B.Tech.

First Semester Theory Examination 2010-11

ENVIRONMENT AND ECOLOGY

Time : 3 Hours] **[Total Marks : 50**

Note : The question paper contains three Sections—Section A, Section B and Section C with the weightage of 10, 15 and 25 marks respectively. Follow the instruction as given in each section.

SECTION : A

This question contains 10 questions of multiple choice/Fill in the blanks/True, False/ Matching correct answer type questions. Attempt all parts of this section. **(10 × 1 = 10)**

Q. 1. Fill in the following blanks with suitable words :

Q. 1. (a) A World Environment Day is observed on ..... **Ans.** 5 June

Q. 1. (b) Chipko movement was started to converse ..... **Ans.** trees

Q. 1. (c) Acid rain is caused due to emission of ..... to the atmosphere. **Ans.** CO_2

Q. 1. (d) Balika Samridhi Yojna is a measure of ..... welfare. **Ans.** girlchild

Q. 1. (e) The ecological pyramid which is always straight is ..... .

Ans. Pyramid of energy

Q. 1. (f) The maximum value of requirement (desirable limit) of Fluoride (as F) in drinking water as per IS 10500 is ..... . **Ans.** 1.5 mg/l

Q. 1. (g) Gas leaked in Bhopal Tragedy was ..... . **Ans.** Methyl iso cynate

Q. 1. (h) The study of interaction between living and non-living organism and environment is called as ..... . **Ans.** Ecosystem

Indicate True or False for the following statements :

Q. 1. (i) Algae is an example of Protozoa. ***(True/False)*** **Ans.** False

Q. 1. (j) Green marketing and eco-laheling are good strategies to protect environment from waste products. ***(True/False)*** **Ans.** True

SECTION-B

Q. 2. Attempt any three parts. All parts carry equal marks. **(5 × 3 = 15)**

Q. 2. (a) Write an explanatory note on the multidisciplinary nature of environmental science.

Ans. The essence of environmental science is its multi-disciplinary nature. A relatively new field environmental science has evolved from the integrated use of various disciplines and includes some of the most important topics of modern civilization as well as some of the oldest philosophical concerns of the human beings—that of the nature of human relationship with his environment. Applied and basic aspects of environmental science require a solid foundation in the natural sciences biology, in addition to fields like anthropology, sociology, history art, literature, religion, law,

economics, management, palentology, ecology, political science and philosophy of the environment. In contrast to more theoretical disciplines, environmental scienre is problem-oriented. *i.e.*, it seeks new, valid, generalizable knowledge about the natural world and our impacts or it. The field of environmental science, integrates the natural sciences, social sciences and humanities with environmental ethics, environmental laws, environmental economies, environmental impacts and environmental planning. As a result, many disciplines contribute to environmental science and help us to understand the entire spectrum of relationships between people and environment.

Q. 2 (b) Discuss the environmental effects of extracting and using mineral resources.

Ans. Environmental Effects of Extracting and Using Mineral Resources : The mining and processing of mineral resources usually have a considerable impact of land, water air and biological resources; they also have a social impact because of the increased demand for housing and services in mining areas. Some of the major environmental impacts of mining and processing operations are :

- degradation of land.
- pollution of surface and ground water resources due to the release of harmful trace elements (cadmium, cobalt, copper, lead and others) by leaching, even if drainage is controlled.
- serious adverse impact on the growth of vegetation due to leaching out of trace elements and minerals.
- air pollution due to emission of dust and gases.
- deforestation including loss of fauna and flora.
- adverse impact of historical monuments and religious places.
- Species are killed by mining activity or contact with toxic soil or water are examples of direct impacts, whereas indirect impacts include changes in nutrient cycling, total biomass, species diversity.
- Local ecological system is damaged due to discharge of pollutants and the pollutants spread over a large area of land on account of earthquake.

Social impacts of large scale mining are rapid influx of workers into areas unprepared for growth. This may cause :

- additional burden on local servires, such as water supplies, sewage and solid waste disposal systems, schools and housing.
- land use shifts from open range, forest and agriculture to urban patterns.
- increased stress on nearby recreation and wilderness area (some of which may be in fragile ecological balance) due to additional people.
- construction activities and urbanization affect local streams/rivers through sedimentation, reduced water quality and increased run off.
- air pollution due to more vehicles, dust from construction and generation of power.

Dereliction (closing or abandoning mines, *i.e.*, deserting and left to fall into ruin) results from the ruthless exploitation of natural resources without consideration for the future. In fact, most dereliction is the result of thoughless and uncontrolled mineral extraction and processing. The harmful effects of dereliction include :

- waste of agriculture and industrial land
- ugliness
- health and accident hazards
- permanent damage to landscape
- shafts that are not filled in may lead to accidents.
- fertility of land is lost.

Q. 2. (c) Write down National Ambient Air Quality Standards for Industrial, Residential, Rural and other area as prescribed by Central Pollution Control Board.

Ans. This Act was promulgated in 1981. It is, therefore, known as The Air (Prevention and Control of Pollution) Act, 1981. It was amended in 1987. Salient features of this Act are briefly given below for appraisal and understanding :

Objectives : This Act is meant to serve the following objectives :

(a) prevention, control and abatement of air pollution

(b) maintaining the quality of air

(c) establishment of Boards for the prevention and control of air-pollution.

Definition of Pollution under tbis Act, 'Act-pollution' means the presence in the atmosphere of any air pollutant.

(a) evaluation and assessment of the functioning of the zoos with respect to be prescribed standards.

(b) recognise and de-recognise zoos.

(c) identification of endangered species of the wild animals for purpose of captive breeding.

(d) co-ordination of acquisition exchange and loading of animals for breeding purposes.

Penalties for violation of the provisions in tbis Act

(a) A person violating any provision of this Act shall be guilty of an offence against this Act and shall be punished with imprisonment for three years or a fine of Rs. 23000/- or both.

(b) When a person is convicted of an offence against this Act, the court may order that any captive animal, wild animal, animals article, tropy, trap, vehicle, weapon etc., be forfeited to the State Govt. and that any licence or permit held by such person under the provisions of this Act be cancelled in addition to the other penalities award in such an offence.

(c) In case of cancellation of licence, the court may order that such a person shall not be eligible for a licence under the Arms Act, 1959, for period of 5 years from the date of conviction.

Q. 2. (d) Discuss the Indian Scenario in solar energy utilization and development.

Ans. Indian Scenario : Coal, oil, gas and water constitute the main sources of energy in our country. The share of different energy sources in the commercial consumption of energy is mostly from coal (56%) and petroleum (32%), the other sources being nuclear, natural gas and water. Also a large amount of traditional energy sources in the form of fuel wood, agriculture waste and animal residue are used.

Commercial energy consumption has grown from 130.7 MTOE in 1991-92 to 176.08 MTOE in 1997-98. The main drivers of this increase are the accompanying structural change of economic growth and a rise in population together with rapid urabanisation.

Industrial sector is the largest consumer of energy consuming about 50% of the total commercial energy evolved in the country followed by the transport sector. Among the most energy intensive industries which together account for nearly 80% of the total industrial energy consumption are the fertiliser, textiles, cement, iron, aluminium, and steel, pulp and paper and chloro-alkali.

Transport sector is the largest consumer of petroleum products—mainly in the form of high speed diesel and gasoline and accounts for nearly 50% of the total consumption.

In the domestic sector, the consumption of natural fuel energy is very high. Around 78% of rural and 30% of urban households depend on fire wood. While, the mix of traditional fuels in the national energy mix is descreasing as more efficient commercial fuels are increasingly subsituting these. In particular between 1970-71 and 1994-95, the annual consumption of electricity per household went up from 7 kwh to 53 kwh; of kerosene form 6.6 kg to 9.9 kg and of cooking gas from 0.33 kg to 3.8 kg. While, there is a marked disparity in the level of energy and type of fuel consumed in rural and urban areas.

Q. 2. (e) Explain intensity, power and pressure levels of noise.

Ans. The Decibel : Decibel is a logarithmic unit used to describe physical values like the ratio of the signal level-power, sound, pressure, voltage or intensity.

The decibel can be expressed as :

$$\text{decibel} = 10 \log (P / P_{ref}) \qquad \ldots(1)$$

where, P = signal power (W)

P_{ref} = reference power (W)

Sound Power Level : Sound power is the energy rate : the energy of sound per unit of time (J/s, W in SI-units) from a sound source.

Sound Power can more practically be expressed as a relation to the threshold of hearing : 10^{-12} W - in a logarithmic scale named Sound Power Level - L_w :

$$L_w = 10 \log (N / N_0) \qquad \ldots(2)$$

where, L_w = Sound Power Level in Decibel (dB)

N = sound power (W)

- The lowest sound level that people of excellent hearing can discern has an acoustic sound power about 10^{-12} W, 0 dB.
- The loudest sound generally encountered is that of a jet aircraft with a sound power of 10^5 W, 170 dB.

Sound Intensity : Sound Intensity is the Acoustic or Sound Power (W) per unit area. The SI-units for Sound Intensity are W/m^2. The Sound Intensity Level can be expressed as :

$$L_1 = 10 \log (I / I_{ref}) \quad ...(3)$$

where, L_1 = sound intensity level (dB)

I = sound intensity (W / m^2)

$I_{ref} = 10^{-12}$ - reference sound intensity (W / m^2)

Sound Pressure Level : The Sound Pressure is the force (N) of sound on a surface area (m^2) perpendicular to the direction of the sound. The SI-units for the Sound Pressure are N/m^2 or Pa.

The Sound Pressure Level : $L_p = 10 \log (p^2 / pref^2) = 10 \log (p / p_{ref})^2 = 20 \log (p / p_{ref})$ ...(4)

where, L_p = sound pressure level (dB)

p = sound pressure (Pa)

$p_{ref} = 2\ 10^{-5}$-fererence sound pressure (Pa)

- If the pressure is doubled, the sound pressure level is increased with 6 dB (20 log (2)).

SECTION-C

Attempt any five questions. **(5 × 5 = 25)**

Q. 3. (a) Define ecology and ecosystem. Explain the role of producers, consumers and decomposers in an ecosystem.

Ans. Ecosystem is considered a unit of Ecology. The meaning—"Eco" means environment, "logy" means science and "system" refers to interaction and interdependence of organisms and environment. Ecology means the science of environment. Ecosystem means environmental system of particular place and in a unit time.

Role of Producers, Consumers and Decomposers : All organisms in an ecosystem require energy for their life process and materials for the formation and maintenance of body structure. Food supplies both energy and materials for the sustenance of life. Though the ecosystems are characterized by a diversity of species; but for their long term survival, the ecosystems must have representatives from the three functional or metabolic groups, *viz., primary producers, consumers and decomposers.*

(i) Primary Producers : Primary producers are those organisms that derive energy from either sun light or inorganic compounds and make organic compounds from inorganic compounds (such as CO_2, water and nutrients like sulphate, phosphate and nitrate). For example, many primary producers like green plants, algae, photosynthetic bacteria obtain energy from sunlight for

making organic compounds (including carbohydrates, proteins and fats) by photosynthesis; while other producers such as sulphur oxidizing bacteria use energy stored in the chemical bonds of inorganic compounds for making organic compounds. As the green plants manufacture their own food, they are called as autotrophs.

The chemical energy (in the form of organic molecules) stored by the primary producers is utilized partly by themselves for their growth and survival, while remaining is stored in the plant parts for their future use.

(ii) Consumers : Consumers are those organisms which use organic compounds for their food and energy. They cannot make organic compounds from inorganic compounds as they lack chlorophyl; but they can transformone form of organic compounds into other forms of organic compounds. For example, animals, protozoa and many bacteria; they depend on the producers for their food and are called as heterotrophs.

The types of consumers are :

(a) Primary consumer : These are the animals that feed on primary producers and are called as herbivores. For example—Deer, goat, grasshopper, cattle, etc.

(b) Secondary consumers : These are the animals that feed on the herbivores and are called as the primary carnivores. For example—hawk, lizard, owl, fox, cat, etc.

(c) Tertiary consumers : These are the large carnivores that feed on the primary carnivores (*i.e.*, secondary consumers). For example—snake, wolves, etc.

(d) Quaternary consumers : These are the largest or top carnivores that fed on the tertiary consumers and are not eaten up by any other animal. For example—lions, tigers, etc.

(iii) Decomposers : Decomposers are those organisms which feed on dead organisms (plants and animals) and transform complex organic compounds back into simple inorganic compounds including water, CO_2 and other nutrients. For example—non-green organisms such as fungi and some bacteria.

The simple inorganic substances released into environment by the decomposers are then reused by the producers. Thus, resulting in a cyclic exchange of materials between the biotic community and the abiotic environment.

Q. 3. (b) With the help of flow chart, describe the Environment Impact Assessment process.

Ans. Energy flow in Ecosystems : All ecosystem needs energy for its survival. The supply of energy has to be continuous to maintain the biotic structures and their functions. The energy flow refers to a cyclic movement of energy through an ecosystem. It means that the energy comes from the environment which is external to the ecosystems, passes through a series of organisms, and then returns to same external environment from where it had come. Schematic arrangement of an energy flow is shown in Fig.

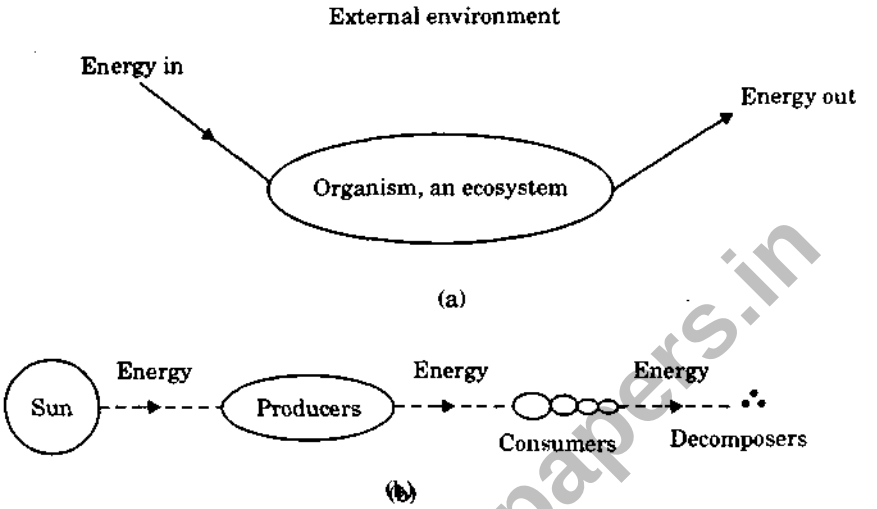


Fig. (a) Schematic arrangement of energy flow, and
(b) One-way flow of solar energy into ecosystems.

The flow of energy through an ecosystem is a very essential requirements. Every ecosystem undergoes this process since the existence of life in ecosystem depended on it. The quality and quantity of energy flow decides the richness or poorness, and abundance or shortness of life. In biospnere, the sun is ultimata source of energy. Importance of its uninterrupted flow can be understood by following examples.

- If the quantity of solar energy (*i.e.*, sunlight) is reduced *i.e.*, the sun shines lesser than its normal hours, the quantity and quality of forests will degrade and the growth will be inadequate.
- If the quality of solar energy (input) is poor *i.e.*,, its intensity is less than the normal, the plautation and vegetation will be scarce.

The flow of energy of continuous and one way in every ecosystem. A unidirectional flow of energy from 'sun' to decomposer is shown in Fig. The path of energy traverses through producers and macro-consumers before raching decomposer. However, it cannot flow in reverse direction. It is because of one way nature of energy flow.

Energy conversions mechanisms : The above fact can be understood with the help of following illustrations :

1. Food once eaten by an organism, cannot be regained as food. It transforms into energy.

2. Energy once used, converts into heat which cannot be recovered as energy.

3. All living beings require food (hence energy) again and again for maintaining their life cycle (Process).

4. The energy comes from an outside source only. It can be utilized in two ways *viz.* by performing some work and/or storing in the body for sometime.

5. Finally, it has to be dissipated into the surrounding (environment). As the released energy

many-only. It holds good for everyone even the non-living machines. Hence the phenomenon is known to occur universally.

Q. 4. (a) What is deforestation ? Enumerate and discuss the various causes of deforestation.

Ans. Deforestation : It is defined as the reckless demolition of trees and plants. Forests are cut down for economic gains. However, the following reasons responsible for it are :

(i) Timber harvesting

(ii) Clearning the land for agriculture

(iii) Expansion of urban area

(iv) Over grazing

(v) Agriculture

(vi) Expansion of cities

(vii) Industries

Deforestation is a disastrous and irreversible occurrence. Its gain are short-lived out the damaging effects are long lasting.

Causes of Deforestation : Main causes of deforestation can be enumerated as follows :

1. Need of land to accommodate increasing population by constructing building, houses etc.
2. Economic gains by selling timber.
3. Industrial growth such as establishing a new power project, a new industry, a corporate office etc.
4. Acquiring land for constructing dams and irrigational canals.
5. Mining and quarrying for minerals, oil exploration etc.
6. As a government sponsored programme, resettlement of landless farmers on forest sites.
7. Conversion of forest to pasture.
8. Overgrazing and conversion of forest to pasture by domestic animals.
9. Commercial logging.
10. Shifting cultivation also called Jum cultivation.

Effects of deforestation : The major detrimental effects are as follows :

1. Decrease in rainfall.
2. Soil erosion.
3. Loss of fertile land.
4. Lowering of water table.
5. Loss of flora and fauna.
6. Increase in climatic temperature.
7. Global warming.
8. Increase of CO_2 in atmosphere.
9. Rise in concentration of pollutants in air.
10. Threat of flood havocs.

11. Lack of firewood, etc.

In many tribal and rural societies, the expenditure of fuel constitutes a major portion of household budget. Therefore, if the forests shrink, there may be serious threat to their living.

Q. 4. (h) Explain the sulphur cycle with neat sketch.

Ans. Sulphur Cycle : Sulphur is one of the constituenta of many proteins, vitamins and harmones. It recycles as in other biogeochemical cycles.

The essential steps of the **sulfur cycle** are :

- Mineralization of organic sulfur to the inorganic form, hydrogen sulfide : (H_2S).
- Oxidation of sulfide and elemental sulfur (S) and related compounds to sulfate (SO_4^{2-}).
- Reduction of sulfate to sulfide.
- Microbial immobilization of the sulfur compounds and subsequent incorporation into the organic form of sulfur.

These are often termed as follows :

Assimilative sulfate reduction (see also sulfur assimilation) in which sulfate (SO_4^{2-}) is reduced to organic sulphydryl (otherwise known as thiol) groups (R—SH) by plants, fungi and various prokaryotes.

The oxidation states of sulfur are +6 in sulfate and –2 in R—SH.

Desulfuration in which organic molecules containing sulfur can be desulfurated, producing hydrogen sulfide gas (H_2S), oxidation state = – 2. Note the similarity to deamination.

Oxidation of hydrogen sulfide produces elemental sulfur (S^0), oxidation state = 0. This reaction is done by the photosynthetic green and purple sulfur bacteria and some chemolithotrophs.

Further *oxidation of elemental sulfur* by sulfur oxidizers produces sulfate.

Dissimilative sulfur reduction in which elemental sulfur can be reduced to hydrogen sulfide.

Dissimilative sulfate reduction in which sulfate reducers generate hydrogen sulfide from sulfate.

Sulfur Sources and Sinks : Sulfur is found in oxidation states ranging from +6 in SO_2 to –2 in sulfides allowing it to either give a receive electrons depending on its environment. The original pool of sulfur on earth was held in igneous rocks largely as igneous pyrite (FeS_2). The sulfur cycle has evolved with the Earth and the amount of sulfur available has been continuously increasing through volcanic activity and weathering of the crust in an oxygenated atmosphere. Earth's main sulfur sink is the oceans as SO_2, where it is the major oxidizing agent.

When SO_2 is assimilated by organisms, it is reduced and converted to organic sulfur, which is an essential component of proteins. However, the biosphere does not act as a major sink for sulfur, instead the majority of sulfur is found in seawater or sedimentary rocks especially pyrite rich shales ande evaporite rocks (anhydrite and baryte). The amount of sulfate in the oceans is controlled by three major processes :

1. input from rivers

2. sulfate reduction and sulfide reoxidation on continental shelves and slopes

3. burial of anhydrite and pyrite in the oceanic crust.

There is no significant amount of sulfur held in the atmosphere with all of it coming from either sea spray or windblown sulfur rich dust, neither of which is long lived in the atmosphere. In recent times the large annual input of sulfur from the burning of coal and other fossil fuels adds a substantial amount SO_2 which acts as an air pollutant.

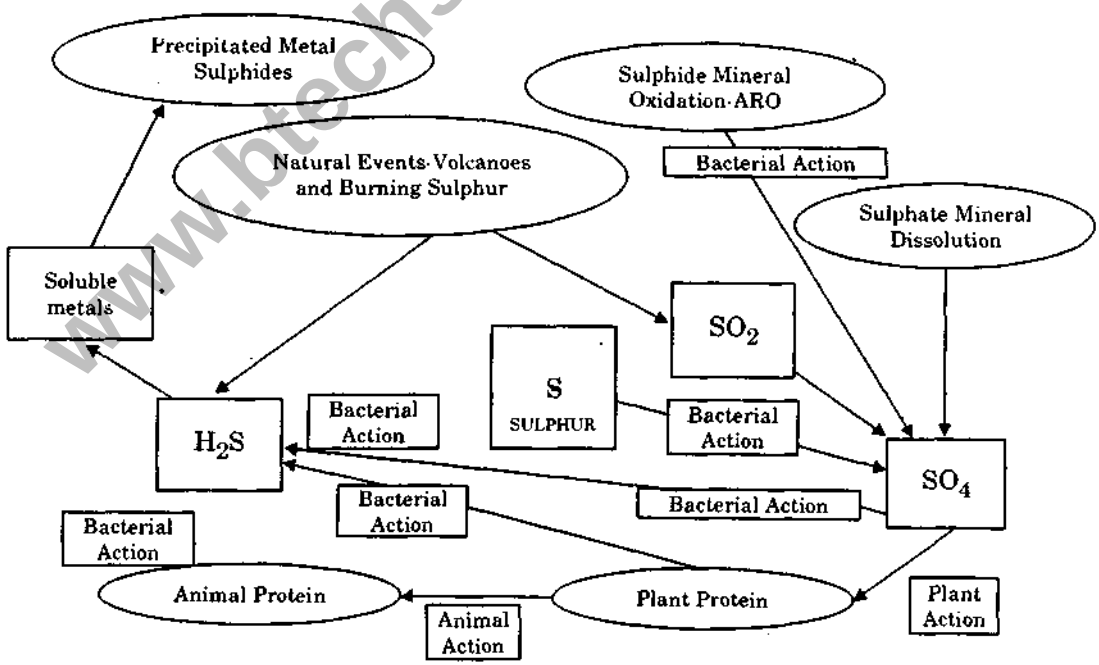
Dimethylsulfide[$(CH_3)_2S$ or DMS] is produced by the decomposition of dimethylsulfoniopropionate DMSP) from dying phytoplankton cells in the shallow levels of the ocean, and is the major biogenic gas emitted from the sea, where it is responsible for the distinctive "smell of the sea" along coastlines. DMS is the largest natural source of sulfur gas, but still only has a residence time of about one day in the atmosphere and a majority of it is redeposited in the oceans rather than making it to land.

Biologically and thermochemically driven sulfate reduction : Sulfur can be reduced both biologically and thermochemically. Dissimilarity sulfate reduction has two different definitions :

1. the microbial process that converts sulfate to sulfide for energy gain, and

2. a set of forward and reverse pathways that progress from the uptake and release of sulfate by the cell to its conversion to various sulfur intermediates, and ultimately to sulfide which is released from the cell.

SIMPLIFIED SULPHUR CYCLE FOR MINERAL DEPOSITS



Q. 5. (a) Define air pollution. What are the sources of air pollutants ? How will you classify air pollutants ?

Ans. While the green house gases and the CFCs may be considered global pollutants (because they potentially harm the climate system and the stratospheric ozone layer worldwide), the term "air pollution" generally refers to substances that on local and regional scales directly harm animals, plants, and people and their artifacts. There have been complaints about air quality for centuries, especially in cities. But the steady expansion of pollution and industrial civilization has changed the nature of air pollution. The pervasive effects of emissions are increasingly mainfest, and the need to control them is influencing to a greater degree the development of technology, particularly in the energy and transportation sectors.

The causes of air pollution

1. Carbon compounds : These are mainly CO_2 and $CO \cdot CO_2$ is released by complete combustion of fossil fuels and CO by automobile exhausts. CO is a poisonous gas.

2. Sulphur compounds : These include $SO_2 \cdot H_2S$ and H_2SO_4. These are mostly released by fossil fuel (coal, etc.) based at thermal power plants and industrial units such as oil refineries.

3. Nitrogen oxides : These include chiefly, NO, NO_2, HNO_3. These are mostly released by automobiles, power plants and industries.

4. Ozone (O_3) : Its level may rise in atmosphere due to human activities.

5. Fluorides : These come from industries, insecticides spray, etc.

6. Hydrocarbons : These are chiefly benzene, benzyprene, etc., which are mostly discharged by automobiles and industries.

7. Metals : These mainly include lead, nickel, arsenic, beryllium, tin, vanadium, titanium, cadmium, etc., which are present in air as solid particles, liquid droplets or gases. They are produced mostly by metallurgical processes, automobiles, spray, etc.

8. Photochemical products : These are the photochemical smog such as PAN, PB_2N, etc., and released mostly by automobiles.

9. Particulate matter : These are fly ash, dust, grit and other suspended particulate matter (SPM) released from power plants and industries like stone crushes, etc.

10. These are bacterial cells, fungal spores and pollens in air as biological particulate pollutants.

11. Toxicants other than heavy metals : These are complex chemical substances released during manufacture of other goods.

Types of Air Pollutants

(a) Primary Pollutants

(i) Natural Pollutants : Natural pollutants are natural fog, bacteria and the products of volcanic eruptions.

Among natural contaminants **'Pollen'** is the most important because of its particular properties irritating to some individuals. They are discharged in to environment from seeds trees and grasses. Because of wind, thousand of pollen grains are liberated. Air transported pollen grains range chiefly between 1 to 50 km in size.

(ii) Aerosols : These refer to the dispersion of solid or liquid particles of microscopic size in gaseous media. *e.g.*, dust, smoke or mist.

An aerosol can also be defined as a colloidal system in which the (**dispersion medium ls gas and dispersed phase is solid or liquid**). Aerosols differs widely in terms, or particles size, particle density and their importance as a pollutants. Their diameter generally ranges from 0.1 μm or less up to about 100 μm. Some of the aerosols are as follows :

(a) Dust : Dust is made up of solid particles predominately larger than those found in **colloidal** and capable of temporary suspension in air or other gases. They do not diffuse but settle under influence of gravity. Dust generally produced by crushing grinding etc., of organic and inorganic matter having diameter over 20 μm, although some are smaller.

(b) Smoke : Smoke is produced by incomplete combustion having carbon particles and other organic combustible materials having size less than 1 μm.

(c) Mists : Low concentration dispersion of liquid droplets of size 40-500 μm in air.

(d) Fog : Visible aerosol in which the dispersed phase is liquid. Dispersion of water or ice in atmosphere, the earth surface reducing visibility to less than 1/2 km. Particles size range 0.1-40 μm.

(iii) Gases : Consist atoms, molecules and also include harmful gases which can freely mix with air without settling down. Example are CO_2, CO, SO_2, H_2O, nitrogen oxides and hydrocarbons.

(B) Secondary Air Pollutants : Secondary air pollutants are produced among two or more primary pollutants or by reaction with normal atmosphere constitute with or without photoactivation. *e.g.*, ozone, formaldehyde, PAN, photochemical smog, etc.

Smog : *The poisonous mixture of smoke, fog, air and other chemicals is called smog.* Smog is a major pollution problem in big cities. Smog is usually formed during winter. There are two general types of smog.

1. *Photochemical smog (Los Angles Smog)*
2. *Chemical smog (London smog).*

Q. 5. (h) What are the sources and effects of solid waste ? Explain waste minimization echniques.

Ans. Solid Waste And Their Sources : The solid wastes are those solids which are discarded nd rendered useless by human beings. It also includes the animal refuses. However, the human xcreta is not included in it. Generally the following unwanted objects fall in the category of solid astes :

1. Wastes materials arising out from construction.
2. Wastes material arising out from demolition.

3. Ashes from industries, thermal power plant and other sources.

4. Rubbish which includes non-consumable combustible and non-combustible solids such as given below.

Combustible rubbish like rubber, plastic, paper, wood, textiles, cardboards, etc.

Non-combustible rubbish like metal scraps, metal containers, glass, ceramic crockeries, tin-cans, aluminium articles etc.

5. Garbage which includes organic wastes like vegetable residues and food residues.

6. Dead animals.

7. Radioactive wastes.

8. Sludge which is a domestic waste excluding human excreta.

Causes of Urban Solid Wastes : Main causes of urban solid wastes are the following :

1. Advances in technology : leading to large scale production of consumable goods.

2. Growtb in consumption bases society : Leading to enhancement of consumption items.

3. Use of throw culture : which has become possible due to availability of disposable items like containers, glass bottles, cans, etc.

4. Advent of packaging tecbnology : due to which almost every items is packed before sale.

5. Affluence : With advancement of technology, the philosophy of 'obsolete goods' declared and consumers having high purchasing capacity is increasing.

6. Increasing urbanization : In has created new life styles such as development of new constructions at a mass scale. Following nature of constructions have immensely added to urban solid wastes :

(i) construction of buildings, markets, shopping malls, etc.

(ii) construction of roads, railways, airways

(iii) construction of bridges, dams, etc.

(iv) construction of water supply and sewage disposal systems, etc.

7. Overpopulation : It is responsible for increased generation of garbage from each house. According to estimates, the collected solid wastes for disposal at some places are as follows :

In USA in 2000, about 7 lakh tonne/day.

Effects of Urban Solid Wastes : The accumulation of solid wastes results in various health and environmental hazards. Main among them are given below :

1. Due to solid wastes, the rats may multiply in numbers and may cause plague, salmonellosis, trichinosis, endemic typhus diseases.

2. Diseases : The disease that spread primarily through contaminated solid wastes are the following types :

(i) Diseases caused by bacterial infections such as Typhoid fever, Cholera, Paratyphoid fever, Bacillary dysentery, etc.

(ii) Diseases caused by vital infections such as infections hepatitis (*i.e.*, infectious jaudice), Polio myelitis, etc.

(iii) Diseases caused by protozoal infections such as Amoebic dysentery.

(iv) Solid wastes may also choke the drains and gully pits resulting in water logging. This may result in breeding of mosquitoes and thus danger of malaria and dengue.

(v) Obnoxious odours also pollute the air due to decomposition of organic solid wastes.

(vi) Percolation of decomposed garbage dumped on the soil may result into pollution of underground water and land.

(vii) The crops and water supply may also get contaminated and may result in large scale epidemic or cholera, jaundice, gastro-intestinal diseases, hepatitis, etc.

(viii) There is also aesthetic danger to the surrounding as the stray animals and scavengers (pigs, etc.) invade the garbage dumps on roadsides.

Control Measure of Urban Solid Wastes : Control on urban solid wastes can be accomplished in following ways :

1. By minimizing generation of domestic garbage and other wastes.

2. By throwing out the rubbish and other unwanted materials at a proper place, from where they may be easily taken for disposal.

3. By enforcing law in this regard.

4. By incorporating various methods of solid waste disposal.

Amongst these, the first two ideas demand a self-discipline. The law in this regard have been implemented here and there by various component agencies (such as nagar Nigam, etc.). However, its scope has to be extended and more strict visil is also needed. The solid waste disposal, is of-course a very important issue.

Q. 6. (a) What are greenhouse gases ? Name and discuss their contribution to global warming. What can be the effects of global warming ?

Ans. Green House Effect : Carbon-dioxide (CO_2) is released into atmosphere in different forms such as smoke, respirations of plants, animals and human beings. It interacts with sun-rays. The sun-rays consist of ultraviolet (UV), visible, and also the nonvisible infrared (IR) radiations. The ozone layer, present in natural form in upper region of atmosphere, absorbs most of the UV radiations and allows only visible and IR radiations to pass through towards the earth. Since the IR radiations are of shorter wavelength, they easily pass through the CO_2 layer in atmosphere. These IR-rays induced heating effect in atmosphere and other objects on earth. In the description given so far, nothing is abnormal as this is a natural phenomenon.

Ahnormal phenomenon : But if a larger amount of CO_2 remains present in atmosphere, it causes greater heating of earth's atmosphere and objects. The industrialization, urbanization, and population explosion etc. have made it so. A very large amount of release of CO_2 into atmosphere, has caused excess, (abnormal) heating of atmosphere to an alarming state. Consequently, the temperature of earth's atmosphere has gone up. The temperature is increasing at a rate of

approximately 0.05°C/year. This phenomenon of temperature rise is causing warming all around. This is called **'global warming'**. It is the effect of 'greenhouse phenomenon'.

Causes of Greenhouse Phenomenon : The concentration of CO_2 is increasing in earth's atmosphere at a rate of approximately 0.75 ppm (parts per million). Main causes of additional increases CO_2 (other than due to natural reasons such as respiration of plants, animals and human population) are the following :

1. Burning of fossil fuels such as coal, petroleum products, gaseous fuels, woods etc. The CO_2 is released into atmosphere in the form of smoke by :

- automobiles
- aircrafts
- ships and other marine vessels
- thermal power plants
- various industrial units etc.

2. Deforestation : Since the plants use CO_2 for photosynthesis and release oxygen, therefore by cutting-down the forests

(i) lesser plants/trees are available to absorb CO_2; and

(ii) reduced quantity of O_2 is released into atmosphere.

Hence the environment becomes unhealthy due to decreased concentration of oxygen.

3. Population explosion : Due to much increased population, there is a greater release of CO_2 in atmosphere.

4. Release of greenhouse gases other than CO_2 such as methane (CH_4), nitrous oxide (NO), chloro-fluoro-carbons (CFCs), SO_2, O_3 etc. These are emitted gases and their sources are listed in the following table

Various greenhouse gases and their sources

	Gases	Major Sources
1.	N_2O	Combustion of fossil fuels, natural soils.
2.	O_3	Photochemical reactions (in troposphere), difflusion from startosphere.
3.	CH_4	Anaerobic decomposition of organic wastes, wet lands, termites.
4.	Freon-11	Industrial refrigeration, aerosol propellant, manufacturing of foams.
5.	Freon-12	Domestic refrigerators, aerosol propellant, manufacturing of foams.
6.	Freon-22	Refrigeration, manufacturing of fluoro polymers.
7.	Freon-113	Large air-conditionong systems, electronic solvents.

8.	CH_3CCl_3	Degreasing solvents.
9.	CCl_4	Solvent intermediatory in production of Freon-1 and Freon-12.

Effects of Global Warming : The effects of global warming are detrimental to environment and living beings. Main amongst these are the following :

1. Average temperature of earth will go on rising above the normal temperature causing tremendous change in climate and weather, forestation, natural resources etc.

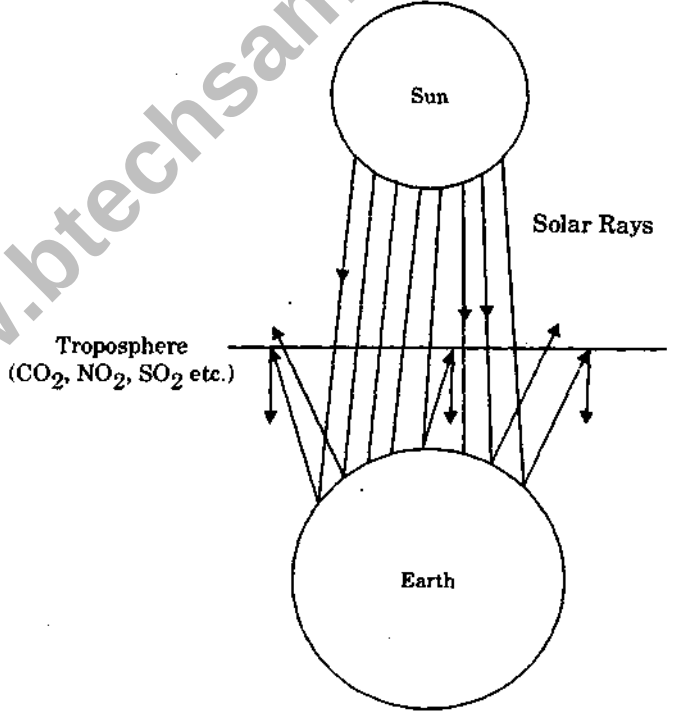
2. The existing eco-systems will be imbalanced.

3. This may lead to *melting of glaciers* and *polar ice caps* which consequently, will result into flooding of many coastal low lying areas, submergence of many islands and cities nearly the ocean.

4. The excess of CO_2 will result into *respirtory disorders* and *suffocation.*

5. Warming may be more in higher latitudes than in topics. The temperature rise in temperate regions is anticipated to be more than the average global temperature but less in tropics.

6. Increase in global average temperature will adversely affect the food production. The fertile lands will shift towards poles. For example, the wheat production in India will drop as the fertile northern belt will shift towards less fertile but further northern regions.



7. There may be more storms of sever intensity.

8. Some ecosystems and biological species may either be dislocated or extincted.

9. There may be alternation in hydrolocial cycle also.

Q. 6. (b) 'The Earth System is not and never has been free from climate change.' Comment.

Ans. Climate change : The climate refers to characteristics weather conditions at a place or a region on earth. Climate is different from weather. Weather refers to day to day state of atmosphere at a place or different place on earth.

Climate represent the state of atmosphere over a long period of time. This period may be seasons, years, centuries. Normally 35 years time period is considered as standard duration.

Global climate change is caused by the accumulation of greenhouse gases in the lower atmosphere. The global concentration of these gases is increasing, mainly due to human activities, such as the combustion of fossil fuels (which release carbon dioxide) and deforestation (because forests remove carbon from the atmosphere). The atmospheric concentration of carbon dioxide, the main greenhouse gas, has increased by 30 percent since preindustrial times.

Following records are the indicator of change in global climate over past 1500 years :

1. The surface air temperature has varied upto +0.6.

2. The warmest 6 years of the 20th century has occurred since 1980.

3. The year 1990 was the warmest year on earth recorded till date.

According to an estimation the mean temperature in India has gone up by about 0.2 to 0.3 c in last 40 years.

Q. 7. (a) What is ozone hole ? What are the causes of ozone hole formation ? What are the effects of depletion of ozone layer ?

Ans. Depletion of ozone layer in the stratosphere : Stratospheric ozone plays a vital role by protosting the living organism from the harmful effects of ultraviolet radiations. The UV radiation causes photo dissociation of ozone into O_2 and O in the stratosphere. But O_2 and O quickly recombine to form O_3. This ozone dynamics dissipates the energy of UV as heat. There is an equilibrium between generation and destruction of O_3, which leads to a steady state concentration of ozone layer in the stratosphere between 20 and 26 km above the seal level. If this stratospheric ozone layer is condensed vertically to standard temperature and pressure, its thickness average 0.29 cm above the equator and may exceed 0.40 cm above the poles at the end of winter seasons. The concentration of O_3 in the stratosphere changes with season. It is highest during the spring season (February—April) and lowest during the fall season (July-October). The ozone layer acts as **ozone shield** and protect the earth's organisms from harmful effects of strong UV radiations. The absorption of UV radiation by ozone layer increase exponentially with its thickness. Therefore, maximum amount of UV radiations are absorbed in the tropics (*i.e.*, near the equator) and this amount decreases towards poles.

Ozone hole (ozone depletion) : Ozone hole refers to the thinning of stratospheric ozone layer during the spring time. It was first discovered in I985 over Antratica. The existence of ozone hole was confirmed above Arctic in 1990. During the spring time, in the year 1956-I970, the thickness of O_3 layer above Antractica varied from 280-235 Dabson unit (1 DU = 1 ppb). It reduced sharply to 225 DU in 1979 and 136 DU in 1985. It continued to decline to about 94 DU in 1994. This decline was termed as *ozone hole*. During the period 1997-2001, the global average total ozone column was about 3 percent below the pre 1980 average value.

A number of pollutants enter into the stratosphere and deplete the ozone layer. These include CFCs, CH_4 and N_2O. Among these CFCs are the most damaging agents of ozone layer. They produce *'active chlorine'*. (Cl and ClO radicals) in the presence of UV radiation. The active chlorine catalytically destroy ozone by converting it into oxygen. CH_4 and N_2O also destroy ozone through a complicated series of reactions. The discoveries related to ozone destruction were made by *Sherwood Rowland, Mario Molina and Paul Crutezen.* They were honoured with Nobel Prize for chemistry in I995.

Effect of ozone depletion : The depletion of ozone layer, allows more UV-B radiation reaching the earth surface. It has been estimated that a 5 percent loss of ozone results in a 10 percent increase in UV-B radiation. Some of the important effects of ozone depletion are as follows :

(a) In humans, the increased UV radiation increases the incidence of cataract, skin cancer (including melanoma) and decline in the functioning of the immune system.

(b) The elevated level of UV radiation damages nucleic acids in the living organism.

(c) UV radiation inhibit photosynthesis in plants and phytoplankton, which in turn affect the whole food chain.

Q. 7. (b) What should be tbe 'guidelines for excellence' for environmental education ?

Ans. The guiding principles are as below :

1. To consider the environment in its totality (natural artificial, technological, social economic, political, moral, cultural, historical and aesthetical).

2. To consider a continuous life precss (from pre-school to all higher levels-formal as well as non-formal).

3. To be interdisciplinary in study approach.

4. To emphasive active participation in prevention and solution to en onment problems.

5. To examine major environmental issues form local, national, regional and international point of view.

6. To focus on current, potential environmental situations.

7. To consider environmental aspects in plans for growth and development.

8. To emphasize the complexity of environmental problems and need to develop critical thinking and problem-solving skills.

9. To promote the value and necessity of local, national and international cooperation in the prevention and solution of environment mental problems.

10. To utilize diverse learning about environment and different approaches to teaching and learning about environment.

11. To help learners to discover the symptom and the real causes of environmental problems.

12. To relate environmental sensitivity, knowledge, problem-solving and values clarification at every grade level.

13. To enable learners to have and role in planning their learning experiences and provide an opportunity for making decision and accepting their consequences.

Q. 8. (a) Discuss the strategy and policy adopted by Government of India for the development of women education.

Ans. Women and Education : Conservation and protection of the environment are indispensable components of sustainable development. It is not possible without the empowerment and active participation of women. A women as a mother grooms the child and is influential in making him child. When women are more informed about the basic issues related to the environment environmental rejuvenation becomes easier and meaningful. The role of a women is not restricted to the home only. She can play a main role in the neighbourhood at bigger platforms. The benefits of women power can be derived only through providing women education. The present scenario in India is very dismal. Although women from urban backgrounds and financially sound families go education, a vast majority of rural women are not fortunate in this regard. The dismal rural economy conditions and grossly inadequate education facilities do not permit them to reach beyond school education :

In fact the ecosystem stands to benefit through providing proper education to rural womenfolk as they are a part of it. Although the crucial roles of women in environmental protection have been recognized over the ages a concerted effort began with the Beijing platform for action (1995) the World Summit on sustainable development for achieving millennium development goals. Drawing inspiration from this declaration many schemes have been launched in India and other developing countries where the environment is threatened the most.

Q. 8. (b) Discuss the role of Government and legal aspects in environmental protection.

Ans. This act was promulgated in 1986. It is therefore, known as the (Protection) Act, 1985. Salient features of this Act are briefly given below for appraisal and understanding.

Objectives of this Act are the following : (a) Protection and improvement of environment (water, air, land) (b) Prevention of hazards to all living creatures (humans, plants, animals) and property, and (c) Maintenance of harmonious relationship between human beings and their environment.

Definition of important terms : Some of these are :

(a) Environment : It includes water, air and land and the inter relationship which exists among them and property.

(b) Environmental Pollutant : It includes any solid, liquid or gaseous substance present in such concentration as may be injurious to environment.

(c) Hazardous Substance : It means any substance which is liable to cause harm to human beings, other living creatures and property or environment by reason of this chemical or physio-chemical properties or handling.

General Powers of the Central Government : For the protection and improvement of environment and for the prevention, control and abatement of pollution, the Central Govt. has the power to take the following measures under section 3.1 :

(a) Coordination of actions by the State Govts. officers and other authorities under this Act and under an other related law.

(b) Planning and execution of a nationwide programme to prevent control and abate environmental pollution.

(c) Laying down the standards for different aspects of environmental quality.

(d) Laying down the standards for emission or discharge of environmental pollutions from various sources.

(e) Restricting the areas in which industries, operations of processes shall not be carried out.

(f) Laying down procedures and safeguards for handling of hazardous substances for prevention of accidents causing environmental pollution and remedial measures.

(g) Examination of manufacturing, process, materials and substances likely to cause environmental pollution.

(h) Carrying out and sponsoring investigations and research in environmental pollution problems.

(i) Inspection of any premises, plant, manufacturing process, equipment or machinery and giving directions to prevent, control and abate environmental pollution.

(j) Establishment and recognition of environmental laboratories and institutes.

(k) Preparation of manuals, codes or guides to disseminate collected information in matters relating to environmental pollution and its prevention, control and abatement.

(l) Any matter, necessary or expendient for the implementation of the provisions of this Act.

(m) If necessary, the Central Govt, any constitute and authority for the purpose of performing such functions and powers for Central Government under Section 4.2 of this Act.

Penalities for violating the provision in this Act : According to Section 15.5, any person failing to comply with any of the provisions of the Act shall be punishable with imprisonment for a term which may extend upto five years or with fine which may extend to one lakh rupees or both.

Q. 9. Write short notes on following :

(a) Effect of transportation activities on environment.

Ans. The Environmental Impacts of Transportation

1. The Issue of Transport and the Environment : The issue of transportation and the environment is paradoxical in nature. From one side, transportation activities support increasing mobility demands for passengers and freight, and this ranging from urban areas to international trade. On the other side, transport activities have resulted in growing levels of motorization and congestion. As a result, the transportation sector is becoming increasingly **linked to environmental problems.** With a technology relying heavily on the combustion of hydrocarbons, notably with the internal combustion engine, the impacts of transportation over environmental systems has increased with motorization. This has reached a point where transportation activities are a dominant factor behind the emission of most pollutants and thus their impacts on the environment. These impacts, like all environmental impacts, can fall within three categories :

- **Direct impacts :** The immediate consequence of transport activities on the environment where the cause and effect relationship is generally clear and well understood.
- **Indirect impacts :** The secondary (or tertiary) effects of transport activities on environmental systams. They are often of higher consequence than direct impacts, but the involved relationships are often misunderstood and difficult to establish.
- **Cumulative impacts :** The additive multiplicative or synergetic consequences of transport activities. They take into account of the varied effects of direct and indirect impacts on an ecosystem, which are often unpredicted.

The complexities of the problems have led to much **controversy** in environmental policy and in the role of transportation. The transportation sector is often subsidized by the public sector, especially through the construction and maintenance of road infrastructure which tend to be free of access. Sometimes, public stakes in transport modes, terminals and infrastructure can be at odd with environmental issues. If the owner and the regulator are the same (different branches of the government), then there is a risk that regulations will not be effectively complied to. It can also lead to another extreme where compliance would lead to inefficient transport systems, but which costs are subsidized.

Total costs incurred by transportation activities, notably environmental damage, are generally not fully assumed by the users. The lack of consideration of the **real costs of transportation** could explain several environmental problems. Yet, a complex hierarchy of costs is involved, ranging from internal (mostly operations), compliance (abiding to regulations), contingent (risk of an event such as a spill) to external (assumed by the society). For instance, external costs account on average for more than 30% of the estimated automobile costs. If environmental costs are not included in this appraisal, the usage of the car is consequently subsidized by the society and costs accumulate as environmental pollution. This requires due consideration as the number of vehicles, especially automobiles, is steadily increasing.

2. The Transport-Environment Link : The relationships between transport and the environment are multidimensional. Some aspects are unknown and some new findings may lead to drastic changes in environmental policies, as it did in regards of acid rain and chlorofluorocarbons in the 1970s and 1980s. The 1990s were characterized by a realization of global environmental issues, epitomized by the growing concerns between anthropogenic effect and climate change. Transportation also became an important dimension of the concept of sustainability, which is expected to become the prime focus of transport activities in the coming decades, ranging from vehicle emissions to green supply chain management practices. These impending developments require a deep understanding of the reciprocal influence between the physical environment and transport infrastructures and yet this understanding is often lacking. The main factors considered in the physical environment are geographical location, topography, geological structure, climate, hydrology, soil, natural vegetation and animal life.

The main environmental dimensions of transportation are related to the **causes,** the activities, the **outputs** and the **results** of transport systems. Establishing linkages between these dimensions is a difficult undertaking. For instance, to what extent carbon monoxide emissions are linked to land use patterns ? Furthermore, transportation is inbedded in environmental cycles, notably over the carbon cycle. The relationships between transport and the environment are also complicated by two observations :

- First, transport activities contribute among other anthropogenic and natural causes, **directly, indirectly and cumulatively to environmental problems.** In some cases, they may be a dominant factor, while in others their role is marginal and difficult to establish.
- Second, transport activities contribute at different geographical scales to environmental problems, ranging from local (noise and CO emissions) to global (climate change?), not foregetting continental/national/regional problems (smog and acid rain).

Establishing environmental policies for transportation thus have to take account of the **level of contribution** and the **geographical scale,** otherwise some policies may just move the problems

elsewhere and have unintended consequences. A noted example are local/regional policies that have forced the construction of higher chimneys for coal burning facilities (power plants) and induced the continental diffusion of acid rain. Thus, even if an administrative division (municipality, county, state/province) have adequate environmental enforcement policies, the geographical scale of pollutants diffusion (notably air pollutants) obviously goes beyond established jurisdications.

In addition to the environmental impacts of the network, traffic and modes, economic/ industrial processes sustaining the transport system most be considered. These include the production of fuels, vehicles and construction materials, some of which are very energy intensive (*e.g.*, aluminium), and the disposal of vehicles, parts and infracture. They all have a life cycle timing their production, utilization and disposal. Thus, the evaluation of the transport-environment link without the consideration of **cycles in the environment and in the product life** alike is likely to convey a limited overview of the situation and may even lead to incorrect appraisal and policies.

(b) Hydrogen as an alternate future source of energy.

Ans. Hydrogen as an Alternative Energy Source : Hydrogen, a carrier of energy, is not an energy source. With greater availability of hydrogen cars, hydrogen production by renewable energy can combat global warming.

In an age of increasing fossil fuel prices, uncertainty of energy supplies and concern over the effect of rising carbon dioxide levels in the atmosphere, the role of hydrogen fuel as an alternative energy source is being reexamined.

Plentiful Supply of Hydrogen : Hydrogen is the most common element in the universe. David L. Heiserman, in his *Exploring Chemical Elements and their Compounds,* published by TAB Books in 1992, lists hydrogen as the most common element in the universe. On Earth, according to *Basic Research Needs for the Hydrogen Economy.* Published by Argonne National Laboratory, U.S. Department of Energy, in May 2003, hydrogen is the third most abundant element. However this hydrogen does not exist as the pure element, but as part of other compounds, mainly water and fossil fuels.

Hydrogen is Not a Source of Energy : Commercially, hydrogen is mainly produced from fossil fuel and to a lesser extent by electrolysis using energy produced from fossil fuels. *Basic Research Needs for the Hydrogen Economy* states, "Hydrogen is currently produced on an industrial scale (9 Mtons/yr in the U.S.) through steam reforming of natural gas."

Hydrogen produced from either fossil fuels or by electrolysis involves a loss of energy and results in high emissions of greenhouse gases. In the *Future of the Hydrogen* "The efficiency of hydrogen production by autothermal reforming is about 90%, but may be less", and further on says,

"Also, more CO_2 is released by this indirect process than by direct use of the hydrocarbon precursors."

Hydrogen as a Fuel : Hydrogen burns clesnly, producing little or no harmful emissions or CO_2. According to the Fact Sheet *Hydrogen Fuel : a Clean and Secure Energy Future* produced by the White House Press Office in February 2006 :

- It has the highest energy content per unit of weight of any known fuel.
- When burned in an engine, hydrogen produces effectively zero emissions; when powering a fuel cell, its only waste is water.
- Hydrogen can be produced from abundant domestic resources including natural gas, coal, biomass and even water.

Marking Hydrogen a Renewable Fuel : As an alternative fuel hydrogen is ideal, producing little or no emissions, with a plentiful supply available. But hydrogen produced by conventional means is not renewable or carbon neutral. Wind power is a totally renewable energy source with no greenhouse gas emissions, but due to its unpredictability, has problems integrating with national grids. Combined together, wind and hydrogen can cancel out their inherent defects and be an effective tool in the battle against carbon dioxide and global warming.