You would have heard about Orissa super cyclone that occurred in the state of Orissa on October 29, 1999 at a wind speed of 270-300 km per hour accompanied by heavy rains continuously for three days. The sea surged up to 7m high and sea



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waves travelled up to 15-20 km in land. This resulted in heavy losses. The agriculture, livestock, infrastructure, industries and environment were badly devastated during this cyclone.



*Fig.30.2 (a) Formation of a Cyclone (b) Cyclones disrupt coastal life and property*

### **Preventive measure and management**

Buildings are to be constructed keeping in mind cyclone safety measures. Decaying trees or any other loosely fixed objects and unsafe buildings need to be demolished;

Extra food and enough drinking water may be stored in advance;

Hurricane lantern filled with kerosene, and flashlights, matchbox, candles etc. should be kept ready;

In case of a cyclone, head for the proper shelter or evacuation point, keep calm and remain there until informed that you may return home. Neither panic nor lend an ear to rumours;

After the cyclone has passed get yourself inoculated against diseases and seek medical care for the injured and sick, clear the house and dwellings of debris and report any loss to the revenue authorities.

### **30.3.3 Earthquakes**

Earthquake is a common phenomenon. It is the shaking, rolling or sudden shock of the earth's surface. We are aware of the serious damages caused by earthquakes to life and property, at Bhuj and Anjar near Ahmedabad and some other places in Gujarat on 26th January 2002. Earlier Latur in Maharashtra had also experienced a similar natural disaster on 30<sup>th</sup> September 1993. Most earthquake pass unnoticed.

#### **Most earthquakes pass unnoticed**

Earthquakes of greater intensity shake buildings, and loosen the bricks. Falling of walls may injure people and property. Earthquakes also cause breakage of water pipes, cut electric lines, damage rail and road routes.





The intensity of earthquake is related to the amount of energy released when rocks give way to the forces within the earth. It is measured with the help of an instrument known as **seismograph**. The intensity of an earthquake is measured on the **Richter scale** (invented by the scientist *C.F. Richter*).

Following values indicate the degree of damage.

Intensity on Richter scale	Extent of Damage
Upto 3	No damages
5	Cracks in old buildings
7	Cracks in roads
Above 8	Falling of buildings

### Impact of a severe earthquake

Recently you have seen the devastation due to earthquake in Sikkim on 18<sup>th</sup> September, 2011 on your TV monitors or pictures in the print medium.

Most problems from an earthquake result due to falling objects and debris because of collapse of the building or ceiling plaster etc., and not due to the ground movement.



*Fig. 30.3 Collapsing of buildings and build up debris*

A severe earthquake damages roads, bridges, dams, fields and settlements or cause fires due to short-circuits or other means

### Preventive measures and management

Modern earthquake-resistant architecture for the buildings, roads, dams, bridges, etc. may be adopted.

In the event of an earthquake stay as safe as possible. Be aware that some earthquakes are actually foreshocks and a larger earthquake might follow. Minimize your movements to a few steps to a nearby safe place and stay indoors until the shaking has stopped and you are sure exiting is safe.

## MODULE - 7

### Humans and Environment



#### Notes

#### Human Impact on Environment

Stay away from glass, windows, outside doors and walls, electricity poles, trees and anything that could fall, such as lighting fixtures mirrors or furniture. If you are in a multi-storyed building stay on the same floor. Do not use elevators or run towards the staircase doors.

Can you suggest a reason as to why we should not use an elevator during an earthquake? You can take help of internet to answer this question. You can give your suggestions in the space provided below.

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---

If travelling, stop the vehicle away from buildings, walls, slopes, trees, electricity poles and wires and move out in the open. Keep calm and stand under strong beams that may not fall or creep under the dining table or a strong bed.

If you are in a building and unable to move, cover your head and body with your arms, pillows or blankets to protect yourself from falling objects.

#### After an earthquake

Keep calm, switch on the radio/TV and obey any instructions you hear on it. Keep away from beaches and low banks of rivers. Huge waves may sweep in. Be prepared for aftershocks.

Immediately clean up any inflammable products that may have spilled (alcohol, paint, etc).

If you know that people have been buried, inform the rescue teams. Do not rush and do not worsen the situation of injured persons or your own situation.

Check for injuries. Apply first aid. Help others.

Check for fire and structural damage and clear blocked exits.



#### ACTIVITY 30.1

On 18<sup>th</sup> Sep 2011 there was a severe earthquake in Sikkim. Earthquake was also experienced in Delhi and NCR (National Capital Region) at the same time. Why is it that there was a loss of property, human lives, and biodiversity in Sikkim whereas no such damage was there in Delhi. Suggest any one reason for it in the space provided.

### 30.3.4 Forest fires

From prehistoric times forests and fire have remained inseparable. In fact the temperate world's forest ecosystem has been re-generated and rejuvenated with active help of forest fires. Forest fires have become a major cause of concern because it threatens human habitats and deprives humans from accessing forest resources. You are already aware of the benefits we derive from forests. Full benefits of forest resources can be obtained only if timber (wood) is protected from fire, diseases and insect pests. Forest cover of India is 19.27% corresponding to 63.3 million hectares.



*Fig. 30.4 Forest fire*

Forest fire can broadly be classified into three categories;

- Natural or controlled forest fire e.g. by lightning striking dry trees.
- Forest fires caused by heat generated in the litter and other biomass in summer and dry season.
- Human negligence eg., by carelessly dropping lighted matchsticks or cigarette stubs.

**Effects of forest fire:** Fires are a major cause of forest degradation and have wide ranging adverse ecological, economic and social impacts:

- Loss of valuable timber resources, biodiversity and extinction of plants and animals; loss of natural vegetation and reduction in forest cover are the damages caused to environment by forest fires. Fires may also lead to degradation of catchment areas;
- Other environmental impacts of forest fire are global warming, change in the microclimate of the area with unhealthy living conditions; soil erosion affecting productivity of soils and depletion of ozone layer.

Approximately 300 million people are directly dependent upon collection of non-timber forest products for their livelihood. Forest fires are also responsible for loss of livelihood for tribal people and other rural poor.

### Preventive Measures and Management

Damage caused due to a forest fire can be controlled by the following means:

- Get dry litter e.g. dying twigs, leaves etc. removed during summer season.
- Call a fire brigade, try to put out the fire by spraying water or digging around the fire zone.



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### Humans and Environment



#### Notes

#### Human Impact on Environment

- Move farm animals and movable goods to a safe place.
- Do not throw smoldering bidi, cigarette or leave burning wood sticks around.
- Do not enter a forest if it is on fire.

Can you answer why it is difficult to control forest fire? You may discuss with your elders or take the help of internet and answer the question in not more than 50 words in the space provided below. Based on the information collected inform all the members of your family and others about the ways in which a fire can be caused and the methods to prevent fire.

### 30.3.5 Tsunami

The word *Tsunami* is a Japanese word meaning 'Harbor wave'. It involves the displacement of very large quantities of water due to earthquakes, landslides or volcanic eruptions. Tsunami occurs due to earthquakes under the ocean. Natural barriers such as shoreline tree cover can mitigate effects of Tsunami.



Fig. 30.5 Tsunami- Earthquake below the sea



#### Do you know

In the aftermath of the Indian Ocean Tsunami of 26 December 2004, the Ministry of Earth Sciences has set up an Indian Tsunami Early Warning Center at the Indian National Centre for Ocean Information Services (INCOIS) Hyderabad. The Center is mandated to provide advance warnings on Tsunamis likely to affect the coastal areas of the country.

#### Some Important Case Studies

**On December 26, 2004** an earthquake of 8.9 intensity struck Sumatra in Indonesia with the epicenter near its west coast. This triggered a series of devastating Tsunamis along the coasts of Indonesia, Sri Lanka and India. In India Tamil Nadu, Pondicherry, Andhra Pradesh, Kerala, Andaman & Nicobar



Islands were severely affected. About 10,000 people died and several thousands were rendered homeless.

**Man Vs Nature – Earthquake, Tsunami, Nuclear Radiation Threat in Japan**

On March 11, 2011 one of the most technologically advanced countries, Japan, was hit by an earthquake of 9.0 magnitude on Richter Scale followed by a 13 ft tsunami in a few minutes. It was the strongest in the world since 130 years. Sendai airport was inundated with cars, trucks, buses and thick mud. A large fire erupted at Cosmo Oil Refinery



*Colossal devastation due to tsunami in Japan in 11<sup>th</sup> March, 2011*



*The Cars drowning in the sea and habitations washed away by high waves due to Tsunami*

State of emergency was declared as five reactors of two nuclear power plants lost cooling ability. Dangerous levels of radiation leak were reported on 15<sup>th</sup> March 2011 from Fukushima plant after third explosion and fire.



*Leakage from the reactor due to effect of Tsunami*



The force of the quake moved the island of Honshu by 8ft to the east and the rotation of the Earth was sped up by 1.6 microseconds. The quake happened at the intersection of the North American and Pacific plates in the North-western side of the 'Ring of fire'. The quake caused a rift 15 miles below sea floor that stretched 186 miles long and 93 miles wide.

### 30.3.6 Landslides

Every monsoon we hear about the massive landslides in the hilly regions leading to blockage of roads. A landslide is the gravitational movement of a mass of rock, earth or debris down a slope. It occurs when a hilly slope becomes unstable. The natural reasons of a landslide are groundwater pressure acting to destabilize the slope, volcanic eruptions, earthquakes, erosion etc. This is one of the natural environmental problems which is influenced by human activities such as deforestation, dynamite blasting of rocks, earth work, constructions, vibrations etc. These activities need cutting down of trees whose roots hold the soil in place.

In majority of the cases, landslides are triggered by heavy or prolonged rainfall. Landslides are a major hazard in most mountains and hilly regions as well as in steep river banks and coastlines. Landslides cause damage to lives, property and disruption in movement of traffic on highways (linking people living in hilly areas). They are a common feature in hilly areas.



*Fig. 30.6 Soil erosion and landslides from mountain heights not only block traffic but also damage habitation*

### 30.3.7 Cloudburst

When we hear the news of landslide it is often accompanied by cloudburst. A cloudburst is an extreme amount of precipitation, sometimes with hailstorms and thunderstorms. It occurs for few minutes and can create flood conditions which often results in landslides.

On 6 August 2010, in Leh, a **cloudburst** and heavy rains caused flash floods. About 193 people were reported to have died and 200 people were reported missing. Thousands of people were rendered homeless and extensive damage to property and infrastructure took place.



*Fig. 30.7 A sudden cloudburst catches humans unawares and damages lives and property equally.*

### Preventive Measures and Management

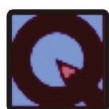
Prevention of natural disasters like cyclone, tsunami, cloudbursts is not in human hands. However, early warning system could help in saving lives. It is also important to have a ready home plan to tackle aftermath especially by those living in the vicinity of disaster prone areas. The following link and helpline may help you in preparing your plan.

- National Disaster Management can be accessed at <http://www.ndmindia.nic.in>
- Helpline during the disasters (1070).



### ACTIVITY 30.2

Retrieve information and graphics about any natural disaster from old newspaper and magazines and write down a report in about 70 words. Also include in your report what role man plays in aggravating the natural calamities and how man can reduce the impact of these natural calamities.



### INTEXT QUESTIONS 30.1

1. Define the term 'natural disaster'? Name any three.  
\_\_\_\_\_
2. You are enjoying a cup of tea with your family sitting on a bed. Suddenly you experience an earthquake. List the first two steps that you and your family should take.  
\_\_\_\_\_
3. State one cause each of (a) forest fire (b) landslide (c) Flood  
\_\_\_\_\_



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#### Notes

#### Human Impact on Environment

4. State any one way by which National Disaster Management Authority of India could help in reducing the loss of life in case of (a) cyclone (b) tsunami.  
\_\_\_\_\_
5. What happens after a cloudburst?  
\_\_\_\_\_

### 30.4 IMPACT OF HUMAN POPULATION ON THE ENVIRONMENT

We all know that the population of India has crossed the figure of 1 billion. Did you know that the world population of humans today is estimated to be 6.91 billion and is expected to rise between 7.5 and 10.5 billion by the year 2050? This population size would require large scale resources such as water, food, space, energy, land, fuel etc. which will certainly have a drastic effect on the environment at the local as well as global level.

Although the growth in the human population leads to added stress on our resources indiscriminate and irresponsible use of our natural resources makes it even worse. Large population means more land under cultivation for food production and water for irrigation, more fertilizers and pesticides in the environment. Forests are also cleared to create space for housing, roads, educational institutes, industries, etc. To meet the demand of food, housing and energy, environmental resources are being depleted at a fast pace. Environment has the potential to replenish most of its resources over a certain period of time. However, over-exploitation of resources and human activities has resulted in many environmental problems, such as:

- Deforestation and loss of ecosystems
- Air, water and land pollution
- Depletion of fossil fuels (oil, coal and natural gas)
- Concentration of pesticides in organisms leading to biomagnification
- Depletion of ozone layer and global warming
- Unhygienic living conditions due to generation of more waste

Let us study these in detail.

#### 30.4.1 Deforestation

Recall what you have studied in the previous lesson about the importance of forests. Can you now justify how large scale depletion of forests would threaten

the survival of living beings? Taking the hint from the figures given below give any two reasons:

1. \_\_\_\_\_
2. \_\_\_\_\_



*Fig. 30.8 Stumps of traces after deforestation*

Cutting of the natural forest cover is called deforestation. Forests are being cut for various purposes. such as for:

- growing crops and grazing cattle
- meeting the demand of wood and paper

Cutting down of forests may result in the following:

- Destruction of habitat for wild plants and animals leading to loss and disappearance of many species leading to loss of biodiversity. You have studied about this in lesson 19.
- Reduced rainfall
- Lowering of water table affecting water cycle and resulting in drier climate
- Soil erosion, loss of fertility of soil and lack of vegetation leading to desertification
- Increased CO<sub>2</sub> levels in the atmosphere leading to global warming.

### Preventive Measures and Management

The cutting and felling of trees should be banned through appropriate legal provisions as you would remember that replenishment of forests in nature takes a long time. This can be done by planting trees in place of cutting down of forests, known as **reforestation**. A reforestation program may include the following:

- Enforcement of strict environmental laws against felling of trees



Notes

## MODULE - 7

### Humans and Environment



#### Notes

#### Human Impact on Environment

- Growing of more -plants to substitute for every single tree that has been cut
- Celebrating Van-Mahotsava enthusiastically. This involves mass plantation in the first week of July.
- Practising silviculture, the cultivation of forest trees, as it provides wood for industries and also increases area under the forest cover.
- Social forestry or planting rows of trees, by groups of local people is a means of 'afforestation' or building new forests

**Reforestation** is the reestablishment of the forest cover naturally or artificially soon after the forest is removed.

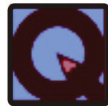
**Afforestation** is the establishment of a forest in an area where the preceding vegetation or land use was not a forest.

**Silviculture** is the practice of controlling the establishment, growth, composition, health, and quality of tree to meet diverse needs and values.



*Fig.30.9 Reforestation – one step to put deforestation on back-gear*

Women in the sub-Himalayan region have started a movement to prevent cutting and felling of trees by hugging them. This is called the “Chipko Movement”.



#### INTEXT QUESTIONS 30.2

Fill in the blanks.

1. The number of animals, such as \_\_\_\_\_ and \_\_\_\_\_ is falling due to cutting of forests.
2. Need for \_\_\_\_\_ leads to felling of trees.
3. Practice of \_\_\_\_\_ and \_\_\_\_\_ can help in reforestation.
4. Environmental problems, such as \_\_\_\_\_ and \_\_\_\_\_ are a result of increase in human population.

#### 30.4.2 POLLUTION

Any undesirable change in the environment due to human activity is **pollution**.



Human life involves a number of daily activities. Bathing and washing of clothes with soaps and detergents add some chemical residue to water and change its quality. Cooking of food by using firewood may give out smoke in the air. Agricultural activities may dump fertilizers and pesticides in the environment. Isn't it surprising that the fertilizers that are added to improve the crop production end up polluting the environment when used indiscriminately?

Each activity, human or industrial, discharges some unwanted substances in the environment. The presence of unwanted substances in a concentration which can have an adverse effect on organisms and environment is called **pollution**. Although the development and technological growth has given new devices for human comfort it has also added substances that may have adverse effects on life and environment.

Thus, **an undesirable change** in the physical, chemical and biological characteristics of the environment especially air, water and land that may **adversely affect human population** and the **wild life** and **cultural assets** (buildings and monuments etc.) is called **pollution**.



*Fig. 30.10 Air and water pollution*



### ACTIVITY 30.3

Look at the picture given below. Is this the state of environment we live in? What major sources of pollution can you identify in the pictures given below? Write a sentence on each of them in the space provided.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_



## MODULE - 7

### Humans and Environment



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## Human Impact on Environment



Depending upon the area or the part of environment affected, pollution may be of the following types:

- Air pollution
- Water pollution
- Land pollution
- Noise pollution

### A. Air Pollution

We all feel and breathe air. Sometimes, we feel very happy and remark about the fresh air around us. The pollution in air may not be noticed until we see dust or smoke coming out from some source or some foul smell present all around. All human activities from cooking at home to the working of highly mechanized industries contribute to air pollution. You have already learnt about sources and prevention of air pollution in lesson-26 “Air and Water”. Recall the information and fill in the given blanks for a quick review.

- Addition of unwanted substances in the environment is called \_\_\_\_\_.
- Automobile exhaust gives out pollutants, such as \_\_\_\_\_ and \_\_\_\_\_.
- Increased carbon dioxide level in earth’s atmosphere leads to the phenomenon of \_\_\_\_\_.
- \_\_\_\_\_ and \_\_\_\_\_ are examples of Suspended Particulate Matter.
- Air pollution can be prevented by installing \_\_\_\_\_ and \_\_\_\_\_ in industries.

**B. Water Pollution**

The contamination of the water bodies by discharge of pollutants directly or indirectly into them is called **water pollution**. Water pollution could be due to natural or human activities. You have already learnt about sources and prevention of water pollution in lesson-26 “Air and Water”. Recall the information.

**Table: 30.1 Some major water pollutants, their sources and effects**

Type of pollutant	Examples	Sources	Effects
Infectious agents	Bacteria, viruses, and other parasites	Human and animal excreta	Water-borne diseases
Organic chemicals	Pesticides, detergents, oil	Agricultural, industrial and domestic waste	Biomagnifications
Inorganic chemicals, fertilizers	Acid, alkalis, metals, salts	Industrial waste, household cleaning agents, surface runoff	Water unfit for drinking
Radioactive materials	Uranium, thorium, iodine	Mining and processing of ores, power plants, natural sources	Genetic disorders

**Table: 30.2 Some major disturbances in the ecosystem due to water pollution**

Pollutant	Sources	Cause	Effect
Nitrates, phosphates, ammonium salts	Agricultural fertilizers, sewage, manure	Plant nutrients	Eutrophication
Animal waste and plant residues	Sewage, paper mills, food processing wastes	Oxygen deficiency	Death of aquatic animals
Heat	Power plants and industrial cooling	Thermal discharge	Death of fish
Oil slick	Leakage from oil ships	Petroleum	Death of marine life due to non-availability of dissolved oxygen

Fertilizers and pesticides are widely used in agriculture. Their excessive use to increase agricultural yield has led to the phenomenon of **eutrophication and biomagnifications**, which are serious consequences of water pollution.

- **Eutrophication:** With the use of high-yielding varieties of crops application of fertilizers and pesticides has increased. Excess fertilizers may mix with surface water bodies (surface runoff). The enrichment of water with nutrients such as nitrates and phosphates that triggers the growth of green algae is called **eutrophication**. This fast growth of algae followed by their decomposition depletes the water body of the dissolved oxygen. As a result, aquatic animals die of oxygen shortage.



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## Human Impact on Environment

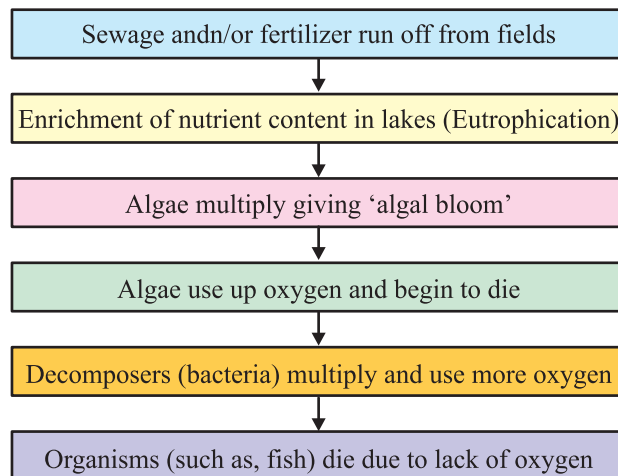


Fig. 30.11 Sequence of events that may occur as a result of eutrophication

- **Biomagnification:** Entry of harmful, non-biodegradable chemicals in small concentration and their accumulation in greater concentration in the various levels of a food chain is called biomagnification. Non-biodegradable pesticides, such as DDT are widely used for crop protection. Once they enter the food chain, their concentration keeps on increasing with each trophic level (steps of a food chain). As a result, accumulation of these compounds takes place in the body of top consumers over a period of time. Consider the following food chain. Is there any difference in the concentration of DDT in water and that of the body of the Pelican bird?

Water → Algae → Fish → Pelican bird (top consumer)  
0.2 ppm → 77 ppm → 500-600 ppm → 1700 ppm  
(ppm = parts per million)

DDT used in small quantities to kill mosquitoes can enter the food chain and may get concentrated due to its non-biodegradable nature in the body of birds (top consumer). This causes adverse effects, such as weak egg shells, resulting in decreased population.

### ? Do you know

Death of vultures in large numbers has been reported due to eutrophication near Bharatpur area (Rajasthan).

High concentration of DDT has been reported in milk from cattle and mother's milk leading to various disorders in the newborn baby.

**“We cannot allow people to die from malaria, but we also cannot continue using DDT if we know about the health risks.”**

*Tiaan de Jager*



### Control of water pollution

- Minimise the water by altering the technique involved.
- Maximum recycling of water after treatment (purification of waste water for reuse), and
- Limiting the quantity of waste water discharge.

### C. Soil pollution and land pollution

Addition of substances that change the quality of soil by making it less fertile and unable to support life is called **soil pollution**. Following are the sources of soil pollution:

- **Domestic sources:** plastic bags, kitchen waste, glass bottles and other solid waste.
- **Industrial sources:** chemical residue, fly ash, metallic waste
- **Agricultural residues:** fertilizers and pesticides

**Soil erosion** also leads to the degradation of soil due to uprooting of plants and over-grazing.

### D. Noise pollution

You may enjoy listening to music. But if the volume is too high you may not enjoy it any longer. It may become irritating. Noise can be simply defined as “unwanted sound”. It is generally higher in urban and industrial areas than in rural areas. Workers using heavy machinery are exposed to high noise levels for long period of work hours everyday. Intensity of sound is measured in a unit called **decibel** or **dB**. *The lowest intensity of sound that human ear can hear is 10 dB.*

### Sources of noise pollution

The major sources of noise pollution are:

- Industrial activities;
- Vehicle such as aircraft, trains, automobiles, etc.;
- Use of loud speakers and loud music systems at public places;
- Noisy fireworks;
- Increased volume of television.

### Effects of noise pollution

- Noise pollution can cause serious damage to ears leading to temporary loss of hearing, earache, sometimes even permanent deafness

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- Noise prevents concentration, increases irritability and causes headache. It may lead to increased blood pressure and irregular heart beat
- Ringing of ears (a feeling of sound coming from within the ear in a very quiet environment) is also a result of noise pollution
- Noise disturbs sleep and causes slow recovery from sickness

#### Preventive Measures and Management

Following steps can be taken to control or minimize noise pollution:

- Keep the volume of your radio and television low
- Use automobile horn only in case of emergency
- Avoid noisy fire crackers
- Tune and service all machines including automobiles at regular intervals. Use of silencers should be mandatory.
- Plant trees, as a green belt around your home is an efficient noise absorber.
- Report playing of loudspeakers during odd hours to the police immediately.



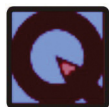
#### ACTIVITY 30.4

Conduct a survey among people living in very noisy areas, such as near railway crossings, place with heavy vehicular traffic, or a construction site (Your survey must be from two different sites and should include at least two persons from each site). Find out if the people living in such places show signs of adverse effect of noise pollution such as of stress, headache, and inability to concentrate, reduced or loss of hearing etc.? Record your observations in the table given below.

Name	Site of residence	Stress	Headache	Lack of concentration	Reduced /Loss of hearing	Any other

Keeping in mind that it is not easy to change the place of residence suggest two ways by which you can reduce noise pollution:

1. \_\_\_\_\_
2. \_\_\_\_\_



## INTEXT QUESTIONS 30.3

## Fill in the blanks.

1. \_\_\_\_\_ and \_\_\_\_\_ are examples of natural resources of water pollution.
2. Thermal discharge into rivers may lead to the death of \_\_\_\_\_.
3. Presence of \_\_\_\_\_ and \_\_\_\_\_ in water may lead to infectious diseases.
4. Enrichment of water bodies with nutrients coming from fields is called \_\_\_\_\_.
5. Non-biodegradable wastes, such as \_\_\_\_\_ may lead to biomagnification upon entering the food chain.
6. Domestic sources, such as \_\_\_\_\_ and \_\_\_\_\_ lead to land pollution.
7. Unwanted sound may lead to \_\_\_\_\_ pollution.
8. Noise pollution may be caused by \_\_\_\_\_ and \_\_\_\_\_

Notes



## 30.5 WASTE AND ITS MANAGEMENT

Anything which is unwanted or useless is termed as waste. The waste generated from various sources can be categorized into two types: Biodegradable waste and Non-biodegradable waste.

1. **Biodegradable waste** includes substances that can be degraded by microbes into harmless and non-toxic substances. Agricultural and animal wastes like leaves, twigs, hay, dung, etc. are biodegradable wastes.
2. **Non-biodegradable waste** cannot be easily degraded. Aluminum cans, plastics, glass, electronic waste, batteries etc. are examples of non-biodegradable wastes.

Waste can also be classified as *municipal waste*, *hazardous waste*, *biomedical waste* etc. **Radioactive waste comes under the category of hazardous waste.** Do you know that radioactive wastes produced during nuclear reactions and take a long time to decay and are harmful to all living organisms including human beings?

With the increasing population size, waste generated is becoming unmanageable. Open dumps and heaps of garbage is a common site. This unhygienic atmosphere leads to problems related to human health and environment because untreated, uncovered waste is a breeding ground for flies, rats, mosquitoes and other insects



which spread various diseases. The rainwater runoff from such sites contaminates nearby land and water.

In fact, cities and some villages use landfills to manage the solid waste. Also, incineration plants are used in big cities to deal with waste especially biomedical waste. **Incineration** is the process of burning of waste after segregating the recyclable material. The end product of this process is called ash which is then disposed off in landfills. Unfortunately incineration produces toxic gases which cause air pollution. In fact, the best practice of waste management is to minimize the generation of waste. Let the 4 R's of conservation – **Reduce, Reuse, Repair** and **Recycle** be our guiding principles for reducing waste generation.

If a waste material is processed by some means and converted to a product, we call the process **recycling**. It helps in efficient management of wastes and also reduces the load on natural resources. Recycling of plastics and paper, converting municipal waste into manure, and rice husk into wood particle board are some such examples. Use of cattle dung for the production of biogas is also good example of recycling of waste for the production of energy. Do you know that human excreta is also being used to generate biogas? Suggest a few more examples from your neighbourhood.

## 30.6 GLOBAL ENVIRONMENTAL PROBLEMS

On the global scale, we will discuss few environmental problems such as ozone hole, global warming, photochemical smog and acid rain etc. The cause of all these and many more problems may be localized but their effect is felt world over.

### 30.6.1 The ozone hole: Depletion of the ozone layer

The ozone layer present in the earth's atmosphere prevents the entry of sun's harmful ultraviolet (UV) radiations reaching the Earth's surface. Industrial use of chemicals called chlorofluorocarbons (CFCs) in refrigeration, air conditioning, cleaning solvents, fire extinguishers and aerosols (spray cans of perfumes, insecticides, medicines etc.) damage the ozone layer.

Chlorine present in the CFCs on reacting with ozone ( $O_3$ ) layer splits the ozone molecule to form oxygen ( $O_2$ ). Amount of ozone, thus, gets reduced and cannot prevent the entry of UV radiations. There has been a reduction by 30-40% in the thickness of the ozone umbrella or shield over the Arctic and Antarctic regions. This thinning of ozone layer is called **ozone hole**.





### The depletion of ozone layer may lead to the following hazards:

- Sunburn, fast ageing of skin, cancer of skin, cataract (opaqueness of eye lens leading to loss of vision), cancer of the retina (sensitive layer of the eye on which the image is formed).
- Genetic disorders
- Reduced productivity at sea and forests

### The damage to the ozone layer can be prevented by:

- Reducing the consumption of CFCs by adopting alternative technologies (substituting air conditioning gases by non-CFCs)
- Discouraging the use of aerosol containing spray cans

### 30.6.2 Global Warming – The greenhouse effect

**Greenhouse** is referred to as a chamber where plants are grown in a closed warm environment as compared to the outside temperature. This is normally practiced in cold region of the hills. The solar radiations bringing heat (in the form of infra-red rays from the sun) are trapped inside the chamber. The atmosphere on earth can also act in a similar way as shown below.



Fig. 30.12 (a) Greenhouse

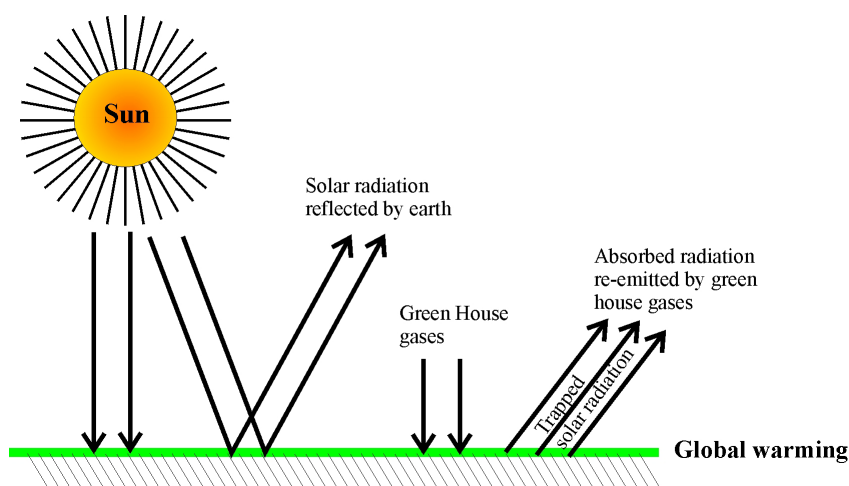


Fig. 30.12(b) The green house effect

Industrialization and urbanization has lead to deforestation and release of gases, such as  $\text{CO}_2$ ,  $\text{CH}_4$  and  $\text{N}_2\text{O}$  into the atmosphere. Do you know that plant eating





animals release a large amount of methane into the atmosphere? These gases have converted the earth's atmosphere into a **Greenhouse**. Heat contained in the solar radiations is allowed to come in, but the heat contained in it is not sent back due to increasing concentration of  $\text{CO}_2$  and other greenhouse gases. As a result, the earth's average temperature is increasing each year leading to **global warming**.

### Effects of global warming

Although the increase in global temperature in the last hundred years has been estimated to rise by only 1 degree, it has resulted in serious consequences, such as:

- Melting of snow caps/ glaciers and rising of sea level.
- Submerging of coastal areas of the Maldives islands in the Indian Ocean.
- Unpredictable weather patterns.
- Early maturation of crops leading to reduced grain size and low yields.
- Interference with the hatching of eggs in certain fish.

### 30.6.3 Photochemical Smog

Pollutants like sulphur dioxide which is released while burning sulphur containing fuel and particulate matter like soot present in stagnant air masses, get modified in sunlight and form a sheet called photochemical smog.

**Smog** is a combination of fog, smoke and fumes released by mills and factories, homes and automobiles.

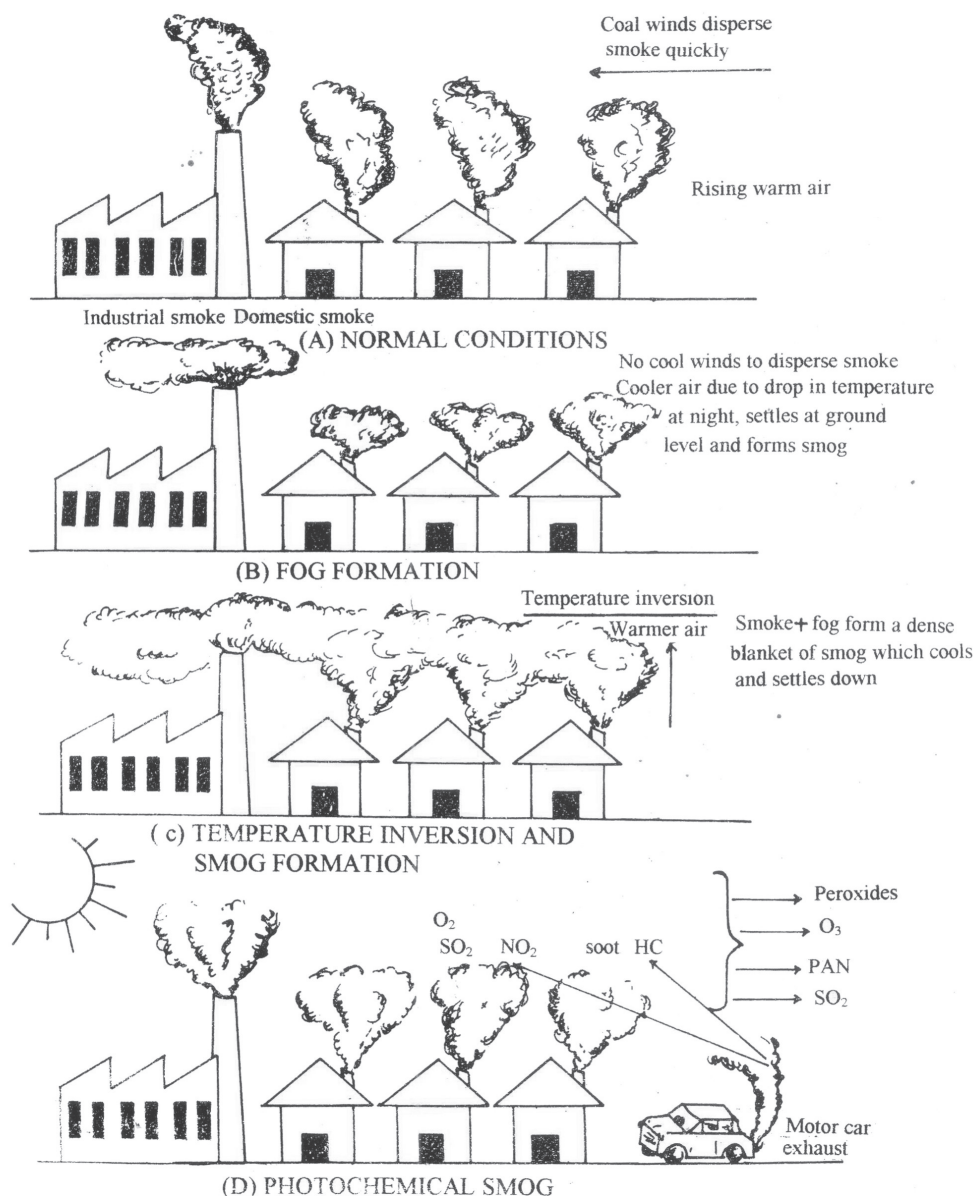
When sunlight falls on stagnant air under low humid conditions in the presence of pollutants such as  $\text{SO}_2$ , soot, nitrogen oxide and hydrocarbons, photochemical smog is formed. (Photochemical: chemical reactions in the presence of light). Smog stays close to the ground and reduces visibility.

Photochemical smog is also called Pan smog due to the production of peroxyacetyl nitrate (PAN) and ozone which form from hydrocarbons and nitrogen oxides in the air in presence of solar radiation. PAN and Ozone are called **photochemical oxidants**. Both of these are toxic irritants to human lungs.

Smog formation is accompanied by temperature inversion or **Thermal inversion**. Temperature inversion causes smog to settle and remain near the ground till wind sweeps it away. Normally, warm air rises up into atmosphere. When a layer of cool air at the ground level is trapped there by an overlying layer of warm stagnant air, it is called temperature or thermal inversion (Fig. 30.13).



Notes



**Fig. 30.13 Photochemical Smog**

Exposure to smog causes respiratory problems, bronchitis, sore throat, cold, headache and irritation to eye (red shot eyes). Smog also destroys crops and reduces crop yield.

### 30.6.4 Acid Rain

Acid rain is caused when nitrogen oxides,  $SO_2$  and particulate matter in the atmosphere react with  $H_2O$  to produce acids. (Fig. 30.14)

Acid rain is harmful to the environment. It affects life in water and on land. The fish cannot survive in acidic water below pH 4.5. It can also damage trees in the

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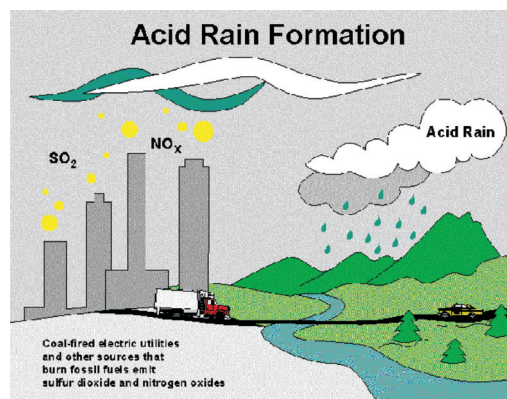


#### Notes

forests. In humans it can cause asthma and premature deaths when food, water or air which is in contact with acid deposits is consumed. The soil characteristics are also greatly affected; this has an effect on the crops and agricultural productivity.

The buildings, monuments are also damaged by acid rain. It also increases the corrosion rate of metals.

#### Human Impact on Environment



*Fig. 30.15(a) Monument prone to damage by acid rain (b) Fish dying due to acidic water of polluted rivers*



#### WHAT YOU HAVE LEARNT

- Our environment is being affected both by human activities as well as natural phenomena.
- Growing human population is depleting natural resources at a very fast rate and the environment is being degraded very fast.
- Earthquakes, floods, and volcanic eruptions, tsunami, landslides are examples of some natural environmental problems.
- Forest fires may be caused due to human negligence; lightning and extreme rise in temperature in rocky areas, and can be controlled by removing inflammable material from fire line.
- Increased population and mindless over-exploitation of resources and many environmental problems, such as pollution, soil degradation, destruction of wild life, etc.
- Trees provide wood for multiple uses, shelter to wild life, soil conservation and rainfall. Cutting down of trees may lead to environmental problems.



- The practice of reforestation includes planting of more trees to develop forest cover.
- Addition of unwanted substances in the environment is called pollution. Pollution could affect air, water, soil and noise quality.
- Soil pollution includes addition of substances that reduce the fertility of the soil.
- Waste can be classified into biodegradable (e.g. cattle dung, vegetable peels, paper, wood etc.) and non-biodegradable (e.g. aluminium cans, glass bottles, plastics, DDT etc.).
- Recycling of wastes, such as cattle dung, paper, sewage and rice husk, into useful products help in conservation of resources.
- Ozone provides a protective layer against harmful ultra-violet rays coming from the sun. Excessive use of chemicals, such as CFCs used in spray cans, gas used in refrigerators and air conditioners, lead to thinning of the ozone layer.
- Accumulation of high concentration of carbon dioxide has led to the phenomenon of global warming (greenhouse effect), and has resulted in increased earth's temperature.



### TERMINAL EXERCISES

1. Choose the correct option
  - (i) Growing trees for afforestation is called
 

a) Monoculture	b) horticulture
c) Silviculture	d) agriculture
  - (ii) Which of the following chemicals lead to depletion of the ozone layer?
 

a) Carbon dioxide	b) Chloro-fluorocarbons
c) Nitrogen	d) Water vapour
  - (iii) Which of the following can be found in the body of top consumers in high concentration?
 

a) Nitrates	b) Phosphates
c) DDT	d) Vitamins
  - (iv) Soil erosion can be prevented by
 

a) Use of pesticides	b) deforestation
c) Afforestation	d) excessive use of fertilizers
2. Which of the following are biodegradable?  
Aluminum foil, paper, ballpoint pen refill, grass

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#### Notes

#### Human Impact on Environment

3. Which gaseous pollutant has the ability to absorb infra-red radiations?
4. A chemical factory in a village discharges its waste that is rich in nitrogen, in a pond. Which phenomenon do you expect to take place?
5. Leakage of gases used in refrigerators and air conditioners for cooling are not considered eco-friendly. Why?
6. A ship carrying oil from the gulf region collides with huge rocks and gets damaged. Is this just news or has some serious consequences? Give your opinion in one sentence.
7. Give the term given to replenishment of the forests from where wood can occasionally be taken for commercial use?
8. List two ways of replenishing forests.
9. To set up a new industry, a large forest area had to be cut. List four ways in which the environment in that area may be affected.
10. How does production of more paper in the world contribute to ecological imbalance? Use only four key phrases to support your answer.
11. What could be a major disadvantage for man being placed at the top of the food chain? Name the phenomenon that may cause this harmful effect.
12. List any three ways in which noise from various sources can affect the well-being of a person. Suggest few methods to control noise pollution.
13. What does 'Global warming' mean? Name the gas responsible for this phenomenon and why should it be considered an environmental problem.
14. It was observed that a large number of vultures were dying around a crop field. Considering the fact that vultures are top consumers, explain the phenomenon that may have caused their death in large numbers.
15. List and classify the waste generated at home? What is the difference between the different 'groups'? How would you manage this waste so that it causes least pollution?
16. Name the instrument used to measure the magnitude of an earthquake. Suggest any one of preventing way with them in earthquake prone areas.



#### ANSWERS TO INTEXT QUESTIONS

##### 30.1

1. An environmental problem caused by natural factors and not by humans.



2. Tsunami/earthquake/floods/forest fire/ etc.  
Tsunami: earthquake under ocean  
Forest fire: lightning striking dry twigs or human negligence  
Land slide : Soil erosion/cutting trees etc.  
Creep under the bed or table; cover your head with your arms/pillow/any other protective material around.
3. (a) Cause of Forest fires :
  - Lightning striking dry grass/trees
  - Heat generate in the litter in dry season
  - Human negligence
- (b) Land slide : Heavy / prolonged rainfall / deforestation / dynamite blasting
- (c) Flood — inadequate capacity within the beaks of the river to mountain the light flora of water during heavy rainfall
4. By issuing early warning of such natural disaster / plan to tackle such disasters.
5. Extreme amount of precipitation alongwith thunderstorm/hailstorm; flash flood cause loss of lives and property.

### 30.2

1. Cheetah, Tiger
2. Housing, construction of roads, industrialization (any one)
3. Silviculture, mass plantation
4. Air pollution, water pollution, global warming (any two)

### 30.3

1. Excreta (Animal/Human) and agricultural water.
2. Fish
3. Human and animal excreta.
4. Eutrophication
5. DDT
6. Plastic bags/kitchen waste/glass bottles etc. (any two)
7. Noise pollution
8. Vehicles/loudspeakers/loud volume of TV, music system/fireworks.





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31

# FOOD PRODUCTION AND ANIMAL-HUSBANDRY

Since ancient times humans have gathered plants and hunted animals for food. Later humans became dependent on agriculture to fulfill their needs for food. Agriculture is a composite term that includes all those activities which involve appropriate utilization of earth's resources for fulfillment of human needs of food, fodder, fibre and fuel, etc.

From time immemorial, India has been famous for its spices and fruits such as mangoes. Columbus actually embarked on a voyage to discover India for its spices during the course of which, he reached America instead. Agriculture includes growing of crops, fruits, flowers and vegetables, on one hand, and animal husbandry and fisheries, on the other. This lesson will help you know about the methods of food production and animal husbandry as is being carried out in our country.



## OBJECTIVES

After completing this lesson, you will be able to:

- *discuss about the current status of crop production in the country keeping food security in mind;*
- *explain the methods of crop-production including organic farming;*
- *explain the methods of protection of crops from insects and weeds;*
- *appreciate the value of animal husbandry, poultry and fisheries as income generating activities;*
- *give credence to the use of both modern technology and genetic engineering thus removing the barriers between science and society in the process and;*
- *describe the link between production, storage and distribution.*



## 31.1 DEVELOPMENT OF AGRICULTURE AND GREEN REVOLUTION

Agricultural practices began around 1000 B.C. Early humans subsisted on raw fruit and roots and hunted animals for their meat. After the discovery of fire, humans learnt to roast the prey to make it conveniently edible and easily digestible. Subsequently, rearing of sheep and goats as animal husbandry and farming of wheat and barley as agriculture was initiated. Since vedic times, our country has been agriculture based though methods of farming have changed from time to time. Agriculture depended as monsoons at that time, through agricultural implements like the plough were already in use. Today agricultural research and sustainable farming has placed India among the top major agricultural nations. Between 1905 and 1907, agricultural universities were established in the country. Indian Agricultural Research Council (Pusa) is located in New Delhi. Several Indian Scientists are engaged in agricultural research and development.



Notes

### 31.1.1 The Green Revolution in Indian Agriculture

A big change related to crop farming and food production occurred in the Indian agricultural scenario between 1968 and 1988. This period has been termed the golden age of agriculture named **Green Revolution**. As a result of the Green Revolution, we have become self-sufficient in the field of agriculture. The credit for this Green Revolution goes to Dr. M.S. Swaminathan a great agricultural scientist of our country for his fight against hunger. He has been awarded the World Food Prize. The joint efforts of our scientists and innumerable farmers had made such a change possible.



*Dr. M. S. Swaminathan*

Green Revolution was initiated with improved wheat and rice farming. Under the Green Revolution agricultural yield increased in the fields with limited area due to the use of improved technology and additional resources. For the food security of India's growing population, agricultural productivity got enhanced. But sustainability of improved agriculture proved to be a major challenge.

As time passed, fertilizers and pesticides began to be used for increasing productivity. On the other hand ecological balance got upset, and productive capacity of the earth began to decline. Today, even though agricultural self reliance has increased, the harmful impact on soil and humans has also come to sight. Organic farming is now being encouraged to sustain the benefits of Green Revolution. The following are necessary for sustaining Green Revolution.

Today, we are at cross-roads, we have to decide whether we let status good prevail or we try to advance further:-

- Industries that manufacture agricultural implements, pumps, fertilizers, and insecticides need to be established.

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#### Notes

## Food Production and Animal-Husbandry

- Irrigation and power projects are to be encouraged to receive a regular supply of water and energy for farming .
- Research and Developmental institutes are needed for the generation of new, healthy, pest-resistant and high quality crops.

Under the aegis of the Green Revolution, encouragement to sustainable organic farming may be given as part of awareness campaigns in villages as well as cities. Also, there needs to be enhancement of decision taking skills and increased competencies in this regard.



### ACTIVITY 30.1

Find out in your area of residence or your neighbourhood old ponds or water harvesting system. Then enquire of five specialists the history of that water body or technique. Also ask how fields used to be irrigated by these water bodies/ techniques in earlier times. Find out as to which crops were grown previously and what kind of implements were in use then. Fill in that information in the form of the following table.

Serial No.	Year/Period	Crops grown during that period			Specific Techniques used in the agriculture of that period		
		Winter	Summer	Rainy Season	Irrigation	Implements	Insecticides/fertilise

If you get an opportunity to travel within Delhi, then definitely go to see the NASC (National Agriculture Science Council) Campus situated in the Todapur area. This trip can provide you with adequate information about the development of agriculture in the country. You can tabulate the relevant information in the table above.



*National Agriculture Science Museum, Delhi*

## 31.2. THE PRINCIPLES AND METHODS OF CROP PRODUCTION

The branch of agricultural science which is concerned with crop production and the management of farms is called **Agronomy**.



Notes

### 31.2.1 Principles of crop production

The following principles should be adopted for crop production and agricultural field management:

- Maintenance of fertility and productivity of soil needs arrangement for prevention of diseases, and removal of used pests and weeds.
- Sowing healthy seeds in the field at the right time, at the right distance and upto the correct depth.
- Proper arrangements for availability of water and fertilizers.
- Selection of right crop types in accordance with variation in type of soil and climate.
- Crop harvesting at a suitable time.
- Scientific storage of harvest.
- Use of multiple cropping and mixed farming.
- Crop rotation
- Soil improvement and management.

### Methods of crop production

Following is a list of the main methods of crop production:

- (a) Crop rotation
- (b) Mixed farming
- (c) Multiple cropping
- (d) Organic farming

Let us now get detailed information about each one of these methods:

#### (a) Crop rotation

Growing of crops in a predetermined sequence, at a particular time, is called **crop rotation**. In this method, those crops are grown first that require more water. Subsequently crops requiring less water are grown on the same field. For instance first rice is planted; then gram. Similarly first those crops are grown which require more fertilizers. Subsequent to this, those crops are planted that require less fertilizer. For instance, first potatoes are grown then, Moong pulses. Similarly first deeps rooted crop are grown and then those with smaller roots. For example cotton is planted first and then ‘Methi’.

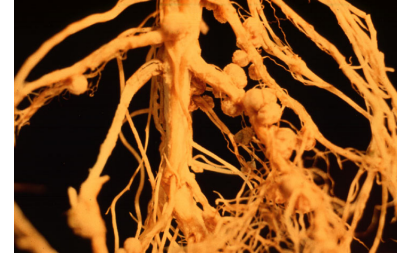
If you are connected in some way to villages or farming then you must have noticed that wheat is planted in November and cut in March or April. Rice is



planted in June-July and cut in October and November. The soil that lies fallow between these two grain crops is utilized by farmers to plant a leguminous crop.

### Peas, beans and pulses are leguminous crops:

They harbor **nitrogen fixing bacteria** in roots. These microbes convert the free nitrogen found in the atmosphere into usable form. Hence, after harvesting of these crops the soil remains fertile for other crops. (figure 31.1)



*Fig. 31.1 Root nodules*

### Benefits of crop rotation

- Maintains fertility of fields and affords soil nutrition due to abundance of nitrogen
- Increases crop production
- Prevents soil erosion
- Economical crop production
- Effective use of available resources
- Control of insects and disease affecting crops
- Regular income throughout the year

### (b) Mixed cropping

Mixed Cropping is the growing of two or more than two crops at the same time in the same field, For instance, mixed cropping of wheat with peas; of wheat with Mustard; or groundnut with sunflowers. During this process the crop seeds are combined and scattered in the fields or they are planted in separate rows as their maturation time and harvesting time are different.

The biggest advantage of mixed cropping is that the farmer gets two crops simultaneously at one time or within a short interval of time from the same field. Mixed cropping also maintains soil fertility.

### (c) Multi cropping

Multi cropping is the planting of two to four crops, during the same year, in the same field. Multicropping is only possible when we plant crops that require planting for a shorter period of time. For better results, properly managed field is essential. In fact, multicropping is an ideal solution for a country facing food problems. Several crops become available at the same time from a small area.



### The classification of crops

The classification of crops in India has been done primarily on the basis of their family. Their life cycle, seasons, economic considerations, specific use, are the factors that are duly taken into account, while classifying them on the basis of life cycle. The crops have been divided into annuals, biennials and perennials. On the basis of seasons, crops have been classified as 'Kharif' (Crops planted between October and December), 'Rabi' (Crops planted between April and July) and 'Zaid Crops' Zaid crops are planted mainly during the summer season or planted in different season, in accordance with specific crops. In the same way, crops have been classified from the economic point of view into grains, spices, fibrous crops, fodder, fruits, medicinal plants, roots, sesame and pulses, stimulants sugary crops are included in this category. In a similar way, crops have been classified on the basis of specific use. For example intermediate crops, cash crops, soil protective crops and green fertilizers. In our country, crops are given priority mainly in the basis of seasons.

### Classification of crops on the basis of Seasons

1. Kharif :- Rice, barley, cotton, groundnut, sugarbeet, 'urad', 'moong', 'lobia', 'millets', 'til', 'andi', 'jute', 'vemp', 'arhar', 'sugarcane', soyabean and lady finger.
2. Rabi – Wheat, millets grains mustard peas 'barseem', 'masoor', potatoes, tobacco, 'lahi' and 'jai'
3. Zaid – Pumpkin, water-melon, red-melon, gourd, 'torai', cucumber, green chillis, tomatoes and sunflower.

Ask your elders about medicinal properties of like turmeric, basil, garlic, ginger and spices like black peeper and cloves etc.

This information can be beneficial for you throughout your life.

### (d) Organic farming

Organic farming works in conjunction with nature and is not opposed to it. It targets high quality crop yields, through the use of various techniques, in such a way, that the natural environment is not adversely affected. It also ensures that humans, who inhabit this natural environment are not affected in a negative way. You will see related information in section 31.3.

### Horticulture

Horticulture includes the gardening of fruits and vegetables. In Horticulture the subject of the increased yield of fruits and vegetables and their appropriate cultivation is studied.



The Agricultural Ministry of the Govt. of India has set up a ‘National Gardening Mission’, which is working in order to enhance horticulture and gardening in cities and villages across the country.



**INTEXT QUESTIONS 31.1**

1. Which council has been set up in India for Agricultural Research and Development?  
\_\_\_\_\_
2. Mention any three advantages of crop rotation.  
(i) \_\_\_\_\_ (ii) \_\_\_\_\_ (iii) \_\_\_\_\_
3. In the table given below fill in the blanks and example has already been done for you.

Name	Method
1. Farming of ‘Moong’ after Potatoes	(A) _____
2. Growing four crops in the same field.	(B) _____
3. _____	(C) Organic farming
4. ‘Barseem’ barley, sun-flower	(D) _____

**31.2.3 Improved agricultural practices**

According to the prominent scientist, Dr. M.S. Swaminathan sustainable agriculture or progressive agriculture is the step-by-step increase in the production of grains in the context of changing environment, such as rise in the earth’s temperature, rise in the sea levels and damage to the ozone layer. Such agriculture practices are concerned with enhancing agriculture production is match/meet such difficulties. In other words, alongwith the rise in earth’s temperature increasing food production to feed the increasing population has emerged as a big challenge.

Unfortunately due to the excessive use of fertilizers, insecticides, pesticides and chemicals the condition of our soil has become worse. Not only have the beneficial insects, worms and other living beings found in the soil has also been destroyed. The quality of nutrients found in the soil has also been affected. Today agricultural scientists maintain that this process of degeneration can be halted by





the use of organic fertilizers. In order to enhance our food production, we may not only sow good quality seeds but can also improve the methods of sowing them for harvesting crops. Scientist can make use of scientific techniques. Methods have been discussed below, which have been developed by scientist and which are being used by our farmer in their fields.

### (A) Making the soil suitable for farming

The uppermost, thin crust of the earth (top soil), covers the earth like a sheath. This itself functions as the basis for plant life and its growth. It functions as a natural medium. This upper crust is formed of the products derived from various kinds of stones that have combined with organic products.

Farming begins with the formation of this top soil. This is a significant process that helps the top soil become more fertile. After mixing fertilizers in the top soil, the top soil is leveled and made loose with the use of agricultural implements like spade, plough and other agricultural implements.

### (B) Treatment of seeds:

Seeds are attacked easily by tiny microbes. The crop that is grown with diseased seed will also be diseased. In order to save these seeds from disease. Farmers 'treat' them by immersing them in chemicals such as Cerocin and Agrocen. These chemicals limit the damage done by these microbes to plants. After 'treating' them once, these seeds can be sown.

### (C) The preparation of seed field and taking care of new plants

Seeds of some crops like rice and some vegetables are not sown directly in the main fields. Firstly these seeds are sown in the nursery field. After a certain period, they are transplanted in the main field. These small plants are called 'New borns' ('Navodit' in Hindi) when the farmers prepare the plant fields, there are following facts should be taken in to account:

- **The field:** Top soil should be soft and loose, so that the delicate roots of saplings can grow properly. This is possible by digging and ploughing the field properly.
- Whenever the saplings are planted; the soil should be even leveled so that water gets distributed evenly upon irrigation.
- All the weeds or unwanted plants should be removed because they receive water and nutrition from the top-soil. As a result, desired plants do not receive adequate nutrition, it is essential to protect the young plants from disease and pests. Chemicals such as Parathion, Sevin, Dymicron and Rojar are sprinkled on the young plants to prevent pest and disease. Fig. 31.2





*Fig. 31.2 Tractor for plantation*

### (D) Transplantation

The process of shifting the new plants from the field where they were sown to the main field is called **transplantation**. Plants containing at least 4-5 healthy leaves should be selected for transplantation. Saplings should be sown at a sufficient distance from each other so that their roots can penetrate deep into the soil and receive adequate nutrition. Before the actual transplantation, the field should be ploughed and fertilizer spread over it. Usually, rice and vegetables like tomatoes and brinjals are sown by this method.

**The use of fertilizer and manner:** For healthy growth, crops need nutrients, which they receive from the topsoil, a total of 16 nutritive elements are needed by plants. Plants receive carbon and oxygen from air, oxygen and hydrogen from water and the remaining thirteen nutrients minerals – are received from the soil.

#### Essential Nutritive elements for the plants

Out of the total number of nutrient element, six are needed by plants in larger quantity. These are called '**macro-nutrients**'. These include-nitrogen, phosphorus, potassium, calcium, magnesium and sulphur. Out of the thirteen nutrient elements obtained from the soil. These are 7, that are needed in small quantity. These are called '**micro nutrients**'. These include iron, manganese, boron, zinc, copper, molybdenum and chlorine.

Manure and fertilizers provide all these nutrient elements to top soil and help in obtaining better harvest. Depending on varying kinds of top soil and crops. Different kinds of organic manure and fertilizers are used. Now, here, we shall learn in details about organic manure and fertilizers in section 31.4.

### (F) The use of plant-growth regulators

These chemicals that control the rate of growth of plants, are called **plant growth regulators**. All the plants contain growth regulators that determining the height of plants and the size of fruits. For better growth of crops, we can use growth

regulators such as Auxin, Gibberellins, Cytokinin, Abscisic acid etc. You shall learn about them in details in the next class.

### (G) Irrigation:

Irrigation is necessary for the proper growth of crops. Irrigation depends upon the characteristics of the top soil and the type of crops. Crops need to be especially irrigated in their young stage, flower bearing stage and grain bearing stages. Rice requires continuous supply of water, now-a-days several methods of irrigation are available. Some of the modern irrigation methods include surface irrigation, underground irrigation, sprinkling irrigation and drip irrigation. (Fig. 31.3) A limited amount of water is used in all these types of irrigation. Thus wastage of water is prevented, in the drip irrigation method, water drips, drop by drop, by a special method as the top soil and mixes with it. In this way, it is available according to the need of the crop. These techniques have been successfully employed in deserts for growing crops.



Fig. 31.3 (a) Drip irrigation (b) Sprinkling irrigation

### (H) Harvesting crops

Till some time back, the farmers used to cut the harvest with sickle but now this work has become easier after the invention of more sophisticated harvesting implements. More implements cut or dig only the required portion of the plants and their various parts. These implements first collect the various parts of the plants and then separate the usable portions and remove unwanted parts. Now-a-days, there are some implements that not only cut the plants, but also load them into auto vehicles. The size and function of these implements may differ in accordance with the types of crops being harvested. This in turn depends upon three factors—the type of crop, the part of the plant and the degree of ripeness of crop.

## 31.2 BIOFERTILIZERS

### (A) Biomass /Organic manure

You have already learnt that organic manure and fertilizers make the top soil more fertile. This increases the crop yield. Different kinds of fertilizers and manure are



Notes



used. Depending on the different types of top soil and variety of crops. Organic manures are all these natural ingredients (except water) which increase soil fertility. When mixed with the soil. From the scientific perspective organic manure includes material remnants such as grass, the droppings/urine of birds/animals or parts of organisms etc. usually all nutrients are contained in these remnants in small quantity. In previous decades our farmers used an excessive quantity of fertilizers in order to increase their crop yields. This unfortunately, had a negative effect on both the top soil and human health. Organic manure includes vermi-compost, cow dung and green manure etc. Now-a-days emphasis is being laid on a sustainable use of organic manure as a major alternative to fertilizers.

Since manure is derived from organic products; it is termed organic fertilizers. Following is a list of some commonly used organic manure.

- **Vermi-compost**

Vermicompost is also called earthworm culture manure or vermiculture. Earthworms are termed “The True Friends of the farmers’ or ‘The Natural ploughers’”. Earthworms feed on cow dung, dry leaves, grass, remnants of rice plants and plant refuse in the fields and they leave their excrements products in the form of vermin-composts. This is a complete natural, nutrients-rich and balanced kind of fertilizers. Vermicomposting can become an income-generating venture for unemployed rural boys and girls.

- **Compost**

Compost is the manure created out of the decomposition of household wastes such as refuse a vegetables and animals (which is part in a ditch in the home backyard).

- **Farmyard manure**

As the name suggests, this is the mixture of urine/excrements of animals, fodder remnants and garbage.

**(B) Fertilizer**

Fertilizers contain one, two or three essential nutrients in large amounts. These fertilizers are prepared commercially in a factory. Nitrogenous fertilizers are usually given in two or three doses. Before transplantation, some of these fertilizers are mixed in the top soil. NPK is the name of the prominent fertilizer. There ‘N’ stands for nitrogen, ‘P’ for phosphates and ‘K;’ represents Potassium. The names of other fertilizers are Kpotassium, urea, Super phosphate and ammonium phosphate and Curate of Potash.

**Case study**

Haria’s owns a small agricultural field. He saw a programme on biofertilisers in Doordarshan’s ‘Krishi Darshan programme’. With the intention of enhancing his

crop production, he went to a shop after watching this programme but was shocked to discover that the fertilizers were far more expensive than manure. Now, he was caught in a dilemma and wondered which fertilizer he should buy? The organic manure was expensive, but fertilizers was cheaper. How will you help Haria take the right decision.



Notes

**Note:** To help him take a decision, the method of vermicomposting is given below:

**ACTIVITY 31.2****Come, let's make vermicompost**

Making vermin-compost is not only an interesting experiment; it is also a memorable experience. You will be able to use vermin-compost made by your own hands to use your fields and gardens. For this purpose, collect waste such as un-used shoots of vegetables peels, old rotten vegetables, leaves and grass etc. and put all this in ditches measuring approximately 3'x1'x1' square meter size. (This should be in a dark place). Then, worms are bought from the market (from agricultural shops) and they are placed in these ditches under supervision of knowledgeable persons. These worms eat the waste matter contained in these ditches and excrete material, which forms the vermicompost. Vermicompost is ready by in approximately within one and half months time. Vermicompost made at home can be used by you in your farms and gardens. **For more information for related issues related to agriculture, you can dial Krishi Helpline No: 18001801551**

**Difference between organic manure and fertilizer**

S, No.	Organic manure	Fertilizer
1.	All the nutrients are found in this, but since their amount is limited. They have to be used in greater quantity.	Only a few nutrients are found in these; but since their amount is more, they are used in smaller quantity.
2.	These can be made easily in the fields.	These can be synthesized only in factories from chemicals.
3.	These cost more.	These cost less.
4.	Their effects in the soil are long-lasting.	Their effect on the soil lasts for in short time.
5.	Because of their use, the fertility of soil is enhanced. Circulation of air increases and the temperature remains controlled.	By their continued use, the condition of the soil becomes worse, air circulation does not increase. The temperature also does not remain in check.
6.	No special precautionary steps are required for their upkeep or storage.	Constant watch is required for their storage- as the fertilizer spoils due to moisture.



### 31.3 PROTECTION OF THE HARVEST

In the fields, crops are vulnerable to insects, weed as well as diseases. For getting better crop yield, weeds have to be removed. In addition, growing crop need to be protected from pests.

#### 31.3.1 Control of weeds

Weeds are those useless plants like *Xanthium*, *Parthenium* and *Cyprus rotundus* that grow along with crops in fertile soil. These weeds compete with the main crop for sunlight, water and space, weeds also take away nutrients from the soil. This reduces the crop yield. Hence, for better yield, weeds should be removed from the fields in the beginning itself.

Some weeds like *Parthenium* cause diseases such as allergy and asthma in human beings. These can be removed by using the plough or harrow. If weeds grow again, along the crops, they can be removed manually. Spraying weedicides like N,C,P,A and Cemazine also removes the weeds.

#### 31.3.2 Control of crop-pests and diseases

Insect pest attack plants in three ways:

- (i) They cut off the roots, branches and leaves.
- (ii) They suck the cellular fluids from various parts of the plants and
- (iii) They make holes in the branches and fruits.

The crop gets destroyed. Insect pests spread on the crops through the seeds, air and the top soil. Two common fungal diseases of wheat and rice are wheat rust and rice smut. To control these, insecticides may be sprayed. At the same time these pesticides may prove toxic for plants and animals, and cause environmental pollution. Just think, cannot diseases resistant crops varieties be used as a control strategy? Along with chemical methods, biological control methods may be used. For example, some water weeds are get eaten up by fish.



#### Do you know

Carrot grass (*Parthenium*) is harmful for human health.

During 1955, India imported wheat from the USA. Along with this wheat, carrot grass (*Parthenium*) also came to India. Today *Parthenium* has spread throughout the country. Pollens from *Parthenium* flowers cause asthma and skin diseases. *Parthenium* causes skin allergy.



Wide spread campaigns have been initiated, not only to spread awareness about *Parthenium* but also to eradicate this grass.

You can also take the initiative of making your neighbours aware of the dangers of carrot grass.

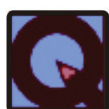


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### 31.4 STORAGE OF GRAIN

After harvesting, grains need to be stored. If there is lack of proper storage facilities, then the grain is vulnerable to attacks by insects, worms, fungi and various kinds of microbes. In the same way, lack of adequate moisture and right temperature at the place of storage increases the possibility of rotting of grain because of all these reasons, the quality of grain declines, its weight reduces and its capacity to bear grain decreases too. This reduces the price of the produce in the market. Following is a list of some techniques that have been developed to prevent the grain from deteriorating as well as maintaining their safe storage.

- **By drying:** Grain can be dried in the sun, or it can be dried by exposing it to hot/warm air.
- **By maintenance of storage vessels:** The godown, sacks, tanks or vessels used for storage of grain should not have crack or holes in them. They should be clean.
- **Chemical treatment:** Prior to storage, there is sprinkling of insecticides and fungicides chemicals on the godowns and the storage vessels. Fumigation (in the form of insecticidal mix or fumigant) is also used. This is known as **chemical treatment**. Grain is also treated with neem leaves, black pepper and oil. This is an organic cure that prevents insects from ovulating (laying eggs).
- **Vessels related to storage:** Now-a days such storage vessels of specific shapes are being manufactured. They are not only air free, but also rodent free and moisture free. Also they maintain an even temperature too. Some of their names are as follows:Pusa Bin, Pusa Cubide, 'Pusa Kothar'-SILOS



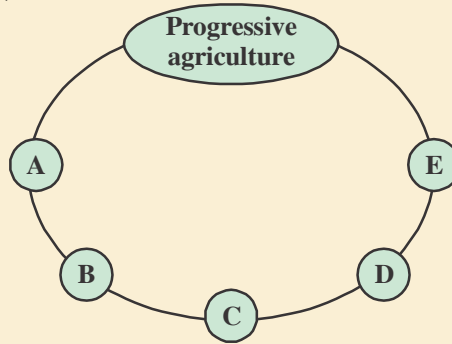
#### INTEXT QUESTION 31.2

1. Some statements are given below. Arrange them in the proper sequence so that the chain given below gets completed.

1. Use of grass cutting implement
2. Transplantation of new plants



3. Preparing the vermicompost
4. Treating the seeds by immersing these in ceresin or agrosin.
5. Use of mix cropping
6. Making topsoil fertile
7. Preparation of the field for sowing



2. Mention a chemical and an organic method for protecting growing crops against attack by weeds.  
\_\_\_\_\_
3. What can be done for removing plant destroying insects etc. what harm can be caused by chemical insecticides?  
\_\_\_\_\_
4. Mention any two better ways of storing grains.  
(i) \_\_\_\_\_ (ii) \_\_\_\_\_

**31.5 ANIMAL HUSBANDARY**

Animal husbandry is that branch of science which is concerned with the management of various methods of better production of food items and procurement of better services from animals. Animal husbandry includes producing proper nutrition to animals, and management of issues related to reproduction and control of diseases. With the increase in population, fulfillment of requirements for food would be possible only if – alongwith agriculturing attention is also paid to animal husbandary. In this way, the production of eggs, milk, honey, wool and meat can be improved and increased.

**31.5.1 Milch animals**

Milch animals includes all those cattle from where human receive milk and also those animals which are helpful to farmers in agricultural work such, as ploughing, irrigation, bearing loads etc. Indian domesticated milch animals have two





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categories- cow (*Bus indicus*) and buffalo (*Bus bucchi*). Milk giving cows are included in the category of milch animals.

Today, scientists are engaged in discovering how disease-resistant capacity of milch animals can be enhanced and how their milk delivering period can be increased. This period is the period when after the birth of the calf, the mother lactates. This means that milk production can increase, also it is essential that the animal be free of disease. The lactation period of certain foreign breeds such as Jersey, Brown Swiss etc. is very long. Similarly in Indian breeds like Red Sindhi, Sahiwal, etc. the disease resistant is higher. If both these breeds are intermixed (hybridised), offsprings are likely to have a combination of strong qualities from both parents, that offspring will have greater disease resistance and its lactation period will be longer.

The quantity and quality of the milk produced from cows and buffaloes are dependent upon these factors- the state of these animals's health and whether they are getting balanced diet. Milch animals should be cleansed regularly, in case of illness, veterinary specialists should have consulted constantly and their delivery place should have adequate light and air, where they can be protected from cold, heat and rain. Now-a days some people normally want to increase milk production by feeding these animals with steroids and hormones. This causes increase in udder size but the milch animals face difficulty in walking.

### 31.5.2 Animal reproduction

In order to get animals with certain desired characteristics in the offspring. Parents with desired qualities are selected and made to interbreed. For instance a variety of cow that yields less milk is mated with one from that yields more milk.

Artificial insemination is an important, effective method of obtaining a variety with desired characteristics. In this process, the semen of the male belonging to a variety growing high yield of milk is injected into the vagina of the female. This process produces offspring with higher yield of milk. This method is used for improving the breeds of the cows, buffaloes, hens, horses and goats.

### 31.5.3 Poultry farming

Poultry farming has a special place in our country. Eggs and chicken meat is major sources of proteins, vitamins and minerals. Poultry farming not only contributing to a better quality of food, but is also a major source of income for many many farmers in the country. Poultry farming enhances the quality of the breed and also enhances the production of eggs and chicken meat. Hens called '**layers**' are reared for eggs; and those reared for chicken meat are called **broilers**. In poultry farming there is a special place for new breeds of hens—so that the quality as well



as quantity of chicken may be enhanced. For production of a new breed of hens, local breed such as 'Asil' and a foreign breed (such as leghorn) are **interbred**. In this way, new chicken breed of chicken have an amazing capacity to tolerate high temperature and their proper rearing their costs much less.

From a commercial view point such chicken are reared which can be given fibrous meal, derived from agricultural by-products. In this way the hens get high protein diet derived from grains with very little fibre.

### The production of eggs and broilers

The following factors need to be kept in mind for rearing hens for better production of eggs and broilers.

- Better management techniques are necessary for better production of which management of proper diet and proper shelter are of prime importance.
- The shelters for the hens should have the right temperature and provision for adequate amount of light and air. Their shelters need to be kept clean.
- The hens are healthy and they produce good quality of eggs and meat. Adequate amount of vitamins should be provided in the diet. For proper growth of broiler chickens.
- Poultry needs to be protected against both disease and pesticides. It is essential to take precautions so that death rate of broiler chickens remains low. At the same time the quality of their features and intestines is maintained.
- The shelter, diet and environmental needs of broilers is different from those of the egg producing hens. Broilers are given a diet of protein and fat, and are sold as meat in the market. A higher proportion of vitamin A and vitamin K is provided in the diet of egg producing 'layer hens'.
- Special attention should be paid to cleanliness in the shelters for hens. Dirty shelters with inadequate air circulation may lead to hens being affected with shelters.
- Germicidal medicines should be sprinkled regularly. Hens should be vaccinated against communicable diseases to avoid epidemics.

### 31.5.4 Fisheries and Aquaculture

The livelihood of lakhs of Asians is connected to fisheries. Fish is a rich source of protein in our diet. Fish is found in two kinds of water : sea water and fresh water. Fresh water is found in rivers and ponds. Hence, fisheries can be both freshwater fisheries and marine fisheries.



### (A) Marine fisheries

The entire Indian Peninsula borders ocean where fish production is done on a large scale. We are proud to belong to a country where, on one hand the world's tallest mountain ranges are found and on the other hand there is an approximately 5600 km. long sea coast. Fishing is done on the shore of this vast sea coast as well as in the depths of the ocean, on a large scale Mackerel, Tuna and Sardine fishes are the most widely consumed sea fish. For catching fish, various kind of nets are thrown into the sea from fishing boats.

Today, with the help of new techniques like satellites and echo-machine, large scale of fish can be accurately detected. By using this methods, fish catch can be increased. By using these new technique the safety and security of fisherman can be established.

Today, fisheries and aquaculture is a successful industry. Finned fish like mullet, pearl spot, prawn, mussel, oysters and oceanic weeds are an inseparable part of the fishing industry and have tremendous economic importance. Oysters are caught their pearls.



#### Do you know

Today marine fish are facing many dangers. In some places, there is reduction in the number of fish due to global warming; in other places fish numbers are reducing due to leakage of oil in ocean water. In future, the reduction in the quantity of marine fish, replenished through fisheries. If this type of preservation is called **Marine Culture Preservation**.

### (B) Inland Fisheries

Do you have any experience of catching fish in a pond, lake, river or canal: if not, then do it whenever you get the chance. Inland fishery includes fishing in fresh water sources like canals, ponds and rivers etc. wherever freshwater is mixed with sea water (salty water)- such as at mouths of rivers as estuary and lagoons. Major store houses fish.

When fishery is undertaken in land sources, its production gets limited. Maximum fish production is done through aquaculture. In India, farmers combine rice farming with fisheries, through mixed fishery, fish can be enhanced. In this process, both local and imported types of fish are used. Rohu, Katla, Mrigel, Silver carp etc are the names of some fishes that are produced in fresh water fisheries.



Notes



**INTEXT QUESTIONS 31.3**

1. Today, most schools of marine fish can be detected by the use of new technology, called\_\_\_\_\_.
2. \_\_\_\_\_ are cultured to get pearl.
3. Mention the names of any two fish of economic importance.
4. By increasing the lactation period of milch animals \_\_\_\_\_production can be simultaneously increased.

**31.6 BIOTECHNOLOGY IN AGRICULTURE**

When plant cells, tissues (collection of cells) and plant parts are used to drive useful products by mixing them with nutrients in test tubes or beakers, it is termed **BIOTECHNOLOGY**. Agricultural biotechnology is the term which is used for growing growing parts of plants, tissues and cells are in synthetic nutrient media in test tubes or beakers or culturing them.

Agricultural biotechnology can be of two types:

- (1) Tissue or cellular culture (2) Genetic engineering

**(1) Tissue or cellular culture**

Tissue culture involves separating of plant cells and tissues and culturing them in nutrient media in test tubes or beakers. Plants grown in this manner are then transplanted in the fields. Through this process better quality plants can be grown in a short period of time. This technique is highly effective for conservation of rare plants or those on the verge of extinction.

**(2) Genetic engineering**

This includes the transfer of a specific gene or DNA from a plant into the cells of another plant. In this process, gene/DNA is transferred from one plant to another through the use of recombinant DNA technology. DNA of one plant is entered into the genetic material of the other plant. Such plants are called **transgenic plants**. This technique is used to produce better quality plants. With the use of genetic engineering, Indian scientists have produced a Genetically Modified (GM) potato. By the use of this technique, potatoes been infused with protein of a specific variety (Amarind). Amarind is a food giving tree, where protein has been inserted now made by potatoes too.



Notes

### Efforts to reduce the distances between science, farmer and society

Today, several ministries and departments of our government are disseminating new information associated with science, agricultural science and technology. The aim is to reach society and farmers information regarding research, associated with science and facts; regarding research, associated with science and facts about advancement of techniques, in their own language. For this purpose, Govt. of India has activated department like Vigyan Prasar, Govt. of India's Department of Science and Technology, National Science and Technology Communication Council and the 'Krishi Vigyan' Kendra established under the aegis of the Agricultural Ministry are largely engaged in spreading scientific information, giving publicity and also financing people for dissemination of scientific information. For further information, you can see the following websites:

[www.vigyanprasar.gov.in](http://www.vigyanprasar.gov.in); [www.dst.gov.in](http://www.dst.gov.in); [www.icar.org.in](http://www.icar.org.in)

## 31.7 FOOD SECURITY

Food security can be defined as the timely and convenient availability of food, for all the people of a particular region or country. This is especially to wherever there is a crisis in food production and the conditions of poor families of becomes depressing. Food production falls in times of natural calamities like floods, tsunami, droughts or feminine. In this way, natural calamity produces food scarcity in affected regions. Due to lack of food, prices increase because of which, families with limited income, cannot bear food expenses. If natural calamity persists in a particular place for a long time, their conditions of livings may emerge-that, in turn, may turn into famine.

Food security is dependent upon the processes related to the public distribution system, governmental alertness and attempts to emerge out of food related issues.

Food security is dependent upon the following factors:

- (a) **Availability of food:** Availability of food refers to food production, food consumption and storage of grain in governmental godowns in the preceding years.
- (b) **Access to food:** This indicates that food is within the reach of every person in the country.
- (c) **Capacity to bear food expenses:** This refers to availability of many with each person to buy safe, nutritious food for his daily needs.



In this way, food security can be established in a country, only in the presence of the following three conditions:

1. When enough food is available for all people.
2. When all people have enough purchasing capacity to buy nutritious food.
3. When there is no obstacle in procuring food.

### **31.7.1 Steps taken for food security**

Today, a large proportion of the country's population is facing insecurity related to food and nutrition. More people who are either landless i.e who have access to very limited agricultural land are more affected. Today, those suffering for food insecurity include the rural laborers, very small scale self-employed people and those who beg for a living. In the urban areas, food insecurity is mainly labourers or who are engaged in work that pays little or who get work only in certain seasons. In addition to those categories, those people also qualify for food insecurity, who migrate from one place to another in search of work in times of natural calamities. A very large number of such people come under the category to those affected by food related insecurity.

### **31.7.2 Effects made in the country for self reliance in food security**

After getting independence, the Indian policy makers have made every attempt to make India self-reliant in food. By adopting new agricultural strategies, India initiated the 'Green Revolution' which began especially with the increased production of wheat and rice. In July, 1968, the erstwhile Prime Minister Indira Gandhi issued a special postal stamp entitled, 'Green Revolution and this conveyed the powerful message of this agricultural revolution to her countrymen. This success with wheat was repeated with rice, later on, although, it also cannot be denied that this increase in crop yield was unequally, distributed in the country. Punjab and Haryana recorded the maximum yield in agricultural production. In states likes Maharashtra , Madhya Pradsh , Bihar, Orissa, and North East States, the grain output swung between increase and decrease. Meanwhile, Tamil Nadu and Andhra Pradesh recorded high output of paddy ( Rice ) .

Today, green revolution can be credited with protecting the country against famine in times of contrary seasonal conditions. Both our farmers and food security have been protected. During the last 30 years, India has achieved self-reliance in food security by growing varied kinds of crops.



### 31.7.3 Buffer stocks

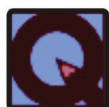
Buffer stocks are those stocks of grains that are obtained by the government through the medium of Food Council of India (FCI). Wheat and Rice have been included in the buffer stock. The Indian Food Council buys wheat and rice from the farmer of these regions, where they are grown in surplus. The farmers are paid a predetermined sum for their crops this sum is called the **Minimum Support Price**.

### 31.7.4 Public distribution system

The grain obtained from the Indian Food Council is distributed among the poor sections of society via the state controlled **Ration shops**. This is known as the **Public Distribution mechanism**. Today, ration shops exist in majority of the neighbourhood of our cities, towns as well as villages. There are approximately 4.6 lakh ration shops in the country.

Grain, sugar and kerosene oil are usually available in these ration shops. These are sold at lower rates than the open market. Any family can buy a rationed amount of these products from such shops on possessing a ration card. For example- 25-30 kilos grain. 5 litres kerosene oil, 5 kg sugar etc. In India distribution through the ration system was initiated in the 1940's.

In view of achieving food security, India's Public Distribution System has proved to be one of government's highly effective public policies. It has not only regulated the price of grains but is also providing ordinary people with items of food at nominal prices. From the perspective of food security, this has proved to be a significant programme.



### INTEXT QUESTIONS 31.4

1. At any given time the capacity of the availability, easy accessibility and expenditure on food of all the people in any region/country is called——  
\_\_\_\_\_.
2. The grain stocks procured by the govt. through the medium of FCI is called——  
\_\_\_\_\_.
3. The rationed material, from the state controlled ration shops is distributed through the \_\_\_\_\_ system.
4. Mention any two programmes that were initiated with the purpose of eradication of poverty and achieving food security.
5. The mixture of separated cells/tissues from plants and nutritive fluids in a funnel/beaker is called———.



**WHAT YOU HAVE LEARNT**

- For the purpose of agricultural research and development an institute was established that is today, known by the name of Indian Council of Agricultural Research.
- Between 1968-1988, a major improvement occurred in Indian agriculture in the field of crop-yield and food production. It was a veritable revolution that is known as the Green Revolution. We also call it the golden age of Indian agriculture. Its credit goes to agricultural scientist Dr M.S. Swaminathan.
- Organic farming is being encouraged in order to continue the Green Revolution. In organic farming, the limited amount of fertilizers are mixed with biofertilizers and used so that there is no ill effect upon the farms or human health.
- That branch of agricultural science that teaches about the management of crop production and farms is called Agronomy.
- Crop rotation takes place when, at an appointed time, crops are grown in a pre-determined sequence in the field.
- Soil has been badly affected by the excessive use of chemical fertilizers and insecticides. The lives of beneficial insects and worm, found in the soil, have seen destroyed. The quantity of micro nutrients has reduced.
- Organic fertilizers are all those natural products that improve soil fertility, a being mixed with it. (These Natural products exclude water). From the scientific perspective natural products like grass, plants, urine and excrement of birds and animals and other remnants are an integral part of biofertilizers.
- Some essential nutritive elements are found in greater quantity in fertilizers: and they are prepared in an artificial manner in the factories.
- More chemicals that control the growth rate of plants are called plant-growth regulators- examples are auxin, gibberin, cytokinin, abscisic acid etc.
- Irrigation is essential for the proper growth of plants. The topsoil and the crops are irrigated, as per requirements.
- Till some years back, farmer used to cut the crops using hard-driven implements; but after the invention of special harvest-cutting implements, the task of cutting crops has become easier.
- Weeds are unwanted, unnecessary plants that grow alongside legitimate crops in fertile agricultural land some examples are Zanthium, carrot grass



(Parthenium) and Motha (*Cyranus prodentis*). These unwanted plants compete for sunlight, water and space in the fields.

- After cutting the harvest, grain is carefully stored. Of storage of grain is not safe, then grain can be attacked by insects, worms, fungi and microbes. And thus, they can be destroyed.
- Animal husbandry is that branch of science, which is concerned with the management of different techniques related to animal rearing and deriving better productivity and services out of them.
- Today, scientists are engaged in the process of seeing how the disease resistant capacity of milch animals can be enhanced; and how their lactation period can be increased.
- The quantity of milk received from buffaloes and cows is dependent upon two factors- the status of their health and the kind of balanced diet they are receiving.
- Eggs and meat of young chicks are major sources of protein, vitamins and minerals nutrients.
- For hen-rearing, such shelters should be available for the young chicks-that have the right temperature, light and air circulation.
- Today, new, sophisticated satellite and echo techniques can be used to detect large reserves of fish. Thus, such technology can be used to increase fish production.
- Biotechnology arises when cells, tissues and parts of plants are put in beakers/funnels and mixed with nutritive fluid to produce useful products.
- Genetic engineering is the transfer of specific genes or DNA from one plant to another plant's cells.
- Food security is achieved when availability, accessibility and expenditure for/of food is within the reach of people of any given country/region.
- Food security is dependent upon the following factors. Availability of food, accessibility of food and the capacity to buy a minimum amount of food.
- The grain obtained from Indian Food Council is distributed among the poor sections of our society through state regulated ration shops. This is known as the public distribution network.

**TERMINAL EXERCISES****Multiple Choice Questions.**

1. The name of the governmental campaign that is encouraging horticulture is:
  - a. National Green Mission
  - b. National Gardening Mission
  - c. National Food Mission
  - d. National Harvest Mission
2. The credit for the green revolution in the country goes to :
  - a. Dr APJ Abdul Kalam
  - b. Dr V Kurian
  - c. Dr M.S. Swaminathan
  - d. Dr. MGK Menon
3. The following are involved in the creation of biofertilizers:
  - (a) Grass, dry leaves and urine/excrete of animals
  - (b) Chemical products
  - (c) Radio-active substances
  - (d) Nitrogen fertilizers
4. Auxin or gibberelin chemicals is associated with this category
  - a. Weed killer
  - b. Fertilizer
  - c. Plant Growth Regulator
  - d. Fungicides
5. For crops productions and management of farms which principles should the farmer be informed of?
6. What do you mean by crop rotation? Classified the advantages of crop rotation?
7. From the prespective of food security, why is mixed cropping and multiple cropping considered better? Explain
8. Comment on the following
  - i. Formation of topsoil
  - ii. Treatment of seeds
  - iii. Preparation of field for sowingseeds aand looking after new-born plants
  - iv. Preservation of cells/tissues



9. just imaginfg that you have been invited to a village chaupal for giving a lecture on ‘Arrangment for Protecting Harvest’. What will you tell the villagers and farmers on this topic.
10. During the storage of grains in granaries, tell about any two possibilities, by which, how can reach the door of the stored grains.
11. What advantage assures to the farmer through animal husbandary. Many animal rights activists protests against animal husbandary. Write a note of one or two pages on this topic.
12. How can the produce of hen rearing and fisheries’ activities be increased?
13. . By explaining being made at the national level in relation to the country’ food security, kindly explain as to why food security is in the country’s interest today.
14. Comment on the following:
  - i. Food security for the increasing population
  - ii. Buffer stocks
  - iii. Public distribution system
  - iv. Green revolution



## ANSWER TO INTEXT QUESTIONS

## 31.1

1. Indian Agricultural Reasearch Council
2. Better harvest, curtaining soil erosion, weeds ,control over pests and diseases
3. (i) Crop rotation (Mixed cropping)  
(ii) to obtain harvest without damaging the environment.
4. National Gardening Mission
5. Agronomy
6. Crop rotation

## 31.2

1. (a) 1      (b) 4      (c) 7      (d) 2      (e) 3
2. Through the sprinkling of weed-killers like N,C,A,A and Cemazine etc.

## MODULE - 7

### *Humans and Environment*



#### Notes

3. To remove insects, we can spray insecticides. But these can be poisonous for both plants and animals and can become a cause for environmental pollution. To control pests disease resistant types of crops can be used. Along with the chemical method, bio-controlled methods can also be used. For instance water weeds are eaten by some fish.
4. Pusa bin, Pusa cubicle

### 31.3

1. Through satellite and echo techniques
2. Oyster
3. Mullet, Pearl spot
4. Milk production

### 31.4

1. Food security
2. Buffer stocks
3. Public distribution
4. Mid day meal scheme, Annapoorna scheme
5. Tissue/ cellular preservation



32



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## HEALTH AND HYGIENE

Good health is an asset for individuals, their communities and the nation at large. A nation cannot progress without a healthy population.

There are large numbers of factors which affect our health. Some of these are balanced food, clean water and clean environment which help to remain healthy while others such as germs and stressful environment cause diseases and disorders.

In this lesson we will learn that good health implies both physical and mental well being. It ,however, requires consistent efforts to maintain good health, at both personal and community levels.

This lesson aims to guide you to live a healthy and positive life so that you can realize your potential.



### OBJECTIVES

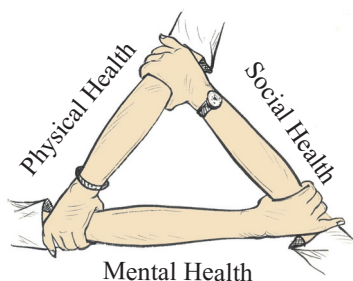
After completing this lesson, you will be able to:

- *appreciate different dimensions of health and the role of proper nutrition, physical exercise and healthy habits in maintaining health and explain the different positive and negative influences on health;*
- *emphasize the importance of hygiene, personal and community health and recognize their interrelationship;*
- *define disease, classify them and explain the causes, symptoms and prevention of a few communicable and non-communicable diseases;*
- *discuss the role of immunity in preventing diseases;*
- *express awareness about the national immunization programme and how it prevents certain communicable diseases;*





Try to recollect when you were sick or suffered from a major illness. Were you not irritable, lost your temper for no reason and did not feel like working because your body became weak and would not permit you to do things that you wanted to? In contrast, when you are healthy, you feel happy and enthusiastic and are likely to enjoy doing the work assigned to you. How do you feel during exams? Very stressful. Stress causes rise in blood pressure and leads to sleeplessness. However, some amount of stress also helps you to perform well. The three different dimensions of health are together referred to as health triangle as shown in Figure 32.1



**Fig. 32.1:** Health triangle showing three different dimensions of health.



Notes

### Do you observe some of these features in your-self?

**Signs of good health:** Given below are some signs of physical, mental and social health. They help in assessing one's state of health.

**A. Signs of physical health:** If you have good physical health you

- shall be energetic and alert.
- have weight which is normal for your age and height.
- have bright and shining eyes.
- have all the body organs functioning normally and fall sick less often.
- have clean and clear skin.
- have normal growing hair of natural colour and texture.
- have odourless breath.
- have good appetite and
- get sound sleep.

Healthy individuals are active, responsive and happy and can work hard and perform well

**B. Signs of mental health:** If you have good mental health, you shall have

- control over your emotions
- balanced feelings, desires, ambitions and ideas
- the ability to accept the realities of life and face them
- confidence in yourself
- the ability to cope with the normal stresses of life
- sensitivity towards needs of others



**Healthy Teenagers**



Notes

- the ability to give and seek help when needed
- the ability to cope with conflict and disagreement

**What do you do when you feel stressed?**

**C. Signs of social health:** If you have good social health, you shall

- have a positive attitude towards life
- get along well with others
- have a pleasant personality
- fulfil responsibility/duties towards others
- have healthy interpersonal relationships
- be able to express disagreement positively

Such people form a progressive society that tries to address social issues and find solutions.



**ACTIVITY 32.1**

Based on the WHO definition of health, complete the table given below. Provide **three reasons** for your conclusion. Two cases are done for you.

Name	Characteristics of the person	Do you consider the person healthy? Answer in yes or no.
1 Reshma	Cheerful, takes interest in work, helpful to others.	Yes
2 Kabir	Lethargic, physically weak and does not want to go <b>for work or play.</b>	No
3 _____ (yourself)		
4 _____ (any friend or family member)		

**32.2 HYGIENE**

To keep ourselves free from diseases and maintain good health we need to practise proper hygiene. **The various practices that help in maintaining health constitute hygiene.** The word hygiene comes from a Greek word *Hygeia* that means ‘Goddess

*of health*'. Adopting hygienic practices and promoting hygiene in the community, school and workplace prevent spread of many infectious diseases.

Hygiene deals with both personal health as well as community health

### 32.2.1 Personal And Community Health

Both personal and community health are important for the well being of an individual as well as the community. Health may be affected by the environment, availability of quality food and other necessities. Participation of local and government organizations becomes essential in promoting community health.

### 32.2.2 Personal Health

In the table below, we have listed some of the 'healthy habits' commonly prescribed by adults. But, we would like to know your ideas about healthy habits. List them in the table given below



#### ACTIVITY 32.2

#### My Health: My Choice

Suggestions by adults	My idea of healthy habits
1. Brush your teeth, cut your nails	1.
2. Have a bath daily, wear clean clothes	2.
3. Eat nutritious food	3.
4. Have regular eating habits	4.
5. Follow a disciplined life	5.
6. Exercise regularly	6.

- Do you think differently from the adults around you? Yes/ No (Encircle one response)
- Do you think this is normal? Yes/ No (Encircle one response)
- Who do you think needs to change? You/ Adults/ Both of you (Encircle one response) Provide two reasons for your response.

Taking care of oneself to remain healthy and free from diseases constitute **personal health**.

Different aspects of **personal health** are given below.



Notes



Notes

(i) **Balanced diet:** A balanced diet is one containing carbohydrates, proteins, fats, vitamins, minerals and fibres in correct proportion to meet the nutritional requirement of a person at a certain age and doing a certain amount of physical work. The energy requirement for moderately active adolescent (teenage) boy is about 2200 to 2400 Calories where as for adolescent girls it is 2000 Calories. The food pyramid shown in figure 32.2 depicts the different categories of food and their quantities that we need to include in our diet.

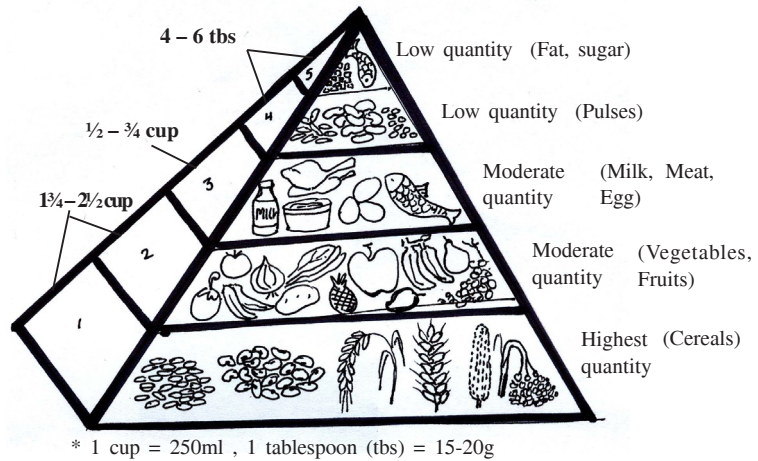


Fig. 32.2: Balanced diet chart for an adult/day

(ii) **Personal hygiene:** Following are some necessary hygienic habits.

- **Regular toilet habit:** Regular bowel movement keeps us free of waste generated within the body.
- **Washing hands before eating:** Our hands may carry many disease causing germs and therefore we must wash them with soap or ash before taking food.
- **Bathing regularly and wearing clean clothes:** Bathing regularly keeps our body free of dirt, body lice and germs.
- **Cleaning the teeth:** When we eat, some food particles may remain stuck to our teeth. These particles attract germs which harm our gums and teeth, and cause bad breath. Brushing teeth every morning and after dinner helps in their removal.
- **Washing hair, cleaning eyes, ears and nails:** Regular washing and combing of hair, and washing eyes with clean water helps to keep the germs away. Nails of both hands should be clipped regularly. Nail biting is unhygienic and must be avoided.

(iii) **Domestic hygiene**

We dust and mop our houses to keep them clean and free from dirt, flies and germs. Disposal of garbage in the allotted bins ensures clean surroundings and prevents breeding of disease causing organisms. Used sanitary napkins need to be wrapped and put in the garbage bins.



**Germs/pathogens** are disease causing microorganisms.



All utensils that are used at home should be kept clean.

#### (iv) Clean food and water

Before they are consumed, fruits and vegetables should be washed thoroughly in clean water to make them free from germs.

In many households it is a common practice to remove the footwear outside before entering the house. What could be the possible advantage of this practice?

Water used for drinking, cooking, bathing and washing utensils should be from a clean source such as taps, hand pumps and covered wells setup by corporations/panchayats.

#### (v) Cooking with care

- Food should be prepared in a clean kitchen.
- While cooking food, it is important to heat it to high temperature to kill germs.
- Cooked food should be eaten fresh or covered and stored in cool and clean place. If stored, food should be kept at a low temperature using either conventional methods or in a refrigerator.

#### (vi) Exercise

Regular walking, yoga and physical exercises and outdoor games keep the heart and circulatory system in good condition. Walking keeps the joints healthy.

#### (vii) Regular sleep and relaxation

Is necessary for good health.

#### (viii) Abstaining from habit-forming substances such as smoking, chewing of betel nut, gutka, tobacco, and drinking alcohol;

These are addictive and their continuous use damages the liver, kidney, heart, gums and teeth. You may have noticed that spitting is quite common among people who chew betel nut, gutka and tobacco. We must stay away from such habits and try to convince others to do the same. You will learn more about it in section 32.6.



#### ACTIVITY 32.3

#### Check list for your personal health status.

Given below are some attributes to help you assess your health status. Please read them carefully and respond honestly. Put a tick mark (✓) in the space provided.



Notes

**Section-I**

<i>Features of personal health and hygiene</i>		<i>No</i>	<i>Yes</i>
1	Each morning when you get up do you have enough energy to carry out your routine/regular activities of the day.		
2	Do you attempt to play, work and study regularly?		
3	Do you have good appetite?		
4	Do you have regular toilet habit?		
5	Do you bathe regularly?		
6	Do you wear clean clothes?		
7	Do you have healthy, good textured hair and clean skin without rashes?		
8	Do you have fresh breath?		
9	Do you get sound sleep?		
10	Do you spend enough time with your family?		

**Section-II**

<i>Features of mental health</i>		<i>No</i>	<i>Yes</i>
1.	Whenever there is a disagreement with your friends/ elders, do you always accept their view to keep them happy?		
2.	Do you often go to bed late but force yourself to get up early in the morning to attend to your jobs /duties well?		
3.	When facing a difficult situation/problem or challenge that you are unable to meet do you feel dejected and not seek help from others?		
4.	Do you often choose fast food like noodles/pizza/burger over home cooked meals?		



**INTEXT QUESTIONS 32.1**

1. Why do we need to be healthy? List any three reasons.

\_\_\_\_\_

2. State the definition of health given by WHO.

\_\_\_\_\_



Notes

3. List the three different dimensions of health.  
\_\_\_\_\_
4. How is hygiene related to health?  
\_\_\_\_\_
5. Identify any one healthy habit. How will you motivate your younger brother/sister to practise this habit?  
\_\_\_\_\_
6. You have prepared lunch early in the morning at 9 A.M. and it will be served at 1.00 P.M. List any two precautions you will take to store it.  
\_\_\_\_\_
7. Suggest any two ways by which you along with your elders can maintain a healthy environment at home.  
\_\_\_\_\_
8. Tick (✓) the situations given below which in your opinion are correct
  - (i) It was 11.30 pm. Raju was celebrating his birthday. There was loud music. His neighbour Tinku had a Mathematics exam the next day and was not able to concentrate. He went to Raju and explained the situation but Raju did not pay any attention. Then, Tinku called the police. They came and stopped the music, the party was spoiled but it was a necessary step.
  - (ii) Rohan believes that taking drugs once or twice is not harmful.
  - (iii) Ashu copied some answers from her friend's sheet during the examination. But later she felt very guilty and confided in her parents. Her friends said that she was a fool to speak the truth.
  - (iv) Its fun driving at a very high speed and gives a lot of thrill. There is nothing wrong in doing so if road has no traffic.
  - (v) People should not be allowed to burst loud crackers especially late at night even if it curtails fun and enjoyment.
  - (vi) Just when you were ready to leave for a movie, you found that your bike is punctured. In your frustration you kicked the dog sleeping nearby to vent your anger. It calmed you down. Later you regretted your action.

### 32.2.3 Community health

In the previous section you studied some of the ways that will help you to remain healthy. However can we remain healthy entirely by our own efforts?

Consider the following situations

1. In absence of potable water, your mother collects water from a shallow hand pump in the neighbourhood.



## MODULE - 7

### Humans and Environment



#### Notes

#### Health and Hygiene

2. Garbage is not collected for many days. As a result it forms a breeding ground for mosquitoes and flies besides leading to bad odour.
3. There is an outbreak of infectious disease like dengue/malaria.
4. A natural calamity like Tsunami strikes a certain part of your country.



How is the health of the population in such areas affected? Mention two short term and two long term effects in the space provided below.

Short term effects: \_\_\_\_\_

\_\_\_\_\_

Long term effects: \_\_\_\_\_

\_\_\_\_\_

**Community health** is the practice of preventing disease and promoting health of a population through the organized efforts of society, public and private organizations, communities and individuals.

There are various activities and programmes undertaken by the government and local organizations to maintain health of the people and keep them free from disease.

Some of these activities and programmes are listed below:

1. Maintain cleanliness of the villages, towns, cities and localities through proper garbage disposal.
2. Ensure that prescribed standards in food stores, meat and milk outlets are strictly followed.
3. Organize health promotion and disease prevention, including
  - a) Immunization programmes for infants and children, for instance The National Pulse Polio Programme that is being run by the government.
  - b) Various awareness programmes have been undertaken against the spread of diseases of national concerns like malaria, AIDS, polio, leprosy, tuberculosis and hepatitis B. The National Malaria Eradication programme is an example of one such programme.



*Activities not conducive for healthy environment*



4. Organize mid day meals in schools to provide adequate nourishment to growing children.
5. Set up hospitals and dispensaries to provide medical facilities to the general public either free of cost or at highly subsidized rates.

Some of the activities undertaken by a community health centre are shown in Figure 32.3



(a) Immunization programme polio vaccination



(b) Mid day meal



(c) Fumigation



(d) Waste disposal

Fig. 32.3: Picture showing community based health activities

### How can we keep our environment clean?

To keep the environment clean we need to:

1. Keep our house clean.
2. Keep our neighbourhood clean.
3. An effective drainage system is essential as stagnated water allows breeding of mosquitoes.



### ACTIVITY 32.4

Have you heard of garbage bins with labels such as “Biodegradable wastes”, “paper waste”, “Biodegradable green waste” and “Non degradable wastes”? Some of the common garbage items generated at our homes are: waste paper,

**Eradication:**  
Elimination or abolition of a disease causing organism

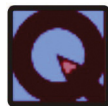


plastic carry bags, vegetable peels, used batteries, stale food items, used pen, old clothes, and broken glass. (a) Identify the garbage items you will put in each of these dust bins shown below. (b) If possible, name the community centre or area where such practice is being adopted.



**The Bhagidari Scheme**

It is the government’s responsibility to provide civic amenities like water, electricity, roads and garbage disposal facilities. However, every individual who uses these facilities has a responsibility in maintaining them. Taking this idea forward, the Government of Delhi has launched a unique scheme named **Bhagidari** which aims at eliciting people’s participation in governance. The basic idea is to establish a dialogue between the stakeholders i.e. the Government Departments and citizens groups like Resident Welfare Associations (RWAs) and Market and Traders Associations (MTAs) in order to work out solutions to common civic problems.



**INTEXT QUESTIONS 32.2**

1. List some of the activities that are undertaken by the government and local organizations to maintain public health.  
\_\_\_\_\_
2. Samina’s family members are expert house keepers. The bathrooms are as clean as the bedrooms and the kitchen. But when Samina steps out, foul odour irritates her nostrils; her feet sink in garbage piles and pot holes. Neither the local government authorities nor anyone in Samina’s neighbourhood seems to care. She is very sad and wants to do something to change this situation.

Taking cue from the ‘Bhagidari initiative’ launched by the Government of Delhi, please provide three suggestions to Samina to enable her to make her neighbourhood clean  
\_\_\_\_\_

**32.3 DISEASE**

A condition that interferes with the normal functioning of the body is called a **disease**. It can be as mild as a cold, sore throat or as serious as cancer or tuberculosis.



A disease can strike any part of the body and at any age. In this section, we will discuss some common diseases of the body. Study the Figure 32.4 carefully.

You have already learnt about the non communicable diseases in lessons on life process I and II and the congenital disease and STIs in the lessons Reproduction and Heredity respectively. Classify the following diseases on the basis of the above table 32.4.

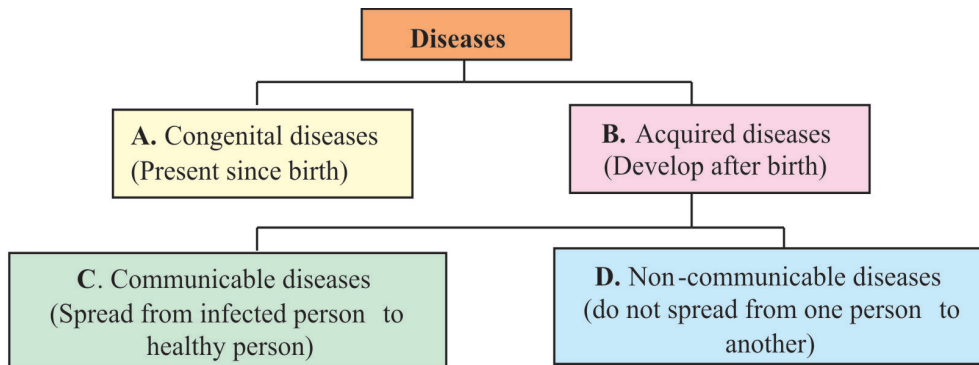


Fig. 32.4: Classification of human diseases

Marasmus, amoebiasis, Hypertension, Diabetes, Dengue, Haemophilia (Bleeders disease), Anaemia.

Which one is caused by dietary deficiency?

Here we shall learn about a few communicable and non-communicable diseases of national concern.

### 32.3.1 Communicable diseases

Communicable diseases spread from one person to another by the entry of pathogens (disease causing organisms). Pathogens enter our body through various means, and then multiply there. They can be transferred from one person to another by **direct** or **indirect contact**.

Method of Transmission	
Direct	Indirect
Close contact with the diseased person	Fomite like bedding, used utensil, towels etc.
Droplet infection	Vector like mosquitoes
Exposure to contaminated blood	Carrier like house flies and cockroaches
Infected mother to the foetus	Through inhalation of in infected droplets present in air



Notes

**Carriers** like flies/ other insects which transfer germs from one place to another and thereby contaminate food or drink.

**Vectors:** Organisms that harbour germs within their body but remain unaffected by them (for example, female *Anopheles* mosquito). The germs multiply/ develop in the vectors' body and get transmitted to humans as vectors come in contact with them.

**? Do you know**


**Droplet infection:** The tiny droplets of mucous that are thrown out when a person is coughing, sneezing or spitting may contain the pathogen if the person is infected. By inhaling the air containing the infected droplets, a healthy person may get the infection. Diseases like cold, influenza, tuberculosis (TB), whooping cough and measles spread through droplet infection

**? Do you know**

Fomite is any non-living object or substance capable of carrying disease causing organisms and hence, transferring them from one individual to a nother. Fomite could be anything, for example, clothing, utensils bedding items and others.

Under no circumstances should the individual suffering from infection be blamed or stigmatized. It is important to remember that certain infections, for example, the Human Immunodeficiency Virus (HIV) do not spread by shaking hands, hugging and/or sharing food. Hence, there should be no hesitation or fear in sharing these activities with HIV-infected individuals.




**Table 32.1 Some common Communicable Diseases**

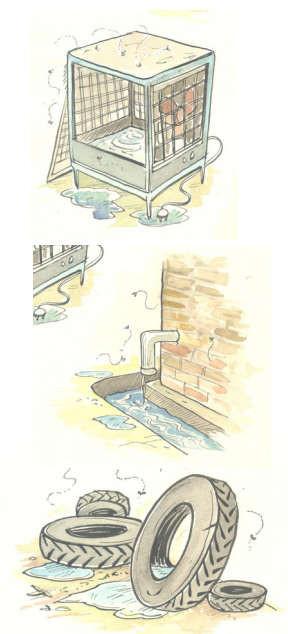
S. No.	Name of disease, its causative agent & mode of transmission	Symptoms	Prevention & Treatment
1.	<p><b>Amoebiasis</b> caused by: <i>Entamoeba histolytica</i> a protozoan parasite infecting large intestine</p> <p><b>Transmission:</b></p> <ul style="list-style-type: none"> <li>by air; by house fly and cockroaches that may carry the pathogen from the infected person's stool to food/water and thereby contaminate it.</li> </ul>	Abdominal pain, constipation, cramps, stools with mucous and blood.	<p><b>Prevention:</b></p> <ul style="list-style-type: none"> <li>Washing hands before eating and after defecation.</li> <li>Proper sanitary disposal faecal matter</li> <li>Personal hygiene</li> <li>Washing fruits and vegetables before eating.</li> </ul> <p><b>Treatment:</b></p> <ul style="list-style-type: none"> <li>Antibiotics (on doctors prescription)</li> </ul>
2.	<p><b>Ascariasis</b> caused by: <i>Ascaris lumbricoides</i> (round worm). That resides in the small intestine.</p> <p><b>Transmission:</b></p> <p>Eggs of the parasite come out along with the faeces of the infected person and contaminate soil, water, plants etc.</p> <p>A healthy person gets infected in the same manner as he/she gets infected for amoebiasis.</p> <p>Why do you think it is more common in children?</p>	<p>Muscular pain, internal bleeding, impaired digestion, colic pain and blockage of intestinal passage.</p> <p>In children, may lead to retarded physical and mental growth.</p>  <p><i>Male and female ascariasis</i></p>	<p><b>Prevention:</b></p> <ul style="list-style-type: none"> <li>Same as Amoebiasis,</li> </ul> <p><b>Treatment:</b></p> <ul style="list-style-type: none"> <li>Anthelmintic drugs (doctor's prescription).</li> </ul>





Notes

<p>3.</p>	<p><b>Malaria Caused by:</b> <i>Plasmodium</i>. It complete its lifecycle in two hosts, human and mosquito. <b>Transmission:</b> By the bite of an infected female <i>Anopheles</i> mosquito. Malarial parasites multiply within the red blood corpuscles (RBCs) of human blood and increase to enormous numbers. So the RBCs rupture and the toxin produced by the parasite is released in the blood.</p>	<ul style="list-style-type: none"> <li>• Shivering and high fever which occurs at regular intervals accompanied by headache and nausea.</li> <li>• Fever may last for 6-10 hrs. After the fever sweating starts and the temperature falls.</li> </ul>  <p><i>Bite of infected mosquito's</i></p>	<p><b>Prevention:</b></p> <ul style="list-style-type: none"> <li>• Eradication of mosquitoes and their larvae by use of kerosene/larvae eating fish</li> <li>• Don't allow water to accumulate in the surrounding areas.</li> <li>• Sleep under mosquito nets.</li> <li>• Use mosquito repellents at night.</li> <li>• Cover doors and windows with wire mesh.</li> </ul> <p><b>Treatment:</b></p> <ul style="list-style-type: none"> <li>• Anti malarial drugs (on doctor's prescription)</li> </ul>
<p>4.</p>	<p><b>Filariasis /Elephantiasis is caused by:</b> <i>Wuchereria bancrofti</i>, another worm similar to <i>Ascaris</i>. <b>Transmission:</b> Bite of the female <i>Culex</i> mosquito.</p>	<ul style="list-style-type: none"> <li>• Fever in the initial days, the parasites reside in the lymph vessels and cause chronic inflammation of the organs, specially in lower limbs resulting in enormous swelling of the limbs.</li> </ul>	<p><b>Prevention:</b></p> <ul style="list-style-type: none"> <li>• Same as Malaria.</li> </ul> <p><b>Treatment:</b></p> <ul style="list-style-type: none"> <li>• Medicines on doctor's prescription</li> </ul> 
<p>5.</p>	<p><b>Dengue fever</b> (break bone fever) caused by a virus <b>Transmission:</b> by the bite of a female mosquito <i>Aedes</i>.</p>	<ul style="list-style-type: none"> <li>• Abrupt high fever,</li> <li>• severe headache and pain behind the eye muscles and joints, loss of appetite, rashes over chest and upper limbs.</li> <li>• Symptoms may turn into haemorrhagic fever causing bleeding from mouth, gums and skin.</li> <li>• Burning mouth, severe stomach pain and frequent vomiting with or without bleeding.</li> </ul>	<p><b>Prevention:</b></p> <ul style="list-style-type: none"> <li>• Same as malaria and filariasis. However aedes</li> </ul> <p><b>Treatment</b></p> <ul style="list-style-type: none"> <li>• doctor to be consulted. mosquito is active during day time and breeds in fresh water. Therefore clothes which cover the arms and legs protect from during day time</li> </ul>
<p>6.</p>	<p><b>Influenza</b> (flu) is a viral infection of the respiratory tract. <b>Transmission :</b>through direct or indirect contact including infected droplets. These viruses mutate all the time and as a result different strains of influenza virus exist. Our immune system needs to fight each new strain in order to provide protection against the virus. You might have heard of H5N1 (bird flu virus) and</p>	<p>Fever (100°F to 103°F), sore throat, cough, sneezing, running nose, headache, body pain, fatigue.</p>  <p><i>Drop Infection</i></p>	<p><b>Prevention:</b></p> <ul style="list-style-type: none"> <li>• The infected person should cover their mouth and nose when they cough or sneeze.</li> <li>• The infected person should avoid public places.</li> <li>• Vaccination.</li> </ul> <p><b>Treatment:</b></p> <ul style="list-style-type: none"> <li>• Patients should take plenty of fluids.</li> <li>• Medicine prescribed by the physician.</li> </ul>



Collage common "mosquito breeding sites"


## MODULE - 7

### Humans and Environment



#### Notes

## Health and Hygiene

7.	<b>Tuberculosis (T.B.)</b> <b>Caused by</b> bacteria <i>Mycobacterium tuberculi</i> . It affects bones, lymph node and most frequently the lungs. <b>Transmitted</b> by inhaling “droplets of patients present in their sputum, cough and sneeze. Requires prolonged contact with the patient and therefore is common in crowded and poor living conditions.	Persistent low grade fever and cough. Blood in sputum. Weight loss, chest pain, excessive fatigue, night sweating, poor appetite. 	<b>Prevention:</b> <ul style="list-style-type: none"><li>• BCG vaccine at birth</li><li>• Patient suffering from T.B. should be kept isolated and given proper medication.</li><li>• Clothes and utensils used by TB patient should be regularly disinfected.</li></ul> <b>Treatment:</b> <ul style="list-style-type: none"><li>• Regular course of antibiotics as prescribed by the doctor. Treatment is for 6-8 months.</li></ul>
			<ul style="list-style-type: none"><li>• Directly Observed Treatment under Supervision (DOTS) is an effective way of treatment</li></ul>



### ACTIVITY 32.5

Have you ever suffered from malaria? List the steps you would take to prevent yourself or anyone else in your family or neighbourhood from getting malaria.

**32.3.2** What are the ways to **prevent contracting infectious diseases**? Some of the practices that are useful in preventing infectious diseases are intake of balanced diet; maintaining personal cleanliness and ensuring clean surroundings, proper disposal of waste, and immunization against vaccine preventable diseases. List in the space given below any two more practices that are not listed here and you think are effective in preventing infectious diseases:

1. \_\_\_\_\_
2. \_\_\_\_\_

**Answer:** *Be aware of what you eat, exercise regularly, wash your bedding and other clothes regularly, wash your hands always thoroughly before cooking and if caring for a sick person, if you are sick allow yourself time to heal and recover. (or any other relevant point)*

### 32.3.3 Non communicable diseases

#### Hypertension, Diabetes and Obesity

In the fast-paced life that many of us live today, there is a lot of conflict, unhealthy competition, and pressure to make quick money and gain power. This kind of lifestyle generates a lot of stress that leads to anger and frustration. In trying to gain



mileage in mindless competition, people are likely to neglect their health and suffer from ailments like high blood pressure (also known as hypertension), increased blood sugar (known as diabetes) and many others. Although these diseases have a genetic predisposition, they have started affecting younger age groups due to undisciplined life style. These are known as life style disorders.

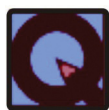
### Causes

1. **Sedentary lifestyle:** Insufficient or no physical activity, no outdoor games, lack of exercise, excessive use of vehicles are some of the factors that are responsible for the above mentioned diseases.
2. **Eating habits:** Easily available fast food that is high in fat and sugar in popular food items like burgers, cakes, aerated drinks lead to obesity at young age. Can never replace the balanced nutrition provided by the Indian meal of chapattis or rice, pulses and vegetables.
3. **Type “A” personality:** People who are always focused on doing better than others rather than doing their best, those who get angry and frustrated easily and are intolerant towards others are more susceptible to lifestyle diseases.
4. **Family history** of heart disease and diabetes also predispose people to these diseases.

### Prevention

- Increased awareness of the reasons for lifestyle related disorders
- Regular exercise, yoga, meditation
- Avoiding junk food, and increasing intake of vegetables and water
- Stress management, increased tolerance for others and positive attitude
- Setting one’s own goals for improvement rather than blindly copying others
- Motivating people around you for practising the above mentioned healthy habits.

It is no secret that stress (over work, grief, depression) can depress the immune system and increase chances of falling ill. Therefore we need to learn how to handle stress in life.



### INTEXT QUESTIONS 32.3

1. Why is Filariasis also called Elephantiasis?



Notes



Notes

2. How will you identify a TB patient? List any four symptoms.

3. Complete the table given below:

Modes of transmission	Disease
Droplet infection	.....a
Bite of Infected <i>Aedes</i> mosquito	.....b
.....c	Amoebiasis
.....d	Malaria

4. Complete the table

Preventive actions	Name of the diseases that are prevented
i Use of mosquito net,	a) _____ b) _____
ii Sanitary condition and proper disposal of human excreta	c) _____
iii BCG vaccine	d) _____
iv Cover your cough, sneeze	e) _____ f) _____

### 32.4 IMMUNIZATION: PROTECTION AGAINST CERTAIN COMMUNICABLE DISEASES

We are exposed to a large number of disease causing agents every day. Our body is able to ward off most of these foreign agents. This overall ability of the body to protect itself against the foreign agents including the disease causing organisms is called **immunity**. It is of **two types**:

- a) Innate immunity
- b) Acquired immunity.

**a) Innate immunity** is present from the time of birth and provides protection against the entry of any foreign agent into our body. Skin and the mucous membranes prevent entry of foreign agents into the body. Hydrochloric acid in the stomach kills the germs that reach the stomach. White blood cells (WBC) engulf foreign particles and destroy them.

**b) Acquired immunity-** It develops during one's life time by producing antibodies in response to foreign bodies termed **antigens**. Each antigen is recognised by a specific antibody. **Antibodies'** are proteins produced by lymphocytes (a type of WBC), against specific antigen. Antibodies remember and recognize the infective agents that have once attacked the body and recognise and kill them when they enter the body again. This is called the **memory** of the immune

system and is the basis of immunisation programme. Such as against mumps or measles.

**Acquired immunity can develop either naturally or artificially.**

**(a) Natural acquired immunity** develops after infection or exposure to a disease. The body develops its own antibodies which remain in the body and provides immunity against the pathogen in the future.

**(b) Artificial acquired immunity** can be developed through **vaccination**: Vaccines are inactivated or weakened pathogens or their products that function as antigens or foreign agents. They activate the immune system forming memory cells. For example, the immunization against diphtheria, pertussis and tetanus require booster or repeat doses for providing protection against these infections.



### Do you know

The diseases against which the national immunization program provides protection? List them.

**Acquired immunity may be active or passive.**

### Acquired immunity

<i>Active immunity</i>	<i>Passive immunity</i>
<ul style="list-style-type: none"> <li>• Host develops antibody against the pathogens</li> <li>• It takes some time to show the response.</li> <li>• For example : BCG for tuberculosis and polio</li> </ul>	<ul style="list-style-type: none"> <li>• Readymade antibodies are given</li> <li>• Provides immediate protection.</li> </ul>

Mother's milk in the initial 1-2 days (also known as colostrum) is considered very essential for new born infant. Do you know why? It contains abundant maternal antibodies to protect the infant. It provides quick immunity.

### Primary immunization

You are aware of various immunization programmes that are run by the government for the general public especially for the pregnant women, infants and children. Table 32.2 below illustrates the primary immunization programme for a new born baby and the subsequent booster doses. Immunization is given free of cost, at all government dispensaries and hospitals. Ask your parents about the vaccines given to you and your sibling during childhood and list them.



Notes



Notes

**Table 32.2 National Immunization Schedule in India for children up to the age of 24 months and pregnant women**

Vaccine	Age				
	Birth	6 weeks	10 weeks	14 weeks	9-12 months
<b>Primary vaccination</b>					
BCG against T.B	✓				
Oral polio	✓	✓	✓	✓	
DPT against Diphtheria, Pertussis, Tetanus		✓	✓	✓	
Measles					✓
<b>Booster Doses</b>					
DPT + Oral polio	16 to 24 months				
DT	5 years				
Tetanus toxoid (TT)	At 10 years and again at 16 years				
Vitamin A	9, 18, 24, 30 and 36 months				
<b>Pregnant women</b>					
Tetanus toxoid :1 <sup>st</sup> dose	As early as possible during pregnancy				
2 <sup>nd</sup> dose	1 month after 1 <sup>st</sup> dose				
Booster	Within 3 years				

The timing, sequence and frequency of the immunization should be followed as detailed in the chart above.



**ACTIVITY 32.6**

Find a child below the age of two years (may be from your family) and compare the immunization status of the child with the table 32.2 and fill up the table given below:

Name of the child :

Date of birth:

Age of child when you check the immunization record:

Vaccine	Age				
	Birth	6 weeks	10 weeks	14 weeks	9-12 months
BCG					
Polio					
DPT					
Measles					



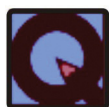
Has the child received all the primary immunizations as per the schedule? Yes/No (encircle one option)

If the child has incomplete or delayed immunizations, give them three important reasons to get their child immunized on time.

If the answer is 'no' (incomplete, delayed or no vaccines received) try to identify the possible reasons. Tick the most possible action you would take.

1. Contact the health workers for possible remedy.
2. Tell the parents that healthy food and hygienic environment can replace immunisation and prevent all diseases.
3. Feel sorry as nothing can now be done.
4. Convince the parents to take the child to the nearest health centre and contact the health worker for possible action

You must have seen posters on **Pulse-Polio Abhiyan** from time to time. What are they about?



### INTEXT QUESTIONS 32.4

1. Mention the six killer diseases that are targeted in primary immunization.  
\_\_\_\_\_
2. Name the vaccines against TB and Polio. At what age are these vaccines first administered?  
\_\_\_\_\_
3. Which day of the week is usually chosen for the pulse polio and why?  
\_\_\_\_\_
4. How will large scale destruction of lymphocytes affect our ability to fight the diseases?  
\_\_\_\_\_
5. Given below are four situations that are conducive to mosquito breeding. Identify with any one situation that you are familiar with and answer the questions that follow.
  - A — building construction site
  - B — Children playing near an open drain/nallah
  - C — Tea stall with used paper cups and plates strewn around allowing water accumulation
  - D — House with leaking roof and water puddles around



Tick (✓) one or more remedial measure that you think are most applicable for prevention of mosquito breeding in the situation selected.

- (i) Apply mosquito repellent cream or use mosquito net and door nets.
- (ii) Fumigate the place or put Kerosene oil in water.
- (iii) Convince the concerned persons prevent accumulation of dirt and water.
- (iv) Not allow stagnation of water in and around your own home.

### 32.5 FIRST AID

While playing, working or otherwise, one could meet with an accident. You may get burnt or hurt or fall sick suddenly. Timely intervention and immediate care can prevent further deterioration of the victim and even save a life. You can be of great help in such situations if you have the basic knowledge of first aid.

**The immediate care given to the victims of an accident or sudden illness before medical help arrives is called first aid.**

However, medical help should be sought after first aid.

**1. Shock-** When a person is hurt, a person experiences ‘shock’ and looks pale and tired. The following first aid can help someone in shock

- Lay down the victim and raise the legs.
- Loosen the clothes
- Calm down the patient
- If mouth feels dry, give a clean, wet cloth to suck.
- Call the doctor immediately.



**2. Severe bleeding-** The following first aid is useful.

- To stop bleeding, keep sterilized dressing or clean handkerchief and press directly on the wound with the thumb.
- Make the victim lie down and elevate the bleeding part to minimize flow of blood.
- Call the doctor.



**3. For Nose bleeding:**

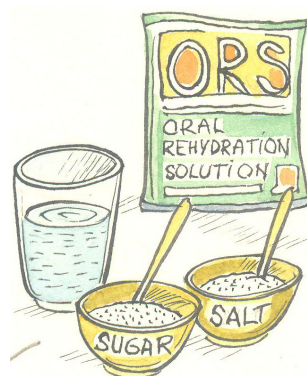
- Make the victim sit up and place a cold compress over the nose.
- Consult a doctor if bleeding doesn't stop.

**4. Dehydration** is excessive loss of body fluid and causes severe headache, dizziness and even fainting. Severe dehydration can result in death.

In **mild to moderate dehydration** there is decreased urine output (8 hours or more without urination), dry sticky mouth, thirst, sunken eyes, restless or irritable behaviour and tiredness. In case of **severe dehydration** the symptoms are fever, and shock with diminished consciousness, little or no urine output, rapid and feeble pulse and finally death.

Dehydration may be caused by extreme heat, excessive physical activity and inability to drink water, frequent vomiting, diarrhoea and in cases of gastrointestinal infection.

- Victim should be made to drink small quantities of Oral Rehydration Solution (ORS) at frequent intervals. ORS can be made by adding one teaspoon of sugar and a pinch of salt in a glass of (about 200 ml) water. ORS packets are also available free of cost at all government health centres



Doctor should be consulted if need be.

#### 5. Animal bites

Can be serious sometimes.

- Wash the area of bite with soap and water. Loosely from a hospital or bandage.
- In case of dog bite, anti-rabies injection is to be taken from a hospital or qualified doctor and dog kept under observation for a week to check for rabies.

**Bee sting:** Do not press the bag (of the sting). Use any blunt edged object to remove the sting. Apply cold pack of weak ammonia or a paste of baking soda and water to relieve pain and itching.

#### 6. Burns

The first-aid for burns depends upon the severity of the injury.

##### For first aid

Place the injured area in cold water immediately to reduce the pain and tissue damage. Blot the area and apply a dry sterile dressing. Do not break any blister formed or apply anything on it.

Severe (third degree) burns destroy the deepest layer. Cover with clean towel / cloth to prevent infection and immediately rush to the hospital.

Chemical burns caused by acids or alkalis should be flushed with large amounts of water for at least 10 minutes.

Notes







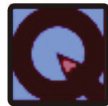
**Notes**

**7. Fractures and dislocations**

Fracture is a break in the bone and dislocation when bone end moves out of its normal position. Signs of fractures and dislocation include pain, tenderness, swelling around the injury and immobility of the affected body part.

**What needs to be done?**

- Do not move the victim until expert help arrives.
- Apply a splint in that area if victim has to be moved. Splint is a support which can be made by padding a stick or scale, umbrella or any rod with a soft cloth. Splint is then placed below the injured area and lightly tied above and below the fracture.
- Do not move a person who has suffered neck or spinal injury. Ask for immediate medical help.



**INTEXT QUESTIONS 32.5**

1. How is O.R.S. solution made at home?  
\_\_\_\_\_
2. What first aid would you give to a person who has received burn?  
\_\_\_\_\_
3. List two precautions to be taken in case of bleeding from any wound.  
\_\_\_\_\_
4. On a hot sultry day you suddenly get a telephone call from your aunt that your cousin who has just returned from Chandigarh has fainted and was bleeding through his nose. Which first aid measures would you suggest to your aunt?  
\_\_\_\_\_

**32.6 PREVENTION OF SUBSTANCE ABUSE**

It is a matter of great concern that use of tobacco, alcohol and drugs is on the rise world over especially among the youth. Young people are more vulnerable to substance abuse. Can you guess the reasons? Yes, you are right. Youth are curious and like to try out new things. In order to further increase their profit margins, tobacco and alcohol companies especially target young people in their media campaigns. Young people also pick up the habit interacting with adults who are addicted to tobacco, alcohol or drugs.

These substances harm both the body and the mind.

In this section of the lesson, we will discuss issues related to substance abuse.

### 32.6.1 What is a drug

Drug is a chemical substance that changes the way our body works. Some chemical drugs are used as medicines for the treatment of physical and mental ailments. Drugs prescribed by the doctors and sold at medical stores are **legal drugs**. There are however, a large number of illegal drugs like cocaine, LSD, heroin, brown sugar, charas, ganja, bhang (Marijuana).

### 32.6.2 What is drug or substance abuse?

When drugs are taken for reasons other than medical or frequently or mode that for pleasure or false sense of happiness, it constitutes **drug or substance abuse**.

**Table-32.3 Some common by abused drugs**

S. No.	Drugs	Used as
1.	Narcotics eg. opium, morphine, brown sugar and smack (obtained from poppy plant)	Analgesics and sedatives and pain killers.
2.	Cocaine(from leaves of cocoa plant) and amphetamines	Sense of euphoria and increased level of energy. Can you now guess why some sport persons abuse drugs?
3.	Barbiturates/Benzodiazepines	Sedative and tranquilizers. Produce a feeling of calmness and relaxation
4.	Alcohol	Depressant of the nervous system. Changes the perception and the state of mind.
5.	Cannabinoids (hallucinogens) like LSD (From ergot fungus)and bhang, ganja, charas and hashish(obtained from <i>Cannabis</i> plant)	Alter thought, feeling and perception, produce pleasing excitement. Affect the cardiovascular system

Use of tobacco is very common in India. It can be smoked in cigarettes and bidis or traditional 'hookahs.' Cigarettes contain nicotine which narrows blood vessels, increases blood pressure and may cause heart disease. Tobacco contains tar which collects in lungs and makes an individual prone to respiratory infections. Tar also causes cancer of lung and throat. Cigarette smoking is not only harmful for the smoker but its poisonous fumes also harm the people around the smoker (*passive smoking*). Smoking in public places is banned.



Prohibitory signs for smoking and drinking



Notes



### How does drug addiction begin? Who takes to drugs and why?

There is no single reason for drug addiction. Some common reasons are :

- Mere curiosity, for excitement and adventure or under peer pressure.
- Desire to do more physical and mental work than one's capacity.
- To overcome pain, boredom, fatigue, depression and stress.
- A false idea that taking drugs once will not make any difference -

### 32.6.3 Drug addiction, dependence and withdrawal symptoms

Addiction is a state where the drug user gets 'hooked on' to the drug and constantly craves for a feeling of well being or euphoria that is associated with the drug or alcohol provides. This leads to taking drugs even when are not needed and is termed 'drug addiction'.

Drug abuse leads to drug **addiction** after developing **tolerance and dependence**. Repeated use of a drug makes body tolerant to lower doses. Subsequently body needs increasing quantities of the drug. This is referred to as the state of **dependence**.



After the user becomes dependent upon the drugs the body manifests a characteristic and unpleasant **withdrawal** syndrome if intake of the drug is abruptly stopped. These may range from anxiety, nausea, mild tremors, abdominal pain, palpitation or sweating, severe agitations and fits. The intensity of the withdrawal symptoms depends upon the type of drug abused and the duration of drug intake. Sometimes these can be more severe and even life threatening and need medical supervision during withdrawal period. **These withdrawal symptoms make it difficult for the user to give up drugs.**

### 32.6.4 Effects of drug

**Short-term effects** – Appear instantly or within a few minutes after the intake of drugs.

**Long-term effects** – Constant and excessive use of drugs over a long period can cause both physical as well as mental damage. Those addicted are not able to focus much on work or studies. Hence, they are not likely to do well in their studies or jobs. Inter-personal relationships suffer. They may get involved in criminal activities. As they always need money to buy the drugs, these individuals are not likely to be financially stable.

## 32.6.5 Prevention



## ACTIVITY 32.7

Suresh knows that drugs are harmful. But taking drugs and watching adult movies is now very common among his friends, and they tempt him to try drugs almost everyday. He is thinking of giving in into peer pressure.

- (i) Do you think his decision is right? Why or why not?
- (ii) Can you suggest to Suresh at least three different ways of refusing his friends and not trying out the drugs?

Yoga, exercise, sports, music, reading etc. help in releasing stress. How do you manage stressful situation during examination?

It is important to remember that **prevention is better than cure. The following tips may help you avoid drugs:**

- **Avoid undue peer pressure:** Good friends will respect your wishes and will not force you into anything. Hence, it is important to say 'no' to peers/ friends if you are not convinced that you want to engage in a particular activity.
- Choose your friends carefully as they may compel you into certain actions which are contradictory to our personal values and beliefs.
- Try to perform the best that you can and do not stress yourself too much.
- **Be optimistic and have a positive outlook.** Learn to face problems and stresses and accept disappointments and failures as part of life; you may seek help from parents and peers because they can provide support and guidance to sort out your problems and vent feelings of anxiety and guilt.

If a friend of yours has confided in you about trying out drugs, what would you do inform parents or elders or any other close friends? Why and why not?

- **Looking for danger signs:-** As friends if you find someone using drugs you should not hesitate to bring it to the notice of the concerned elders. Timely intervention would help in initiating proper remedial steps or treatment.

## Danger signs

- ✓ Desire to have the substance on a regular basis to deal with problem or have fun and relax
- ✓ Sudden change in work or school attendance and quality of work
- ✓ Frequent borrowing money or stealing items from home/school/ workplace

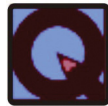


Notes



- ✓ Outbursts of anger, lack of concentration, running nose, and red eyes, dark circles under eyes, nausea, vomiting and body pain
- ✓ Deteriorating personal appearance and grooming
- ✓ Staying away from friends who are non users
- ✓ Engaging in secretive behavior
- ✓ Talking about the substance all the time and pressurizing others to use it
- ✓ Feeling exhausted, depressed or suicidal
- ✓ Fresh and numerous injection sites on the body
- **Seeking professional / medical help:** A lot of help is available in the form of highly qualified psychologists, psychiatrists and de-addiction and rehabilitation programmes to help individuals who have unfortunately got into the trap of drug or alcohol abuse. With such help and with sufficient effort and willpower on the part of the individual these problems can be solved and individuals can lead a perfectly normal and healthy life. In case you know of someone who is addicted to substance, try to lend a helping hand and take the person to the professional institution where s/he can be treated.

**NOTE:** To know more about the ways of staying away from drug abuse help is available at NIOS helpline number 18001809393



### INTEXT QUESTIONS 32.6

1. How will you convince your friend not to take drugs? Give any three reasons.  
\_\_\_\_\_
2. How will you get to know if a friend of yours is taking drug or not? List three important signs that will help you to identify him/her.  
\_\_\_\_\_

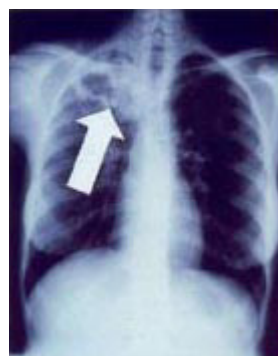
### 32.7 SOME MODERN DAY DIAGNOSTIC TECHNIQUES

Whenever we fall ill and visit a doctor, he has to ascertain the nature of the disease, damage caused and its extent. For this certain tests or examinations such as blood tests, x-ray, ECG or MRI etc are recommended. These examination procedures and the equipment used are called diagnostic techniques and tools respectively. Given below is a brief account of some of these remarkable and modern diagnostic techniques.

### 32.7.1 Radiography (X Ray)

1. X-ray radiography is one of the oldest and still the most widely used diagnostic imaging technique.

It uses a beam of x-rays/electromagnetic waves of very short wavelength) directed at the body part to be examined. The rays pass through the body part to be examined and fall on an x-ray sensitive film and produce a shadowy image of the dense parts of the body. Dense structures like tumours absorb the x-rays the most and so appear as light areas on the radiograph (the film). Hollow organs, fat tissues absorb x-rays to a lesser extent and appear as dark areas (Source: Wikipedia)



*X-Ray*

**Uses:** Visualizes hard bony structures the best. Therefore, it is useful in cases of dislocation and fractures of bones. Locates abnormally dense structures (tumour, T.B. nodules) in the lungs. Helps in diagnosing conditions like osteoporosis and rickets.

**32.7.2 Ultrasound imaging technique or sonography** is a simple, non invasive technique based on ultrasound (frequencies above 20KHz or 20,000 cycles per second) that are beyond the range of human hearing. Diagnostic ultrasound uses 1-15 MHz ( $10^6$  cycles/sec = 1 MHz)

The body is probed with precise sequence/pulses of ultrasound waves that traverse through different body tissues. Sound waves get reflected and scattered to different extent by the body tissues depending on their densities. These reflected waves are received back and processed by a computer to construct visual image of the outline of the body organ under investigation.

To obtain the image, a single hand held device is used both to emit the sound waves and to pick up the reflected waves. The device is easy to move around and is slid across the skin overlying the area to be imaged.

**Use:** It is a safer method of imaging. The ultrasound waves seem to be safer than the radiations used in some other imaging techniques. Used in imaging internal organs or structures and provide valuable information regarding size, location, displacement etc. of a given structure. Tumours can be detected. It is used to assess foetal growth and structure.

### 32.7.3 MRI of human brain taken

**MRI (Magnetic resonance imaging)** is a technique that produces high contrast image of our soft tissues (Muscles, cartilage, ligaments, tendons, blood vessels) an area in which x-rays and other imaging techniques are weak.



Notes





Notes



MRI

For MRI, the patient is positioned at the centre of a machine which has powerful magnets. It creates a magnetic field. The protons (of Hydrogen molecule) align themselves in this magnetic field. When the magnetic field is turned off, energy is released by the protons. This energy is received by sensitive detectors and is fed to powerful computers to generate extraordinarily detailed images from any part of the body. Image of different tissue can be contracted depending and their water content.

Patients, who have metal implants, pace-makers etc. cannot be imaged.



**INTEXT QUESTIONS 32.7**

1. Read the following table carefully and fill in the blanks.

Name of the technique	Basis of the technique	Technique best used for
Radiography	Use of beam of electromagnetic waves of short wave length	detecting fracture, <b>a-----</b> , <b>b-----</b>
<b>c-----</b>	Powerful magnetic field is used to map the distribution of water in different tissues	Detecting <b>d----</b> , <b>e-----</b> , multiple sclerosis of brain.
Sonography	<b>f -----</b> <b>-----</b>	providing information for <b>g-----</b> , <b>h-----</b>



**WHAT YOU HAVE LEARNT**

- Health is not mere physical fitness or absence of diseases. It is a “state of complete physical, mental and social well being.”
- A physically healthy person is energetic, alert and is able to perform his/her jobs well.
- Mentally and socially healthy persons have control over their emotions, do not worry unnecessarily and have confidence in themselves. They take care of themselves and fulfill their duties towards others in the society.
- Hygiene deals with various practices, principles or habits that help in maintaining health. Hygiene deals both at personal as well as at community level.
- Balanced diet, personal hygiene, domestic hygiene, clean food, exercise, regular sleep habits and abstaining from habit forming substances are some of the important prerequisites of personal health.



- Provision of clean environment, standard food and safe drinking water, health services and immunization against common infectious diseases are needed for a healthy community life.
- There may be various causes of disease. These could be communicable or non communicable.
- Amoebiasis is an intestinal disease caused by protozoan parasite; filariasis, malaria and dengue fever are spread by different species of mosquitoes and caused by worms, Protoctista (Protista) and virus respectively.
- Pneumonia and T.B. are bacterial diseases spread through droplets expelled by the patients.
- Cases of hypertension and diabetes are on the rise. This is due to faulty lifestyle practices.
- Vaccines are available against some of the deadly diseases such as TB, polio, tetanus, pertusis, diphtheria and hepatitis.
- The ability of the body to fight the disease causing organisms is known as immunity. It can be inborn or acquired during our life time.
- Acquired immunity develops either when we survive a disease or through vaccination. Active immunity is when we develop antibodies against a pathogen. In passive immunity readymade antibodies are injected into the body.
- We must have the basic knowledge of first aid so that in case of an emergency immediate care can be provided to the affected person.
- Drugs are chemicals that alter the way our body works. These are normally prescribed for treatment of physical and mental illness. When taken for non medical purpose it leads to drug abuse and has serious consequences on our health.
- Opium, morphine, smack, cocaine, LSD, marijuana, ganja, and charas are some of the commonly abused drugs.
- Drug addiction is a state where a person gets hooked on to the drug and constantly craves for it. Repeated use of drug leads to the drug tolerance where high doses are demanded by the body. This leads to drug dependence. When drugs are discontinued it leads to withdrawal syndrome. Medical help enables the addicts to overcome this difficult phase.
- One must be aware of the signs of drug addiction, ways of staying away from it and seek or provide help to a person in need.



## MODULE - 7

### Humans and Environment



Notes

- X-ray, MRI and ultrasound imaging are certain non invasive diagnostic techniques that help in detection of diseases/damages of the internal organs of the body.



### TERMINAL EXERCISES

1. Differentiate between dislocation and fracture. Mention the role of a splint.
2. What is drug abuse? Explain its dangers in terms of addiction, tolerance and dependence.
3. List any four steps that can help a person stay away from drugs.
4. List the danger signs of drug addiction.
5. What role does vaccination play in control of diseases? Explain.
6. How is innate immunity different from acquired immunity?
7. List at least six steps you think are essential to remain healthy.
8. How are personal health and community health related? Explain with the help of an example.
9. What precautions will you take while storing food?
10. List the activities that are carried out by community health organizations.
11. Chill and high fever at periodic interval is characteristic of malaria. What is responsible for this periodic symptom? List any two other symptoms of malaria.
12. List the various preventive measures that are essential for controlling spread of TB.
13. BCG vaccine provides an artificial and active immunity. Justify.
14. Why do bones appear lighter on a radiograph?
15. Brain appears clearer in an MRI than in an X-ray. Explain.
16. Name the technique that is best used for monitoring foetal growth.



### ANSWERS TO INTEXT QUESTIONS

#### 32.1

1. We need to be healthy because healthy persons are energetic, efficient, happy and productive.



2. Health is state of complete physical, mental and social well being and not merely the absence of disease.
3. Physical, mental and social aspects.
4. Principles, practices or habits that help in remaining healthy are known as hygiene. Thus hygienic ways help in remaining healthy.
5. Brushing teeth regularly is very important *Brushing teeth* removes the food particles that remain stuck to our teeth. These food particles allow germs to multiply and harm our teeth and gums and lead to bad breath. or any other healthy habit
6. Food should be covered, stored in cool and insect proof place.
7. Try to maintain physical health of self/family members, be confident and sensitive towards others' needs, have healthy interpersonal relationship and try to fulfil duties towards others. (or any other correct point)
8. Items I, V, VI are correct. Reasons are I: sensitivity towards other's need, V: duty towards others, VI: control over your emotions  
II, III, IV does not reflect mental/social health.

### 32.2

1. Removal of garbage, supply of clean drinking water, fumigation, organizing immunization programmes, ensuring food standards in food stores and milk outlets.
2. Discussions with neighbours convincing them with the association between healthy population and clean environment and therefore the need to keep their neighbourhood clean; forming peer groups and distribution of hand bills to educate people around, making posters depicting ways of keeping a place clean, contacting the municipality for providing garbage bins and garbage collection, and also for repair of the roads

### 32.3

1. In this disease the swollen leg resembles that of an elephant.
2. Persistent low grade fever, blood in sputum, cough, weight loss, chest pain, fatigue. (any four)
3. a: TB, b: Filaria c: contaminated food, water d: bite of a infected female Anopheles mosquito.
4. a) malaria, b) dengue/ filariasis c) amoebiasis /ascariasis d) tuberculosis e) influenza f) /tuberculosis

**32.4**

1. Tuberculosis, Diphtheria, Tetanus, Pertussis, Polio, Measles.
2. BCG; to be given within two weeks of infant's birth and OPV; at the age of two months.
3. Sunday, for the convenience of the parents to take their children to the Polio Booth for vaccination.
4. It is the lymphocytes that recognize an antigen (disease causing agent) and produce antibodies against it to destroy it. If lymphocytes are destroyed, our body will become more susceptible to diseases as there will be no antibodies to counter the antigens.

**32.5**

1. By adding one teaspoon of sugar and a pinch of salt in a glass of (about 200mL) water.
2. a) Place the injured area in cold water/ice to relieve the pain.,  
b) Blot the area and apply a dry sterile dressing.
3. Press directly on the wound with thumb, make the victim lie down and elevate the bleeding part above the rest of the body.
4. Dehydration; give him/her lot of house made fluid or ORS. Keep in a cool place and consult the doctor.

**32.6**

1. Reasons; drugs are harmful for both physical as well as psychological health and such chemicals will have serious consequences on their health. May cause physical as well as mental damage. It may affect their academic field, employment; interpersonal relationship. It also leads to financial ruin and increased risk of contracting STDs.
2. a) Sudden change in work or school attendance and quality of work;  
b) Outbursts of anger, lack of concentration, running nose, red eyes, dark circles under the eyes, nausea, vomiting and body pain;  
c) Engaging in secretive behaviour and staying away from friends who are non users, frequent borrowing money or stealing items from home/work place.

**32.7**

1. a—rickets, b—osteoporosis, c—MRI, d— tumour , e—slipped disc, f— Sound waves of 1-15MHz used which are absorbed and then reflected and scattered to different extent by different tissues, g —provides valuable information of different internal organs, h—foetal growth

I like the religion  
that teaches liberty,  
equality and  
fraternity...

--- DR.B.R AMBEDKAR

