

Model Set Questions with Answers

MODEL - 1

[BST - 501]

Full Marks - 70

Time - 3 Hours

Answer any **five** questions.

The figures in the right-hand margin indicate marks.

- (a) Define the "Source of Energy". [2]
(b) Explain the importance of solar energy. [5]
(c) What is Geo-thermal Energy? Explain the uses of geo-thermal energy for electricity generation. [7]
2. (a) What is Green Technology? [2]
(b) What are the various gas pollutants? [5]
(c) Explain the different components of an Ecosystem. [7]
3. (a) What is Water-Pollution? [2]
(b) Explain the different components of water pollution. [5]
(c) Describe the various methods of controlling Air-pollution from the Industry. [7]
4. (a) What is life cycle assessment? [2]
(b) Discuss the power of Central Government to protect and improve environment. [5]
(c) What are the policies for environmental management keeping the pace of economic growth? [7]
5. (a) What do you mean by environmental audit? [2]
(b) How is air pollution accountable for ill-health? [5]
(c) What is environmental impact assessment? Write the different steps involved. [7]
6. (a) Why is ozone important? [2]
(b) How is water pollution the cause of water-borne diseases? [5]
(c) How will environmental education help in the nature of environment? [7]
7. (a) What is acid rain? [2]
(b) What is radiation pollution? [5]
(c) What is air-pollution? What are its effects? Explain the control strategies. [7]

ANSWER TO MODEL - 1

1. (a) Define the "Source of Energy".

Ans. Source of Energy : An energy source may be defined as the one that can provide us with an adequate amount of energy in a usable form over a long period of time. These sources can be divided into the two major types :

- Renewable energy sources
- Non-renewable energy sources

The renewable energy sources are those energy sources which are either perpetually available in nature.

The non-renewable energy sources are those energy sources which have accumulated in nature over a long span of time (millions of years) and cannot be replenished in hundred years.

Accordingly, we may have the following types of energy sources :

- | | |
|--------------------------|---|
| (1) Solar energy | } Renewable energies & Non-renewable energies |
| (2) Wind energy | |
| (3) Tidal energy | |
| (4) Ocean thermal energy | |
| (5) Geo-thermal energy | |
| (6) Hydro-power | |
| (7) Biomass energy | |
| (8) Thermal power | |
| (9) Nuclear power | |

Hydrogen has been shown to be capable of being used as an alternative source of energy in the future.

(b) Explain the importance of solar energy.

Ans. Important of Solar Energy : The solar energy is the direct heat and light energy, released continuously by the sun, as the sun is a perpetual source of energy. The nuclear fusion reactions occurring inside the sun are understood to be releasing enormous quantities of energy in the form of heat and light. The solar energy, received by the near space surrounding the Earth, is estimated to be about $1.4 \text{ KJ/second/m}^2$. This constant is known as the solar constant.

Solar energy holds a tremendous potential for the future, since the total energy we receive each year from the sun is around 35,000 times the total energy being used presently by man. However, about 1/3rd of this total energy is either absorbed by the outer atmosphere, or reflected back into the space, through a process called albedo. In spite of such a huge amount of solar energy being received on earth, its present utilization is on a very small scale in homes and to heat up waters of swimming pools. In homes, it is being used for cooking food in solar water cookers, but on a very very small scale. Its use in solar water heaters to supply hot water in houses and hotels, however, is more popular. There is an urgent need to increase their use in hotels, hospitals, and individual homes to replace the usual electrical geysers, for obtaining hot waters for bathing and washing purposes. In future, solar energy can possibly be used to run cars, power plants and space-ships.

(c) What is Geo-thermal Energy ? Explain the uses of geo-thermal energy for electricity generation.

Ans. Geo-thermal Energy : It is a renewable source of energy. The geo-thermal energy which is otherwise known as heat energy is available in abundance inside the body of the Earth in the form of very high temperature as high as 4000°C . This high temperature inside the earth crust makes the fluid inside it very hot and can be used to evaporate water to form steam for generation of electricity or for direct heating purposes. The hot geothermal resources (fluid) can in fact be divided into the following two types :

- (i) High temperature resources, with temperatures above 150°C . They are mainly used for generation of electricity. The high temperature resources are generally restricted to the volcanic and geothermal zones of the Earth.
- (ii) Low temperature resources, with temperatures of the geothermal fluids below 150°C , are mainly used for direct heating purposes.

Use of Geo-thermal Energy for Electricity Generation:

To generate electricity, fluids above 150°C are extracted from underground reservoir contained in porous and fractured rocks at depths between a few hundred to 3000 metres from the ground surface, through drilling of production well. Some geothermal reservoirs yields steam directly, while some others may produce water and steam both, from which steam is separated

and fed to a turbine engine couples to a generator to produce electricity. Some of the developed steam plants may be included with an additional flashing stage. Here the used steam is passed through condenser unit for cooling to convert it into water, which can be injected back into the underground geothermal reservoir to ensure its continued recharging. The heat withdrawn in cooling the steam is again reused, as direct heat energy. The line diagram of such an efficient flash steam power plant is shown in figure below. The size of such a steam power plant range from 0.1 to 150 MW.

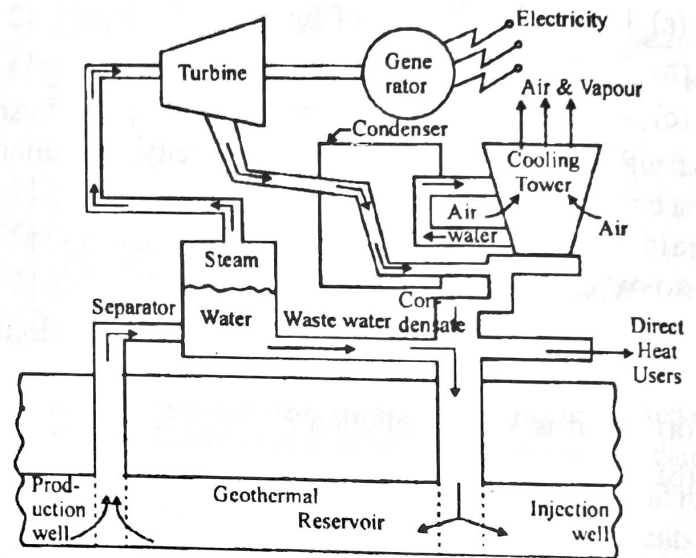


Fig : Flash Steam Power Plant

Although electricity is usually developed from high temperature geothermal sources having temperatures more than 150°C , but the advanced types of plants have even been designed to generate electricity from geothermal resources having temperatures between 100°C and 150°C . This is being done by using binary plant technology. In this method, the hot fluid obtained from the geothermal low temperature sources is passed through a heat exchanger to heat up a secondary working fluid like isobutane, isopentane or ammonia, which vaporises at a lower temperature than water. The vapour of this secondary fluid are then directed on the turbine blades to run the generator to produce electricity. The secondary fluid vapour, after coming out of the turbines is condensed by passing it through a condenser, before being reheated again by the geothermal water for re-vaporisation to pass through turbines and the cycle loop continues as shown. The size of a binary power plant may range from 0.1 to 40 MW.

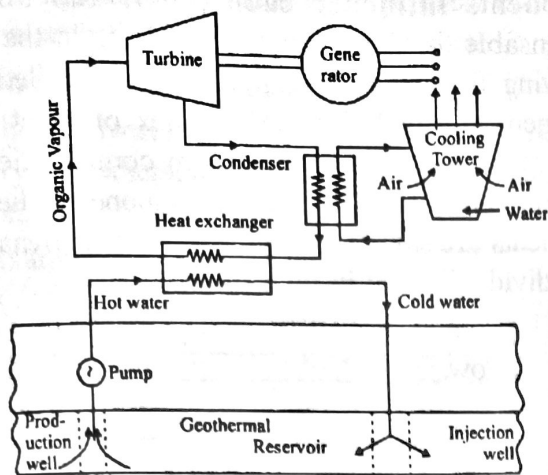


Fig : Binary Cycle Power Plant Producing Power from Low Temperature Geothermal Fluids.

2.(a) What is Green Technology ?

Ans. As the name implies green technology is one that has a 'green' purpose. By green we do not mean the colour, however, mother nature is quite green and the long short term impact, an invention has on the environment is what we are talking about. Green inventions are environmentally friendly inventions that often involve energy efficiency, recycling, safety and health concerns, renewable resources and more.

Example of Green Technology would be solar cells, wind turbines, bioreactors, reusable water bottle etc.

(b) What are the various gas pollutant ?

Ans. The various Gas Pollutant are :

The atmospheric air may contain hundreds of air pollutants from the natural or the anthropogenic sources. All these pollutants which are emitted directly from the identifiable sources, either from the natural hazardous events like dust storms, volcanoes etc. or from human activities like burning of wood, coal, oil in homes or industries or automobiles etc. are called the primary pollutants. The following five primary pollutants contribute to about 90% of the global air-pollution.

(i) Oxides of Sulphur, Particularly the Sulphur Dioxide (SO₂) :

Sulphur dioxide (SO₂) is the basic air-pollutant amongst all the oxides of sulphur.

SO₂ mainly originates in the atmospheric air from the refineries and chemical plants, smelting operations, and burning of fossil fuels. Thermal power plants may emit SO₂ quantities as high as 1/10 th of the coal burnt by them. Open burning of garbage as well as municipal incineration plants may also emit sulphur dioxide in the air.

(ii) Oxides of carbon like carbon monoxide (CO) and carbon dioxide (CO₂), particularly the carbon monoxide (CO) :

Carbon monoxide is a colourless, odour less and toxic gas, produced when organic materials like natural gas, coal or wood are incompletely burnt. Vehicles exhausts are the single largest source of carbon monoxide, as the number of vehicles have increased and is increasing by leaps and bound over the world. Poorly maintained vehicles and those having inefficient engines, without being fitted with adequate pollution control devices, release greater amounts of carbon monoxide.

(iii) Oxides of Nitrogen, like NO, NO₂, NO₃ (expressed as NO_x) :

Atmospheric nitrogen may combine with oxygen at high temperatures, as generated during fuel combustion, to form nitrogen oxide (NO). The nitrogen oxide (NO) at low levels is relatively harmless, but at high concentrations may cause asphyxiation and respiratory discomfort, because it combines about 3 lakh times faster with haemoglobin than oxygen. Larger concentrations may cause quick deaths.

The oxides of nitrogen originates into the atmosphere from automobile exhausts, incineration plants, furnace smokes, etc. all involving high temperatures due to combustion of fuel.

Oxides of nitrogen become more significant, as they are involved in the formation of secondary air pollutants, such as ozone.

(iv) Volatile Organic Compounds, mostly Hydrocarbons (HC) :

Hydrocarbons are the groups of compounds consisting of carbon and hydrogen atoms. They are either evaporates into the atmosphere from the petroleum fuel supplies or are emitted out in the automobile exhausts as the remnants of petroleum fuel that did not burn completely. The hydrocarbons may, therefore, also be contained in the smokes of incinerations using petroleum fuel for burning. They may also be contained in the fumes of oil refineries.

(v) Suspended Particulate Matter (SPM) :

The particulate matter in air may occur in air largely in solid form as particles of dust, smoke, fume, etc. and also in liquid form as mist and fog. The particles larger than a molecule but small enough to remain suspended in air are called aerosols.

The suspended particulate matter in the

atmosphere is a variable component and is introduced either through natural phenomena like winds, volcanic eruptions, pollens and spores, decomposing particles of organic matter, etc. or through human activities like mining, burning of fossil fuels, industrial processes etc.

Certain less important primary pollutants are hydrogen sulphide (H_2S), hydrogen fluoride (H_2F) and other fluorides, methyl and ethyl mercaptans, etc. which are usually rarely found in our general atmosphere, although if present, may prove quite harmful.

These primary pollutants often react with one another or with water vapour, aided and abetted by the sunlight, to form entirely a new set of pollutants, called the secondary pollutants. These secondary pollutants are the chemical substances, which are produced from the chemical reactions of natural or anthropogenic pollutants or due to their oxidation, caused by the energy of the sun. These new pollutants are often more harmful than the original basic chemicals that produce them.

The important secondary pollutants are :

- (i) Sulphuric acid (H_2SO_4)
- (ii) Ozone (O_3)
- (iii) Formaldehydes and
- (iv) Peroxy-acyl-nitrate (PAN) etc.

H_2SO_4 is formed by the simple chemical reaction between SO_2 and H_2O vapour, and is a much more toxic pollutant than SO_2 , having far reaching effects on environment, since it causes acid rains.

Other secondary pollutants like ozone, formaldehyde, PAN etc. are formed by the photo-chemical reactions, caused by sun light between two primary pollutants. For example, O_3 is formed due to the photo-chemical reaction between hydrocarbons (HC) and nitrogen oxide (NO). Similarly, aldehydes may be formed by photo-chemical oxidation of hydrocarbons in the atmosphere.

(c) Explain the different components of an Ecosystem.

Ans. Ecosystem is defined as any unit that includes all of the organisms in a given area interacting with the physical environment, so that a flow of energy leads to clearly defined trophic structures, biotic diversity and material cycles within the environment.

Components of Ecosystem :

Ecosystem is a complex interaction and interdependence of living and non-living factors. It is a dynamic system where in the living and non-living

components influence each other, and both are indispensable for the maintenance of life in the world. The living factors in the environment is called biotic component and includes the complex of plant (flora) animal (fauna) and micro-organism communities. The non-living factor is called abiotic component. These two components are said to exhibit considerable dynamism, both individually and in their interactions.

The components of the ecosystem are presented in figure below.

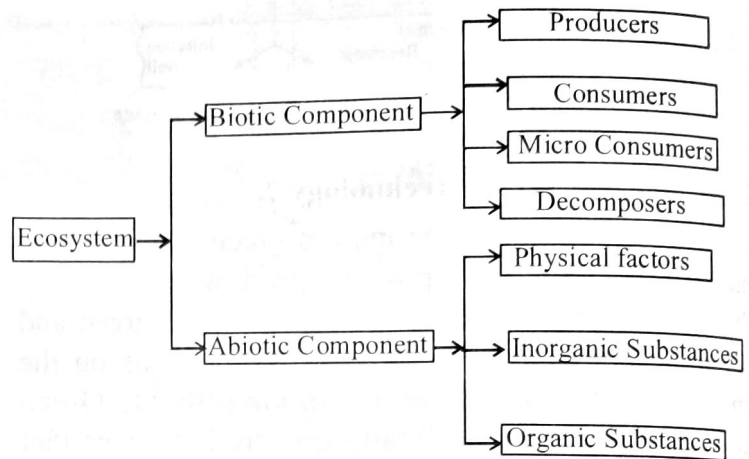


Fig: Components of Ecosystem

(a) Biotic Components : The living organisms including plants, animals and micro-organisms (Bacteria and Fungi) that are present in an ecosystem form the biotic components. From the trophic stand-point, they may be divided into four main groups :

(i) *Producers or Autotrophs* : They are self-nourishing green plants and certain photo-synthetic or chemosynthetic bacteria, which can convert the light energy into chemical energy in the form of organic compounds needed by the plants for their own growth and development. They are known as Autotrophs (i.e., auto = self, trophos = feeder). Oxygen is produced as a by-product that is needed by all living organisms for respiration. They are also known as converters or transducers, as they change radiant energy into chemical form. About 99% of living organisms are producers.

(ii) *Consumers or Heterotrophs* : The animals lack chlorophyll and are unable to synthesise their own food. Therefore, they depend on the producers for their food. They are known as heterotrophs (i.e., heteros = other, trophos = feeder).

An organism that feeds upon the producers is called a primary consumer or herbivores.

Example are rabbit, deer, goat etc.

An organism that feeds upon primary consumer is called a secondary consumer or carnivores.

Examples are cats, snakes etc.

The herbivores and carnivores together are known as tertiary consumers, macro-consumers, phototrophs or biophores.

Examples are wolves.

Animals that feed upon macro or tertiary consumers and are not eaten up by any other animal are known as quaternary consumers or omnivores. Examples are lions and tigers.

An animals that feeds upon another animal is known as predator. The animal that is fed upon, whether it is herbivore or a carnimore, is referred to as prey.

(iii) *Micro consumers* : They include parasites, detritus feeders and decomposers. Parasites become intimately associated with their host and feed on it over an extended prior of time, typically without killing it but usually causing harm to it. Some parasites, such as tape worms live inside their host and are called endoparasites. Other parasites, such as lice, attach themselves to the outside of their host and are called ectoparasites.

The dead plant material, dead animal bodies and faecal wastes, all comprise a mass of dead organic material called detritus. Organisms that feed upon detritus are often considered as detritus feeders.

(iv) *Decomposers or Reducers* : Much of the detritus, particularly dead leaves and wood is apperently not eaten by detritus but nots, decays and decomposes. Actually, this rotting or decomposition is caused by the feeding activity of certain oranisms called decomposers. They are fungi and bacteria. The decomposers are also known as saprotrophs (i.e., sapos = rotten, trophos = feeder).

(b) Abiotic Components : The non-living factors or the physical environment prevailing in an ecosystem from the abiotic components. They have strong influence on the structure distribution and inter-relationship of organisms.

Structurally, abiotic components include :

(i) *Physical factors* : Physical factors such as light, temperature, precipitation, humidity, wind, soil, topography etc.

(ii) *Inorganic substances* : Inorganic substances include water, minerals and gases. The inorganic substances required for the synthesis of organic

substances are biogenetic substances. The minerals and atmospheric gases keep on cycling. They enter into biotic systems and after the death and decay of organisms, return to the soil and atmosphere. This is known as biogeochemical cycle. This circulation of materials involve trapping of solar energy by green plants, which is ultimately lost by the organisms in several ways.

(iii) *Organic substances* : Organic substances include carbohydrates, proteins, lipids and humus. There are innumerable interactions among these abiotic factors. Despite their complexity, consideration of these factors is very important, because they determine the type or structure of the ecosystem. However, the overall structure of the ecosystem may be determined by a single abiotic factor known as limiting factor. For most of the land areas, the amount of rain fall in the limiting factor, which is responsible for the categorisation of the ecosystem into forests, grasslands or deserts.

(iv) *Climatic factors* : These include rain, temperature, light, wind, humidity etc.

(v) *Edaphic factor* : These include soil, p^H , topography minerals etc.

3. (a) What is Water-Pollution ?

Ans. Water-Pollution : Water pollution is defined as the alternations in the physical, chemical or biological characteristic of water due to the presence of solid, liquid or gaseous substances in as much quantity as to make it harmful to public health or to be health of other biotic life, including animals, plants or aquatic organisms. Such a polluted or contaminated water becomes unsuitable for domestic, commercial, industrial, agricultural or other legitimate uses.

(b) Explain the different components of water pollution.

Ans. Different Components of Water Pollution:

Water pollution is defined as the alterations in the physical, chemical or biological characteristics of water due to the presence of solid, liquid or gaseous substances in as much quantity as to make it harmful to public health or to the health of other biotic life, including animals, plants or aquatic organisms. Such a polluted or contaminated water becomes unsuitable for domestic, commercial, industrial, agricultural or other legitimate uses.

A water may become polluted due to various types of pollutants.

(i) Pathogens or Pathogenic Bacteria :

Bacteria are the minute single cell organisms, possessing no defined nucleus and having no green material (chlorophyll) to help them manufacture their own food. They are reproduced by binary fission and may be of various shapes.

Most bacteria present in water are harmless, and under certain conditions beneficial to human beings, animals and crops. Such bacteria or micro-organisms are called non-pathogenic bacteria or non-pathogens. However, certain other bacteria are the deadly foes of humans as well as animals and may enter their tissues, causing serious water borne diseases, such cholera, typhoid, infectious hepatitis, etc., such harmful bacteria or organisms are known as the pathogenic bacteria or pathogens.

(ii) Biodegradable Oxygen Depleting Organic Matter :

The biodegradable organic matter in a water body is that larger fraction of the total organic matter, which is decomposed by bacteria under biological action within the water body. Since this oxidation of organic matter is caused by the bacteria, which consume the dissolved oxygen from water, this type of pollutants reduces the dissolved oxygen (DO) available in the given water.

The excessive disposal of organic matter in the given water body may, thus, quickly consume the D.O., killing all biological life, and turning the water body into a stinking dirty mass. To avoid excessive discharge of organic matter and large scale D.O. depletion in a water body, it becomes necessary to pre-treat the sewage and industrial effluents before they are discharged into the water body.

(iii) Non-Biodegradable Organic Substances and Chemicals :

The biodegradable organic chemicals represent another class of pollutants present in polluted waters. These substances may include organic substances like oils, gasoline, plastics, pesticides, cleaning solvents, detergents and many other chemicals. These are extremely harmful to aquatic life and human health. Moreover, pollutants like pesticides cannot be easily removed from the polluted waters by ordinary methods of treatment of raw waters.

(iv) Suspended Sediments of Inorganic Solids :

This class of pollutants represents the insoluble particles of soil and other inorganic solids that remain suspended in a moving water body like a river, but tend

to settle down as and when the velocity of the moving water reduces. These sediments are produced due to erosion of soil from the land. Higher concentrations of these suspended settleable solids in a moving water body interferes with the penetration of sun-light, which reduces the photosynthetic activity of aquatic plants and algae, living within the water body, thereby disturbing the ecological balance of its aquatic life.

(v) Inorganic Nutrients :

Compounds containing inorganic plant nutrients like phosphorus, nitrogen etc. if present in excessive quantities in a given water body, may pollute the water of that water body, since it leads to the excessive growth of plants and algae, which on decay and death, consume a lot of dissolved oxygen from the water, causing shortage of DO, leading to "fish kills" and ultimate development of anaerobic conditions and foul smelling putrefaction.

(vi) Water Soluble Inorganic Toxic Chemical Compounds of Heavy Metals :

This is another class of water pollutants, consisting of acids, salts and compounds of toxic heavy metals, such as arsenic, mercury, lead, cadmium, etc. The presence of higher concentrations of these metallic chemicals in water may cause several diseases, to make it unfit to drink to harm fish and other aquatic life, to reduce crop yields, and to accelerate the corrosion of equipment coming in contact with such polluted waters.

(vii) Water Soluble Radioactive Isotopes :

Water soluble radioactive isotopes may also pollute the surface waters, as they may get concentrated in various tissues and organs by passing through the food chain, as in the case of toxic heavy metals and pesticides. The ionizing radiations emitted by such isotopes may cause birth defects and genetic changes.

(viii) Hot Water Releases Causing Thermal Pollution :

The hot waters released by power plants and industries, using large volume of water for cooling processes, may result in a sharp and sudden rise in the temperature of the local water bodies, causing what is known as the thermal pollution.

Although small amounts of heat released into a water body may not have any serious repercussions, yet large quantities may certainly kill heat-in tolerant plants and water animals. Elimination of heat intolerant species would lead to flourishing of heat tolerant species, which are usually less desirable species.

(ix) Volatile Synthetic Organic Chemicals :

Volatile synthetic organic chemicals are usually not found in surface waters due to their tendency to evaporate. They may, however, be found in ground waters, due to leakages from the under ground storage tanks, or from the waste waters containing such chemicals - seeping to the underground reservoir, or due to infiltration of rain water bringing such chemicals from the air atmosphere. These synthetic volatile organic chemicals (VOC_s) are produced and used in various industries and are extremely harmful to human health as they are highly carcinogenic and mutagenic.

(c) Describe the various methods of controlling Air-pollution from the Industry.

Ans. Various Methods of Controlling Air-pollution from the Industry : Industry is the single largest source of pollution in all over the world. The public can take individual and collective action to reduce industrial pollution. Following are some methods being adopted to control air-pollution from the industries.

(i) *Dilution method for controlling air-pollution from stationary sources or factories :* These can be done by spreading the emitted smokes from thermal power plant, diesel generator sets etc. Over a larger area through the use of high rise chimneys, thereby transporting the pollutants over larger distances, and, thus, reducing the pollution near the emission source.

(ii) *Controlling air-pollution from stationary sources (factories) by installing engineering devices :* The important engineering devices, which are used to control emission of particulate matter, from the industrial activities are :

- Gravitational settling chambers.
- Centrifugal collectors including cyclone collectors and dynamic precipitators.
- Wet scrubbers (collectors) including spray towers, venturi-scrubbers and wet cyclone scrubbers.
- Electrostatic precipitators (ESP).
- Fabric filters.

The important engineering devices which are used to control emission of gaseous pollutants from the industrial activities are :

- Absorption units like spray towers and venturi scrubbers.
- Adsorption units like adsorption towers.
- Combustion or incineration devices, using direct flame combustion and catalytic combustion.

- Chemical alteration of the pollutant usually through combustion or catalytic treatment.

(iii) *Changing the raw materials :* If a particular raw material is responsible for causing air-pollution, use of a pure grade of raw is often beneficial and may reduce the formation of undesirable impurities and byproducts or may even eliminate the troublesome effluent. A typical example of this approach is the use of low-sulphur fuel in place of high sulphur ones. LPG (Liquid petroleum gas) and LNG (Liquified natural gas) may be used in place of coal, as they will produce much less pollutants in the emissions.

(iv) *Process changes :* Replacement of old obsolete processes in industries with the new efficient processes may also lead to reduced pollution emissions. For example, rotary kilns are a major source of dust generation in cement plants. Some degree of dust control may be achieved in the kiln operation by adjusting operating conditions. Reduction of feed gas velocities within the kiln, modification of the rate and location of feed introduction and employment of a dense curtain of light weight chain at the discharge end of the kiln can lead to dust control.

(v) *Equipment modification or replacement :* Air-pollutant emissions can be minimized by suitable modification or replacement of process equipment.

For example – Replacement of the open hearth furnace by oxygen furnace in steel industry and development of an alternative power source for automobiles in place of the I.C. engine are examples of equipment alternation.

(vi) *By complete combustion of fuels :* When a pollutant is to be destroyed, the combustion must be complete, otherwise intermediate products of combustion will form which may be more noxious than the original contaminant. For complete combustion, the oxygen must come into intimate contact with the combustible material through adequate turbulence at sufficiently high temperature and have a sufficiently long residence time. In fact time, temperature and turbulence have so predominant role in combustion reaction that they are often called the “three T’s of combustion.”

Other measures of prevention of industrial pollution are as follows :

- Properly centralize factories to reduce wastes emission from a single area.
- Consolidate legal systems for environmental

protection, integrate legal approaches, administrative methods, economic measures, technologic methods and thinking education.

- Establish evaluation system for environments of industrial production and construction and also include environmental protection into economic responsibility system of all levels.
- Afforestation : A heavily forested area is capable of reducing wind speed and drop down the large dust particle in the air, the rough surface of leaves is capable of absorbing and attaching plenty of floating dust.
- Support companies that promote green methods of production and products.

4. (a) What is life cycle assessment ?

Ans. Life Cycle Assessment is a tool to evaluate the environmental consequence of a product or an activity holistically across its entire life, i.e., looking at the resources usage and release to the environmental starting from the steps involved in its preparation, uses and after the expiry of the product. In this assessment both manufacturers and consumers are experiencing the need to look at the cradle-to-grave environmental consequence of the products they make or use. The cradle-to-grave principle means that all aspects of environmental impacts have to be considered from the raw material to the finished products during use and final disposal of the used products.

The Life Cycle Assessment is a process to assess :

- (i) The environmental burdens associated with the product, process or activity by identifying and quantifying the energy, materials used and wastes released to the environmental.
- (ii) The impact of these energy and raw materials used and unwanted release to the environment.
- (iii) To identify and evaluate opportunity to effect environmental improvements.
- (iv) Devise ways and means to decrease environmental release and use of energy and raw materials.
- (v) Establishes relationship among resource depletion, pollution and sustainable development.

(b) Discuss the power of Central Government to protect and improve environment.

Ans. Subject to the provisions of Environmental Protection Act, 1986, the Central Government shall have

the power to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of environmental and preventing, controlling and abating environmental pollution.

The measures include all or any of the following :

- (i) Co-ordination of actions by the State Governments, officers and other authorities –
 - (a) Under this Act or the rules made there under, or
 - (b) Under any other law for the time being in force which is relatable to the objects of this Act.
- (ii) Planning and execution of a nation-wide programme for the prevention, control and abatement of environmental pollution.
- (iii) Laying down standards for the quality of environment in its various aspects.
- (iv) Laying down standards for emission or discharge of environmental pollutions from various sources whatsoever, provided that different standards for emission or discharge may be laid down under this clause from different sources having regard to the quality or composition of the emission or discharge of environmental pollutants from such sources.
- (v) Restriction of areas in which any industries, operations or process shall not be carried out or shall be carried out subject to certain safeguards.
- (vi) Laying down procedure and safe-guards for the prevention of accidents which may cause environmental pollution and remedial measures for such accidents.
- (vii) Laying down procedures and safe-guards for the handling of hazardous substances.
- (viii) Examination of such manufacturing process, material and substances as are likely to cause environmental pollution.
- (ix) Carrying out and sponsoring investigations and research relating to problems of environmental pollution.
- (x) Inspection of any premises, plant, equipment, machinery, manufacturing or other process, materials, or substances and giving by order, of such direction to such authorities, officers or persons as it may consider necessary to take steps for the prevention, control and abatement of environmental pollution.

(xi) Establishment of environmental laboratories and institutes to carry out the functions entrusted to such environmental laboratories and institutes under this Act.

(xii) Collection and dissemination of information in respect of matters relating to environmental pollution.

(xiii) Preparation of manuals, codes or guides relating to the prevention, control and abatement of environmental pollution.

(xiv) Such other matters as the Central Government deems necessary or expedient for the purpose of securing the effective implementation of the provisions of this Act.

Now-withstanding anything contained in any other law but subject to the provisions of this Act, the Central Government may, in the exercise of its powers and performance of its functions under this Act, issue directions in writing to any person, officer or any authority and such person, officer or authority shall be bound to comply with such directions.

(c) What are the policies for environmental management keeping the pace of economic growth ?

Ans. Protection of environment is a major problem of present. Without adequate environmental protection, development is undermined. There are two ways - in which it can happen. First, environment quality - water that is safe and plentiful and air that is healthy in itself part of the improvement in welfare that development attempts to bring. Second, environmental damage can undermine future productivity. Ecosystems that are destroyed in the name of rising incomes today can jeopardise the prospects for earning income tomorrow.

Economic growth can cause environment problems, but can also with right policies and institutions, help address them. Three problem patterns as follows :

First some problems decline as income increases. Secondly, some problems initially worsen but then improve as income rises. Most form of water and air-pollution fit into this category. There is nothing automatic about this improvement, it occurs when governments deliberately introduce policies to ensure that additional resources are devoted to dealing with environment problems. Thirdly, some indicators of environmental stress worsen as incomes increases.

Emission of carbon and nitrogen oxides and municipal wastes are current examples. In these cases abatement is relatively expensive, but here also, the key is again policy.

Two broad sets of policies are needed to attack the causes of environmental damages. The first set of policies seeks to harness the positive links between development and environment by correcting or preventing policy failures, improving access to resources and technology, and promoting equitable income growth.

This Includes :

- (i) Removing subsidies that encourage excessive use of fossil fuel, irrigation water, pesticides and excessive logging.
- (ii) Clarifying rights to manage and own land, forests, and fisheries.
- (iii) According to provisions of sanitation and clean water, education, family planning, service, agricultural extension, credit and research.
- (iv) Taking measures to empower, educate and involve farmers, local communities, indigenous people and women so that they can make decision and investment in their long-term interests.

The second set of policies are targeted at specific environmental problems.

Policies designed for this purpose are of two broad type:

- (i) Those based on incentives, which tax or charge polluters according to the amount of damage they do.
- (ii) *Those based on quantitative restrictions, which provide no such flexibility.*
 1. Trade offs between income and environmental quality need to be carefully assessed, taking long term, uncertain and irreversible impacts into account.
 2. Standards and policies need to be realistic and consistent with the monitoring and enforcement capacity and the administrative traditions of the country.
 3. Policies need to work with gain of the market rather than against it, using incentives rather than regulations where possible.
 4. Local participation should be encouraged, in setting and implementing environmental policies. The costs of protecting and improving the

environment are high in absolute terms, but they are modest in comparison with the potential gains from economic growth.

5. (a) What do you mean by environmental audit ?

Ans. Environmental Audit is defined as the basic management tool comprising of systematic, documented, periodic and objective evaluation of an organisation. It helps the management of an industry to evaluate the effectiveness of its overall environmental management system as well as assess their compliance with the company policies to meet the regulatory requirements.

Environment Audit aims at :

1. Assessing the probable risks and hazards associated with the malfunctioning of the pollution control unit.
2. Assessing the scope of optimum utilisation of the resources.
3. Improving energy utilization.
4. Establishing performance base line.
5. Setting priority and plans for future environment.
6. Increasing awareness of the employees about their role and responsibility in the protection of environment.

Environmental audit follows through steps, i.e., pre-audit, site visit and post audit. Pre-audit is the planning of the audit programme and site visit include, meeting with staff, inspection, examination of records, identifying the sources and available monitoring facilities etc. The post-audit activity involves a written assessment of the facilities compliance status which include recommendation to correct deficiencies. The important part of the post audit step is the active and meaningful participation of the industry personnel during the environmental audit to develop meaningful environmental audit report.

(b) How air pollution is accountable for ill-health ?

Ans. Air-pollution is a growing threat to health throughout the world. It was considered a great threat after the terrible incidence of epidemics of asthma in USA and Japan in 1995 and death of about 4000 people in London in 1852. Air-pollution reduces the quality of air we breath by limiting the availability of oxygen. Besides, we are forced to breath in substances that are harmful to lungs. Exposure to smoke or fine dust immediately causes irritation to eye, nose, throat, etc. while other pollutants may cause watering of eyes,

burning in and blocking of nose, sneezing and headache. This may be followed by irritation in throat, change in voice, cough and so on. Some gases on deeper penetration cause irritable cough, difficulty in breathing, increased rate of respiration and other severe problems that may be fatal. These are some acute effects which are immediately manifested after exposure to pollutants. Most air-pollutants cause respiratory problems. Long exposure may result in diseases like emphysema, bronchitis, chronic cough and asthma.

Smoggy polluted air contributes to serious health problems such as allergies and heart diseases. One of the components of smog is carbon monoxide which on breathing interferes with the binding of oxygen to haemoglobin in red blood cells. The increase in the levels of carbon monoxide in heavily congested traffic may cause headache. Other air-pollutants such as oxides of nitrogen, lead, hydrocarbons, particulate matter produced by automobile exhaust and sulphur dioxide produced on burning of coal or oil containing sulphur. Air-pollution causes chronic bronchitis, pulmonary fibrosis, acute and chronic bronchitis, pulmonary fibrosis, acute and chronic asthma, edema of respiratory tract and emphysema.

The particulate insoluble matter like dust, carbon, asbestos, etc. is deposited in the lungs, whereas the soluble matter like metal fumes enter the blood and carried to other sites where it may accumulate. In either case, the pollutants may damage or kill many cells. The sudden death of cells in a short time leads to secondary effects. The death cells releases harmful substances that causes blood capillaries to expand and water to come out of the capillaries. The water accumulates in the nearby tissues, making them swollen. If it accumulates in the alveoli, the rate of gas exchange by lungs reduces. The heart is affected because it has to work harder to cope with oxygen stress. Although all parts of the respiratory system work hard to eliminate a pollutant, long-term exposure give rise to acute and chronic irritation, inflammation, excessive mucous production and impairment of lung function. The diseases like silicosis, byssionosis, bagassosis, asbestosis, anthracosis, talcosis caused by dusts. If dust stays in the respiratory system for many years fibrosis occurs and function of lungs decreases. This in turn put stress on heart.

In the advanced stage, the patient suffer breathlessness all the time and eventually dies, such effects depend on :

- (i) Chemical composition of dust.
- (ii) Particle size of the dust.
- (iii) Concentration of dust in the air.
- (iv) Period of exposure.
- (v) Health status of the person exposed.

This health effect of air-pollution are very severe and prolonge exposure may cause fatal.

(c) What is environmental impact assessment ? Write the different steps involved.

Ans. Environment impact assessment is vey important step involved in the decision making process. It must be carried out before the final decision is taken about any project. However, it is considered by the project proponents as a regulatory requirement and post decision activity. This defeats the very purposes of EIA. In order to prepare a thorough and unbiased report regarding the project, the EIA should be carried out by a non-interest party. The project proponents and those who oppose are considered as interested parties.

The EIA consists of different steps such as :

- (a) project initiation,
- (b) planning and designing of the project,
- (c) baseline survery,
- (d) public consultation,
- (e) final decision.

Project planning and design : This is the very early step taken by the project developer after conceiving the idea about the project.

This step involves :

- 1. Review of the alternatives ways to meet the overall objective of the project including zero option, i.e., abandoning the project.
- 2. Examination of alternative location for the proposed project if it is not location specific.
- 3. Study of the alternative process design, site layouts and other facilities of the proposed project.

Technical and financial studies should be done to arrive at optimizing environmentally compatible alternatives while accomodating, to the extent possible, all other vital interests of the developer. In this step, the various alternatives available will be many and detailed EIA studies for all the alternatives is neither possible nor necessary. Most of the alternatives are eliminated by a rapid environmental sreeening (RES) systematic

EIA study may be made for only one or two final alternatives after RES.

Base Line Study and Impact Assessment :

The environmental components where the impact is felt are :

- 1. The receiving environmental media i.e., air, water and land.
- 2. The living acceptors i.e., man, flora and fauna.
- 3. The built environment i.e., buildings, monuments etc.
- 4. Social environment i.e., economic status, social system and culture.

After getting the baseline informations, impact assessment is undertaken. Impact can be both positive and negative. The impacts are not restricted to those of direct or immediate nature and they are not necessarily independent of each other. All the impacts will have a combined effect on man, his activity and quality of life. Impact on the environmental components include decrease of non-renewable resources. Change in air and water quality, land use pattern and quality of land.

Socio-economic impacts are many and complicated. The positive impact are increased employment, and standard of living. Negative impacts include involuntary displacement of some people and change in socio-cultural values particularly of the indigenous population.

Public Consultation : In a professional decision-making process, the technical experts take the decision after examination of all the aspects of the process. Opinion of all other stake holders are not taken into consideration. Very often the technical experts fail to appreciate the social dimension. A sound decision-making process, should be transparent and participatory in nature where views of all stake holders, including environment interest groups are taken in consideration.

Clean Technology : Adoption of clean technologies, particularly in manufacturing process, have become an absolute necessity. Cleaner technologies are practical application for knowledge, methods and means to provide the most rational use of natural resources and energy in order to protect the environment. Raw materials are utilised to produce the desirable product in an industry. Air, water and land pollution is caused by the discharge of waste materials generated in the manufacturing process. The waste material may contain the unused raw material and products

economically unfit are disposed off. The approaches to cleaner technology are waste minimisation, waste utilization.

The objective of pollution control is to protect the recipient medium and set an acceptable limit for environmental quality standards. The environmental quality standards are expressed as the maximum permissible concentration of a pollutant in the ambient air and water. The geo-climatic condition and the extent of sensitivity of an area are taken into consideration in fixing the ambient air quality standard.

6. (a) Why is ozone important ?

Ans. Ozone is a form of oxygen containing three oxygen atoms. It is present in the air in the trace amount and its concentration increases reaching the maximum height of about 25 km upward. In the stratosphere it plays a major role in preventing ultraviolet radiations from reaching the earth.

(b) How water pollution is the cause of water borne diseases ?

Ans. Man's health may be affected by the ingestion of contaminated water either directly or indirectly through food, and by the use of contaminated water for the purpose of personal hygiene and recreation. The hazards of water pollution may be classified into two broad groups - biological and chemical.

Biological Hazards : These comprise the classical water borne diseases caused by the presence of an infective agent or an aquatic host in water. The water borne diseases those caused by infective agent such as viral hepatitis, poliomyelitis due to presence of viruses. The diseases like - cholera, typhoid, paratyphoid, bacillary dysentery, colidiarrohea, rota virus diarrhoea are caused by bacterias. Amoebiasis, giardiasis, round worm, whipworm, thread worm are also make their entry through water. Some diseases are also caused due to presence of aquatic hosts. The cyclops is the cause of guinea worm, fish tape worm and snail is the cause of schistosomiasis.

Chemical Hazards : Chemical pollutants of diverse nature derived from industrial and agricultural wastes are increasingly finding their way into public water suppliers. These pollutants include, detergent, solvents, cyanides, heavy metals, minerals and organic acids, nitrogenous substances, bleaching agents, dyes, pigments, sulphides ammonia, toxic and biocidal organic compounds of great variety. Chemical pollutants may

affect human health not only directly but also indirectly by accumulating in aquatic life used as human food.

The present concern about chemical pollutants in water relates not so much as to their acute toxic effects on human health as to the possible long term effects of low level exposure, which are often non-specific and difficult to detect. While pollution seems to be an inevitable consequence of modern industrial technology, the problem, now is to determine the level of pollution that permits economic and social development without presenting hazards to health. The water borne communicable diseases and water borne chemical hazards can be disappeared by providing safe drinking water and following zero effluent discharge to water bodies.

(c) How environmental education will help in nature of environment ?

Ans. The important of environmental education cannot be over emphasized, because environmental is common heritage and its restoration either through preventive or curative strategie is an enormous task. Each individual must develop a stake and becomes its protector. Environment is essentially partnership programme in which an individual plays a pivotal role. If individuals are environmentally educated, the society and government are automatically educated because the latter two are only an extension of an individual.

Environmental pollution is a social problem. The success of environmental protection and preservation depends upon the success of environmental education of the society. Awareness of the problem due to pollution and committment to their solution will definitely help to protect our environment.

The objective and during principle for developing environmental education in all these countries are as follows :

1. **Awareness :** To help social groups and individual so as to get an awareness of an sensitivity to the total environmental and its called problems.
2. **Knowledge :** To help social groups and individuals so as to gain a variety of experience in and get a basic understanding of the environment and its associated problems.
3. **Attitude :** To help social groups and individuals achieve a set of values and filling of concern for the environment and the motivation for activity participating in environmental improvement and protection.

4. **Skill** : To help social groups and individuals so as to acquire skills for identifying and solving environmental problems.

5. **Evaluation ability** : The help individuals and social group so as to evaluate environmental measures and education programme in terms of ecological, economic social, aesthetic and educational factors.

6. **Participation** : To give social groups and individuals an opportunity so as to be actively involved at all levels in working towards the resolution of environmental problems.

Guiding Principles :

The guiding principles of environmental education are :

1. The environment has to be considered in its totality natural as well as built technological and social, economic, political, moral, cultural, historical and aesthetic aspects.
2. Environmental education should be an interdisciplinary in its approach. The specific contents of each discipline should play specific role in making possible a holistic and balanced perspective.
3. Environmental education should be an continuous life process which in beginning at the pre-school level and continuing through all formal and non-formal stages.
4. Environmental education should emphasize active participation in preventing and solving environmental problems.
5. Environmental education should examine major environmental issues from local, national, regional and international point of view so that learners get insights into environmental conditions in other geographical areas.
6. Environmental education should focus on current and potential environmental situations while taking into consideration the historical perspective.
7. Environmental education should explicitly regard environment aspects in plans for development and growth.
8. Environmental education should be able to promote the value and necessity of local, national and international co-operation in the prevention and solution of environmental problems.

9. Environmental education should emphasize the complexity of environmental problems and thereby the need to develop critical thinking and problem solving skills.

10. Environmental education should use diverse learning environment and a broad array of educational approaches with due stress on practical activities and first hand experience.

11. Environmental education should help learners to find out the symptoms and the real causes of environmental problems.

12. Environmental education should be able to relate environment sensitivity, knowledge, problem-solving and values classification at every grade laying, but special emphasis on environment sensitivity to the learner's own community in early years, and

13. Environmental education should make learners to have a role to planning their learning experience and give an opportunity for making decisions and accepting their consequences.

All Nations are spending crores of ruppees to keep this planet safe for the survival of human life. Within the co-operation of everyone, it is impossible to keep the earth clean and safe. To get the co-operation of all, the triple 'E' concept is appropriate i.e., E = Educate, E = Enact and E = Enforce. In this concept the first one is very important. If an individual is educated thoroughly and properly and convinced to observe eco-friendly technologies, he/she would definitely follow the same. Motivation is necessary at regular intervals for effective and fruitful practice. Educating every individual is a gigantic task.

7.(a) What is acid rain ?

Ans. Acid Rain : In a broad sense, acid rain refers to several ways in which acids from the atmosphere are deposited on the earth. Acid deposition includes wet and dry deposition. Wet deposition refers to acidic water received through rain, fog and snow. Dry deposition relates to the wind blown acidic gases and particles in the atmosphere, which settle down on the ground. About 60% of the acidity is due to sulphur gases and about 40% is due to nitrogen gases.

Nitrogen oxides (NO_x), volcanic carbons (VOCs) and sulphur dioxide (SO_2) are produced during combustion of coal (in industry) and petroleum (in automobiles). Lightning in sky also produces NO_x naturally. These gases are highly reacting in air. They

rapidly oxidise to acids (Sulphuric or nitric), which quickly dissolve in water and are washed out to the ground as "acid rain".

Normally rain water is slightly acidic (pH = 4.0 – 4.5) because water of CO_2 combines in air to form a weak acid. The pH of acid rain may be as low as 2.0.

(b) What is radiation pollution ?

Ans. Radiation Pollution : It is a physical phenomenon in which energy travels through space. There are two types of radiations : one is non-ionising e.g., ultraviolet rays, other is ionising e.g., X-rays, alpha, beta, gamma rays, protons and neutrons.

Sun is the source of spectrum of radiation such as radio-waves, infra-red, ultraviolet, X-rays, gamma rays, and cosmic rays. Besides, radioactive isotopes give off sub-atomic particles such as protons, neutrons, electrons, alpha particles in the process of decomposition from an unstable state to a stable state.

Non-ionising radiations : Radiations of shorter wavelength have greater energy and are harmful to micro-organisms. These radiations are capable of injuring only the surface tissue of higher plants and animals. They also increase the rate of mutation.

Ionising radiations : Ionising radiations are very high energy radiations that are able to remove electrons from atoms and attach them to other atoms thereby producing positive and negative ion pairs, known as ionising radiations. Ionising radiations induce mutations and break in chromosomes. The damage is more during the cell division process. In man, the sensitive areas are epithelial linings of the skin and intestines, blood forming cells in the bone marrow and reproductive cells. Excessive use of X-rays cause death of tissues.

Man-made radiations : The greatest exposure to human being comes from the diagnostic use of X-rays, about, 70 milirems a year per person, and radioactive isotopes used as tracers. Radium dial wrist watches and TV sets add another millirem per day. Besides we are increasingly being exposed to cosmic radiations because of more radiations.

Nuclear wastes : Nuclear wastes from Atomic power plants come in the form of spent fuel of uranium and the by-products such as plutonium. It is estimated that these can remain toxic to humans for over 200,000 years. Radioactive waste, another waste from the power atomic plants, can cause cancer of thyroid glands. Wastes coming from the production of nuclear weapons,

produces radioactive strontium and calcium both of which are carcinogenic. These materials generate heat and penetrating radiations from centuries. The nuclear wastes such as contaminated dust, debris, clothing, industrial clothing, ash etc. when dumped into the soil, pollute the drinking water. It is therefore, necessary that the wastes coming from power stations and defence establishments should be carefully handled, isolated, buried and protected.

(c) What is air-pollution ? What are its effects ? Explain the control strategies.

Ans. Air-pollution : The contamination of environment becomes pollution, on these elevated concentration begin to have an adverse effect called pollution. Pollution is an undesirable change in physical, chemical or biological characteristics of our air, land and water caused by excessive accumulation of pollutants. By polluting the environment, man has wiped out many of wild life and has pushed several other species in the danger of extinction. Pollution adversely affects biological species including humans. It damages our industrial processes, living conditions and cultural aspects by deteriorating our raw material resources.

Air-pollution may occur due to the increase in concentration of CO_2 , SO_2 and NO_3 and other green house gases and depletion of stratospheric ozone layer. Natural pollution results from volcanic eruption. UV radiation, soil erosion, dust storms, decomposition of organic matter etc.

Important Primary Air Pollutants :

(i) Carbon monoxide (CO) : It is highly poisonous to most of the animals. When inhaled CO reduces the oxygen carrying capacity of blood. It is a product of incomplete combustion of fossil fuels. Nearly 50% of all CO emission originated from automobiles.

(ii) Hydrocarbons (HCs) : These are generated during the burning of fossil fuel (coal and petroleum). HCs are produced naturally during decomposition of organic matter and by certain types of plants. Methane (CH_4), the most abundant hydrocarbon in the atmosphere.

(iii) Nitrogen oxides (NO_x) : NO_x are formed mainly from N_2 and O_2 during combustion of fossil fuels at high temperature in automobile engines. Nitrogen oxides cause reddish-brown haze (brown-air) in traffic congested city air, which contribute to heart and lung problems and may be carcinogenic.

Nitrogen oxides also contribute to "acid rain" because they combine with water droplets to produce nitric acid (HNO_3) and other acids.

Secondary Air Pollutants :

Secondary air-pollutants are formed during chemical reactions between air-pollutants and other atmospheric constituents e.g., water (H_2O) vapours.

1. Photo-chemical smog : It refers gray air. It is formed by addition of mainly of ozone (O_3) + Peroxyacetyl nitrate (PAN) + NO_x . It is generally called as brown air where solar radiation is intense. PAN affects leaf chloroplasts.

Oil Spills :

An accidental discharge of petroleum in ocean.

Green house gases :

CO_2 , CH_4 , N_2O , CFC-11 (Chlorofluorocarbons).
HFC-23 (Hydrofluorocarbons).

2. Acid Rain : In a broad sense, acid rain refers to several ways in which acids from the atmosphere are deposited on the earth. Acid deposition includes wet and dry deposition. Wet deposition refers to acidic water received through rain, fog and snow. Dry deposition relates to the wind blown acidic gases and particles in the atmosphere, which settle down on the ground. About 60% of the acidity is due to sulphur gases and about 40% is due to nitrogen gases.

Nitrogen oxides (NO_x), volcanic carbons (VOCs) and sulphur dioxide (SO_2) are produced during combustion of coal (in industry) and petroleum (in automobiles). Lightning in sky also produces NO_x naturally. These gases are highly reacting in air. They rapidly oxidise to acids (Sulphuric or nitric), which quickly dissolve in water and are washed out to the ground as "acid rain".

Normally rain water is slightly acidic ($\text{pH} = 4.0 - 4.5$) because water of CO_2 combines in air to form a weak acid. The pH of acid rain may be as low as 2.0.

Effects of Acid Rain :

- (i) Damage building material and furnishing fabrics, territorial and aquatic vegetation.
- (ii) Low pH condition of acid rain also damages soil microbial community.

According to the physical nature of pollutants, the other categories can be named as Gaseous pollution, Dust pollution, Thermal pollution, Noise pollution and Radioactive pollution etc.

From ecosystem point of view, pollutants can be categorized into three groups :

1. Non-biodegradable pollutants : For example, DDT, BHC, waste plastic bottles, polythene bags, used soft drinks cans, Non-biodegradable pollutants are difficult to manage.

2. Biodegradable pollutants : For example, market garbage, livestock wastes and municipal sewage. Biodegradable pollutants are easily manageable by natural process or in engineered systems like waste treatment plants.

3. Aerosols : Aerosols refer particulate matters i.e., it comprises solid particles as liquid droplets, small enough to remain suspended in air e.g., soot, smoke, dust, asbestos, fibres, pesticides, some metals including Hg, Pb, Cu and Fe and also biological agents like tiny mites and flower pollen.

Table 1 : Major Pollutants and Their Sources :

Pollutant	Sources
Carbon monoxide	Incomplete fuel consumption, burning of sulphur containing fuel life coal in power plants and emission by vehicles.
Oxide of nitrogen	Fuel consumption of motor vehicles, emission from power station, industrial furnaces.
Volatile hydrocarbons	Partial combustion of carbonaceous fuels.
Oxidants and ozone	Emission from motor vehicles, photo-chemical radiations of nitrogen oxides and reactive hydrocarbons.
Suspended particulate	Emission from motor vehicle. Smoke from domestic industrial and vehicular sources.

Table 2 : Pollutants and Their Health Hazards :

Pollutant	Health Effects
Carbon monoxide	Fata in case of large dose, aggravates heart disorders, affects central nervous system, impairs oxygen carrying capacity of blood.
Nitrogen oxide	Irritation in respiratory tract.

Ozone	Eye, nose and throat irritation, risk asthmatic, children's and those involved in heavy exercise.
Lead	Extremely toxic; affects nervous system and blood, can impair mental development of children.
Hydrocarbons	Drowsiness, eye-irritation, coughing
Benzene	Carcinogenic
Aldehydes	Irritation of eye, nose and throat; sneezing, coughing, nausea, breathing difficulties, carcinogenic in animal.
Polycyclic aromatic	Carcinogenic

- (i) *Use of arrester* : Used to separate air-pollutant from contaminated air. Cyclonic separators, Trajectory separators.
- (ii) *Use of scrubbers* : Used to clean air for both dust and gases.
- (iii) *Filters* : Use of collect extremely fine particulate matters.
- (iv) *Electrostatic precipitators* : Most effective device.
- (v) *Combustion, absorption and adsorption process* : Done on large solid surfaces.
- (vi) *Efficient engines* : These have catalytic converter filters.

MODEL - 2

[BST - 501]

Full Marks - 70

Time - 3 Hours

Answer any five questions.

The figures in the right-hand margin indicate marks.

Procedure for Control of Air-pollution :

1. Important preventive strategies to control air-pollution are :

- (i) Suitable fuel selection (e.g., fuel with low sulphur content).
- (ii) Modification in industrial process and/or equipment to reduce emissions.
- (iii) Correct selection of manufacturing site and zoning for industrial set-up to disperse pollution sources (e.g., reducing pollutants to acceptable level by reducing or destroying the pollutant by thermal or catalytic combustion or collecting the pollutant by use of equipment to prevent its escape into the atmosphere.

2. In addition to '1' the control of air-pollution requires environmental monitoring. Thus, in turn needs :

- (i) Careful study of environmental characteristics.
- (ii) Laying down environment quality standards.
- (iii) Periodical assessment of environmental characteristics.
- (iv) Noting the changes in the environment and finding out their likely effect.
- (v) Warning people in time of likelihood of pollution.
- (vi) Planning strategies to tackle pollution such as educating people about pollution hazards, enacting environmental laws, legal action against offenders etc.

3. Different devices to control air-pollution are :

- 1. (a) What is Environmental Pollution? [2]
- (b) Write the importance of Environmental studies. [5]
- (c) Explain the structure of an Eco-system. [7]
- 2. (a) What is Green Technology? [2]
- (b) Explain Biotic and Abiotic Ecosystem. [5]
- (c) Write the function of food-chain and food webs in Ecosystem. [7]
- 3. (a) How is soil pollution is occurred? [2]
- (b) Discuss the pond as an eco-system. [5]
- (c) What is Green-house effect? How does it cause global warming? [7]
- 4. (a) What is Air-pollution? [2]
- (b) Explain the different causes of Air-pollution. [5]
- (c) Describe the various methods of controlling Air-pollution from the Industry. [7]
- 5. (a) What is Water-Pollution? [2]
- (b) Explain the different sources of Water-Pollution? [5]
- (c) Write the different methods for controlling Water-Pollution? [7]
- 6. (a) What is source of energy? [2]
- (b) What is population explosion? [5]
- (c) What is the necessity of environmental legislation? [7]

7. (a) What is Acid Rain ? [2]
 (b) How social awareness can improve environmental management ? [5]
 (c) What is plastic pollution ? How biodegradable plastics will be helpful for sustainable environment ? [7]

ANSWER TO MODEL - 2

1. (a) What is Environmental Pollution ?

Ans. Environmental Pollution : Any undesirable change in the physical, chemical or the biological properties of our surrounding environment that may have harmful effects on plants, animals and human being is called the environmental pollution.

The environmental pollution is principally caused by human activities which release pollutants (including the solid, liquid or gaseous substances) into the various components of our physical environment, viz. air, water and land, in quantities in excess of what can be tolerated by them under their normal self-cleansing capacities and the natural tolerance limits.

(b) Write the importance of Environmental studies.

Ans. Importance of Environmental Studies : Environmental study deals with the systematic study of environment. It aims to bring awareness among all citizens of the society to maintain a balance between men and environment. It aims to bring living for all in perfect harmony with nature. Since ancient times man has kept an important relationship with nature. The history of human civilization has started with the discovery of fire and use of various tools to hunt animals. They gradually settled in one place and started farming. With the advent of modern science, man started exploiting nature for his comfort. By this way man has done excessive damage to the environment. There is now pollution of air, water and soil. All living organisms including human beings are now in danger due to pollution. There is excessive exploration of forest and other natural resources by human beings for their comfort. Environmental Education thus aims to create a society committed to conserve, preserve and protect the environment for the benefit of all in this planet.

Importance :

The main importance of the study of the environment are as follows :

- (i) Environment study helps us to gather knowledge about environment and its components.
- (ii) It helps to realise why it is called 'earth as the only suitable habitat for man'.
- (iii) It indicates the existence of inter-relationship between organisms at population and community level.
- (iv) It helps to develop the sense why earth is called as the only suitable habitat for man and to develop sense to conserve the environment for the well-being of next generation.
- (v) It reveals how organisms are structurally adapted and functionally adjusted to their physical environment.
- (vi) It reveals the biological productivity of nature and how this may be utilized best for the benefit of mankind.
- (vii) It helps to acquire knowledge about the cause, remedy of environmental diseases. Environmental study is necessary for the development of public health.
- (viii) It helps to acquire the scientific knowledge about eco-system.
- (ix) It helps to acquire knowledge about the distribution and bad effects of population explosion.
- (x) It helps us to assess and to predict effects of environmental hazards and to develop the different mathematical models to counteract those effects.
- (xi) It helps to acquire knowledge about public health and to adopt measures to improve the public health.
- (xii) It gives an idea about the improvement of agricultural production with least deterioration of natural resources and environment.
- (xiii) It suggests to develop and adopt various policies for improvement of environment through effective environmental management.

(c) Explain the structure of an Eco-system.

Ans. Structure of an Eco-system : Eco-system is essentially a technical term for nature that was previously used by many ecologists. The eco-system is the basic functional unit in ecology since it includes all the living organism in an area interacting with the physical environment. H.G. Tansley, a British ecologist, first proposed the term 'eco-system' in the year 1935.

The complex system in which interaction between the different components of environment occur is termed as an eco-system. In other words, any spatial or organisational unit which includes the living and non-living constituents interacting with each other and producing an exchange of material between the two is termed as an eco-system.

The earth upon which we live may be considered a vast eco-system. The portion of the earth whose biotic components are present called the biosphere or ecosphere. The biosphere obtains its energy from the sun. The abiotic (i.e., non-living) materials from the soil (i.e., lithosphere), water (i.e., hydrosphere) and air (i.e., atmosphere).

The eco-system is generally divided into two components on the basis of functional principles.

(1) Abiotic Components (i.e., non-living components) : These are divided into three different types as follows :

(i) Inorganic Components : Soils, mineral, water and various gases together constitute the inorganic components of eco-system. Soils and minerals are mixed with water and at the same time various gases are dissolved in water plants absorb the soil solution and prepare food by the process of photo-synthesis.

(ii) Organic Components : Various dead and decomposed bodies of the organisms and excretory materials of different organisms mix-up with the soil and form organic components.

(iii) Physical Components : The weather controlling elements (e.g., sun-light, temperature, rain-fall, atmospheric, humidity etc.) constitute the physical components.

(2) Biotic Components (i.e., Living components) : A large number of individuals belonging to different species which adjust, adopt, interact with each other and share the same general environment and resources form a biotic community or the biosphere. Based on the function and the general manner in which organisms obtain their food material, individuals within a biotic community can be grouped into producer, consumer or decomposer.

(i) Producers : The community of green plants, called primary producers, absorb carbon dioxide, mineral nutrients, water and build up organic matter with the help of solar energy, releasing oxygen in this process. Without producers life activity in the system shall

collapse or else the system shall have to run on organic material imported from other system. Mineral nutrients enter the biosphere through green plants.

(ii) Consumers : Producers are consumed by herbivorous animals, the primary consumers, which are in turn consumed by carnivorous animals, the secondary consumers and so on. Thus a chain of organisms based on trophic relationship is established which is known as food chain. The energy trapped by green plants is released to be used by consumers when organic matter is digested and oxidised. Oxygen is used and carbon-dioxide is released in the process. In a complicated eco-system where each trophic level consists of number of species, there may be several interlinked food chains and the trophic structure assumes the shape of a complicated food web.

(iii) Decomposer (Recylers) : Faecal matter, exudates and excreta of plants, animals and their dead bodies are decomposed by the activity of bacteria, fungi and other small organisms which live on a dead and decaying organic matter. These constitute the community of decomposers which bring the constituents of the plants and animal bodies back to the surrounding medium or to the soil.

A portion of land, a lake or river can be visualised as an eco-system in which plants produce organic matter which is consumed by herbivores. Herbivores are in turn eaten by carnivores while decomposers mineralise the exudates and remains of the living organisms.

2. (a) What is Green Technology ?

Ans. As the name implies green technology is one that has a 'green' purpose. By green we do not mean the colour, however, mother nature is quite green and the long short term impact, an invention has on the environment is what we are talking about. Green inventions are environmentally friendly inventions that often involve energy efficiency, recycling, safety and health concerns, renewable resources and more.

Example of Green Technology would be solar cells, wind turbines, bioreactors, reusable water bottle etc.

(b) Explain Biotic and Abiotic Ecosystem.

Ans. Biotic Ecosystem : The biotic component of an ecosystem, called the biological environment consists of all the living organisms present in the particular ecosystem. All types of animals and plants do come in this category of living organisms. Some of the

living animals and plant may be larger in size, while some may be tiny or even microscopic, which cannot be seen with a naked eye. Hence, bacteria, fungi, small algae, plants, shrubs, trees, insects, birds, fish, whales, elephants, lions and all types of animals do come within the biotic part. Man is also a part of this vast assemblage of organisms. He is the only organism, however, who can modify vast areas of his environment (physical as well as biological) within a very short time, by using his muscle power and the tools and machines made by him.

The living organisms, forming the biotic component of an ecosystem can be divided into the following three types :

- (i) Producers
- (ii) Consumers and
- (iii) Decomposers

(i) Producers : The producers are plants and some bacteria, capable of producing their own food photosynthetically or by chemical synthesis. These organisms are, thus self-nourishing, as they can produce their own food by using the energy from the physical environment surrounding them. These are also known as autotrophic organisms.

All green plants are hence autotropic and since they use solar energy for producing their required food through photosynthesis, they are also called as photo-autotrophs. Certain bacteria which can survive on the energy generated through chemical reactions alone are also include in this category of organisms and are called chemoautotrophs.

(ii) Consumers : The consumers are the animals that obtain their food directly by grazing on plants or by feeding on other animals or by both. Since these organisms consume food generated by producers, they are called the consumers.

Since these organisms depend on other organisms or on the food produced by other organisms for their nourishment (since they cannot make their own food from the energy of the physical environment alone), they are also called as heterotrophic organisms.

The consumers are sometimes grouped into the following classes :

- (a) Macro-consumers and
- (b) Micro-consumers.

The macro consumer class includes all types of animals, while the micro-consumer class includes microscopic sized bacteria and fungi that decomposes

the organic matter produced by the living organisms as well as the remains of the dead organisms.

Depending upon as to whether the animals feed on plants or on flesh of other animals, the consumers are also divided into the following two categories :

- (a) Herbivores and
- (b) Carnivores

Plant eating animals including elephants are, thus, categories as herbivores or herbivorous animals, while the animals who eat the flesh, like lions are categorised as carnivores or carnivorous animals. A third category of animals, is of omnivores and represent those animals who eat plant food along with eating meat (like cats, dogs, etc.).

(iii) Decomposers : The decomposers or recyclers or detritivores are the fungi and bacteria that decompose the dead organic matter of producers and consumers for their food, releasing simple inorganic and organic substances produced as by-products of their metabolisms. These simple substances are re-used by the producers, resulting in a cyclic exchange of materials between the biotic community and the abiotic environment of an ecosystem.

Abiotic Ecosystem : The abiotic component of an ecosystem is everything other than the living organisms. It includes the three basic elements of nature, i.e., (i) land (ii) water and (iii) air.

By including land, it includes all the organic and inorganic substances present in an ecosystem. By including water and air, it includes all the climatic factors that affect the functioning of the ecosystem. Like biotic component, each ecosystem is unique in possessing its own set of different abiotic factors.

Inorganic components like water, carbon dioxide, phosphates, carbonates, nitrates, etc. and chemical elements like carbon, nitrogen, sulphur, phosphorus etc. are found in the ecosystem. All simple and complex organic substances like amino acids, humic acid, acetates etc. are also included in the abiotic component.

These inorganic and organic substances may be present in the ecosystem in such a form that the living organisms can utilize them as food or for producing their food. Some substances, may however, be complex or bound with some other substance and thus may not become easily available to the living organisms. In any case, the life of all the living organisms depend upon the presence of these abiotic substances, since these substances are the building materials with which the living organisms construct their body structures.

As a matter of fact, the inorganic chemical elements are constantly circulating between the biotic and abiotic compartments of an ecosystem. For example, we exhale carbon dioxide and plants take it up to fix the carbon into a sugar molecule when the sugar molecule is oxidized, once again carbon dioxide gets produced.

Climatic factors also form a part of the abiotic component, because they control the entire functioning of an ecosystem.

(c) Write the function of food-chain and food webs in Ecosystem.

Ans. Function of Food-chain and Food Webs in Ecosystem : The animals of the biotic components of an ecosystem may feed on the plants, or may eat another animal and may, in turn, be eaten by yet another animal. The food energy may thus, get transferred from one living organisms to the other. This linkage between the living organisms (plants and animals) for the transfer of food energy is known as the food-chain.

The food-chain may be divided into the following two types :

- (i) the grazing food-chain and
- (ii) the detritus food-chain.

The grazing food-chain starts with a green plant, which will be eaten by a plant eating animal (herbivore). The herbivore will, in turn be eaten by a flesh eating animal (carnivore).

This food-chain can, thus be simply reflected as:

Plant → Herbivore → Carnivore
 (Grass) (Insect) (Lizard/Frog/Bird)

An insect or a grass-hopper feeding on a particular plant, and a bird or a frog feeding on that insect or grass-hopper can be quoted as an example of such a simple grazing food-chain.

The detritus food-chain begins with the organic matter resulting from the wastes of animals and dead plants and animals, etc. This organic matter is degraded or decomposed by micro-organisms (called detritivores or decomposers). Thus, dead leaves, dead stems, dead plants, dead wood, etc. or dead animals or their organic wastes will be decomposed by decomposers. The decomposers like fungi will generate their food by decomposing such organic wastes. Such decomposition of organic wastes may even release important inorganic nutrients, that can be once again used by other organisms. Thus, if there would have been no decomposers, a lot of energy would have remained locked

up in the dead bodies of organisms. A simple illustration of grazing and detritus food-chains is reflected in figure with a insect like a grass-hopper feeding on a particular plant, and a frog eating that grass-hopper.

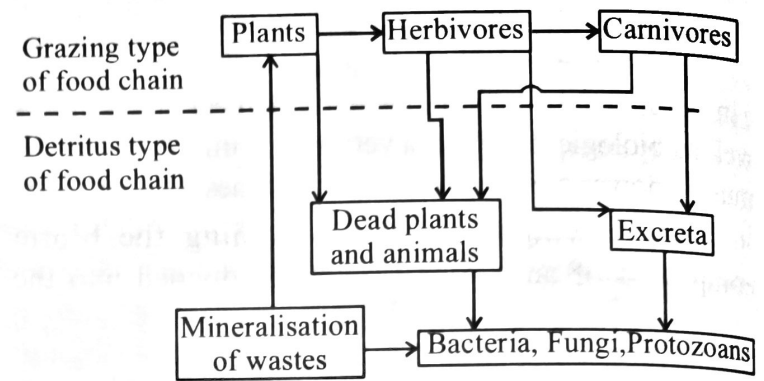


Fig. Simple grazing and detritus food-chains and their inter-relationship.

However, in most of the ecosystems, the food-chains are not so simple and straight forward. An insect or a grass-hopper may feed on a dozen different plants instead of only on one single plant. Similarly, a frog may eat several other insects along with the grass-hopper. Thus, the food-chains do not remain simple isolated sequences. Actually, a lot of inter-locking of food chains do take place. Such a food-chain is called food-web. This is because of the fact that a single animal, during its development and growth, may be a part of different food-chain, and hence a part of a food-web.

Although food-chains in an ecosystem, are generally complex and hence called food-webs, yet two food-webs involving the same number of steps, are said to be belonging to the same trophic level. For example-

- (i) Grass → Grass-hopper → Frog → Snake
- (ii) Tree → Beetle → Lizard → Bird

In both these food-webs, grass-hopper and beetle both occupy the same trophic level, and since both are directly using the plant as food, they are called as the primary consumers. The plants i.e., the grass and tree both are the producers. Likewise, the first animals eaters, i.e., frog and lizard occupy the same level, Both the frog and lizard will be the secondary consumers. Similarly, both the snake and bird are the tertiary consumers. The trophic levels can, thus be states as :

Producer → Primary consumer → Secondary consumer
 (Plants) (Herbivores) (Pre-dators)
 Tertiary consumer (Large carnivores of upper level).

It is however, not necessary that one animal will always occupy only the trophic level, as it can occupy one or more than one trophic levels, depending upon the food-webs used by it.

3. (a) How is soil pollution is occurred ?

Ans. Soil Pollution : There are a number of ways through which soil receives foreign matter which impair its resources quality. Air borne sources such as fumes emitted by factory chimneys travel to several kilometers on the windward side and slowly deposited on soil. Sulphur present in the fumes are responsible for acid rains and consequent lowering of pH. Chlorine and Nitrogen oxides are other common pollutants which combine with water and pollute the soil. Particulate matter near cement factories, coal transshipments, mining belts etc, reach soil surface of neighbouring regions. Mine overburden is a common site of waste land. There is no universal solution for the conservation and reclamation of all typer or mine spoils. The magnetic dust increases the pH and decreases exchangeable, potassium, calcium, magnesium and available phosphorous and potassium to almost a critical level. Heavy fall-out near metal smelter destroys the soil property.

(b) Discuss the pond as an eco-system.

Ans. The pond is an aquatic ecosystem where biotic and abiotic components interact with each other. The biotic components are water, dissolved oxygen (D.O.), carbon dioxide, inorganic salt like phosphate, nitrate, chloride etc. Similarly the organic components are like aminoacids, humic acid etc. The biotic components of the pond can be divided into two groups (i) porducer (ii) consumer.

Producer : The producers are the plants which contain green pigments i.e., chloriphil. The producers synthesise the food material by taking carbondioxide from water in the presence of sunlight. Different types of plants are found in the pond, they are -

Hydrophytes-floating on the surface, submerged hydrophytes, attached floating hydrophytes, amphibious hydrophytes etc. There are a number of very small plants called phytoplankton which are usually not visible, but when they grow abundantly impart green colour to water. The phytoplanktons are important food material in the fresh water. The phytoplankton not only produce food but also supply and maintain dissolved oxygen concentration.

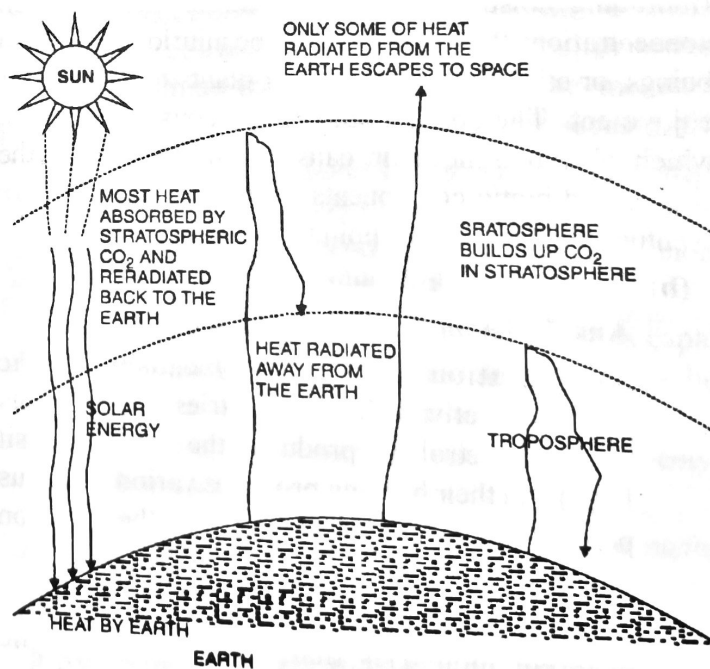
Consumer : In the pond ecosystem the consumers are classified into two groups - macro consumer and miro consumer. The fish, snake, insects are grouped under macro consumer. The zooplankton is micro consumer. The consumer may be a herbivor or carnivor. The herbivors are called as primary consumer. The consumer which eat on primary consumer is called carnivor. The carnivor may be secondary or tertiary consumer and so on. In this way the food chain is formed and energy flow takes place.

(c) What is Green-house effect ? How does it cause global warming ?

Ans. Green-house Effect : When solar radiation arrives on earth atmosphere, about half of the visible light is reflected back into the space. Otherwise, the temperature of earth would be far too hot to support life. The remainder reaches earth surface and causes warming. The warm surface then reradiate this energy as heat energy which falls in the infrared portion of the electromagnetic spectrum. In infrared region, the water vapour, ozone, methane, carbondioxide present in the atmosphere readily absorb some of this heat and in turn warm the atmosphere creating green-house effect.

A botonical green-house operates on the same principle. The botanical green-house is made up of glass walls and roof which is of green colour and used for the study of germination of seeds. Glass transmits the visible light but blocks infrared radiation trying to escape. The effect is a warming of the air inside the green-house. In the warm weather, the windows of the green-house must be kept opened, otherwise the plants inside will over-heat and die.

All the green-house gases act as an absorbing blanket that prevents radiation losses and keeps earth atmospheric temperature comfortable in winter, however it is a problem in summer. Water vapours in atmosphere are subjected to such a vast cycles that manly activitie does not seem to alter it. Ozone is present in relatively low concentration and methane is produced naturally in vast quantities. So the attention should be focussed on carbondioxide the green house gas whose concentration in the atmosphere is closely related to human activity.



Stratospheric green-house gases act as irremovable permanent blanket for the earth for which global warming happens. The carbon dioxide is among the main green-house gases and its atmospheric concentration of carbon dioxide in 1900 was 296 PPM which became 318 ppm in 1970 and by 1993 it reached 360 ppm. The rate at which its concentration is increasing is quite alarming. Carbon dioxide is going to prove itself as a salient killer of the earth. The increasing concentration of carbon dioxide is attributed to deforestation, industrial emission, vehicular emission, wars, etc. Thermal power plants all over the world contributing a huge fraction of electricity about 80 percent of total power consumption, for the comfort of civilised life and these are the chief source for carbon dioxide emission into the atmosphere.

To control the global warming the only way available is to control human activity and minimise vehicular emission of carbon dioxide and deforestation. Forest is the only sink for carbon dioxide as trees translate carbon dioxide to usable form. Control in carbon dioxide emission world wide will undoubtedly be more difficult than to control CFCs or the acid rain as the source of its generation is unlimited. Global warming is a major potential problem and its effect appears to be measurable in the human time scale.

4. (a) What is Air-pollution ?

Ans. Air-Pollution : Air-pollution is defined as the presence of any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentrations that may or tend to be injurious to human beings, or other living creatures or plants to property or enjoyment. The solid, liquid or gaseous substances, which when present in air, cause harmful effects on the abiotic and biotic components of our environment, are eventually called the air-pollutants.

(b) Explain the different causes of Air-pollution.

Ans. Different Causes of Air-pollution :

- Air pollution is principally caused by the industrial activity. Most industries consume lots of coal or petroleum products (the so called fossil fuels) and their burning produces various gaseous pollutants. SO_2 , CO and CO_2 are the common pollutants produced by this activity.
- Other gaseous pollutants are also produced by different industries that use various organic chemicals. Gases like xylene, methane, toluene

etc. come under this category. Methane (CH_4), for example, is also produced by anaerobic decomposition of biodegradable organic matter by anaerobic bacteria, as well as by ruminant live stock, domesticated by human beings.

- Cement producing factories cause immense air-pollution, emitting huge quantities of dust. Ash is generated by coal-burning power stations and furnaces.
- Mining and ore processing also cause serious particulate air-pollution.
- Pesticides manufacturing industries often have to use poisonous gases and these gases often cause toxic air-pollution.
- Chlorine and ammonia gases, which likewise, are routinely used in industries, also have a large potential to cause pollution.
- Apart from industries, air-pollution is largely being caused by automobiles. In highly urbanised areas, the mixture of air-pollutants, giving rise to photo-chemical smog.
- Various particulate pollutants are also produced by the industrial activity. Stone crushing, glass manufacturing, cement production, etc. generate lots of dust particles.
- All coal burning machines and thermal power plants produce lots of unburnt carbon.
- Motor cars, heavy transport vehicles, rail engines, generators and other equipments using diesel oil, cause significant air-pollution by generating particulate matter, especially carbon.
- Air-conditioners, refrigerators, and some sprays use chlorofluorocarbon (CFC) gas. This has proved to be one of the most harmful gaseous pollutants of the century, as the compound is found to be destructive of the atmospheric ozone layer, which protects us from the harmful ultra-violet radiations from the sun rays, causing ozone depletion, having global impacts.
- Jet aeroplanes also cause air-pollution, and so is the case with satellite launching vehicles (rockets).

(c) Describe the various methods of controlling Air-pollution from the Industry.

Ans. Various Methods of Controlling Air-pollution from the Industry : Industry is the single largest source of pollution in all over the world. The

lic can take individual and collective action to reduce industrial pollution. Following are some methods being adopted to control air-pollution from the industries.

(i) *Dilution method for controlling air-pollution from stationary sources or factories* : These can be done by spreading the emitted smokes from thermal power plant, diesel generator sets etc. Over a larger area through the use of high rise chimneys, thereby transporting the pollutants over larger distances, and, thus, reducing the pollution near the emission source.

(ii) *Controlling air-pollution from stationary sources (factories) by installing engineering devices* : The important engineering devices, which are used to control emission of particulate matter, from the industrial activities are :

- Gravitational settling chambers.
- Centrifugal collectors including cyclone collectors and dynamic precipitators.
- Wet scrubbers (collectors) including spray towers, venturi-scrubbers and wet cyclone scrubbers.
- Electrostatic precipitators (ESP).
- Fabric filters.

The important engineering devices which are used to control emission of gaseous pollutants from the industrial activities are :

- Absorption units like spray towers and venturi scrubbers.
- Adsorption units like adsorption towers.
- Combustion or incineration devices, using direct flame combustion and catalytic combustion.
- Chemical alteration of the pollutant usually through combustion or catalytic treatment.

(iii) *Changing the raw materials* : If a particular raw material is responsible for causing air-pollution, use of a pure grade of raw is often beneficial and may reduce the formation of undesirable impurities and byproducts or may even eliminate the troublesome effluent. A typical example of this approach is the use of low-sulphur fuel in place of high sulphur ones. LPG (Liquid petroleum gas) and LNG (Liquefied natural gas) may be used in place of coal, as they will produce much less pollutants in the emissions.

(iv) *Process changes* : Replacement of old obsolete processes in industries with the new efficient processes may also lead to reduced pollution emissions. For example, rotary kilns are a major source of dust generation in cement plants. Some degree of dust control

may be achieved in the kiln operation by adjusting operating conditions. Reduction of feed gas velocities within the kiln, modification of the rate and location of feed introduction and employment of a dense curtain of light weight chain at the discharge end of the kiln can lead to dust control.

(v) *Equipment modification or replacement* : Air-pollutant emissions can be minimized by suitable modification or replacement of process equipment.

For example – Replacement of the open hearth furnace by oxygen furnace in steel industry and development of an alternative power source for automobiles in place of the I.C. engine are examples of equipment alternation.

(vi) *By complete combustion of fuels* : When a pollutant is to be destroyed, the combustion must be complete, otherwise intermediate products of combustion will form which may be more noxious than the original contaminant. For complete combustion, the oxygen must come into intimate contact with the combustible material through adequate turbulence at sufficiently high temperature and have a sufficiently long residence time. In fact time, temperature and turbulence have so predominant role in combustion reaction that they are often called the “three T’s of combustion.”

Other measures of prevention of industrial pollution are as follows :

- Properly centralize factories to reduce wastes emission from a single area.
- Consolidate legal systems for environmental protection, integrate legal approaches, administrative methods, economic measures, technologic methods and thinking education.
- Establish evaluation system for environments of industrial production and construction and also include environmental protection into economic responsibility system of all levels.
- Afforestation : A heavily forested area is capable of reducing wind speed and drop down the large dust particle in the air, the rough surface of leaves is capable of absorbing and attaching plenty of floating dust.
- Support companies that promote green methods of production and products.

Ans. Refer

5. (a) What is Water-Pollution ?

Ans. **Water-Pollution** : Water pollution is defined

as the alternations in the physical, chemical or biological characteristic of water due to the presence of solid, liquid or gaseous substances in as much quantity as to make it harmful to public health or to be health of other biotic life, including animals, plants or aquatic organisms. Such a polluted or contaminated water becomes unsuitable for domestic, commercial, industrial, agricultural or other legitimate uses.

(b) Explain the different sources of Water-Pollution ?

Ans. Different Sources of Water-Pollution

The different water pollutants generally originate from human activities such as from domestic sewage, industrial waste waters and from run-off flowing over the agricultural land. Some amount of pollutants may, of course, be emitted from natural hazardour events like volcanic eruptions, etc. but these are only occassional events and the rivers have their self-purification capacity, which usually is enough to take care of the natural pollution. The human activities, however, have created so much of water pollutants that the water of most of rivers and takes have become extremely contaminated and totally unfit to drink, although they used to be quite good only about a few decades back. The prime cause of this pollution is the discharge of untreated and highly foul sewage and industrial wastes into our rivers and lakes.

The sources of water pollution can be classified into two categories, i.e.,

(i) point sources

(ii) non-point sources

(i) Point sources of water pollution are those sources of pollution of water, which can be readily identified, because a point source is a definite source and a definite place of disposal in the water body. Thus, the waste waters from municipal sewers and sewage treatment plants, or from the industries and their common or individual effluent treatmetn plants etc. discharging into a water body through pipes and sewers at particular points in a water body, are known as the point sources of pollution.

(ii) Non-point sources of pollution of water are those sources, which cannot be identified and do not discharge at isolated points in a water body. Say for example, acid rain contributing to water pollutants is one such non-point source. Similarly, the run-off from the agricultural fields, or from

over the land having water polluting substances (like mining wastes, building debris, consturction materials, scrap materials, etc.) placed over it, do fall in this category. Although the non-point sources of water pollution are many and scattered over vast areas, but theie cumalative effect in causing water pollution may, sometimes, be quite heavy, as dangerous pollutants like pesticides may enter the water bodies through such on-point sources.

(c) Write the different methods for controlling Water-Pollution ?

Ans. Different Methods for Controlling Water-

Pollution : Any change or modification in the physical, chemical and biological properties of water that will have a detrimental consequence on living things is water pollution. Water pollution not only affects the human but also entire functioning ecosystems that exists the water. Human above now realised the importance of clæn water as a foundation for life. Dealing with water pollution is something that every one needs to get involved with. Here are a few methods to prevent water-pollution.

(i) Treatment of Industrial Waste Water : The industrial waste water usually contain a lot of pollutants and to have a great potential for polluting the water bodies. The nature and composition of industrial waste water usually vary from industry to industry and even within the same industry, depending upon the raw materials used and the technologies adopted by the industry. The industrial waste water may contain pollutants of almost all the nine types ranging from simple nutrients and biodegradable organic matter to complex toxic heavy metals and dangerous volatile organic chmicals (VOCs).

The waster water from industries like dairies, tanneries, sugar factories, textiles etc. contain a lot of biodegradable organic matter and can be treated using biological treatment methods. Waste water from industries like fertilizers, oil-refineries, petro-chemicals, pharmaceuticals, paint industries, plastic industries etc. contain several highly toxic pollutants and need elaborate treatment processes before discharging them into rivers or seas.

(ii) Treatment of municipal waster water solid wastes before discharging them into water bodies.

(iii) Domestic waster water i.e., sewages which

contains human excreta, waste water from bathrooms containing water from cloth washings, like soaps, detergents etc. should be treated and can be reused for gardening and washing purposes etc.

- (iv) Using more and more organic manure and pesticides instead of using chemical fertilizers and pesticides in agriculture to prevent water contamination.
- (v) Not throwing animal excreta, dead bodies and agricultural wastes into water bodies.
- (vi) Preventing run-offs from the agricultural fields or from over the land having water polluting substances like mining wastes, building debris, construction materials, scrap materials etc. by planting more trees modifying the cultivation process etc.
- (vii) In industrial area, attempt should be taken for recycling of used water in the factory.
- (viii) Radio-active wastes properly treated and sufficient care must be taken before discharging them into water bodies.
- (ix) Use environmentally safe cleaning liquids for the use at home and other public places.
- (x) Enforcing strict legislative measures for industries and local bodies (municipality pollution).
- (xi) Last but not the least by creating awareness among people about the ill effects of any sorts of pollution e.g., water pollution and their remedies to check it, so that it will be fruitful.
- (xii) Thermal pollution i.e., the rise or fall of temperature of a natural water body like the use of water as a coolant by power plant and industrial manufacturers etc., results in change in the physical property of water and also decreases oxygen content which can kill fish and can alter food chain composition and reduce species biodiversity. It is best controlled by the dilution of water, cooling, evaporation etc. to keep the water cool in rivers and streams.

6. (a) What is source of energy ?

Ans. Refer to Model - 1, Q. No. 1.(a)

(b) What is population explosion ?

Ans. Population Explosion : The population growth rate depends on the birth rate as well as death rate. The population explosion refers to the sudden and dramatic increase in the number of human beings which

has been observed in the recent years. The growth of population is as dangerous as explosion of bomb. Hence the word explosion is used with it. For most of the human history, the total human population remained small. It was less than 300 million before 2000 years, however by 1850 it reached 1 billion (1000 million) and since then it was grown very rapidly and exceeded 5000 million in 135 years. It is estimated that man in the stone age had an average life expectancy of only 17 years. However, the average life expectancy in many countries of the world today is more than 70 years. Many died due to disease, famine, war and large scale epidemics which swept across the continents from time to time. Wars are also responsible for killing large numbers of people including civilians. Wars cause famine and diseases. Despite of all the odds the growth of human population favoured. The population explosion is attributed to remarkable increase of life expectancy and sharp decline in the death rate and natural checks are successfully mitigated.

Whenever something increases in such a way that the increase in fixed proportion of its own size of any time, the growth is said to be exponential. This exponential growth curve for population growth indicates the awaiting population explosion. Population growth curves vary from nation to nation. Nations having growth rate of 3 percent or more is high growth rate, some are not growing at all and few others have declining population. Human population can be maintained due to attainment of demographic transition. It is the point where birth and death rate are roughly equal.

(c) What is the necessity of environmental legislation ?

Ans. The depletion of ozone layer, increasing rate of species extinction, disposal of toxic and nuclear wastes in the vulnerable areas of the planet, the loss of forests, and soil at an alarming rate are a few of the many global environmental changes going to affect the survival of the present and future generations. Each individual's life today depends upon the performance of many other individuals. Carelessness in welding or in maintenance in a nuclear reactor or chemical plant could kill thousands and hundreds of thousands of people not only in the plant and its vicinity but even at a considerable distance away from it. The chance of serious accident that could wipe out human, animal and plant life and destroy the environment have steadily increased. An urgent need for collaborative action on a global level has long been felt.

In 1972, representatives of 113 world governments assembled in Stockholm to participate in the United Nations Conference on Human Environment. The conference proclaimed that, "the protection and improvement of human environment is a major issue which affects the well-being of the people and economic development throughout the world and it is the duty of all government and people to exert common effort for the preservation and improvement of human environment, for the benefit of all people and their prosperity.

Many countries have therefore introduced control mechanisms to deter and punish the enterprises violating the environment. India was the first country to impose a constitutional obligation on the state and citizens to protect and improve the environment as one of the primary duties.

Article 48A of the Indian Constitution provides:

"The state shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country."

Article 51A provides, "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for leaving creatures.

The constitution of India has provision to make environmental legislations. The central, state and the concurrent lists of subject on which Parliament and State Legislatures are empowered to legislate span : noise control, land control, smoke control, water pollution, forests, wildlife, recreation etc. consequently laws have been enacted on some of the subjects such as :

- The Factories Act, 1948
- The Insecticide Act, 1968
- The Water (prevention and control of pollution) Act. 1974.
- The Air (prevention and control of pollution) Act. 1981.
- The Forest Conservation Act, 1980
- The Wildlife Protection Act. 1972.
- The Environment Protection Act. 1986.

7.(a) What is Acid Rain ?

Ans. Acid Rain : Rain water having p^H (p^H value of water indicates the logarithm of reciprocal of hydrogen ion concentration present in water) equal to or less than 5.6 (nearly 20 or more times acidic than a neutral rain having $p^H = 7$) are specifically called acidic rains. Acid rain is the adverse effect of air pollution.

Large quantities of SO_2 and NO_2 emitted into the atmosphere due to burning of fossil fuels (coal, petroleum etc.) and react with moisture present in the air and produce sulphuric acid and nitric acid which fall as acid rain on the earth surface. The acid rain affects the aquatic animals, plants leading to the destruction of eco-system and also the important monuments.

(b) How social awareness can improve environmental management ?

Ans. There is a need to develop strategy for the management of environment. This should be expressed in a language which will appeal to the common man in a creative manner by establishing the relevance of environmental education to their day-to-day lives. Man's basic needs are food, shelter, clothing and recreation. The concern about the environmental education arising out of food production, enhanced ways of earning livelihood, effect of technology on day-to-day life and the impact of all these developments on health will be more relevant to a common man.

Agriculture : It was the activity in the evolutionary process of present civilisation. The concern about environment has come up because of the rapidly changing balance between the forested and cultivated land. When man took to agriculture there was very little fear of adverse effect on environment. The traditional agriculture has been based on renewable energy resources, solar energy, rainfall, animal residues, waste products and the microbial activity which decompose them. The concept of industrial inputs in agriculture like chemical fertilisers, pesticides and farm machines evolved new problem for environment.

Land use Patterns : In India land use planning is guided by economics. Due to expanding population, soil is cultivated extensively which poses a threat to productivity. The problems has further aggravated due to soil erosion and deforestation. For various reasons the top soil is damaged year after year. So a well planned policy of land use is most inevitable.

Water Resources : Water is an integral input into agricultural productivity besides being a major life support system. Its misuse can cause degradation as well as erosion, affecting lives of people and crop yields. Most of the North Indian rivers are augmented by melting of snow but Southern rivers do not have this advantage. These are dependent on land surface management. Nearly 70% of the area in India is subjected to water stress i.e., water scarcity or flood.

This is further aggravated by -

- (i) ignorance about nation's water capacity the common man considers it to be abundant and unlimited.
- (ii) the concept of water conservation and management is still alien to the mass.

The chronic water shortage in Tamil Nadu in recent years is a warning signal for the years to come.

Irrigation : Irrigation schemes have been developed as an answer to unpredictable rain pattern in India. On the other hand, large areas, which have become submerged under reservoirs got water logged or were destroyed by the construction of roads and colonies. This has resulted in less cultivated area, displacement of local people and other problems related to forced migration.

The concern with increasing agricultural productivity is wide spread in terms of its implication as well as the categories of people involved. A farmer, the immediate persons to be affected are, as much involved in the processes of destruction and regeneration, as is the planner at the national level. Hence social awareness can help better management of the resource and environment. Maintaining the quality of life amidst population explosion, increased consumption and increased waste accumulation calls for disciplined human decision. The general public be made conscious of any unavoidable effects.

That may result from encroachments on environment and be helped to tackle them so that the adverse effects may be minimised. These safeguards are possible only if a multifaceted approach is taken and directed all strata of the society through a hierarchical national network.

(c) What is plastic pollution ? How biodegradable plastics will be helpful for sustainable environment ?

Ans. Plastic Pollution : Plastics have become an important part of modern life and are used in different sectors of applications like packaging, building materials, consumer products and much more. Each year about 100 million tons of plastics are produced world-wide. Demand for plastics in India reached about 4.3 million tons in the year 2001-2002 and was expected to exceed 8 million tons in the year 2007-08. Currently, however, the per capita consumption of plastics in India is only about 3 kg. compared to 30-40 kg in the developed countries. Most of today's plastics and synthetic

polymers are produced from petro-chemicals. As conventional plastics are persistent in the environment, improperly disposed plastics materials are a significant source of environmental pollution, potential harming life. The plastic sheets or bags do not allow water and air to go into earth which causes reduction in fertility status of soil, preventing degradation of other normal substances, depletion of underground water source and danger to animal life. In the seas too, plastic rubbish from ropes and nets to the plastic bands from beer pock-choke and entangle and marine mammals. Based on the degradation process biodegradable plastics can be divided into Biodegradable, Compostable, Hydro-biodegradable, Photo-biodegradable, Bioerodable.

Biodegradable: Biodegradable plastics literally the capability of undergoing decomposition into carbon dioxide, methane, water, inorganic compounds, or biomass in which the predominant mechanism is the enzymatic action of micro-organisms, which can be measured by standardised tests, in a specific period of time, reflecting available disposal condition.

Compostable : It can be defined as capable of undergoing biological decomposition in a compost site as part of an available program, such that the plastics is not visually distinguishable and breaks down to carbon dioxide, water inorganic compounds, and biomass, at a rate consistent with known compostable materials (e.g. cellulose).

Hydro-biodegradable and Photo-biodegradable :

Hydro-biodegradable and Photo-biodegradable polymers are broken down in two-step process - an initial hydrolysis or photo-degradation stage, followed by further biodegradation. Single degradation phase 'Water soluble' and 'Photodegradable' polymers also exist.

Bio-erodable : Many polymers that are claimed to be biodegradable are in face 'biodegradable' and degrade without the action of micro-organisms-at least initially. This is also known as abiotic disintegration, and may include processes such as dissolution in water, 'oxidative embrittlement' (V ageing). Biodegradable plastics that are intended to be 'degradable plastics that are intended to be degradable in vivo' (in the body i.e., implants), are considered to be beyond the scope of this study.

Plastics from Starch : Starch is natural polymer. It is a white, granular carbohydrate produced by plants during photosynthesis and it serves as the plant's energy store. Cereal plants and tubers normally control starch

in large proportions. Starch can be processed directly into a bioplastic but, because it is soluble in water, articles made from starch will swell and deform when exposed to moisture, limiting its use. This problem can be overcome by modifying the starch into a different polymer. First, starch is harvested from corn, wheat or potatoes, then micro-organisms transform it into lactic acid, a monomer. Finally, the lactic acid is chemically treated to cause the molecules of lactic acid to link up into long chains or polymers, which bind together to form a plastic called polylactide (PLA). PLA can be used for products such as plant pots and disposable nappies. It has been commercially available since 1990, and certain blends have proved successful in medical implants, sutures and drug delivery systems because of their capacity to dissolve away over time. However, because PLA is significantly more expensive than conventional plastics it has failed to win widespread consumer acceptance.

Plastics from Bacteria : Another way of making biodegradable polymers involves getting bacteria to produce granules of a plastic called polyhydroxyalkanoate (PHA) inside their cells. Bacteria are simply grown in culture, and the plastics is then harvested. Going one step further, scientists have taken genes from this kind of bacteria and stitched them into corn plants, which then manufacture and plastic in their own cells.

Conclusion : Biodegradable plastic products currently on the market are from two ten time more expensive than traditional plastics. However, environmentalists argue that the cheaper price of traditional plastics does not reflect their true cost when their full impact is considered. To bring the biodegradable plastics in to practice, the plastic bags must be charged for its disposal after the use. By this way, traditional plastics would cost more and biodegradable plastics might be more competitive.

MODEL - 3

[BST - 501]

Full Marks - 70

Time - 3 Hours

Answer any five questions.

The figures in the right-hand margin indicate marks.

1. (a) What is Aquatic Ecosystem ? [2]
- (b) Write the function of food-chain and food webs in Ecosystem. [5]

- (c) Explain the different components of an Eco-system. [7]
2. (a) What is food chain ? [2]
- (b) State the drawbacks of Nuclear Power and their adverse Environmental Impacts ? [5]
- (c) Explain 'Global Warming'. [7]
3. (a) What is Air-Pollution ? [2]
- (b) Explain the present status of Air-Pollution. [5]
- (c) Explain the different methods of controlling Air-Pollution ? [7]
4. (a) What is ozone pollution ? [2]
- (b) What is radiation pollution ? [5]
- (c) How does flow of energy take place in an eco-system ? [7]
5. (a) What are nuclear fall-out ? What is its effect ? [2]
- (b) Describe the forest as an ecosystem. [5]
- (c) Define urbanisation. Describe the effect of urbanisation on the environment. [7]
6. (a) What are the harmful consequences of excessive noise ? [2]
- (b) How education can be used to save environment ? [5]
- (c) How can carelessness in developmental activities affect human beings ? Discuss with two suitable examples. [7]
7. (a) Describe the different types of radiation. How are they measured ? [2]
- (b) State the feasibility of "sustainable development" seeks to strike a balance between economic progress and environment protection. [5]
- (c) Waste can be converted to wealth. Illustrate with suitable examples. [7]

ANSWER TO MODEL - 3

1. (a) What is Aquatic Ecosystem ?

Ans. Aquatic Ecosystem : The aquatic ecosystem consists of marine ecosystem and fresh water ecosystem. The seas and oceans form the marine ecosystem, and rivers, ponds, lakes and wet lands form the fresh water ecosystem. The aquatic ecosystem provide the human beings with a wide range of services, which includes foods like fish and crustaceans breaking down of chemical and organic wastes etc. The plants and animals of aquatic ecosystem are adapted to live in water.

The aquatic ecosystem provides the human beings with a wealth of natural resources. There are different species of living beings which are adapted to live in different types of aquatic habitats. Like the terrestrial ecosystem, the aquatic ecosystem is also either natural or artificial / man made.

(b) Write the function of food-chain and food webs in Ecosystem.

Ans. Refer to Model - 2, Q. No. 2.(c)

(c) Explain the different components of an Ecosystem.

Ans. Refer to Model - 1 Q. No. 2.(c)

2. (a) What is food chain ?

Ans. Food Chain : The animals of the biotic components of an eco-system may feed on the plants, or may eat another animal (s) and may, in turn to be eaten by yet another animal (s). The food energy may, thus, get transferred from one living organism to the other. This linkage between the living organisms (plants and animals) for the transfer of food energy is known as the "food-chain". Following figure shows a simple food chain.

Plant → Herbivore → Carnivore
(Grass) (Insect) (Lizard / Frog / Bird)

Fig : Simple Food Chain

A network of many food chain is called a food web.

(b) State the drawbacks of Nuclear Power and their adverse Environmental Impacts ?

Ans. Nuclear Power and their adverse Environmental Impacts : The nuclear power, since is inception in 1957, has been considered to be the cleaner and the cheaper source of electricity, particularly in comparison to the thermal power. It is to be a good substitute for thermal power, which is produced by fossil fuels and causes a lot of air pollution due to emissions of particulate matter and gases like CO_2 , SO_2 and NO_x which also cause global warming and acid rains. The fact that a very small quantity of 1 kg of uranium 235 (U-235) produces as much heat energy as much as produced by burning 16000 tons of coals, makes uranium as the most important source of clear energy, throughout the world. But however, the bad experience with a few nuclear power plants has however shown that nuclear power is not as harmless as it appears to be. The biggest drawback of a nuclear power plant is

that the uranium rods need to be changed periodically. This produces a lot of high level nuclear waste which poses serious problems of disposal. When not disposed off properly, the radio-active nuclear wastes produce a very adverse impact on the environment and human health. It is now fully established that when human body is subjected to the radio-active radiations, large scale health hazards like cancers, shortening of life spans, deformations and genetic changes may occur, depending upon the quantum of radiation or exposure, although however smaller and calculated doses of radio-active radiations are used on human body for medical diagnosis through X-rays etc.

The safe disposal of nuclear waste is an extremely difficult and costly exercise. Besides the continuous production of nuclear wastes from nuclear power plants, which need safe disposal, enormous problems do arise in decommissioning of old plants.

In addition to the problem of safe disposal of nuclear wastes, another problem posed by the nuclear power plants is for the disposal of hot waste water. Such waste water damage aquatic ecosystems, even if cooled by some water systems before being released.

Although the above mentioned conventional environmental impacts caused by nuclear power developments are not considered unsurmountable, but what is most threatening a dangerous is the possibility of a nuclear accident. A nuclear accident can have devastating effects that would last for long periods of time. While the nuclear power does not pollute air and water routinely like oil or biomass fuels, a single nuclear accident can kill thousand of people, make many others seriously ill with incurable diseases, and destroy an area for decades by its radio-activity, which leads to deaths, cancers, genetic deformities etc. Land, water and vegetation are destroyed for long periods of time. There have, infact, actually occurred a few such nuclear accidents like the Chernobyl nuclear accident of April 26, 1986 in Soviet Union (USSR) and 11th March, 2011 in Japan due to Tsunami, which should be sufficient to open our eyes for keeping away from nuclear power production to the extent possible.

(c) Explain 'Global Warming'.

Ans. Global Warming : It has been observed and scientifically proven that the Earth is getting hotter and hotter, year after years. The average increases in its temperature in the post industrial era and during the last

about 100 years has been estimated to be about 0.75°C with maximum contribution from the last three decades. This warming of the Earth is called Global Warming.

The primary reason for this warming of the globe is found to be increasing concentration of carbon dioxide (CO_2), carbon monoxide (CO) and other such gases, together called green house gases (GHGs) in the lower atmosphere of the Earth. These GHGs—primarily CO_2 , existing in the lower atmosphere of the Earth, in fact act like the glass of a green house, trapping some of the heat as it radiates back from the Earth into the space. Such gases and their heating effects, have in fact, survived life on earth, as otherwise, temperature on earth could well have been below freezing, like that on Mars, where the temperature may be as low as -140°C . Excessive quantities of these gases, evidently, may cause excessive heat, again to make life impossible, like that on Venus, where CO_2 is found 60,000 times higher than that on Earth, giving it as high a temperature as 460°C .

Thus, the very existence of the right and the balanced amount of CO_2 in our atmosphere, that trapped the right amount of heat from escaping, has made our planet (Earth) liveable. However the large scale emission of CO_2 due to the continuous and excessive burning of fossil fuels, such as coal, oil, natural gases etc. to run our power plants, factories, automobiles, planes, cooling etc. in the industrialized world has been found to be disturbing this CO_2 balance in the Earth's atmosphere. Besides these mass scale urbanization, industrialization etc. due to population growth etc., causing to deforestation. As a result the natural carbon sinks i.e., forests are extinguishing at an alarming rate, which is also contributing to rise in CO_2 concentration in the atmosphere.

Effects of Global Warming :

- (i) Due to the rise in concentration of GHGs like CO_2 etc., the earth's temperature is now increasing, which is the main cause to melt the ice bergs in the poles. East Antarctica for example, has been losing at least 5 billion tonnes (Bts) of ice per year. All ice sheets of Arctic and glaciers are thus losing their ice, causing reduced capacity to reflect back sun light and thereby further contributing to the global warming.
- (ii) The global warming has also resulted in raising the water level of the oceans, partly due to the thermal expansion of water, volume contained in the world ocean, and partly due to the melting of

glaciers and ice sheets. Due to rise in sea levels more than half of the world's population, living within 60 km of the seas will be seriously affected by the submerged land and ingress of salt water.

- (iii) Human society is also likely to be seriously affected by the changing climate, which will increase floods and droughts. The rainfall is likely to increase in higher altitude areas and decrease in lower levels. There will be increased frequency of droughts cross the world. The frequency and occurrence of tropical cyclones will increase. There will be more warm nights and fewer cold ones.
- (iv) Food production may be adversely affected in vulnerable regions directly and also indirectly through the increase in pests and plant or animal diseases.
- (v) Climate change related impacts on human health may lead to large scale migration and displacement of large number of people, creating environmental refuges.
- (vi) Changes in climate may also increase the spread of vector born species, such as mosquitoes, which in turn may increase the spread of diseases such as malaria, filariasis, dengue, yellow fever etc. All in all, severe climate changes may adversely affect human health quite severely, leading to large scale death and destruction.

3. (a) What is Air-Pollution ?

Ans. Air-Pollution : Air-pollution is defined as the presence of any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentrations that may or tend to be injurious to human beings, or other living creatures or plants to property or enjoyment. The solid, liquid or gaseous substances, which when present in air, cause harmful effects on the abiotic and biotic components of our environment, are eventually called the air-pollutants.

(b) Explain the present status of Air-Pollution.

Ans. Present Status of Air-Pollution : The air-pollution on Earth originated when the man started using firewood for cooking and heating processes. Hippocrates, a well-known ancient physician, who practised medicine on the Greek Island of Cos, at about 400 BC and is considered to be the father of the medicine for his 80 written medical works, and written about the air-pollution prevailing even in those ancient times. With

the discovery and increasing use of coal, air-pollution has gone on becoming more and more pronounced, especially in urban areas. Smoke pollution in London became so pronounced at about 1200 AD, that King Edward-I was prompted to order the first anti-pollution law in the year 1273 to restrict people from using coal for domestic heating. In the year 1300, another law was enacted in London, banning the use of coal, and prescribing capital punishment for defiance of this law. In spite of such harsh measures, air-pollution assumed gigantic proportions in London during the Industrial Revolution, due to wide-spread use of coal in industries. So much so that a major disaster caused by "London Smog" occurred in December 1952, which caused the death of about 4000 people due to accumulation of air-pollutants over the London city for five consecutive days. By the middle of 19th century, barks of many trees in Europe, were blackened by smoke, due to which, the peppered Moths (insect worms living on trees, like caterpillars) of all colours other than the black coloured varieties, were easily picked up by birds, as they failed to camouflage on black coloured varieties, on black tree bark, as they did when on a clean Lichen-covered tree. Thus, although the normal Pepper patterned moths continued to survive in clean non-industrial areas, only black coloured moths could survive in industrial areas, as they alone could successfully camouflage. Thus, with the increased air-pollution, only black coloured moths could survive, and other species started to become extinct. This is a classic example of air-pollution, leading to adaptations and environmental imbalances caused in various biological species.

Air-pollution further began to increase in the beginning of the 20th century with the development of industries and automobiles, using coal and petroleum products like diesel, petrol, gasoline, etc. Air-pollution caused by the emissions of smokes from factories, coke ovens, furnaces, steam engines etc. exhaust fumes from automobiles, power plants etc. injurious chemical fumes from oil-refineries, zinc refineries, chemical industries, metallurgical plants, iron and steel plants, incineration plants etc. evolution of radio-active gases and suspended radio-active dusts from atomic explosions and accidental discharges from nuclear reactors etc. have polluted our natural air environment to such a great extent that it has now assumed regional and global dimensions, rather than having remained confined to causing only local effects.

(c) Explain the different methods of controlling Air-Pollution ?

Ans. Different Methods of Controlling Air-Pollution : Air-pollution can be controlled by the help of different modern technologies as follows :

(1) Controlling Air-pollution from Automobiles

- (i) Measures should be taken to prevent the air-pollution which is caused by smoke of the automobiles. The owner of vehicles should use the crankcase ventilation or catalytic converter.
- (ii) Low sulphur fuel which has less pollution potential can be used as an alternative to high sulphur fuels.
- (iii) Comparatively more refined liquified petroleum gas (LPG) or compressed natural gas (CNG) can be used in stead of traditional high contaminant fuels.
- (iv) Using unleaded fuel in vehicles can reduce lead menace.
- (v) Upkeep and maintenance of the auto engines, also of utmost importance to reduce air-pollution. The proper tuning of the engine and carburettor is very essential.
- (vi) The auto engines based on old and out-dated technologies further need to be replaced by modern engines provided with multi-point fuel injection (MPFI) system with dual intake valves to limit the fuel intake exactly to the needs of the engine, with no excess fuel usage at any point.

(2) Controlling Air-pollution from Industries :

- (i) Industries should be established at a considerable distance from residential areas to keep air-clean.
- (ii) Diluting smokes over a larger area, through the use of high rise chimneys, thereby transporting the pollutants over larger distances and thus reducing the pollution near the emission source.
- (iii) The chimney of an industry should be provided with filter.
- (iv) The particulate matter (dust) should be separated from air by using electro-static precipitators (ESP), gravitational settling chambers, fabric filters etc.
- (v) Control of emission of gaseous pollutants (smoke) from the industrial activities can be done by absorption units like spray towers and venturi-scrubbers etc. and also using adsorption towers.

- (vi) Atmospheric pollutants emissions can be reduced by adopting modified or new processes, e.g., using washed coal before pulverisation can reduce fly ash emissions, controlling proper air intake of boiler furnace etc.
- (vii) Use of exhaust hoods and ducts over several types of industrial ovens have not only reduce pollutants but also have resulted in the recovering of valuable solvents that could have become air-pollutants.
- (viii) Volatile substances can be recovered by condensation and the non-condensable gases can be recycled for additional reactions.
- (ix) Modifying or replacing the older equipments which contribute to greater degree of air-pollution. For example, smoke, CO_2 , CO etc. can be reduced if open hearth furnaces are replaced with controlled basic oxygen furnaces or electric furnaces.
- (x) An appreciable amount of pollution is caused due to poor maintenance of the equipment, which includes the leakage around ducts, pipes, valves etc. Emission of pollutants due to negligence can be minimised by a routine check up of the seals and gaskets.

(3) **Vegetation** : Plants contribute a lot towards controlling air-pollution by utilising CO_2 and releasing oxygen (O_2) in the process of photosynthesis. This purifies the air. Plenty of trees should be planted, especially around those areas like industries, cities etc. when are declared as high risk areas of pollution. Deforestation must be legally checked.

(4) **Other Methods to Check Air-pollution are :**

- (i) Enforcing legislative measures like EURO norms for automobiles, the air-pollution control Act, 1981 etc.
- (ii) Creating awareness among people, like observing "The World's Environment Day", including "Environmental Studies" in the curriculum of schools and colleges etc.
- (iii) Importance should be given on biological methods of pest control in place of chemical method of pest control in agriculture etc.
- (iv) Use of more non-convectional sources of energy like solar, wind etc.
- (v) Using public transportation system.

- (vi) Using energy efficient home appliances and switching of electrical appliances like fans, lights etc. when not in use.

4. (a) **What is ozone pollution ?**

Ans. Ozone Pollution : The layer of ozone in the atmosphere gives protection to the inhabitants of earth by absorbing the ultraviolet rays of the sun. However, ozone in the troposphere is a pollutant and causes harmful effect to animals and plants and earns a name bad ozone. The good ozone layer is also depleting due to the excessive release of chlorofluoro carbons (CFSs) from industries as they accelerate the destructions of ozone molecules. This is called ozone pollution.

(b) **What is radiation pollution ?**

Ans. Radiation Pollution : It is a physical phenomenon in which energy travels through space. There are two types of radiations, one is non-ionising e.g., ultraviolet rays, other is ionising e.g., X-rays, alpha, beta, gamma rays, protons and neutrons.

Sun is the source of spectrum of radiation such as radio-waves, infra-red, ultraviolet, X-rays, gamma rays, and cosmic rays. Besides, radioactive isotopes give off sub-atomic particles such as protons, neutrons, electrons, alpha particles, in the process of decomposition from an unstable state to a stable state.

Non-ionising Radiations : Radiations of shorter wavelength have greater energy and are harmful to micro-organisms. These radiations are capable of injuring only the surface tissue of higher plants and animals. They also increase the rate of mutation.

Ionising Radiations : Ionising radiations are very high energy radiations that are able to remove electrons from atoms and attach them to other atoms thereby producing positive and negative ion pairs, known as ionising radiations. Ionising radiations induce mutations and break in chromosomes. The damage is more during the cell division process. In man, the sensitive areas are epithelial linings of the skin and intestines, blood forming cells in the bone marrow and reproductive cells. Excessive use of X-rays causes death of tissues.

Man-made Radiations : The greatest exposure to human being comes from the diagnostic use of X-rays, about 70 millierms a year per person, and radioactive isotopes used as tracers. Radium dial wrist watches and TV sets add another millirem per day. Besides we are increasingly being exposed to cosmic radiations, because of more radiations.

Nuclear Wastes : Nuclear wastes from the Atomic power plants come in the form of spent fuel of uranium and the by-products such as plutonium. It is estimated that these can remain toxic to humans for over 200,000 years. Radioactive waste, another waste from the power atomic plants, can cause cancer of thyroid glands. Wastes coming from the production of nuclear weapons, produces radioactive strontium and calcium both of which are carcinogenic. These materials generate heat and penetrating radiations from centuries. The nuclear wastes such as contaminated dust, debris, clothing, industrial clothing, ash etc. when dumped into the soil, pollute the drinking water. It is therefore, necessary that the wastes coming from power-stations and defence establishments should be carefully handled, isolated, buried and protected.

(c) How does flow of energy take place in an ecosystem ?

Ans. Refer to 2017(S) Q. No. 4.(b)

5.(a) What are nuclear fall-out ? What is its effect ?

Ans. Nuclear fall-out are the radioactive debris coming from inside an atom bomb during the explosion, from material in the bomb casing and from earth or water carried aloft by the fireball. The radioactive debris of a nuclear explosion can remain aloft for months and years before it descend to earth as fall-out, depending upon how high in the atmosphere it is carried initially. The principal hazard from the fall-out are gamma radiations from local fall-out and radiation from Strontium-90, a radioactive isotope of the element strontium which can cause bone cancer and leukemia. A person may become sterile as a result of nuclear fall-out or the hereditary factors may be so altered that children may be born with serious birth defects.

(b) Describe the forest as an ecosystem.

Ans. It is a terrestrial ecosystem. It has both abiotic and biotic components. The abiotic components include soil, moisture, air, sunlight etc. The biotic components are producer, consumer and decomposer.

All the green plants of a forest are producers and they are the main source of the food for all animals. There are a number of consumers in a dense forest. The primary consumers are the grasshoppers, rabbit, deer, monkeys, birds and others who live on green food. These are called herbivores. They all utilise the plants directly as their food. The secondary consumers are wolves,

python, jackal etc. which consume the herbivores. The lion, tiger etc. are the consumers of top level.

The role of decomposers and transformers is very important. These are the micro-organisms, like bacteria, fungi which attach the dead bodies of producers and consumers and convert the complex organic compounds into simpler compounds and elements. These elements again return to the abiotic components and the reutilised by the producer as their nutrients.

The forest is a natural ecosystem but now-a-days the artificial ecosystems are produced which function first like natural forest ecosystem.

(c) Define urbanisation. Describe the effect of urbanisation on the environment.

Ans. Urbanisation is the process by which large number of people become permanently concentrated in small areas forming cities. The definition of city and urban area changes from time to time and place to place, the UNO has recommended that member countries regard :

All places with more than 20,000 inhabitants living close together as urban.

The 1961 and 1971 census of India has defined urban areas to include :

- all such places which have minimum population of 5000.
- places where atleast 75% of the male working population are employed in occupations other than agriculture.
- all places which have a population density of more than 1000 persons per square km.
- all municipalities, corporations, cantonments and notified town areas.

Human settlements are growing tremendously throughout the world thwarting environmental degradation in a number of ways, such as :

- (i) Encroachment of agricultural and fertile land for housing, industries, construction of roads and dams etc.
- (ii) Depletion of water resource due to increase in the water requirement.
- (iii) Pollution from industrial and other human activity.
- (iv) Emergence of slums which deteriorates the surrounding areas.

1. **Change in land use** : Town and cities grow with economic growth of human societies. These, therefore, emerge at locations where land provides a base for some viable economic activity both of agriculture and non-agricultural types. As towns grow they invade the productive crop lands and rich forests. Both intracity and regionally open lands are converted into built up areas. Thus, the land with all its biological resources is irreversibly lost.

2. **Depletion of water resource** : Water requirement of the urban population also increases many times and almost all of it has to be met through the water supply system. With rapidly increasing urban population and limited resources, it is becoming increasingly difficult to meet the requirements of the municipal water supply. As a result most of the cities have to draw water from outside. With further growth the demands increase and cities draw water from distant sources. Presently Delhi is drawing water from Ram Ganga 180 km. away. In each of the case, water from the cities has to be drawn at the cost of cultivation and rural demands, path followed also affects the ecosystem.

3. **Building materials** : Construction of houses and other structures need large quantities of building materials. Huge quantity of bricks took their shape from fertile land thus causing further damage to good agricultural land.

4. **Industries** : Industrial development goes almost hand in hand with urbanisation. Metropolitan towns like Kolkata, Mumbai and Chennai are alarming examples. Nearly 60% of industries in Maharashtra are located in Mumbai alone. Industries draw upon water resources heavily.

5. **Slums** : Slums represent one of the worst type of environmental degradation which have become concomitant to urbanisation and industrialisation. National Building Organisation reveal that in small and medium towns slum dwellers comprises about 10% while the figure is 20% for cities. Bihar has largest slum dwellers. The slum dwellers have an environment, with inadequate living space, water supply, sewerage facilities. This causes steady deterioration of surrounding regions as well as human health.

6. **Water pollution** : Pollution of fresh water through urbanisation and industrialisation is colossal. About 90% of the drinking water in the country comes from rivers polluted by these human activities. In India, cities are either not fully sewered or have very inadequate

facilities. Thus sewage either seep into the soil and pollute ground water or it flows through streams and rivers.

7. **Air pollution** : Most of the air-pollution in urban locations results from the discharge of sulphur dioxide, oxides of nitrogen, hydrogen sulphide and suspended particles, such as fly ash etc. The ingredients which are causing air-pollution come from automobiles, industries, kitchens and cause considerable damage to plants, animals and to human health.

In addition to environmental degradation, urbanisation has affected the social organisation, family structure, culture and behaviour of the population living in the urban areas as well as those who are living outside the urban centres.

6. (a) **What are the harmful consequences of excessive noise ?**

Ans. Prolonged exposure to noise levels above 85 decibels can cause permanent hearing damage. Noise can have adverse cardiovascular, respiratory, glandular and neurological effects. It can arise blood pressure and cause ulcers and stress and even insanity. It may cause abortion to pregnant women and hearing unpairment to the fetus.

(b) **How education can be used to save environment ?**

Ans. Education for environmental awareness is essential for the younger generation as well as for the older generation. It also needs to cover both urban and rural population. The beneficiaries at the grassroot level are as much a client for environmental education as are the policy makers, the decision makers and the project implementers. Hence environmental education need to be conveyed to these different categories of people through formal education systems, non-formal education systems and the use of mass media.

The education system is divided into two major stages, namely school and university education.

School Stage. Four components are required to build up the social awareness about environmental education at the school level. These are awareness, exposure to real life situations, concepts and conservation and sustainable development.

Awareness involves making the individual conscious about the physical, social and aesthetic aspects of environment. One has to appreciate the fact that man is only one of the numerous species on earth and is linked



with the life support systems with six elements, air, water, land, flora, fauna and sunlight. These elements are crucial to the well being of human kind as well as other species.

Real life situations brings men closer to the environment. These conditions are location specific, with different environmental aspects being emphasised in different states. For example, agriculture based areas may lay emphasis on pollution due to agricultural practices.

As far as conservations and sustainable development are concerned, the main focus would be on utilisation of resources and not on exploitation. Utilisation stands for long term sustainability of the resources. Sustainable development aims at utilisation of resources not only by the present generations but their preservation for the future generation.

At the primary stage, emphasis will be more on awareness followed by real-life situation and the focus on conservation. From the lower secondary stage onwards and awareness will begin to decrease in favour of increased knowledge about real life situation, conservation and sustainable development. At the higher secondary stage, conservation will get priority over other factors.

(c) How can carelessness in developmental activities affect human beings ? Discuss with two suitable examples.

Ans. Carelessness in development activities affect human beings in several ways. The negative aspect of industrialisation and growing menace resulting from environmental pollution are always output of development activities. Extensive industrialisation, use of chemicals and fertilisers for agriculture and high energy input technologies are potential threat to environment. Over consumption and wasteful use of natural resources by the developed nations and the privileged strata in the developing nations pose another kind of threat. Global problems created by inequitable development go far deeper. At the same time acid rain and ozone depletion are indicators of a slow poisoning of environment.

Like any life form, man also has to depend on the natural resources for his survival. He has to transport materials available in nature and transform them into desired forms and quality. Human force is the driving force for exchange between nature and society. These exchanges occurring constantly. Man is under pressure

to accelerate the exchanges to sustain as well as to develop. However he has done little to maintain the delicate balance between these exchanges. Almost all activities of the human society have degraded environment physically, chemically, biologically and even ethically. The continuous intervention in the dynamic natural evolutionary process leads to loss of environmental steady state. The perfect compatibility is also in conflict with man's effort to innovate and improve the state of affairs in his, own interest. Growing development activities create hazardous waste which is a threat to environment and public health. Also there is occurring degradation of soil, degeneration of environment, deforestation, air-pollution, water pollution, depletion, of natural resources, extinction of flora and fauna, growing number of accidental deaths etc.

All these effects are originated from development activity. Bhopal gas tragedy and Chernobyl accident are examples of increasing catastrophic hazard. The 1999 super-cyclone of Odisha and present endemic draught in various parts of India, growing global temperature also attributed to the developmental activities.

7. (a) Describe the different types of radiation. How are they measured ?

Ans. There are different types of radiations as α -ray, β -ray, γ -ray, X-ray and ultraviolet ray. These radiations have high energy and harmful. The extent of damage depends upon exposure to the amount of radiation and is measured in units of rad (Radiations absorbed dose). One rad is equal to 100 ergs of energy deposited per gram of tissue. The rate of transfer of energy to the tissue is also important. This is called Linear Energy Transfer (LET). It is amount of energy transferred per unit of distance the radiation travels into the tissue. Alpha α particles travel slowly. So they transfer more energy than β , γ and X-rays that travel faster. Another unit rem (Roentgen Equivalent Man) which takes into account linear energy transfer is used to measure radiation exposure. Rad and Rem are equivalent for X-rays, β -rays and γ -rays, but for α particle, 1 rad is equivalent to 10-20 Rem. International unit of measurement are Gray = 100 rad and 1 Sievert = 100 rem.

(b) State the feasibility of "sustainable development" seeks to strike a balance between economic progress and environment protection.

Ans. Sustainable development implies achieving economic development through use of natural resources without damaging permanently the environment or ecological balance. Developed countries having fully exploited resources are now seeking to impose these views-element of science and technology imperialism. Developing countries need not blindly follow West but they can develop environmental friendly development processes. There is nothing wrong if industrial pollution is checked and safely standards set, health ensured, but these are costly and difficult to implement at times. Developed countries having reached a high level are now asking. Third World countries to reduce energy consumption. In this matter the developed countries should extend concrete help-financial and technological.

There is a vicious circle to escape from developing countries, by developing rapidly enough to reduce poverty, one undermines the resources base that makes continued development possible. If poverty is not reduced population will grow at an alarming rate, non-sustainable practices of cultivation will accelerated, and the resource base will be destroyed any way. The only way out of this trap is to manage resources in a sustainable way.

Waste is not the necessary consequence of economic development but of inappropriate institutions, infrastructure and economic policies. There is absolutely no reason why suitable policies can not be devised for sustainable development, even for developing countries.

(c) Waste can be converted to wealth. Illustrate with suitable examples.

Ans. In true sense the waste can be converted to wealth. For example - consider Gobar gas.

As the very name indicates it is generated from 'Gobar', the animal excreta. Also it can be generated from wood and straw in specially built digestions. Its main constituent is methane gas. Any farmer who owns two to three cattle heads can maintain the plant. The cow dung can be either used for fuel or manure in the field unidirectionally. Its multipurpose beneficial use can be made by gober gas plant. One of the greatest merits of gober gas is its versatility that is it can be used for cooking, lighting and power generation, running refrigeration or tubewell pumpsets and the residue left over after digestion. "Spentisulry" is a good fertiliser rich in NPK than the previously used fung manure. The spent slurry contains significant number of bacteria beneficial to the crops.

The dung is collected and diluted with water along with straw, wood savings or other agriculture of abattoir residues.

The range of raw materials that can be digested in gober gas digestion is infact very wide, kitchen wastes, human night soil, piggery refuse, waste newspapers, city sewage. Almost any natural organic matter can be digested to produce gober gas which is collected in the dome above the digester, from where it is taken to the kitchen through pipes and burnt in gas burner for cooking. Its other benefits include reduction of indiscriminate feeling of trees for fuel, improvement in sanitation, reduction in the incidence of eye disease among village women and easy and efficient cooking.



PRACTICE SETS

SET - 1

[BST - 501]

Full Marks - 70

Time - 3 Hours

Answer any five questions.

The figures in the right-hand margin indicate marks.

1. (a) What do you mean by environment ? [2]
(b) Write the importance of environmental studies and the need for public awareness. [5]
(c) Explain briefly about the various sources of environmental pollution. [7]
2. (a) Define Green Technology. [2]
(b) Briefly explain the characteristics of an eco-system. Differentiate between food chain and food web. [5]
(c) Explain briefly about aquatic and terrestrial eco-system. [7]
3. (a) Name some air-polluting gases. [2]
(b) State the drawback of nuclear power and their adverse environmental impact. [5]
(c) Write the sources, effects and control measures of green house gases. [7]
4. (a) Define (i) Biotic component and (ii) Abiotic component of an eco-system. [2]
(b) Discuss about Desert eco-system. [5]
(c) How does flow of energy take place in an eco-system ? [7]
5. (a) Define waste. [2]
(b) Briefly explain the various sources of waste generation. [5]
(c) Define energy. Explain briefly about the various sources of renewable and non-renewable energy. [7]
6. (a) Differentiate between nuclear fission and nuclear fusion. [2]
(b) What is population explosion ? State its adverse effects. [5]
(c) Explain the sources of noise and its effect. [7]
7. (a) Define sustainable development. [2]

- (b) How social awareness can improve environmental management ? [5]
- (c) What do you mean by bio-diversity ? Explain briefly. [7]

SET - 2

[BST - 501]

Full Marks - 70

Time - 3 Hours

Answer any five questions.

The figures in the right-hand margin indicate marks.

1. (a) Define eco-system. [2]
(b) What do you know about biotic components of eco-system ? Explain. [5]
(c) Explain the structural and functional aspects of an eco-system. [7]
2. (a) Differentiate between food chain and food web. [2]
(b) Describe grassland ecosystem. [5]
(c) Explain the flow of energy in an ecosystem. [7]
3. (a) What is energy and state its importance ? [2]
(b) Explain production of Gobar gas from bio-mass. [5]
(c) Differentiate between renewable and non-renewable sources of energy. [7]
4. (a) What is solar energy ? State its advantages. [2]
(b) Write the various sources of air-pollution and its effect on environment. [5]
(c) Explain the methods adopted in thermal power plant to control air and water pollution. [7]
5. (a) Define noise. In which unit it is measured ? [2]
(b) State the various sources of noise pollution and its controlling methods. [5]
(c) Explain the effects of water pollution on human and aquatic animals. [7]
6. (a) Define hazardous waste. [2]
(b) Discuss about the functions of pollution control board to safe-guard environment. [5]
(c) Define urbanisation. Describe the effects of unplanned urbanisation on the environment. [7]
7. (a) What are the major air and water borne diseases ? [2]

- (b) Explain Green house effect. [5]
 (c) State and explain global warming with its adverse effect on environment. [7]

SET - 3

[BST - 501]

Full Marks - 70 **Time - 3 Hours**

Answer any five questions.

The figures in the right-hand margin indicate marks.

1. (a) Define energy. State its importance. [2]
 (b) Explain briefly about the scope and importance of environmental studies. [5]
 (c) Explain the function of Ecosystem. [7]
2. (a) State the name of some natural resources. [2]
 (b) What is the use of multipurpose water reservoir projects? Examine the benefits and problems. [5]
 (c) Why rain water harvesting is inevitable for conservation and management of water? [7]
3. (a) What do you mean by Green Technology? [2]
 (b) Explain hydrogen as an energy sources. [5]
 (c) Write the necessity, importance and method of conserving energy. [7]
4. (a) Draw the diagram of flow of energy in an ecosystem. [2]
 (b) Explain briefly about forest ecosystem. [5]
 (c) Explain briefly about green house effect and acid rain. [7]
5. (a) Define pollution. [2]
 (b) Can economic growth and environmental protection go together? Explain with an example. [5]
 (c) How can carelessness in developmental activities affect human beings? Discuss with suitable examples. [7]
6. (a) Define sustainable development. [2]
 (b) How awareness of public be used to save environment. [5]
 (c) Explain the grave consequences of global warming. [7]
7. (a) Define thermal pollution. [2]
 (b) Explain the different causes of air pollution. [5]
 (c) Describe the various methods of controlling air pollution. [7]

SET - 4

[BST - 501]

Full Marks - 70

Time - 3 Hours

Answer any five questions.

The figures in the right-hand margin indicate marks.

1. (a) Define ecology and biome. [2]
 (b) Explain briefly about various threats to biodiversity with examples. [5]
 (c) Explain need of land resources. Write the main causes of degradation of land. [7]
2. (a) What do you know about biotic components of ecosystem? [2]
 (b) Write short notes on : Food chain and Food web. [5]
 (c) How does flow of energy take place in an ecosystem? [7]
3. (a) What is meant by global warming? [2]
 (b) What are the major components of environment? Discuss their importance to the mankind? [5]
 (c) Define noise. How noise is measured? What are the impact of noise pollution? [7]
4. (a) What is soil pollution? [2]
 (b) How does pollution of marine ecosystem take place? What steps are taken for its control? [5]
 (c) What is solid waste pollution? How are they disposed? [7]
5. (a) What is green house effect? [2]
 (b) How can air pollution be controlled? [5]
 (c) What are the causes and effects of water pollution? [7]
6. (a) What is organic farming? [2]
 (b) What is acid rain? What are its effect? How can its effect be checked? [5]
 (c) What are the ill-effect of pesticides and explain the safety precautions to be followed during the use of pesticides? [7]
7. (a) Why conservation of natural resources is necessary? [2]
 (b) List any five natural sources of energy and describe briefly about them. [5]
 (c) What are the different media that can be used to educate people about environment? Explain the role of NGOs in imparting environmental education and awareness. [7]