



26



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## CONSERVATION AND USE OF NATURAL RESOURCES

Nature provides us with the basic needs for our survival such as food, shelter, clothes, etc. We use air, water, soil, minerals, coal, petroleum, animals, plants etc. in our daily life ? But do you ever think, how long these precious materials of nature will last ? The growing population, rapid industrialisation and– urbanisation have created heavy demand on natural resources. This lesson deals with means of conservation of natural resources through prevention of resource over exploitation and sustainable development.



### OBJECTIVES

After completing this lesson, you will be able to:

- *explain the term natural resources;*
- *familiarise with the traditions practised in India for conservation of nature;*
- *describe the reasons for degradation of natural resources and suggest measures to prevent these;*
- *define biodiversity and describe the need to conserve biodiversity;*
- *list the various endangered species of animals and plants;*
- *state the various environmental laws passed to conserve the natural resources;*
- *explain sustainable development and justify its need; and*
- *describe the various conventional as well as non-conventional sources of energy.*

### 26.1 NATURAL RESOURCES

The term “natural resource” means any thing that we use from our environment to achieve our objective. For example, we require bricks, cement, iron, wood etc. to construct a building. All these items are called resources for construction of building. **A resource can be defined as ‘any natural or artificial substance, energy or organism, which is used by human being for its welfare.** These resources can be two types:



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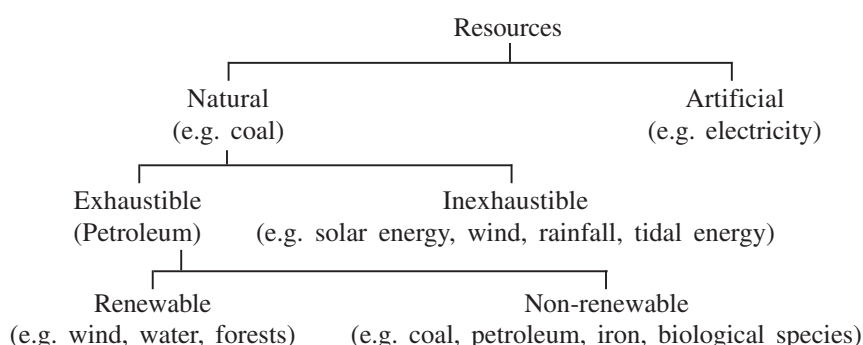
(a) Natural resources

(b) Artificial resources.

All that nature has provided such as soil, air, water, minerals, coal, sunshine (sunlight), animals and plants, etc., are known as **natural resources**. The resources, which have been developed by human beings during the growth of civilization, are called **artificial resources**. For example, biogas, thermal electricity, plastics. These man-made resources are generally derived from some other natural resources. For example, plastics from the natural resource, petroleum.

### 26.1.1 Classification of Natural Resources

The air we breathe and the light we get from the sun are available in unlimited quantity. But what about coal, forest, and petroleum? The stock of these resources is limited and is depleting day by day.



#### ● Inexhaustible Resources

The resources which cannot be exhausted by human consumption are called **inexhaustible resources**. These include energy sources like solar radiation, wind power, water power (flowing streams) and tidal power, and substances like sand, clay, air, water in oceans, etc.

#### ● Exhaustible Resources

On the other hand, there are some resources, which are available in limited quantities and are going to be exhausted as a result of continuous use. These are called **exhaustible resources**. For example, the stock of coal in the earth is limited and one day there will be no more coal available for our use.

#### ● Renewable Resources

Some of the exhaustible resources are naturally regenerated after consumption and are known as **renewable resources**. e.g. Forest trees and plants that make a forest may be destroyed but new ones grow in their place. But if forest is totally cut down to get land for construction of buildings, it is lost forever. Some other examples are fresh water, fertile soil, forest (yielding wood and other products), vegetation, wildlife, etc.

#### ● Non-renewable Resources

The resources, which cannot be replaced after the use, are known as **non-renewable Resources**. These include minerals (copper, iron etc.) fossil fuels (coal, oil etc.). Even wildlife species (rare plants and animals) belong to this category.

**INTEXT QUESTIONS 26.1**

1. Given below are certain wrong statements. Identify the mistake and write the correct statement below each.

(i) Plastic is a natural resource.

.....

(ii) Forest is an exhaustible non-renewable resource.

.....

(iii) The exhaustible resources, which are not replaced after consumption are known as renewable resources.

.....

2. Classify the following under the three respective categories of natural resources:

Air, iron, sand, petroleum, wind, clay, fish, forest, gold, pearls.

**Inexhaustible**

**Renewable**

**Non- renewable**

.....

.....

.....

.....

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.....

**26.2 CONSERVATION OF NATURAL RESOURCES**

Consumption of natural resources is increasing with growing population. With the increasing industrialisation and urbanisation, we need to conserve natural resources for their destruction will also upset the ecological balance.

*Conservation is the proper management of a natural resource to prevent its exploitation, destruction or degradation.*

Conservation is the sum total of activities, which can derive benefits from natural resources but at the same time prevent excessive use leading to destruction or degradation.

**26.2.1. Need for Conservation of Natural Resources**

We know that nature provides us with all our basic needs but we tend to over exploit. If we go on exploiting nature, there will be no more resources available in future. Hence there is an urgent need to conserve nature for the following reasons. Some of the needs are :

- to maintain ecological balance for supporting life.
- to preserve different kinds of species (biodiversity).
- to make the resources available for present and future generations.
- to ensure survival of human race.



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## 26.2.2. Conservation of Natural Resources and Traditions of India

The need for conservation of natural resources was felt by our predecessors and in India, there was a tradition of respecting and preserving nature and natural resources. Natural resources were conserved in the form of sacred groves/forests, sacred pools and lakes, sacred species etc e.g. the river Ganges. In our country the conservation of natural forests is known from the time of Lord Ashoka. Sacred forests are forest patches of different dimensions dedicated by the tribals to their deities and ancestral spirits. Cutting down trees, hunting and other human interferences were strictly prohibited in these forests. This practice is widespread particularly in peninsular, central and eastern India and has resulted in the protection of a large number of plants and animals. Similarly, several water bodies, e.g., Khecheopalri lake in Sikkim was declared sacred by people, thus, protecting aquatic flora and fauna. **Worshipping** certain plants like banyan, peepal, tulsi etc. has not only preserved them but also encouraged their plantation. History recalls numerous instances where people have laid down their lives for protecting trees.

Recent Chipko movement in India is one of the best examples. This movement was started by women in Gopeshwar village in Garhwal in the Himalayas. They stopped the felling of trees by hugging them when the lumbermen arrived to cut them. This saved about 12000 square kilometers of sensitive water catchment area. Similar movements also occurred in some other parts of the country.



### INTEXT QUESTIONS 26.2

1. Why should we conserve natural resources? State any two reasons.
  - (i) .....
  - (ii) .....
2. Given below are certain incomplete words. Complete them by taking clues from the statement given below for each. Each blank space represents one letter only.
  - (i) \_ \_ \_ p k \_  
(A movement started by women to stop the felling of trees by hugging them)
  - (ii) T \_ \_ \_ i  
(A sacred plant worshipped in India)
  - (iii) Kh \_ ch \_ \_ pa \_ \_ i  
(A lake in Sikkim that was declared sacred by the people)



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### 26.3 SOIL

Soil is a very important natural resource and an abiotic component of the environment. Soil is the uppermost layer of earth's crust, which supports growth of plants. It is a complex mixture of (i) mineral particles (formed from rocks), (ii) humus (organic material formed from decaying plant remains), (iii) mineral salts, (iv) water, (v) air, and (vi) living organisms (larger ones like earthworms and insects and microorganisms like the bacteria and fungi).

#### Humus

A brown or black organic substance consisting of partially or wholly decayed vegetable or animal matter that provides nutrients for plants and increases the ability of soil to retain water.

Soil is both a renewable as well as non-renewable resource.

- Soil is renewable because its productivity can be maintained with fertilizers and manures rich in humus.
- If the soil has been removed from a certain place by erosion, it is practically non-renewable because formation of new soil may take hundreds and thousands of years.

#### 26.3.1. Soil Erosion

Erosion literally means “to wear away”. You might have noticed that in summer, when wind blows it carries away sand and soil particles. Similarly flowing water removes some amount of soil along with it. **This removal of top layers of soil by wind and water is called soil erosion.** The top layers of soil contain humus and mineral salts, which are vital for the growth of plants. Thus, erosion causes a significant loss of humus and nutrients, and decreases the fertility of soil.

#### 26.4.2. Causes of soil Erosion

There are several causes of soil erosion.

- (a) Natural causes; and
- (b) Anthropogenic causes (human generated causes)

##### (a) Natural Causes of Soil Erosion

Erosion of soil takes places due to the effect of natural agents like wind and water. High velocity winds over lands, without vegetation, carry away the loose top soil. Similarly in areas with no or very little vegetation, pouring raindrops carry away the soil.

##### (b) Anthropogenic Causes of Soil Erosion

Besides the natural agents, there are some human activities, which cause soil erosion. Let us know about them.

1. **Deforestation:** If the forests are cut down for timber, or for farming purposes, or construction then the soil is no longer protected from the effect of falling rains. Consequently, the top soil is washed away into the rivers and oceans.



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2. **Poor farming methods:** Improper tillage and failure to replace humus after successive crops and burning the stubble. The short, stiff stalks of grain or hay remaining on a field after harvesting of weeds reduce the water-holding capacity of the soil. So the soil becomes dry and can be blown away as dust.
3. **Overgrazing:** Overgrazing by flocks of cattle, buffaloes, goats and sheep leave very little plant-cover on the soil. Their hooves make the soil dry and soil can be blown away easily.

## 26.4.3 Conservation of Soil

Soil conservation means checking soil erosion and improving soil fertility by adopting various methods.

1. **Maintenance of soil fertility:** The fertility can be maintained by adding manure and fertilizers regularly as well as by rotation of crop.
2. **Control on grazing:** Grazing should be allowed only on specified areas.
3. **Reforestation:** Planting of trees and vegetation reduces soil erosion.
4. **Terracing:** Dividing a slope into several flat fields to control rapid run of water. It is practised mostly in hilly areas.
5. **Contour ploughing:** Ploughing at right angles to the slope allows the furrows to trap water and check soil erosion by rain water.



## INTEXT QUESTIONS 26.3

1. How do the following cause soil erosion?

Wind : \_\_\_\_\_

Overgrazing : \_\_\_\_\_

Water : \_\_\_\_\_

2. Match the items of column A with those of Column B.

### Column-A

- (i) Terracing
- (ii) Erosion
- (iii) Deforestation
- (iv) Humus

### Column-B

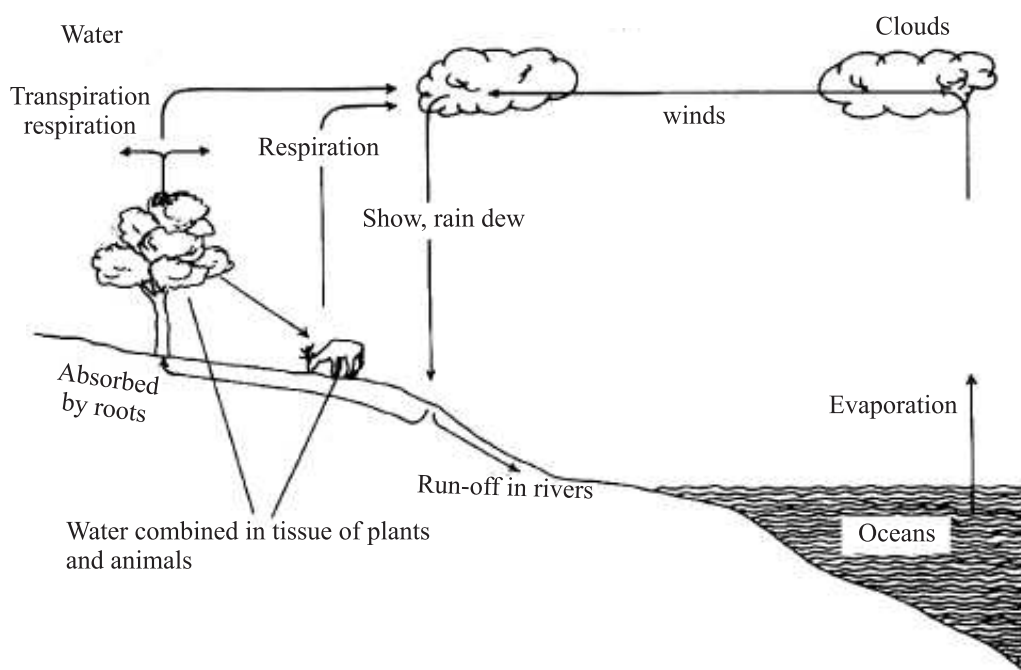
- (a) Decayed vegetable or animal matter
- (b) Cutting down forests
- (c) Practised in hilly areas
- (d) To wear away

## 26.4 WATER – A PRECIOUS RESOURCE

Water is essential for survival of all living organisms. It is the most important component of all life forms and necessary for sustaining life. Water also regulates

climate, generates electricity and is also useful in agriculture and industries.

**About 97% of the water on earth is saline in nature**, found in seas and oceans. The remaining 3% is fresh water, most of which is stored in ice caps and glaciers, and just about 0.36% is distributed in lakes, rivers, ponds, etc. as 'fresh water'. Sea water supports marine life and contributes to the production of fish and sea foods and several other commercial products (iodine, agar, coral, pearls, etc.). Fresh water is needed by humans for their personal use (drinking, cleaning, sewage disposal), It is also used by other animals, in agriculture, and in industries. Fresh water is a renewable resource as it is continuously being produced through hydrological cycle (evaporation, condensation and precipitation). A from lesson 24.



**Fig. 26.1** Hydrological cycle

### 26.4.1.Degradation of Water

With increase in population and industrial growth, water is being degraded day by day. The main reasons for the degradation of water are:

1. to meet the need of increasing population, surface water (water from ponds, lakes, rivers, etc) and ground water are overdrawn, depleting volume of water.
2. sewage i.e., waste water from domestic and municipal use makes fresh water unfit for use by human beings and animals.
3. waste water, from all industries flows down into the surface water bodies and ground water bodies and they get polluted.

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4. agricultural wastes containing manures, fertilizers and pesticides enter the water bodies and degrade the quality of water.
5. the continuous decrease of ground water level along coastal regions often cause movement of saline sea water into freshwater wells, thus, spoiling their water quality.

## 26.4.2. Conservation of Water

Conservation and management of water are essential for the survival of mankind, plants and animals. This can be achieved adopting the following methods:

1. **Growing vegetation** in the catchment areas, which will hold water in the soil and allow it to percolate into deeper layers and contribute to formation of ground water.
2. **Constructing dams and reservoirs** to regulate supply of water to the fields, as well as to enable generation of hydroelectricity.
3. **Sewage** should be treated and only the clear water should be released into the rivers.
4. **Industrial wastes (effluents)** should be treated to prevent chemical and thermal pollution of fresh water.
5. **Judicious use** of water in our day-to-day life.
6. **Rainwater harvesting** should be done by storing rainwater and recharging groundwater.



## INTEXT QUESTIONS 26.4

1. Why do we consider fresh water as a renewable resource?

.....

2. Give three methods of water conservation.

.....

## 26.5 BIODIVERSITY

When we observe our surroundings, we find different types of plants, ranging from small green grasses to large trees, large variety of animals, from tiny insects to human beings and many other big animals. Besides these there are micro-organisms in the soil, air and water that we can't see through our naked eyes. These varieties of plants, animals and microbes together form the biological diversity or biodiversity of your surroundings.

So **biodiversity can be defined as the flora and fauna i.e. variety of all plants, animals and microbes of a region.**

### 26.5.1 Importance of Biodiversity

Biodiversity is essential for maintenance of ecosystem. It maintains gaseous composition of atmosphere, controls climate, helps in natural pest control, pollination

of plants by insects and birds, soil formation and conservation, water purification and conservation, geo-chemical cycles etc.

Some of the uses of biodiversity are given below :

- Food : All kind of food is derived from plants and animals.
- Drugs and Medicines : Around 25% of drugs are obtained from plants e.g. quinin used for treatment of malaria is obtained from *Cinchona officinalis*. All antibiotics are derived from microbes.
- Cultural and Aesthetic value : You enjoy watching butterflies, animals, birds and flowers. Eco-tourism is a source of income.
- Religious values : Plants like tulsi, peepal, banyan and animals like cows, ox, elephant are worshiped.
- Biodiversity conservation is essential for maintenance of ecosystem.
- It is also required for disposal and pollination in plants, formation and conservation of soil and purification and conservation of water.

### Hot Spots of Biodiversity

Biodiversity is not uniformly distributed across the geographical regions of the earth. Certain regions of the world are very rich in biodiversity. We call such areas as “**mega diversity zones**”. We also refer to them as “**hot-spots**”. For example, India accounts for only 2.4 % of the land area of the world; but it contributes approximately 8% species to the global diversity due to existence of such pockets. The hot spots are the richest and the most threatened reservoirs of biodiversity on the earth. The criteria for determining an area as a hot spot are:

- (i) The area should support >1500 endemic species,
- (ii) It must have lost over 70 % of the original habitat

Twenty-five biodiversity hot spots have been identified in the world. These hot spots are characterized by supporting exceptionally high biodiversity.

Among the 25 hot spots of the world, two are found in India namely **Western Ghats** and the **Eastern Himalayas**. These two areas of the country are exceptionally rich in flowering plants, reptiles, amphibians, butterflies and some species of mammals.

The eastern Himalayan hot spot extends to the north – eastern India and Bhutan. The temperate forests are found at an altitude of 1780 to 3500 m. Many deep and semiisolated valleys are exceptionally rich in endemic plant species.



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1. Tropical Andes, 2. Mesoamerica, 3. Caribbean, 4. Brazil's Atlantic Forests, 5. Chico/Darien/Western Ecuador, 6. Brazil's Cerrado, 7. Central Chile, 8. California Floristic Province, 9. Madagascar, 10. Eastern Arc and Coastal Forests of Tanzania/Kenya, 11. West African Forests, 12. Cape Floristic Province, 13. Succulent Karoo, 14. Mediterranean Basin, 15. Caucasus, 16. Sundland, 17. Wallacea, 18. Phillipplnes, 19. Indo-Burma, 20. South Central Chaina, 21. Western Ghats/Sri Lanka, 22. Southwest Australia, 23. New Caledonia, 24. New Zealand, 25. Polynesia/Micronesia.

**Fig. 12.1a:** The terrestrial biodiversity hot spots

## CASE STUDIES

There are many amongst us humans who are motivated to solve societal problems, however difficult. There are several success stories of which three are mentioned below regarding water management in water starved areas:

### Case Study 1

Rajasthan for many years suffered as 'land without water'. Geared by an urge to solve the water crisis, Rajinder Singh, a devout follower of Mahatma Gandhi and Jaiprakash Narayan, gave up a lucrative job to serve the people. With the help of villagers, he dug 'johads', which means 'dug out ponds' as water conservation structures where rain water began to collect year after year. Rajendra Singh's initiative worked wonders and today there are 3500 'people made' water conservation structures and no water scarcity.

### Case Study 2

In Gandhigram, a coastal village in Kutch district, the villagers had been facing a drinking water crisis for the past 10 to 12 years. The groundwater table had fallen

below the sea level due to over extraction and the seawater had seeped into the ground water aquifers. The villagers formed a village development group, Gram Vikas Mandal. The mandal took a loan from the bank and the villagers contributed voluntary labour (Shramdan). A check dam was built on a nearby seasonal river, which flowed past the village. Apart from the dam, the villagers also undertook a micro-watershed project. Due to these water retention structures, the villages now have sufficient drinking water.



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### Case Study 3

**Rainwater harvesting – another success story:** The area surrounding the River Ruparel in Rajasthan is a good example of proper water conservation. The site receives very little rainfall, but proper management and conservation have ensured water availability throughout the year. The water level in the river began declining due to extensive deforestation and agricultural activities along the banks and, by the 1980s, a drought-like situation began to spread. Under the guidance of local people, the women living in the area were encouraged to take the initiative in building johads (round ponds) and dams to hold back rain water. Gradually, water began coming back as proper methods of conserving and harvesting rainwater were followed. The revival of the river has transformed the ecology of the place and the lives of the people living along its banks.

### 26.5.2. Threat to Biodiversity

Though biodiversity is so important for our survival, we are destroying it knowingly or unknowingly. It is under threat due to the following reasons:

- (i) Destruction of habitat by cutting down trees, filling up the wetland, ploughing of grassland or burning a forest.
- (ii) Population explosion has increased demand for food and shelter. It has led to culture of single crop (monoculture) that will result in disappearance of some other crops.
- (iii) Industrialisation and urbanisation has changed and destroyed the natural habitat of plants and animals.
- (iv) Pollution of soil, air and water changes the habitat quality and may reduce or eliminate sensitive species.
- (v) Mining activities add to the pollution of air and water and threaten the survival of the animals in the nearby areas.
- (vi) Construction of dams, roads and railways destroys huge patches of forests, grassland etc. thus, disturb the biodiversity.
- (vii) Indiscriminate killing of animals for different purposes has resulted in their reduction.



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- (viii) Introduction of exotic/foreign species in an area threaten the survival of existing natural biodiversity; e.g., water hyacinth clogs rivers and lakes and threatens the life of many aquatic species in our country.

## 26.5.3 Conservation of Biodiversity

There are two basic strategies for conservation of biodiversity:

- (i) **In-situ** conservation
  - (ii) **Ex-situ** conservation
- (i) **In-situ (on site)** conservation includes the protection of plants and animals within their natural habitats or in protected areas. Protected areas are areas of land or sea dedicated to protection and maintenance of biodiversity. For example: e.g., National Parks, Wildlife Sanctuaries, Biosphere Reserves, etc.
- (ii) **Ex-situ (off site)** conservation is the conservation of plants and animals outside their natural habitats. These include Botanical Gardens, Zoo, Gene Banks, DNA Banks, Seed Banks, Pollen Banks, Seedling and Tissue Culture etc.



## INTEXT QUESTIONS 26.5

1. Some of the following words/terms are related to conservation of biodiversity and some are threat to biodiversity. Identify the points relating to conservation by mentioning 'C' and threat to biodiversity by mentioning 'T' against the points.
  - (i) Wildlife sanctuaries (.....)
  - (ii) Population explosion (.....)
  - (iii) Industrialisation (.....)
  - (iv) Zoo (.....)
  - (v) Tissue culture (.....)
  - (vi) Pollution (.....)

## 26.6 ENDANGERED SPECIES

You have already learnt about the various reasons due to which our biodiversity is under constant threat. You also learnt about the strategy to protect the biodiversity. Let us know about some of the plants and animals which have already become extinct or are going to be extinct from the earth surface.

The species, which have already disappeared, are called the **extinct** species and the phenomenon of disappearance is known as extinction. Another category of species called **endangered species** are those which have been reduced in number to a critical level and facing a high risk of extinction in the near future.

The World Conservation Union, formerly International Union for the Conservation of Nature and Natural Resources (IUCN) has enlisted endangered plants and animals in the **Red Data Book**. Few endangered plants and animals are listed below:

**Endangered Animals**

1. Asiatic Lion,
2. Green sea turtle, loggerhead turtle,
3. Tortoise
4. Marsh crocodile and gharial
5. Tiger
6. Rhinoceros
7. Asiatic Elephant, Indian Python
8. Great Indian Bustard, butterflies

**Endangered Plants**

1. Pitcher plant
2. Indian belladonna
3. Orchids
4. Nilgiri Lily
5. *Ginkgo biloba* (Maiden hair tree)

**Notes****26.7 WILDLIFE**

Now we shall learn about an important resource of nature called wildlife. At home you may have a pet dog or a cat, even some of you may have cows, buffalos, sheep, goats etc. In your garden you may grow different types of vegetables and flowering plants. In addition to these, there are other plants and animals, which are not cultivated by you. **The plants, animals and microorganisms other than the cultivated plants and domesticated animals constitute wildlife.**

Animals and plants living in their natural habitat constitute **wildlife**. Wildlife forms an important resource as it plays a major role in maintaining ecological balance. It is used in research as experimental material and also used for recreational purposes. Like other resources it is also facing severe threat. So it should be conserved and maintained for the use of future generation.

**26.7.1 Need for Conservation of wildlife**

Wildlife needs to be conserved for :

- maintaining ecological balance for supporting life.
- preserving different kinds of species (biodiversity).
- preserving economically important plants and animals.
- conserving the endangered species.

**26.7.2 Methods of Conservation of Wildlife**

After knowing the need for conservation of wildlife, let us discuss how to conserve it. We can protect it by adopting various means, like:

- Establishing biosphere reserves, national parks and sanctuaries.
- Afforestation (Tree planting programme).
- Special schemes for preservation of threatened species.
- Improvement of natural habitats of wildlife.



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- Educating people about the need and methods of conservation of wildlife.
- Formulation of Acts and Regulations to prevent poaching (killing animals) for sports and money.

Wildlife week is being observed in India in the month of July every year since 1955. It aims at creating awareness among people about the importance of wildlife and to highlight the conservational and management needs of wildlife.



## INTEXT QUESTIONS 26.6

1. What is Red Data Book?

.....

2. Define the term Wildlife.

.....

3. Below are certain incomplete words. Complete them by taking clues from the statement given below for each. Each blank represent the letter only.

(i) A \_ \_ \_ or \_ \_ \_ \_ at \_ \_ on

(Tree planting programme)

(ii) Be \_ \_ \_ ado \_ \_ \_ a

(An endangered Indian plant)

(iii) Rh \_ \_ no \_ \_ \_ r \_ \_ \_

(An endangered animal)

### 26.7.3 Wildlife Reserves in India

Many National Parks and Sanctuaries have been established to preserve wildlife in their natural environment. Some of them are given below along with the important species found in these.

- Kaziranga sanctuary (Assam) – one-horned rhinoceros
- Manas sanctuary (Assam) – wild buffaloes
- Gir forest (Gujarat) – lions, chital, sambar, wild bears
- Kelameru bird sanctuary (Andhra) – pelicans and marine birds
- Dachigam sanctuary (Jammu and Kashmir) – Kashmir stags, Himalayan tahr, wild goats, sheep, antelopes
- Bandipur sanctuary (Karnataka) – Indian bison, elephants, langurs
- Periyar sanctuary (Kerala) – elephants, barking deer, sambar



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- Kanha National Park (Madhya Pradesh) – tiger, leopards, wild dogs
- Similipal National Park (Orissa) – mangroves, marine turtles lay eggs
- Bharatpur bird sanctuary (Rajasthan) – ducks, herons
- Corbett National Park (Uttaranchal) – tigers, barking deer, sambar, wild bear, rhesus monkey
- Jaladpara sanctuary (West Bengal) – rhinoceros

#### 26.7.4 Agencies Dealing with Conservation of Wildlife

There are various agencies both at national and international levels which take care of conservation of wildlife. Some of them are given below

- Indian Board for Wildlife (IBWL) advises state government on wildlife protection.
- Constitution of India includes forest and wildlife protection.
- World Wildlife Fund for nature (WWF) : It is an international organisation formed in the year 1961 and is engaged in protection of wildlife. India became a member of it in 1969 and has its headquarter in Mumbai. It has supported the well-known “Project Tiger”.
- International Union for Conservation of Nature and Natural resources (IUCN), World Conservation Union (WCU) is engaged in protection of wildlife and their habitats.
- Convention of International Trade in Endangered Species (CITES) is an international organisation to check trade products from endangered animals. India became a party to CITES in 1976.

#### 26.8 LEGISLATION FOR CONSERVATION

Various acts and laws have been passed in Indian constitution for conservation of natural resources. Some of them are:

- Environment Protection Act, 1986
- Forest (Conservation) Act, 1980
- National Forest Policy, 1988
- Wildlife Protection Act, 1972 and amended in 1991



#### INTEXT QUESTIONS 26.7

1. Expand the following.

- WWF .....
- CITES .....
- IUCN .....



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2. Match the items of column A with those of Column B.

Column – A	Column – B
(i) Periyar sanctuary	(a) Rajasthan
(ii) Kanha National Park	(b) Orissa
(iii) Similipal National Park	(c) Uttaranchal
(iv) Bharatpur bird sanctuary	(d) Kerala
(v) Corbett National Park	(e) Madhya Pradesh

## 26.9 SUSTAINABLE DEVELOPMENT

However, these industries, factories, cities, towns, roads, railways, dams etc. for development, the governors of all countries build have replaced the natural habitats of plants and animals. Natural resources have been depleted gradually and a day will come when many natural resources will not be available for our future generation. So it is high time to think about maintaining a balance between environment and development so that both present and future generations can derive proper benefits out of these resources. This can only be achieved by the process of sustainable development.

**Sustainable development** is the development that meets the needs of the present generation and conserves resources for the future generation.

Sustainable development should include –

- reducing excessive use of resources and enhancing resource conservation.
- recycling and reuse of waste materials.
- scientific management of renewable resources, especially bio-resources.
- planting more trees.
- green grassy patches to be interspersed between concrete buildings.
- using more environment friendly material or biodegradable material.
- use of technologies, which are environmental friendly and based on efficient use of resources.



## INTEXT QUESTIONS 26.8

1. A and B are two friends. In their daily life both have different opinion on certain matters. Considering the necessity of sustainable development give your suggestions in the given space.

A says - Polythene bags should be used to carry vegetables.

B says – Jute bags should be used to carry vegetables.

Who is right and why?

.....

2. Mention any two activities which will help in sustainable development.

.....

### 26.10 ENERGY RESOURCES

We have always been using different forms of energy obtained from various sources for our daily activities like cooking, heating, ploughing, transportation, lighting, etc. For example, heat energy required for cooking purpose is obtained from firewood, kerosene oil, coal, electricity or cooking gas. LPG (liquefied petroleum gas) We use animal power (horse, bullock, etc.) for transportation and for running minor mechanical devices like the Persian wheel for irrigation or for running a “kolhu” for extracting oil from oilseeds. Different forms of these energies are obtained from various sources. We will discuss about them in detail.

#### 26.10.1 Types of Energy Sources

There are two main categories of energy sources:

- (i) **Conventional Sources of Energy**, which are easily available and have been in usage for a long time.
- (ii) **Non-Conventional Sources of Energy**, that are other than the usual, or that are different from those in common practice.

The table 26.2 below summarises the list of both the above categories of energy resources.

**Table 26.2** Various types of energy sources

Sources of Energy		
Conventional Energy		Non-Conventional Energy
<b>Conventional Non-renewable Energy</b>  (Mostly fossil fuels found under the Ground)  Examples: Coal, Oil, Natural gas etc.	<b>Conventional Renewable Energy</b>  (Mostly non-fossil fuels seen above the Ground)  Examples: Firewood, Cattle Dung, Farm Vegetable Wastes, Wood charcoal, etc	<ul style="list-style-type: none"> <li>● Solar Energy</li> <li>● Hydel Energy</li> <li>● Wind Energy</li> <li>● Nuclear Energy</li> <li>● Hydrogen Energy</li> <li>● Geothermal Energy</li> <li>● Biogas</li> <li>● Tidal Energy</li> <li>● Bio-fuel</li> </ul>



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## 26.10.2 Conventional Sources of Energy

Conventional sources of energy have been in use since ancient times. Most important among them are the fossil fuels.

### Fossil Fuels

Fossil fuels are the fossilised remains of plants and animals, which over millions of years have been transformed into coal, petroleum products and natural gas.

**Coal** is the most abundant fossil fuel. It is widely used for combustion in cooking and industrial activities. There are different types of coal products such as coal gas, coal tar, benzene, toluene, etc., which are used for various purposes.

**Oil and Natural gases** are formed from plants and animals which once lived in the tropical seas. Oil (or petroleum) is a source of countless products. Apart from petrol, diesel and other fuels, petroleum products include lubricants, waxes, solvents, dyes, etc. Petroleum reserves are supposed to last for another 100 years or so.

**Natural gas** is often found with petroleum. The gas mainly contains methane. Apart from serving as fuel in several industries, it is being increasingly used as domestic fuel in many countries including India. United States of America is the largest producer as well as consumer of natural gas.

Now-a-days in big cities and towns it is being supplied through pipelines which is called Piped Natural Gas (PNG). The natural gas is also used as a fuel to run vehicles. It is known as Compressed Natural Gas (CNG). It is accepted as an economical and less polluting fuel for transport.

The Liquefied Petroleum Gas (LPG) is the common cooking gas used in Indian homes. It is a mixture of propane and butane gases kept under pressure in liquid form, but they burn in gaseous form. This gas is made available in a specific container for domestic as well as industrial uses. It is a byproduct of petroleum refineries.



### INTEXT QUESTIONS 26.9

1. Coal is a non-renewable source of energy whereas wood charcoal is renewable. Why ?  
.....
2. How are the following useful in our day to day life?
  - (i) CNG .....
  - (ii) PNG .....
  - (iii) LPG .....

3. A and B are two friends. In their daily life both have different opinion on certain matters. Considering the necessity of sustainable development give your suggestions in the given space.

A says – Coal should be used as a fuel to cook our food

B says – LPG should be used as a fuel to cook our food.

Who is right and why?

.....



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### 26.10.3 Non-Conventional Sources of Energy

We have already learnt known about conventional sources of energy, whether renewable or non-renewable (coal, oil, etc.), which are fast depleting and will not last long. Therefore, greater utilisation of non-conventional sources of energy (solar, wind, hydro, geothermal, etc) will have to be used.

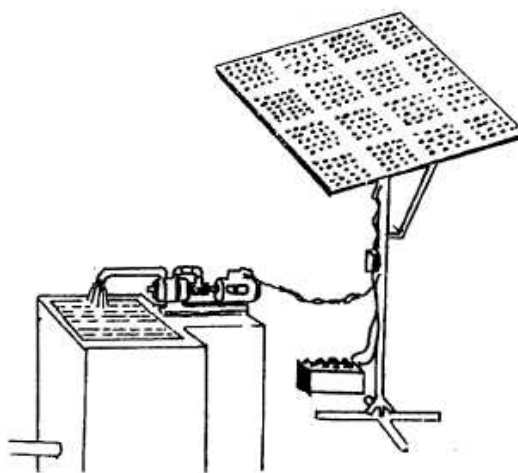
#### 1. Solar Energy

Solar energy is the ultimate source of all energy on earth. Firewood, coal, oil or natural gas are the products of plants and other organisms, which had used solar energy for the synthesis of organic molecules during photosynthesis. Even today it will turn out to be the most important answer to problems of energy except nuclear energy. The solar energy has the following advantages:

- (i) It is abundant
- (ii) It is everlasting
- (iii) It is available almost everywhere.
- (iv) It is free from political barriers.

Various technologies in which solar energy can be, and is being utilised are as follows:

- (i) Solar cookers
- (ii) Solar hot water systems
- (iii) Solar dryers (used for drying crop yields)
- (iv) Solar air heaters
- (v) Solar kilns



**Fig. 25.2** Solar battery that can run a water pump or put to any other use.

**Notes**

(vi) Solar desalination systems

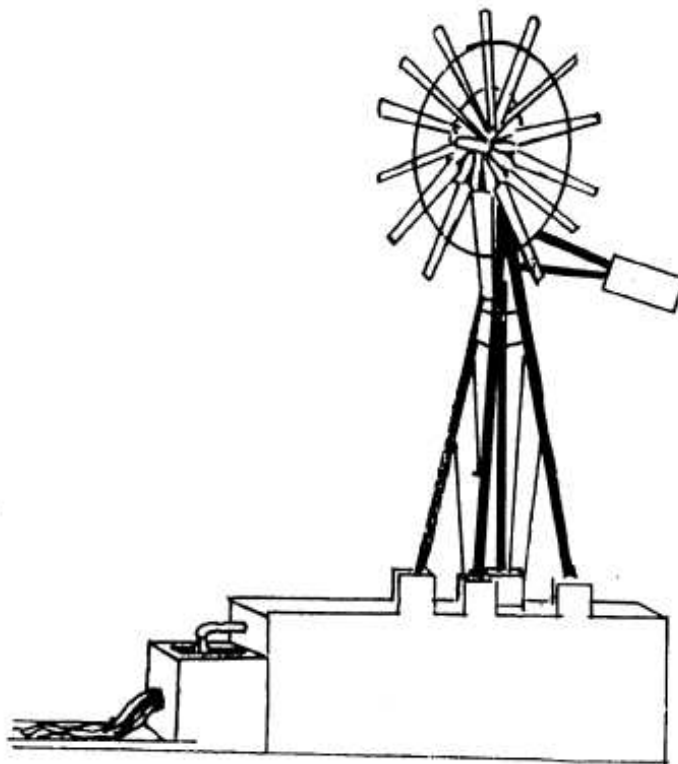
(vii) Solar batteries (Fig. 26.2).

## 2. Hydel /Hydro Energy

The generation of electricity by using the force of falling water is called hydro-electricity or hydel power. It is cheaper than thermal or nuclear power. For its generation dams are built to store water, which is made to fall to rotate turbines that generate electricity.

## 3. Wind Energy

Wind as an energy can be utilised in our daily life by converting it into mechanical energy. This mechanical energy is used to generate electricity, raise water from wells and rivers for irrigation and other purposes. Windmills have been in use since early times to provide power for grinding grains. It is also used for grain cutting and shelling. In India a large number of windmills are being constructed on the sea beach and hilly areas. (Fig. 26.3).



**Fig: 26.3** Windmill

Minimum wind speed required for operating the windmill is 7 km/hour. A windmill can draw water upto a maximum depth of 55 feet and the output is 4000-9000 litres (of water) per hour.



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#### 4. Tidal Energy

Tidal energy is one that is produced by making the use of water movement from a high tide to a low tide. Ocean waves and tides can be made to turn a turbine and generate electricity. Areas where rivers flow into the sea experience waves and tides and electricity can be generated there. It has much potential. As you know we have a large coastline and major river systems in our country, electricity can be generated on a large scale from waves and tides.

#### 5. Nuclear Energy

Radioactive elements like uranium and thorium disintegrate spontaneously releasing large quantities of energy. This energy can be trapped to produce electricity. 25% of world's thorium reserve is found in our country, which can be utilised to generate electricity. Most advanced countries have nuclear power stations. We too have some in India, for example, Tarapur (Maharashtra), Kalpakkam (Tamil Nadu), Narora (Uttar Pradesh), Kota (Rajasthan). Approximately 3% of India's electricity comes from nuclear power and about 25% is expected to come by 2050.

Installation costs of nuclear power stations are very high, but maintenance costs are relatively low. If not carefully maintained, these also have an inherent risk of causing radioactive pollution.

#### 6. Hydrogen Energy

Hydrogen is the primary fuel for the hydrogen based fuel cells and power plants. Power can be generated for industrial, residential and transport purposes by using hydrogen.

#### 7. Geothermal Energy

This is the energy derived from the heat in the interior of the earth. In volcanic regions, springs and fountains of hot water called "geysers" are commonly found. These eruptions of hot steaming water can be used to turn turbines and produce electricity in geothermal power plants. In this method cold water is allowed to seep through the fissures in the rocks till it reaches the hot rocks in the lower layers. Water gets heated and gets converted into steam which forces out to the surface to be used in power generation. Besides the superheated steam of hot springs can also generate electricity. There are 46 hydrothermal areas in India where the water temperature normally exceeds 150 degree centigrade. Electricity can be generated from these hot springs.

#### 8. Biogas

Another form of non-conventional energy is **biogas**. It is produced by the microbial activity on cattle dung in a specially designed tank called digester. A mixture of water and cattle dung is poured in this digester where anaerobic decomposition takes place and biogas is generated. This gas contains 55 – 70 percent methane, which is



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inflammable and it is generally used as cooking gas and for generation of electricity. The “waste” left in the tank after the generation of biogas is used as manures. Thus, biogas plant provides us both the fuel and the manure. Biogas plants are becoming very popular in rural India.

There are two types of biogas plants:

- (a) Family type gas plants- These are small and are used individually by a family.
- (b) Community type gas plants- These are large and are used by larger rural populations.

## 9. Bio-fuel

You know it very well that fossil fuels have been the main source of energy for transportation and industries for more than a century. Their rapid consumption has depleted the reserves of fossil fuels. Their fast depletion and non-renewable nature has sent an alarm to look for alternative fuel. Among the fuels, consumption of liquid fuels is the highest. So there are attempts to identify potential plant species as sources of liquid hydrocarbons, a substitute for liquid fossil fuels. The hydrocarbons present in such plants can be converted into petroleum hydrocarbons. This liquid hydrocarbon is the bio-fuel and the plants producing it are called petro-plants. The plant species, *Jatropha curcus* is the most suitable one, which yields bio-diesel. The Indian Oil Corporation is carrying out experiments for preparation of bio-diesel from various vegetable oils extracted from rice bran, palm, karanjia, sunflower etc.

### Advantages of Bio-diesel

Bio-diesel has several advantages; some of them are given below-

- It is an agriculture based fuel substitute.
- It can be made from both vegetable oil and animal fats.
- It can be used without major modifications in engines.
- It does not need separate infrastructure for storage and delivery.
- Handling bio-diesel is safer.
- Planting of *Jatropha curcus* will utilise wasteland in our country.
- It's combustion emits less carbon monoxide, sulphates, unburnt hydrocarbons and particulate matters, thus reduces air pollution.

### 26.10.4 Conservation of Energy Sources

We have already learnt about the different types of sources of energy and how they are useful to us. Now you think about your daily activities and the types of energy you are using in each activity. Make a list of the sources, which produce these

energies. Everyday you and your family members are using four to five sources of energy. Similarly other people, industries and different establishments are using energy everyday. The demand for energy is increasing day-by-day and exploitation of the energy sources is on the rise. Thus, energy sources are depleting gradually. There is an urgent need to conserve energy, else adequate energy will not be available in future. Some methods to conserve energy are:

- Minimise exploitation of non-renewable energy resources.
- Emphasis on use of renewable sources of energy.
- Stop wastage of energy.
- Creating awareness among people regarding wise and judicious use of energy.
- Make more use of bio-mass based energy.

**INTEXT QUESTIONS 26.10**

1. Why do we consider sun as the best source of energy?  
.....
2. What is meant by 'radioactive pollution'?  
.....
3. What are the advantages and disadvantages of nuclear energy?  
.....
4. The following table contains the different sources of energy and their uses. Put a tick mark under the source against the appropriate use(s).
 

	Geothermal	Bio gas	Bio-diesel
(i) Generation of Electricity			
(ii) Fuel for Cooking			
(iii) Fuel for Vehicles			
5. Mention any three ways of conservation of electric energy at your home.
  - (i) .....
  - (ii) .....
  - (iii) .....

**Notes**



## WHAT YOU HAVE LEARNT

- Any natural or artificial substance, energy or organism, which is used by human being for its welfare is called a resource. Two types of resources are, (a) Natural resources; and (b) Artificial resources.
- Natural resources are classified into (i) inexhaustible- air, water (in oceans), solar energy etc. and (ii) exhaustible- soil, forest, fresh water, minerals, fossil fuels, etc. Exhaustible resources may be non-renewable such as metals fossil fuels, and renewable such as water, wood, natural pastures, forests, etc.
- Conservation is the sum total of activities, which can derive benefits from natural resources but at the same time prevent excessive use leading to destruction or neglect.
- Soil is the uppermost layer of earth's crust, which supports growth of plants. It is both a renewable and non-renewable resource.
- Water is the most important component of all life forms. It regulates climate, generates electricity and is also useful in agriculture and industries. With increase in population and industrial growth, water is degraded day by day. Conservation and management of water are essential for the survival of mankind, plants and animals
- The variety of all plants, animals and microbes of a region is termed biodiversity. Biodiversity is essential for maintenance of ecosystem.
- Though biodiversity is important for our survival, it is under threat due to the various human activities. So we should protect biodiversity by strategies like, (i) In situ conservation, and (ii) Ex situ conservation.
- The endangered species are those, which have been reduced in number to a critical level and facing a high risk of extinction in the near future.
- The plants, animals and microorganisms other than the cultivated plants and domesticated animals constitute wildlife. Wildlife forms an important resource for maintaining ecological balance. Conserve it by establishing biosphere reserves, national parks and sanctuaries etc.
- Sustainable development is the development that meets the needs of the present generation and conserves it for the future generation.
- There are two main categories of energy sources: (i) conventional sources of energy; and (ii) non-conventional sources of energy. Conventional sources of energy may be (a) **conventional non-renewable energy** (Mostly fossil fuels found under the ground like coal, oil and natural gas etc.); and (b) **Conventional renewable energy** (firewood, cattle dung, charcoal etc.)

Notes

- The Non-Conventional Energy includes Solar energy, Hydel energy, Wind energy, Nuclear energy, Hydrogen energy, Geothermal energy, Biogas energy, Tidal energy, Bio-fuel, etc.
- The demand for energy and exploitation of the energy sources is increasing day-by-day. Energy sources are depleting fast. There is an urgent need to conserve energy; else adequate energy will not be available in future.



Notes



### TERMINAL EXERCISES

1. Define conservation.
2. What is meant by soil erosion?
3. Define the term biodiversity.
4. State the meaning of sustainable development.
5. Mention any two methods of conservation of energy resource.
6. Why should wildlife be conserved?
7. Why is soil considered as both renewable and non-renewable resource?
8. State any three reasons for degradation of water.
9. Distinguish between *in-situ* and *ex-situ* conservation strategies.
10. Describe natural gas as conventional source of energy.
11. Describe the natural and the anthropogenic causes of soil erosion.
12. Describe the various methods of conservation of soil.
13. Future generations of mankind will depend more and more on non-conventional sources of energy. Discuss.
14. Explain any five methods of conservation of water.
15. Describe any three non-conventional sources of energy.



### ANSWERS TO INTEXT QUESTIONS

- 26.1** 1. (i) Plastic is an artificial resource.  
(ii) Forest is an exhaustible renewable resource.  
(iii) The exhaustible resources, which are not replaced after consumption are known as non-renewable resources.

OR

The exhaustible resources, which are replaced after consumption, are known as renewable resources



2.	Inexhaustible	Renewable	Non- renewable
	Air	Fish	Iron
	Sand	Forest	Petroleum
	Wind	Pearls	Gold
	Clay		

2. (i) Chipko
- (ii) Tulsi
- (iii) Khecheopalri

2.	Column – A	Column – B
(i)	Terracing	(c) Practised in hilly areas
(ii)	Erosion	(d) To wear away
(iii)	Deforestation	(b) Cutting down forests
(iv)	Humus	(a) Decayed vegetable or animal matter

2.
  - (i) Constructing dams and reservoirs
  - (ii) Rainwater harvesting
  - (iii) Judicious use

**26.6** 1. It is published by IUCN that gives information on endangered plants and animals.

2. The plants, animals and microbes other than the cultivated plants and domesticated animals constitute the wildlife.

3. (i) Afforestation
- (ii) Belladonna
- (iii) Rhinoceros

**26.7** 1. (i) World Wildlife Fund  
(ii) Convention of International Trade in Endangered species  
(iii) International Union for Conservation of Natural Resources

2. (i) (d), (ii) (e) (iii) (b)(iv) (a)(v) (c)



Notes

- 26.8** 1. (i) B is right; because jute bags are biodegradable and eco-friendly. Though science has invented the bio-degradable polythene bags, all are not bio-degradable, hence cause pollution.  
(ii) see text
- 26.9** 1. Coal cannot be regenerated after consumption. But wood charcoal is obtained from wood and wood can be obtained continuously from trees/forest.  
2. CNG : Cooking, Transportation  
PNG : Cooking  
LPG : Cooking, Lightening, Transportation  
3. B is right LPG causes less pollution than coal.
- 26.10** 1. It is available free of cost and in ample quantity, everlasting. It has no boundaries and is also free from political barriers.  
2. The radioactive elements when not disposed off properly cause disintegration in the soil and water and thus cause pollution.  
3. India has sufficient Thorium to generate electricity cause pollution.  
4.
- |                               | Geothermal | Bio-gas | Bio-diesel |
|-------------------------------|------------|---------|------------|
| (i) Generation of Electricity | √          | √       | √          |
| (ii) Fuel for Cooking         |            | √       |            |
| (iii) Fuel for Vehicles       |            |         | √          |
5. (i) Judicious use of electricity  
(ii) Use of florescent lamp instead of incandescent lamp  
(iii) Create awareness about the proper use of electricity, or any other.