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POLLUTION AND CONSERVATION

9

SYLLABUS

1. Understanding the terms : renewable and non-renewable resources, biodegradable and non-biodegradable materials, conservation, deforestation, afforestation, corrosion, contamination, pollution.
2. Ways in which pollution can affect air, water and soil — steps to be taken to preserve these resources.
3. Deforestation and depletion of wildlife — upsetting the balance of nature — how it affects Man — what steps need to be taken to prevent/reduce these.
4. Fossil fuels — alternate sources of energy — briefly.
5. Setting personal goals and practising methods of reducing pollution and conserving energy and materials.
   * Identifying local problems of air, water and noise pollution and steps to be taken to reduce the same.
   * Practising small but significant changes in life style through participation in campaigns at school, home and outside E.g. "Say 'NO' to plastic", Save water, Switch off electrical appliances when not in use (to save electricity), setting up compost pits in gardens, collecting garbage, recycling materials, creating useful products from waste etc.
   * Experiments to find out how long, different materials take to get degraded in a compost heap; which ones do not get degraded etc. (E).

Human beings have always been utilising air, water, plants and animals for their survival. With the progress of civilisation, their needs increased and became more varied.

With the coming up of industries, man started extracting various minerals and metals from the earth. With the technological advancement, the needs went on increasing and the human beings started obtaining more and more from nature and using it for their benefit.

Because of ever increasing human population, large scale urbanisation and industrialisation, humans have been exploring materials which they utilise for their maintenance and welfare. Such materials of use are called resources or more commonly, natural resources.

Natural resources are those materials that have been created by natural processes or in other words, we can say that they are resources (or things of use) that nature has provided us.

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Classification of Natural Resources

Natural resources can be classified into two major categories depending on the extent of their availability :

1. Inexhaustible resources : They are unlimited in quantity, and are not likely to be finished or exhausted.

Examples : Air, water and solar radiation.

2. Exhaustible resources : They are limited in quantity, and are likely to be finished forever or exhausted.

The exhaustible resources can be further classified into two sub-categories :

(a) Renewable resources :

- Once finished, these resources can regenerate or replenish themselves by recycling in a reasonable time.
- They are not likely to be exhausted.

Examples : Soil, forests, flora and fauna.

(b) Non-renewable resources :

- Once finished, these resources cannot regenerate or replenish themselves by recycling.
- They may finish forever.

Examples: Minerals and fossil fuels like coal and petroleum.

Some renewable resources, like ground water, forests and wildlife, if not managed properly, can become non-renewable.

POLLUTION

Pollution is the degradation of environmental air, water and land with wastes from human activities. In earlier times, the human population was very small and people used to live a simple life. There were hardly any factories as well as vehicles. The industrial revolution, the growth of cities, advanced technology and the widespread use of vehicles are contributing lot of pollution to the environment.

To understand the phenomenon of pollution, let us take an example. If we **pour a glass of hot water into a river,** it would hardly affect the quality of water and the organisms living in it. But if we continuously drain hot water from a factory into the river, the river water would get heated to an extent that it would disturb and may destroy the aquatic plants and animals. In this situation, we can say that river water has become polluted. In this example, **heat is the pollutant.**

Some major polluting factors are :

1. Smoke from factory chimneys.
2. Industrial wastes discharged into rivers, ponds or the sea (water bodies).
3. Agricultural chemicals polluting the water bodies as well as the soil.
4. Exhaust fumes from automobiles.
5. Radioactive substances.
6. Oil spills.
7. Sewage discharged into lakes and rivers.
8. Loud noise and music.

CATEGORIES OF POLLUTANTS

Substances which we come across in our daily life, if not taken care properly, can pollute our homes and surroundings. They can be classified into two kinds :

1. Biodegradable
2. Non-biodegradable

Biodegradable substances are those which can be easily broken down by biological agents (*e.g.* microorganisms). These include kitchen wastes, waste paper, residual food items, crop residues, *etc.* If managed poperly, they can be turned into useful resources.

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Non-biodegradable are those which can not be broken down by biological agents. For example, glass, aluminium, plastics, *etc*.

How grave can be a pollutant – an example of carbon dioxide :

All animals give out carbon dioxide as a product of respiration, but most of this gas is used up by the green plants in producing their food during photosynthesis. But, look at the two situations.

- Factory chimneys throughout the world are pouring out huge quantities of carbon dioxide day and night in the environment. Apart from these, the discharges from automobiles, thermal power houses, *etc*. are the other major sources of carbon dioxide.
- Forests which used to absorb a greater part of the atmospheric carbon dioxide, have been mercilessly cut down by man.
- Due to two extreme conditions, the production of carbon dioxide has increased and the utilisation or absorption has decreased. Thus, carbon dioxide is now playing the role of a pollutant.

MAJOR KINDS OF POLLUTION

There are *five* **major kinds** of pollution :

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

AIR POLLUTION

Air pollution is a grave problem, particularly for people living in large congested industrialised cities. The air above such places is heavily laden with dust, smoke, poisonous gases, solid impurities and offensive odours. These can be grouped under two categories :

A. Particulate pollutants. These include **unburnt particles** of coal or coke which are the main constituents of smoke, and **particles from abrasive materials** which are given out from the brake-linings of motor vehicles.

Fig. 9.1 Air pollution

B. Gaseous pollutants. These include a variety of gases mostly given out during the burning of coal and oil during the industrial process. These gases are mainly emitted in the form of **sulphur dioxide, nitrogen dioxide, hydrogen sulphide, carbon monoxide, ammonia,** *etc*. Efforts are being made to replace the conventional fuel – petrol and diesel – in automobiles with much less polluting CNG (Compressed Natural Gas) fuel.

Fig. 9.2 Particulate and gaseous emissions from an automobile

HARMFUL EFFECTS OF AIR POLLUTION

The air pollution affects human life directly as well as indirectly. Some of its effects are given :

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(1) **Direct inhalation** of particulate matter and poisonous gases affect human health in many ways.

High quantities of **smoke** and **other particles** may cause lung diseases, including lung cancer.

Sulphur dioxide (SO_2), in particular, causes serious damage to the respiratory system.

Acid Rain

The oxides of sulphur and nitrogen released into the air, damage the environment in yet another way. They combine with rain water to form sulphuric and nitric acids and come down as **acid rain**. Acid rain harms plants, affects soil fertility, and even corrodes buildings. You must have heard that the marble of Taj Mahal at Agra is getting corroded by acid rain. It is due to the release of sulphur dioxide gas from nearby factories e.g., Mathura Oil Refinery *etc.*

Carbon monoxide (CO) is highly poisonous. It makes a stable compound with haemoglobin in the human blood. Its inhalation in large quantity, as from burning coal in a small closed room or from the exhaust of motor vehicles specially in a closed garage, may lead to death. When inhaled in small quantities, it leads to headaches and nausea.

(2) **Indirect effects of air pollution** on human life includes damage to trees, crops, clothes, rubber-tubing and buildings.

- A thick cloud of smoke may prevent sun rays to enter houses and other dwellings and the germs of many diseases may not be killed.
- Many plants and vegetables show poor growth in the presence of poisonous gases.
- Sulphur dioxide is causing much damage to the buildings. It combines with water vapours to produce sulphuric acid which corrodes metals and etches marble. 'Acid rain' is the result of gaseous pollutants (chiefly, sulphur dioxide and nitrogen oxides), that cause much damage to plants and other organisms.

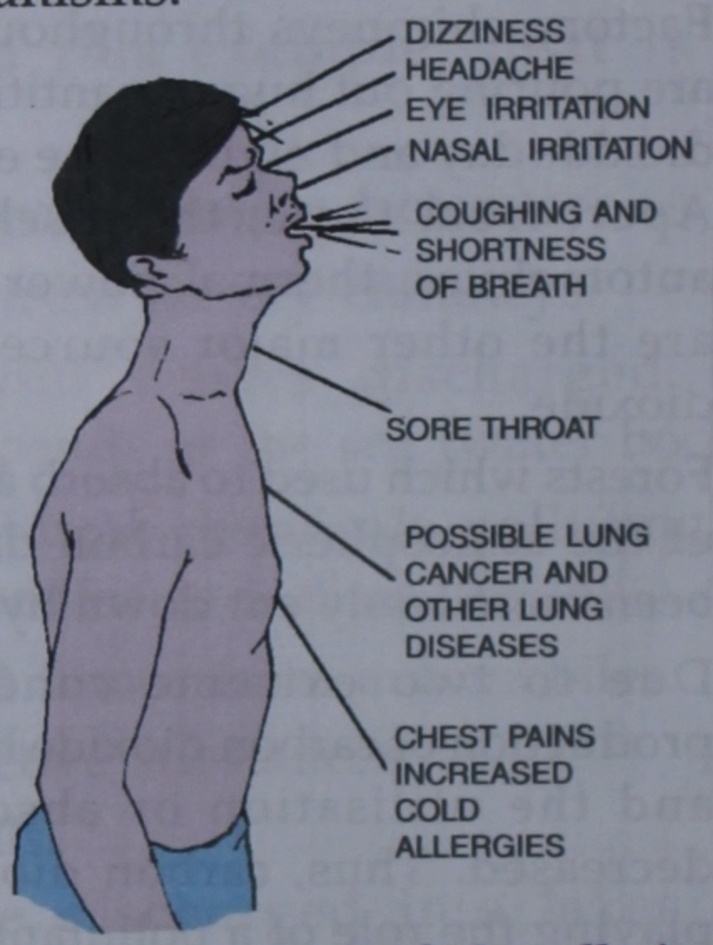

Fig. 9.3 Some of the effects of air pollution on human health

GREENHOUSE EFFECT AND GLOBAL WARMING

You know that our earth gets its heat from the sun. When the surface of the earth becomes quite warm, it radiates it back into the space. But carbon dioxide present in the atmosphere traps some of this heat and sends it back to the earth to keep it comfortably warm. This phenomenon is exactly similar to the mechanism in a green house. You must have heard about such green houses where the flowering plants are kept in a warm atmosphere during winters. The glass walls of the greenhouse traps the heat inside it and provide

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sufficient warmth to the plants. This is called the **greenhouse effect**.

Some gases present in the atmosphere prevent the escape of heat from the earth. An increase in the percentage of these gases in the environment would cause the temperature to increase worldwide. One such gas is carbon dioxide which has a major role to play in the greenhouse effect. An increase of the carbon dioxide content in the atmosphere would cause more heat to be retained by the atmosphere which can lead to **Global Warming**.

MEASURES TO CONTROL AIR POLLUTION

The following measures may be adopted to control air pollution :

(1) **Special devices** such as precipitators should be installed in factories to remove 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. Nowadays, a cheap and non-polluting fuel CNG is being used in all types of automobiles.

(3) **Safer fuels.** Use of coal and other fossil fuels should be replaced by the use of electricity, or other sources of energy.

(4) **Tree plantation.** The more the greenery, the less the pollution. Large scale tree plantation (social forestry) along roadsides and elsewhere in cities and towns reduces air pollution.

WATER POLLUTION

The pollution of fresh water streams, rivers and lakes is caused by different kinds of domestic and industrial wastes poured into them **(effluents).** The water pollutants may consist of organic materials (dead remains of animals and plants), **synthetic detergents, acids, alkalis and a variety of soluble salts.**

Some of the river and pond water pollutants and their effects on human life are as follows :

(1) **Organic pollutants** lead to bacterial growth which reduces the amount of oxygen dissolved in water and, this in turn, kills the fish and destroys the aquatic life.

(2) **Poisonous insecticides** such as DDT and some industrial wastes containing mercury flow into water bodies. There, they are picked up by microscopic plants through which they enter the food chain and may ultimately reach fishes, and in turn, get into humans. These are highly injurious.

(3) **Sewage** is a major source of water pollution. Many cities still continue to pour their sewage directly into rivers, without treating it. This poses health hazards (causing diseases like cholera, typhoid, *etc.*).

Fig. 9.4 Water pollution

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Marine pollution is equally serious. Various kinds of industrial wastes are disposed off into the sea. The accidents of oil tankers in sea spread oil over large areas of water killing thousands of fishes.

MEASURES TO CONTROL WATER POLLUTION

(i) All types of waste and effluents should be treated before they are released into water bodies. The pollutants should be detoxified before being dumped.

(ii) The sewage should be fully treated before releasing it into rivers or fields.

SOIL POLLUTION

Soil pollution is a result of **two** major kinds of pollutants :

1. **Pollutants washed out of the atmosphere.**
2. **Insecticides or pesticides** used in agriculture. Both alter the basic structure of the soil. They kill minute organisms present in the soil and may even reach the human body through food grown therein.

Soil pollution can be reduced by restricting the use of chemical pesticides and following other eco-friendly alternative methods.

THERMAL (HEAT) POLLUTION

Thermal pollution is the release of any kind of **heated gases** or **heated water** into the environment. The envelope of warmer air over cities adversely affects their climate. The heated water released by thermal power stations or other industrial establishments into rivers and lakes causes a decrease in the oxygen dissolved in water which kills aquatic life including fish. The best alternative is to release cooled and treated effluents.

NOISE (SOUND) POLLUTION

Noise is becoming an ever-increasing problem in this age of mechanical inventions. Its major sources are workshops, trains, automobiles on the roads, jet aeroplanes in the air, loud conversation on the radio or television in houses, the loudspeakers and musical bands in public places, and so on.

Classifying sound as noise is highly subjective. *For example*, if you are reading something seriously or solving a mathematical problem, even a mild conversation in the room acts as noise. On another occasion, if you are doing a light reading while travelling in a train, you may not get much disturbed. The loudspeaker at a congregation in your neighbourhood (Fig. 9.5) may disturb your study or sleep but to them, it is enjoyment.

Noise is usually defined as any unwanted sound.

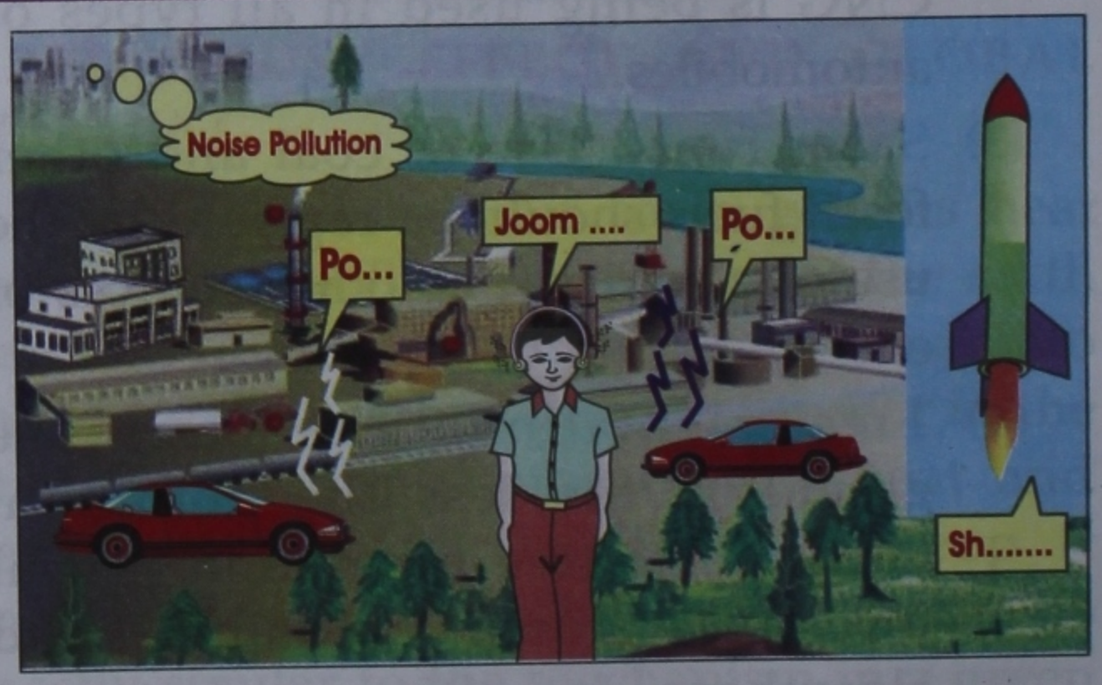

Fig. 9.5 Noise pollution.

Noise is a pollutant because it produces several adverse effects on human as well as animal life.

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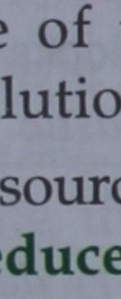
HOW NOISE POLLUTION AFFECTS HUMAN BEINGS

- It **disturbs sleep** and leads to nervous irritability.
- It **lowers the efficiency** of work.
- It affects the peace of mind and **interrupts the concentration** of thought.
- Sudden loud sound can cause acute **damage to the ear drum.**
- It **interferes in communication.**
- Prolonged noise as that from the pounding machines in some industries may cause temporary or permanent **deafness,** by damaging the internal ear.

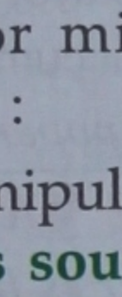
MINIMISING NOISE POLLUTION

Some of the methods for minimising noise pollution are as follows :

1. The source should be manipulated so as to **reduce the noise at its source.**
2. **To interrupt the path of transmission.** The rows of trees by the sides of roads, the curtains and doors in houses, *etc.*, to some extent, reduce the noise reaching our ears.
3. **Prohibiting blowing of horns,** specially near schools and hospitals in particular.
4. Avoid playing music, *etc.* at high volume.



Activity 1



To identify local problems of pollution and steps to be taken to reduce it.

For this activity, you would require a diary or a note-book, and a photographic camera.

Make a large-size one or two full-page record sheets as suggested below.

RECORD SHEET

Name of the place visited .....

Date and time .....

A. Nature of pollution observed

(a) Air pollution — Any smoke coming out from different sources like automobiles, chimneys, *etc.*

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(b) Water pollution — Any unwanted material being discharged into the river/ pond/lake/sea, *etc.*

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(c) Noise pollution – Any unwanted/ disturbing sound during the daytime and during night.

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(d) Thermal pollution

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B. Steps taken for removing the pollution

(a) By local people

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(b) By municipal or governing bodies

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➢ Select any **one** area in your vicinity. It could be a residential area, a market place, a factory, a busy roadside, a nearby lake,

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the sea shore, a mountain hill, any public congregration place, *etc*.

- ➢ Visit the selected area preferably early in the morning or late in the afternoon.
- ➢ Watch carefully all around to locate any unwanted wastes here and there.
- ➢ Look for any smoke being released from the different sources.
- ➢ Is the place quiet or noisy ? Is it so noisy that you cannot easily bear the noise ?
- ➢ Write briefly about any other kind of pollution you observe.
- ➢ Interview some persons around the place, and ask them about their reactions to the cleanliness of the area.
- ➢ Enquire from the people around, what steps have been taken in the recent past for keeping the area pollution-free.
- ➢ Fill in as much information as you can in the record sheets. (You can modify the record sheets according to the kind of information you get).

CONSERVATION OF NATURAL RESOURCES

Due to the increasing human population, there is a growing demand for the basic needs like land, water, clothing and food. Most of our requirements are met by natural resources like soil, forest and ground water and through agriculture. Man uses soil for growing crops, water for irrigation and drinking purposes and forest wood for fuel, timber and furniture. Raw materials like metal ores, fuels, coal, oil and natural gas are extracted from the earth's crust for industries. Man has extracted these natural resources to such an extent that it has disturbed the ecological balance.

Thus, if man expects a future on earth, he must use these resources in a judicious manner. Let us see how best conservation of our resources is possible.

Activity 2

To practise some desired changes in life-style through campaigns for betterment of life.

Make large-size placards of three items as follows :

1. SAVE ELECTRICITY

(*It is a resource in shortage*)

- Switch off lights when not in use.
- Switch on the fan only when you require it.

2. NO PLASTICS HERE-AFTER

- It stays, does not decompose.
- It accumulates, chokes & blocks outlets.

(*Use paper bags instead of plastic bags.*)

3. SAVE WATER

(*Water is becoming scarce every day*)

- Close the taps when not in use.
- Repair the leaking taps.
- Use minimum water for cleaning car.
- See that water is not wasted by the overflow of water tanks of your houses.

A. At home : See that electricity is not being wasted due to unecessary use of lights, fans, etc. Switch them off if not required. Let every member of the family read your placard. Or, selecting a proper time, read out your placard loudly for all inmates to hear.

- Repeat the same for "Save water".
- Request your parents and all others to carry paper bags or cloth bags to bring articles from the market instead of the plastic bags.

B. At school :

- Take out small processions during lunch interval carrying the placards and raising slogans for each of the three items.

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C. At other places : Take out small processions similarly.

[Talk to some persons both at school and at other places if they could follow the spirit of the campaign. Make them conscious not to waste the natural reasources and to keep the environment clean].

D. You can also permanently display these placards at suitable places to draw attention of the people.

Conservation of soil. Growing the same crop year after year depletes the soil of its nutrients. Soil can be replenished by

- practising crop rotation (growing different crops alternately).
- multiple cropping or mixed cropping (growing two or more crops together).
- leaving the field free for one season.
- By adding manures and chemical fertilisers.

Conservation of ground water. We depend on surface water and ground water to meet our needs. Despite the fact that the water cycle continually regenerates these sources of water, many parts of the world are still facing acute shortage of water. Deforesfation, overuse of ground water for irrigation and domestic use, and pollution of surface water bodies are the cause for water shortage. 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 it whenever needed.

Conservation of forests. Indiscriminate cutting down of forests (*deforestation*) leads to the following adverse effects :

(i) It reduces rainfall, and the forests turn into barren lands.

(ii) Loss of fertile soil, through wind and soil erosion. Forests check the velocity of wind and water.

(iii) Leads to frequent floods.

(iv) Causes destruction of the natural habitat of wild animals which may lead to their extinction.

Forest trees are cut in large numbers by man for fuel, construction purposes, furniture, paper industries, etc.

Trees keep on growing in the forests by natural process. If the cutting down of forest trees exceeds the rate by which they grow, it will lead to ecological imbalance. We should plant trees to replace those which have either been fallen or cut in the greed of wood (*afforestation*), so that ecological balance is restored.

Conservation of wild life

Though the word "wild life" is often used to mean wild animals found in the forests, but it actually include all organisms i.e. plants as well as animals living in natural habitats.

From the environmental point of view, each species plays its own role in the ecosystem. It is linked to several other species through food chains. Destroying or depleting the population of one species can have an impact on many other species.

Some causes for the depletion of wild life are as follows :

- Large scale killing of animals for food, trade and pleasure.
- Deforestation destroys the habitat of animals endangering their survival.

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The best way to conserve wild life is to conserve their habitat. India has 500 wild life sanctuaries and 92 national parks. National parks are completely protected areas, while sanctuaries are those places where grazing and firewood collection is permitted. Under the Forest Act, no one can use forest land for "non-forest purposes" without the permission of the government.

In India, some special projects have been launched to protect wild life. Some of these are Project Tiger, Project Elephant, Project Crocodile, *etc*.

Conservation of Energy

Fossil fuels (coal and petroleum) are the primary source of energy for industries, agriculture, transport and households. They meet more than 90% of India's needs. This includes the use of fossil fuels for generating electricity in thermal power stations.

The progress of any country depends on energy, and since the fossil fuels are the best source for energy, there is an urgent need to conserve fossil fuels. There are two ways by which we can conserve fossil fuels:

- By finding alternative sources of energy, and
- By using energy judiciously.

We can adopt the following methods for conserving energy by :

- Reducing the consumption of petroleum fuels; by using public transport or forming car pools.
- Using fuel-saving technology in vehicles and industries.
- Controlling wastage of electricity in homes, offices and industries.
- Using fuel-efficient burners or stoves and fuel-saving cooking devices like pressure cookers.
- Desiging buildings to utilise the natural light to the maximum.

By alternative sources of energy

Fossil fuels and nuclear fuels are the conventional sources of energy which can not be renewed easily. As such, scientists have come out with alternative renewable sources of energy which are also known as non-conventional sources of energy. Let us know about these alternative sources of energy :

1. Solar energy : Sun is the primary source of energy. Plants utilise solar energy in producing starch during photosynthesis. Animals get the energy stored in their body from plants. Solar energy can also be utilised directly for heating and for producing electricity.

Fig. 9.6 Solar panels

- **Solar heating devices**, like solar cookers and solar heaters.

Fig. 9.7 Solar cooker

- **Solar cells** which can convert solar energy into electric energy. Only small amount of power can be generated by solar cells, which is just sufficient to run watches and calculators. But, if a large number of solar cells are joined together to form a solar panel, greater amount of power can be generated.

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The power generated in this way can be stored in the form of a battery.

Fig. 9.8 Solar heater

2. Biomass energy : In our villages, biomass energy is used to a great extent as a domestic fuel. Wood, dry leaves and twigs, agricultural waste and cakes of cattle dung are used for producing biomass fuel. Burning this type of fuel directly in open chullah may cause indoor pollution. As such, nowadays, biomass is first converted into **Biogas**, commonly called **"gobergas"**. Biogas is mainly methane and can easily be used by our farmers for domestic purposes.

Fig. 9.9 Gobar gas plants

3. Wind energy : Another renewable and alternative source of energy is wind energy. It can be converted into mechanical and electrical energy and is particularly useful in remote areas. Wind energy can be made to run turbines to generate electricity.

Fig. 9.10 Wind mills

4. Hydroelectric energy : Electricity generated by utilising the energy of flowing water is called hydroelectric or hydel energy. Water stored behind a dam constructed across a river is allowed to flow through pipes. The force of rushing water drives the blades of turbines connected to a generator, which produces electricity.

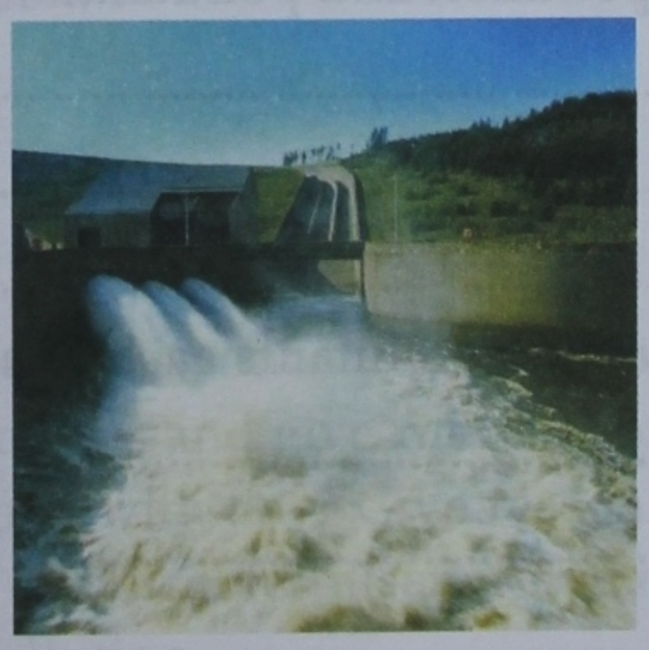

Fig. 9.11 Hydroelectric power plant

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REVIEW QUESTIONS

Multiple Choice Questions :

1. Put a tick mark (✓) against the correct alternative in the following statements :

(a) Which one of the following is not a major source of pollution ?

(i) Radioactive substances (ii) Oil spills

(iii) Smoke from factory chimneys (iv) A bucket full of hot water poured into a river

(b) In which one of the following conditions, CO_2 cannot be a pollutant ?

(i) Emission of CO_2 from the huge factory chimneys

(ii) Discharge of CO_2 by trucks, buses and other automobiles

(iii) Release of CO_2 by human beings during respiration

(iv) Discharge of CO_2 from power house.

(c) Which one of the following forms a stable compound with haemoglobin ?

(i) SO_2 (ii) CO_2 (iii) CO (iv) O_2

(d) Which one of the following is a renewable natural resource ?

(i) Coal (ii) Minerals (iii) Soil (iv) Petroleum

(e) The release of CO_2 into air can cause :

(i) Global warming (ii) Eutrophication

(iii) Acid rain (iv) Respiratory problems

(f) Which one of the following is not a cause of soil erosion ?

(i) Faulty methods of agriculture (ii) Deforestation

(iii) Overgrazing (iv) Monoculture

Short Answer Questions :

1. Define pollution and pollutant.

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.....

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2. List any *three* pollutants each of air, water and soil.

Ans. : ....

Ans. : ....

Ans. : ....

3. Mention any *two* harmful effects of air pollution.

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4. How can the supersonic jets be a source of serious environmental pollution ?

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5. List the harmful effects of noise on human health.

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6. Name the following pollutants :

(a) The gas which is mainly responsible for causing acid rain .....

(b) The gas that leads to the reduction in the oxygen carrying capacity of blood .....

(c) Dead remains of animals and plants added in a water body .....

7. Fill in the blanks :

(a) Sulphur ..... and nitrogen ..... are polluting gases.

(b) ..... and ..... are two common water-borne diseases.

(c) ..... pollution interferes in communication.

8. Name the following :

(a) Inhalation of cigarette smoke through active smokers.

.....

(b) The natural purifiers of the air.

.....

(c) Reduces the efficiency of blood to transport oxygen.

.....

Long Answer Questions (*Write the answers in your note-book*) :

1. What are the main causes of air and water pollution?
2. Mention various ways to check air and water pollution.
3. Write in brief about "acid rain" :
4. Write down harmful effects of noise and soil pollution.
5. Too much cutting down of forest trees has disturbed the environment. Give reasons.
6. Differentiate between renewable and non-renewable resources and give *two* examples of each.
7. Environmental pollution is a recent problem. Do you agree with this? Give reason.
8. Cow-dung or organic manures are preferred in place of chemical fertilisers. Give reasons.
9. Suggest *two* steps each to reduce air, water and noise pollution.
10. "Conservation of energy is essential for us." Explain this statement.
11. Briefly describe any *three* alternative sources of energy.
12. How conservation of forests will lead to ecological imbalance ?
13. What is rain water harvesting ? Suggest a simple method of harvesting rain water.
14. Describe in brief any *three* alternative sources of energy.
15. What is global warming ? How greenhouse effect cause global warming ?

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