POLLUTION AND POLLUTANTS

9

SYLLABUS

Pollution — different kinds, mentioning their causes, effects and prevention.

The need for conservation of all kinds of resources — a few examples of ways in which individuals can practice this in their daily lives (saving energy, fuels, materials, water, avoiding polluting practices).

* Collection of magazine/newspaper clippings about pollution/ conservation efforts and creating a bulletin board on the same — followed by discussion.
* Find out about the Greenhouse Effect (E).

From the very beginning of human civilization, man has been interfering with the environment to suit his needs.

Human activities have not only damaged the environment but have also degraded the quality of water, air and soil in many ways. *For example* :

1. Discharging **sewage, municipal** and **industrial wastes, chemicals,** *etc.*, into the rivers, lakes and seas.
2. **Pesticides** and **fertilizers** used on a large scale by farmers get washed by the rain water into ponds and rivers.
3. Burning of fossil fuels results in the **discharge of poisonous gases** into the air.
4. High intensity sounds from noisy buses, trucks, cars, loud speakers, music systems, jet planes, etc.

Pollution and Pollutant

Pollution is an addition of any such constituent to air, water or soil, which adversely alters the natural quality of the environment (ecological system). The constituent thus added is called a pollutant.

The pollutants in the environment, can be dispersed, broken down, stored or recycled naturally. As a result, it becomes dangerous to the lives of organisms (including man) in the environment. For example, if we pour a glass of hot water in a river, it would hardly affect the quality of water and the life living in it; but if we continuously drain hot water from a factory into the river, the river water would get warmed to an extent that it would disturb the river organisms and

may affect aquatic life. In this example, **heat** is the **pollutant**.

Similarly, sewage is another kind of pollutant. In small proportions, sewage can be a good fertilizer; but too much of it can spread infection and create epidemics.

MAJOR KINDS OF POLLUTION

There are *four* major kinds of pollution :

1. Air pollution 2. Water pollution
3. Soil pollution 4. Noise pollution

1. AIR POLLUTION

Harmful gases, dust, smoke, *etc.*, released by the factories, motor vehicles, burning of fuels (coal and wood), *etc.*, pollute the air. Harmful pollutants, like sulphur dioxide and the oxides of nitrogen form acids during rain. Such gases do not allow heat of the earth to reflect into the space but sunlight continues to fall on the earth. Due to this, the temperature of the earth is rising. Such effect is called **'Green House Effect'** and such gases are causing **global warming**.

Fig. 9.1 Air Pollution

Green House Effect

Green House Effect is the phenomenon in which the **earth's atmosphere** traps the heat of sunlight reflected from the surface of earth and prevents it from escaping. The phenomenon is named so because earth's atmosphere acts like a green house made of glass in which sunlight enters through transparent glass, but the heat is not allowed to escape (Fig. 9.2). As a result of this, the temperature increases inside the green-house and saves the plants from cold. This method is used in extremely cold areas for growing certain plants.

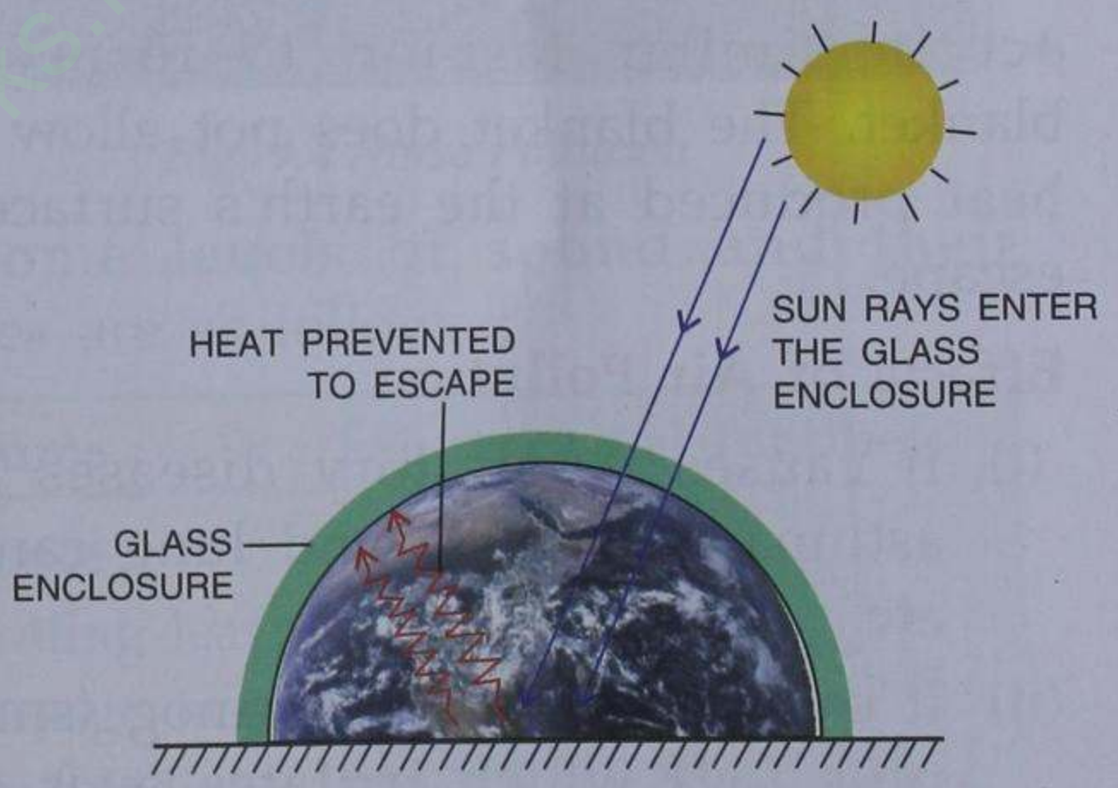

Fig. 9.2 Green house effect

The **Green House Effect** is also referred to as **Global Warming**. The green house effect is leading to the progressive gradual warming of the earth's atmosphere, thus, disturbing the whole system in which the earth's climate is being maintained.

You already know that carbon dioxide is produced when fuels (oil, petrol, coal, etc.) are burnt. Plants use this carbon dioxide for preparing their food, and in return they release oxygen which is

utilized by animals for respiration. In modern days, the amount of carbon dioxide produced due to human activities is increasing and at the same time, the number of plants is depleting. The plants in the world are thus unable to utilize this increased carbon dioxide. The situation is worsening day by day because many of the forests are being cut down by human beings to get more land for housing and industries.

Thus, more and more carbon dioxide is gathering in the atmosphere in the form of a blanket. Carbon monoxide, methane, etc. are other gases which act in similar fashion to form this blanket. The blanket does not allow the heat produced at the earth's surface to escape.

Effects of Air Pollution

(i) It causes respiratory diseases like asthma, bronchitis and lung cancer, etc.

(ii) It causes formation of smog (smoke plus fog) which irritates eyes and creates breathing problems. It also reduces visibility at night.

Prevention of Air Pollution

(i) Use public transport instead of single own vehicle.

(ii) Let the pollution rate of your vehicle be regularly checked.

(iii) Walk or use bicycle for shorter distances.

(iv) Try to do marketing from your nearby area, so that you don't have to use any vehicle for this purpose.

(v) Get CNG system installed in your vehicle. Nowadays, this is also a preventive measure to check air pollution.

2. WATER POLLUTION

Addition of unwanted and harmful chemical substances into water bodies from various sources, *e.g.*, sewage, industrial run off, pesticides, fertilizers, garbage, *etc.*, causes water pollution. The physical and chemical properties of the water are changed when water gets polluted.

We should avoid throwing such pollutants into the water bodies directly. It should always be remembered that life is impossible without water.

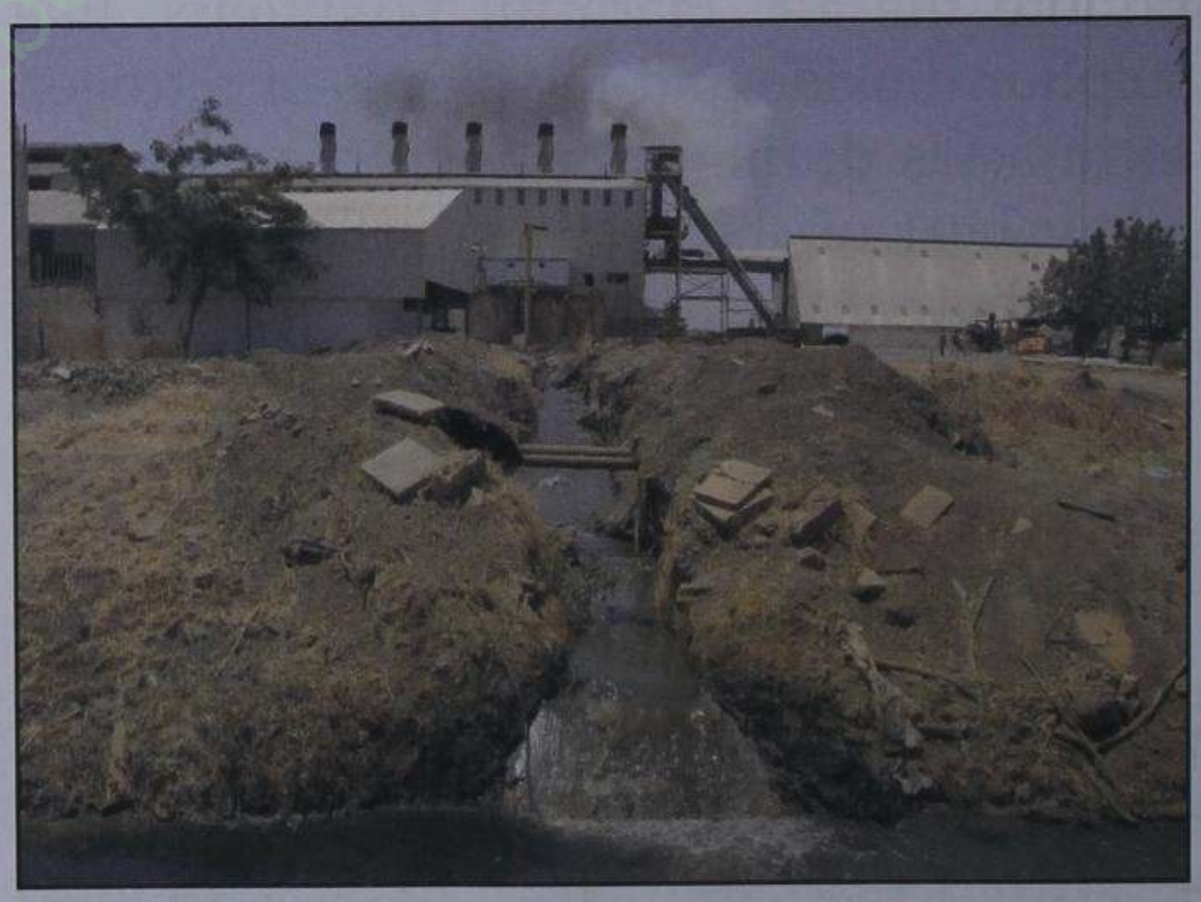

Fig. 9.3 Sewage and factory wastes cause water pollution

EFFECTS OF WATER POLLUTION

(i) Water pollution causes growth of such micro-organisms which cause water-borne diseases such as cholera, typhoid, jaundice and dysentery, *etc.*

(ii) It reduces oxygen availablity to the marine life such as fishes.

(iii) Harmful substances like lead and mercury enter into the human body through the food chain.

Prevention of Water Pollution

(i) Do not throw wastes directly into the water bodies.

(ii) Stop people and animals defecating near the water sources.

(iii) Industrial effluents should be treated before their discharge into water.

(iv) Take care not to overuse pesticides and fertilisers. This will present runoffs of the material into nearby water sources.

Water and air pollution are very common and they cause harmful effects directly to our life.

3. SOIL POLLUTION

Soil pollution is the result of two kinds of pollutants.

(i) Pollutants washed out of the atmosphere, as by **acid rain**, and

(ii) **Insecticides** and **fertilizers** used in agriculture.

Both of these alter the basic structure of the soil, kill minute organisms in it, and even reach the human body through crops grown in such fields.

Effects of Soil Pollution

Acid rain, chemicals and fertilizers, insecticides, pesticides, city garbage, etc., cause soil pollution.

They kill micro-organisms found in the soil which otherwise help to maintain soil fertility and even affect human health because of adulterated crops.

4. NOISE POLLUTION

Noise pollution means unwanted sound. Noisy vehicles like buses, trucks, cars, loud speakers, music systems, television, jet planes *etc.*, cause noise pollution. High intensity sounds are harmful to man.

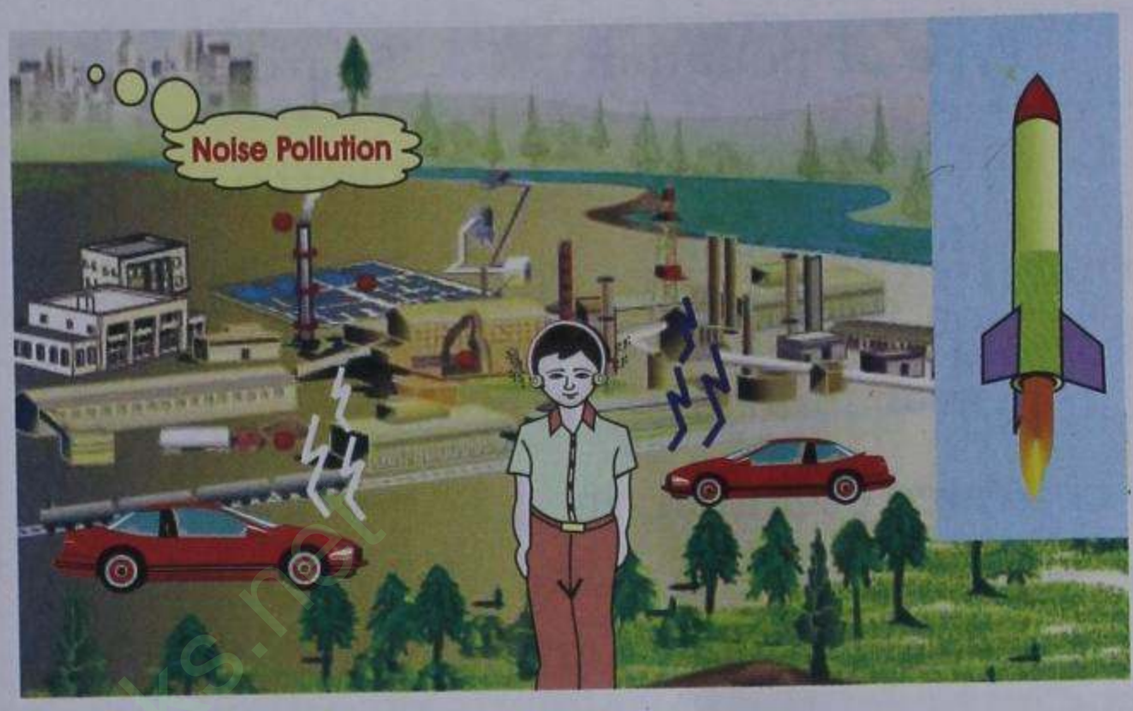

Fig. 9.4 Noise Pollution

Some levels of sound and their sources are as follows :

Source	Sound level (decibel)
Silence	0
Rustling leaf	10
Average home	30
Loud radio	80
Loud thunder	120
Rocket engine	180

Effects of Noise Pollution

Noise reduces concentration on work, reduces hearing efficiency, and causes headache.

Prevention of Noise Pollution

1. Play radios, televisions, stereos at low sound volume.
2. Close your doors if the outside noise is not under your control.
3. Do not scream, speak in soft voice.

ACTIVITY 1

Prepare a list of sources of air, water and noise pollution in your city/town in the format given below. Write their names in the space provided.

Type of pollution	Source
1. Air pollution,	
• inside houses	1 .....
• on the roads	2 .....
• near industrial areas	3 .....
2. Water pollution, in	
• ponds	1 .....
• rivers	2 .....
• sea	3 .....
• wells	4 .....
3. Noise pollution, around	
• residence	1 .....
• schools	2 .....
• hospitals	3 .....

HOW TO CONTROL POLLUTION ?

Pollution is a serious problem of the modern age. With rapidly increasing industries, specially in developing countries like India, this problem is serious and needs prompt attention.

Some measures to control various forms of pollution are as follows :

1. **Special devices :** Such as precipitators, should be installed in the factories to remove harmful particles and poisonous gases from the fumes before releasing them into the atmosphere.
2. **Controlling automobile exhausts :** Steps should be taken to ensure that automobiles do not release unburnt fuels from their exhausts. A compulsory checking is done in many cities like Delhi, on the exhaust fumes of the motor vehicles and corrective measures are taken so that poisonous gases are not allowed to be emitted above a certain level.
3. **Safer fuels :** Use of coal and other fossil fuels should be replaced by the use of electricity, or other sources of energy. Recently CNG (Compressed Natural Gas) has been introduced in Delhi for running the city transport, and Metro rail system run by electric power is contributing in the prevention of pollution.
4. **Tree plantation :** Large scale tree plantation along the roadsides and elsewhere in the cities and towns (social forestry) reduces air pollution.

VAN MAHOTSAVA

India has embarked upon a massive tree plantation programme to reduce pollution and improve the overall quality of the environment. Every year at the beginning of the rainy season, we plant thousands and thousands of new saplings to promote forestry.

5. All effluents should be cleaned before they are released into the environment. The pollutants should be detoxified before being dumped.
6. The sewage should be fully treated before releasing it into rivers or fields.

7. Prohibiting blowing of horns near schools and hospitals in particular, reduces the harmful effects of noise on the inmates.
8. Personal protection by holding hands over ears under noisy situations, or stuffing the ears with cotton, or using ear plugs, etc.
9. Avoid wastage of water.
10. Avoid using polythene bags.
11. Use public transport or pool cars.

CONSERVATION OF RESOURCES

In the last few decades, there has been a continuous increase in the demands for our resources. The increase is due to the following factors :

- Increase in the population
- Advancement of industrialization
- Rise in the standard of living
- High expectation for better life

Because of over-consumption of our resources, they are not only being depleted and polluted, but some of them are being exhausted. Therefore, we should be very careful in utilizing them. We should use them rationally and also keep in mind how best they can be replaced. Following measures have been suggested for the conservation of resources :

1. **Conservation of soil fertility :** The top most layer of the land is most fertile and best suited for plant growth. This layer can be preserved by (i) prevention of soil erosion, and (ii) restoration of soil fertility by providing natural fertilizers and manures.
2. **Conservation of water :** If the rate of ground water used through tubewells, etc. and the rate of its replishment through rain water are equal, then the water level remains constant at a certain depth, and it will be possible for the plants to draw water for their growth. But the problem arises when the water taken out is more than the rain water going into the soil.

Apart from this, rapid population growth in recent years has resulted in greater demand for water. This has put great load on water resources, resulting in the water shortage in many parts of the world.

Steps to conserve water :

1. Build **dams** and **reservoirs** to hold back and store river and rain water for use in dry periods.
2. Build **tanks** and **ponds** to retain rain water for later use (water harvesting).
3. **Reforestation** of hill slopes and catchment areas to hold back rain water and prevent its loss in floods.
4. To maintain the water table (depth of soil where soil pores are charged with water), it should be recharged through rain water (rain harvesting). Rain water harvesting means collecting or trapping water from nature and putting it to use.

A simple way of harvesting rain water domestically is to channelise the water that usually runs off roofs. This is done by letting the water

flow into collection tanks, and use whenever needed.

5. Mass awareness programmes for **judicious use of water**.

Conservation of forests : The forest conservation includes :

1. Use of alternative sources of energy, such as biogases, solar energy, etc.
2. Grazing of cattle in the forests should be discouraged.
3. Reforestation programmes should be launched on a wide scale.

Conservation of wild life : Dense forests are essential for the survival of wild animals. As the forest areas are decreasing, wild life species are becoming extinct. To conserve wild life, the following steps should be taken :

1. **Conserve natural habitats :** Natural habitats should be conserved for different wild animals. Different species require different habitats.
2. **Ban hunting:** Hunting of endangered species like lion, tiger, peacock, bustard, etc. should be banned. The Government of India has passed strict laws so that their killing is prohibited. Wild animals are usually killed for their skin, horns, etc.
3. **National Parks and Wild Life Sanctuaries :** A number of National Parks and Wild Life Sanctuaries have been developed that provide natural habitat for wild animals. Examples : Jim Corbett National Park (Uttaranchal); Kanha National Park (Madhya Pradesh); Gir Forest in Gujarat; Kaziranga in Assam; Ghana Sanctuary in Bharatpur (Rajasthan).

Conservation of Coal and petroleum : Coal is formed from vegetable matter buried under earth in the distant past. It is believed that about 300 million years ago, there were dense forests, marshlands and rivers. The forests died, decayed and were submerged in the water and got covered with sand and clay. Due to huge pressure and high temperature, the vegetable matter got converted into coal. Coal is thus known as a fossil fuel. ("Fossil" refers to any remains or impressions of living being of past geological ages that have been preserved in the earth's crust).

Coal deposits are limited and once finished, will never be produced again. Thus coal is a **non-renewable** source of energy.

Petroleum is found beneath the earth's surface. It is formed from the bacterial decomposition of the remains of animals and plants which got buried under the sea, millions of years ago. Over that long period, due to high temperature, pressure and catalytic action, these remains got converted into petroleum. In its natural form, petroleum looks like a thick black liquid and it is called ***crude oil***.

The crude petroleum is pumped out by drilling a hole in the earth. In this process, ***natural gas*** also comes out.

Different products are obtained from the distillation of crude petroleum and their uses are as follows :

(a) **Petroleum gas :** It is mainly used as a fuel as such or in the form of liquefied petroleum gas (LPG).

(b) **Petrol :** It is mainly used as a fuel in motor vehicles.

(c) **Kerosene :** It is used as a household fuel.

(d) **Diesel :** It is used as a fuel in heavy vehicles like buses and trucks, etc.

(e) **Lubricating oil :** It is used as a lubricant.

(f) **Paraffin wax :** It is used for making vaseline, ointments, candles, etc.

The name natural gas has become quite familiar. Nowadays, **Compressed Natural Gas** (CNG) is being used as an alternate automobile fuel in many parts of the world. India too is fast adopting it as an almost pollution-free fuel.

Coal and petroleum are exhaustible non-renewable resources : Coal and petroleum if once finished, would take millions of years to be produced again. The fast increasing human population, the multiplying industries, the expanding transport system are fast consuming these energy resources. It is estimated that at the current rate of consumption, the petroleum resources may last a couple of centuries and the coal deposits only a few more centuries. It is therefore, urgently needed that their uses are minimised and wherever possible replaced by alternate sources of energy such as the wind, solar, tidal, geothermal energy. Biogas generated by microbial action on human, animal and agricultural wastes will greatly help in prolonging the availability of coal and petroleum.

ACTIVITY 2

Read the newspapers/magazines daily and spot any news related to pollution or conservation efforts made by some agency. Cut such news and paste them in your scrap book. Discuss these news with your classmates and if possible, with your teacher also.

REVIEW QUESTIONS

1. What is pollution ? Elaborate your answer by giving suitable examples.
2. Suggest how air pollution can be prevented.
3. What do you understand by "Green House Effect" ? How is it responsible for global warming ?
4. What is "Smog" ? Give its any *two* ill-effects on human beings.
5. Mention any *three* harmful effects of water pollution.
6. Name *two* harmful gases released into the air by the factories, motor vehicles, etc. What are the *two* major effects of air pollution on humans ?

7. Why is coal called a fossil fuel ? Why is it considered a non-renewable source of energy ?
8. List any *five* products which are obtained by distillation of crude petroleum.
9. Which type of pollution is shown in the picture given alongside ? List the possible effects of this type of pollution on human health.

10. State any *two* causes of soil-pollution. How soil-pollution degrade the soil fertility ?
11. What are the ill-effect of noise-pollution on human beings ? Suggest any *two* means to prevent noise-pollution.

SCIENTIFIC TERMS TO REMEMBER

AFFORESTATION	:	Planting of trees.
AMPHIBIANS	:	Animals which live in water and on land also.
ANGIOSPERMS	:	Flowering plants bearing seeds inside fruit.
ANNELIDS	:	Animals having segmented bodies.
ANNUALS	:	Plants which live for one season or for a year.
ANTIBIOTIC	:	A medicine used to kill disease causing microorganisms.
APICULTURE	:	Rearing bees.
ARBOREAL	:	Animals which live on trees.
ARTHROPODS	:	Animals having many joints in their bodies. For example – insects, etc.
BALANCED DIET	:	Balanced diet is the diet consisting of essential nutrients (carbohydrates, fats, proteins, vitamins and minerals) and roughage in adequate proportions.
BIENNIALS	:	Plants which live for two years.
BRYOPHYTA	:	A word used for mosses (*bryon* = moss, *phyton* = plant). They have stems and leaves but no roots.
BULB	:	Underground disc-like modification of stem covered with overlapping scaly leaves.
CARNIVOROUS	:	Flesh-eating animals.
CARPEL	:	Female part of a flower.
COMMUNITY	:	Community means people living together in a particular area.
CONSERVATION OF SOIL	:	Protection of top fertile soil.
CONSUMER	:	An animal which depends on plants and plant-products for its food.
CORE	:	Innermost, hottest part of the earth.
CORM	:	An underground round, vertically growing modification of stem.
CRUST	:	Upper, thin topmost layer of the earth.
CRUSTACEA	:	A subdivision of arthropods that have hand and thorax fused, *e.g.*, crabs, prawns, etc.
CRYPTOGAMS	:	Flowerless plants like thallophytes, mosses, ferns that reproduce by means of spores rather than seeds.
DECIDUOUS	:	Plants that shed their leaves once in a year.
DECOMPOSER	:	Microorganism which breaks down the dead remains of animals and plants.
DEFORESTATION	:	Cutting down of trees.
DICOT SEED	:	A seed in which two cotyledons are found.
DICOTYLEDONOUS	:	Plants having two cotyledons in their seeds.
DISPERSAL	:	Distribution of fruits and seeds away from the parent plant.
ECOLOGY	:	Interaction between living beings and their surroundings.
ECOSYSTEM	:	Plants and animals along with the non-living world form a system called ecosystem.
EVERGREEN	:	Plants that keep shedding some leaves throughout the year but never shed all their leaves at one time.
FERTILIZATION	:	Fusion of male and female sex cells.
FIRST-AID	:	First-aid is an immediate care given to the victim at the time of emergency before he is taken to the doctor.
FOOD CHAIN	:	Flow of food from the producer through a given series of consumers.
FOOD WEB	:	Inter-woven pattern of several inter-connected food-chains.
GERMINATION	:	Development of an embryo of a seed into a baby plant.
GYMNOSPERMS	:	Plants bearing seeds but no fruit and flowers.
HABITAT	:	Natural place where an organism is found.
HEALTH	:	Health is a state of complete physical, mental and social well-being, and not merely an absence of disease or infirmity.
HERBS	:	Small plants having soft, green and perishable stems.
HETEROTROPHS	:	Animals and non-green plants which take their food directly on indirectly from plants.
HOMO SAPIENS	:	Biological name used for humans.
HUMUS	:	Decomposed organic matter in the soil.
HYDROPHYTES	:	Plants growing in water (*hydro* = water, *phytes* = plants).
INVERTEBRATES	:	Animals without backbone.
LEGUMINOUS	:	Plants whose seeds are enclosed within pods or legumes.
LIFE SPAN	:	Period from the birth of an organism till its natural death.
LITHOSPHERE	:	The rocky region of the earth.
MANTLE	:	Middle layer of the earth.

MESOPHYTES	:	Plants growing in moderate conditions like land (*meso* = moderate, *phytes* = plants).
MOLLUSCS	:	Animals having soft bodies, enclosed in a hard shell, such as snail, pearl, octopus, etc.
MONOCOT SEED	:	A seed in which one cotyledon is found.
MONOCOTYLEDONOUS	:	Plants having one cotyledon in their seeds.
MULTICELLULAR	:	Organisms formed of many cells.
MYRIAPODA	:	Arthropods which have many segments in their bodies, such as centipede.
NECTAR	:	A sweetened fluid produced by plants within flowers.
NUCLEUS	:	Distinct round part inside a cell.
NUTRITION	:	Taking food for growth and energy.
OMNIVORE	:	An animal that feeds on both plants and animals.
OVARY	:	Reproductive organ containing small egg-like structures called ovules.
OVULE	:	The future seed of a plant.
PARASITES	:	Organisms which live on outside or inside of bodies of other animals or plants to get their nutrition.
PERENNIALS	:	Plants which live for more than two years.
PETALS	:	The large bright attractive parts of a flower.
PHANEROGAMAE	:	Flowering plants which bear seeds and fruits.
PHYLLOCLADE	:	Thick, green stem to manufacture food, bearing nodes and internodes.
POLLEN	:	Powdery mass present on the anthers.
POLLEN	:	Powdery substance produced by male reproductive organ of flowers.
POLLINATION	:	Transfer of pollen from the anther to the stigma.
POLLUTANT	:	Substance which pollutes the environment.
POLLUTION	:	Addition of harmful substances which alters the natural quality of an environment.
PORIFERS	:	Animals (sponges) having pores on their body.
POULTRY	:	Keeping birds for meat and eggs.
PRODUCER	:	Green-plants, which produce food using carbon dioxide and water in the presence of sunlight.
PTERIDOPHYTA	:	A word used for ferns (*pteron* = feather, *phyton* = plant). The leaves of ferns are often large and look like feathers.
REPRODUCTION	:	To give birth to young ones to continue the race.
RESPIRATION	:	Burning (oxidation) of food to release energy.
RESPONSE	:	Reaction or change in the activity of an individual due to a stimulus.
RHIZOME	:	Underground irregularly shaped modification of stem having scaly leaves.
SAPROPHYTES	:	Organisms which feed on dead and decaying organic matter such as fungi.
SCAVENGER	:	Animal that feeds on dead flesh.
SEED	:	Mature ovule after fertilisation.
SEPALS	:	The green outer covering parts of a flower.
SERICULTURE	:	Rearing silkworms.
SHRUBS	:	Medium sized plants with woody stem, and branches arising immediately above the soil.
SOIL EROSION	:	Loss of fertile soil by the action of wind and flowing water.
SOIL PROFILE	:	Three layers by which the soil is made of are top soil, sub-soil and parent rock.
SOIL	:	Fragments of rocks, minerals, living organisms and humus form soil.
SPECIES	:	A group of individuals having common characteristics which can together produce their own young ones.
SPORE	:	A unicellular asexual reproductive body.
STAMEN	:	Male part of a flower.
STIGMA	:	Terminal expanded portion of the carpel.
STIMULUS	:	Happening or change in the surroundings which affects the activity of an individual.
TERRESTRIAL	:	Land inhabiting animals and plants.
THALAMUS	:	The flattened part of the stalk of a flower.
THALLOPHYTA	:	Organisms which possess undivided bodies named as thalli, *e.g.*, bacteria, fungi and algae.
TREES	:	Tall plants with woody main stem called trunk. They live for many years.
TUBER	:	Underground modification of stem to store food having number of buds.
UNICELLULAR	:	Organisms formed of only one cell.
VENATION	:	Arrangement of pattern of veins in the leaf lamina.
VERTEBRATES	:	Animals having backbone.
WEATHERING	:	Breaking of surface rocks into small pieces due to physical and chemical changes.
XEROPHYTES	:	Plants growing in dry areas, such as deserts (*xero* = dry, *phytes* = plants).
ZYGOTE	:	Fertilised egg-cell.