

Mark the Statement True or False

1. All pollutants are degradable
2. Smog causes cracking of rubber
3. PAN is a primary pollutant
4. Underground waster is non-pollutant and safe.
5. The noise is measured Richter scale.

Fill in the Blanks

1. Automobiles are largest sources ofpollution in cities.
2. Increase in the concentration of soluble salts in soil is called
3. PAN is formed by the interaction of oxides of nitrogen and in presence of sunlight
4. Mina-mata is caused due to biomagnification of
5. The instrument used for measuring the intensity of earthquake is called.....
6. The unit for measuring the intensity of an earthquake is.....

ANSWERS**Multiple Choice Questions**

- | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|
| 1. (c) | 2. (b) | 3. (a) | 4. (b) | 5. (b) | 6. (c) | 7. (a) |
| 8. (d) | 9. (a) | 10. (a) | 11. (a) | 12. (d) | 13. (b) | 14. (c) |
| 15. (d) | 16. (d) | 17. (b) | 18. (d) | 19. (c) | 20. (d) | 21. (c) |
| 22. (c) | 23. (c) | 24. (d) | 25. (d) | 26. (d) | 27. (c) | |

True or False

1. False 2. False 3. False 4. False 5. False

Fill in the Blanks

- | | | |
|------------|-----------------|------------------|
| 1. air | 2. salinization | 3. Hydrocarbons |
| 4. mercury | 5. seismometer | 6. Richter scale |



6

Chapter

Social Issues and Environment

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6.1 SUSTAINABLE DEVELOPMENT

Sustainable development is defined as 'meeting the needs of the present without compromising the ability of future generation to meet their own need'.

G.H. Brundtland
Norwegian Prime Minister
Director WHO

In order to achieve a sustainable life, a balance and equal distribution of natural resources is necessary throughout the world so that basic needs of each and every living being may be fulfilled.

The idea of sustainable development was conceived in early 1970's, when the need was felt to preserve our natural resources as they were depleting at a very faster rate. Prior to that, the developments were unsustainable. Although the fears about such unsustainable growth and development emerged on an international leveling 1992 in the UN conference on environment and Development (UNCED), popularly known as The Earth Summit, held at Brazil.

Out of its five significant agreements Agenda-21 proposes a global programme of action on sustainable development in social, economic and practical context for the 21st century.

The necessary conditions for achieving sustainable development are —

- **Social equity:** There should be an equilibrium condition in the society among the same generation within and between nation (intra-generation equity) and between two different generations (inter-generation equity). We should hand over a safe, healthy and resourceful environment to our future generations.
- **Economical equity:** The technology should address to the problem of the developing countries, producing drought tolerant varieties for uncertain climates, vaccines for infectious diseases, clean fuel for domestic and industrial use. This type of technological development will support the economic growth of the poor countries and help in narrowing the wealth gap and lead to sustainability.
- **Ecological security:** If any development process protects our biodiversity, decreases the rate of soil erosion and increases the forest cover area that brings the ecological security.

Objectives of Sustainable Development

1. It should protect our biodiversity.
2. It should prevent soil erosion.
3. It should slow down the population growth.
4. It should increase forest cover.
5. It should cut off the emissions of CFC, SO_x , NO_x and CO_2 .
6. It should reduce waste generation.
7. It should eliminate poverty and deprivation.
8. It should bring benefits to all.

6.1.1 Unsustainable to Sustainable Development

There are few measures by adopting we can convert a unsustainable development to sustainable development. They are as follows:

1. By using appropriate technology which is locally adoptable, eco-friendly, resource-efficient and culturally suitable.
2. By adopting reduce, reuse and recycle approach.
3. By prompting environmental education and awareness.
4. The demand should be reduced up to the system's carrying capacity that a system can sustain on a long-term basis. Consumption should not exceed regeneration and changes should not be allowed to occur beyond the tolerance capacity of the system. Components of carrying capacity are supporting capacity i.e. the capacity to regenerate and Assimilative capacity i.e. the capacity to tolerate different stresses.

The Indian context: Though, India has made a lot of progress since independence, yet the increasing needs and aspirations of expanding human population

have forced a change in land use and imposed excessive demand on the natural resources. If the current practice of utilising natural resources continues, the coming generation will have less chance of getting sufficient food to eat, space to live and pure air to breath. Thus, besides increase in production, the protection of environment and conservation of natural resources are essential.

India has still to go long way in implanting the concept of sustainable development. We have to lay emphasis on farming a well-planned strategy for our development activity while increasing economical growth.

The National Council of Environmental Planning and Coordination (1972) works on this regards. MOEF (1985) has formulated guidelines for various development activities keeping in view the sustainable principles.

CASE STUDY

The City of Santa Monica, California in 1994 implemented a progressive new course of action regarding the city's local responsibilities, with environmental concerns becoming a prominent issue in local decision-making. Working under the sustainable development framework, the city reworked eleven major citywide policies with regard to both urgent environmental concerns as well as cost effectiveness of each improvement plan. The idea was to create an example for other communities of the feasibility and success of a city structured around long-term environmental sustainability. Santa Monica exhibits just what specific policies are required to achieve sustainability, moving from the ideological level to the implementation stage.

The Netherlands has been at the forefront of the "sustainable development" movement across the globe. The Dutch government announced its National Environmental Policy Plan (NEPP) in 1989 after years of debate and even government upheaval. The NEPP includes management plans for various air pollutants, energy conservation, recycling, mass transit, pesticides, and wastes. It was the first attempt of any national government to develop such a comprehensive policy.

6.2 URBAN PROBLEM RELATED TO ENERGY

As the population and industrialisation is increasing, it results in migration of rural population to the urban cities and the demand for energy has undergone a sharp rise in urban area. Whereas on one hand the energy demand is increasing at a fast rate on the other hand the conventional energy sources are getting exhausted. It has created a wide gap between demand and supply. Apart from that the energy requirement of urban population are much more higher than that of rural ones because of higher standard of life and their lifestyle demands more energy inputs in every sphere of life. The energy demanding activities include:

1. Residential and commercial lightning.
2. Transportation means for moving from one place to other.

3. Electrical gadget in daily life.
4. Industrial plants using a big proportion of energy.
5. A large amount of waste generated which has to be disposed off properly using energy based techniques.
6. For the control and prevention of air and water pollution, we have energy dependent technologies.

6.3 WATER CONSERVATION

Water conservation is the management technique which eliminates the wastage of water or maximises efficiency of its use. The most important step in the direction of finding solutions to issues of water and environmental conservation is to change people's attitudes and habits. We can follow some of the simple things that have been listed below and contribute to water conservation.

- Run-off losses can be reduced by allowing most of the water to infiltrate into the soil. This can be achieved by using contour cultivation, terrace farming, water spreading, chemical treatment or improver water storage.
- Reducing evaporation losses
- Storing water in soil
- Reducing irrigation losses –
 - (a) Use of lined or covered canals to reduce seepage.
 - (b) Irrigation in early morning and late evening.
 - (c) Sprinkling irrigation and drip irrigation.
 - (d) Growing hybrid crop varieties with less water requirement and tolerance to saline water.
- Reuse of water-
 - (a) Treated water can be used for ferti-irrigation.
 - (b) Using gray water.
 - (c) Preventing wastage of water.
 - (d) Closing taps when not in use.
 - (e) Repairing any leakage from pipes.

6.4 RAINWATER HARVESTING

Rainwater Harvesting is a method of utilising rainwater for domestic and agricultural use by capturing and storing the rainwater above the ground or recharge the underground for its later use. This happens naturally in open rural areas. Rainwater harvesting is not only proving useful for poor and scanty rainfall region but also for the rich ones.

It is a method which has been used since ancient times and is increasingly being accepted as a practical method of providing potable water in development projects

throughout the world. Extensive rainwater harvesting apparatus existed 4000 years ago in the Palestine and Greece. In ancient Rome, residences were built with individual cisterns and paved courtyards to capture rainwater to augment water from city's aqueducts. As early as the third millennium BC, farming communities in Baluchistan and Kutch impounded rain water and used it for irrigation dams.

Rain water harvesting is essential because:

- Surface water is inadequate to meet our demand and we have to depend on ground water.
- Due to rapid urbanisation, infiltration of rainwater into the subsoil has decreased drastically and recharging of ground water has diminished.

Rainwater harvesting has the following objectives:

- To reduce run-off loss.
- To avoid flooding of roads.
- To meet the increasing demand of water.
- To raise the water table by recharging groundwater.
- To reduce groundwater contamination.
- To supplement groundwater supplies during lean season.
- Prevents soil erosion and flooding especially in urban areas.

Rainwater can be mainly harvested by any other of the following methods by adopting modern or traditional harvesting:

1. Storage of rainwater on surface for future use by constructing pits, dug-well, lagoons, trench or check-dams on small rivulets.
2. Recharge to groundwater.

The storage of rainwater on surface is a traditional techniques and structures used were underground tanks, ponds, check dams, weirs etc. Recharge to groundwater is a new concept of rainwater harvesting and the structures generally used are:

Pits: Recharge pits are constructed for recharging the shallow aquifer. These are constructed 1 to 2 m wide and 3 m deep which are back filled with boulders, gravels, coarse sand.

Trenches: These are constructed when the permeable stream is available at shallow depth. Trench may be 0.5 to 1 m. wide, 1 to 1.5 m deep and 10 to 20 m long depending up availability of water. These are back filled with filter materials.

Dug-wells: Existing dug-wells may be utilised as recharge structure and water should pass through filter media before putting into dug-well.

Recharge wells: Recharge wells of 100 to 300 mm diameter are generally constructed for recharging the deeper aquifers and water is passed through filter media to avoid choking of recharge wells.

Recharge shafts: For recharging the shallow aquifer which is located below clayey surface, recharge shafts of 0.5 to 3 m diameter and 10 to 15 m deep are constructed and back filled with boulders, gravels and coarse sand.

Lateral shafts with bore wells: For recharging the upper as well as deeper aquifers lateral shafts of 1.5 to 2 m wide and 10 to 30 m long depending upon availability of water with one or two bore wells is constructed. The lateral shafts are back filled with boulders, gravels and coarse sand.

Spreading techniques: When permeable strata start from top then this technique is used. Spread the water in streams/nalas by making check dams, nala bunds, cement plugs, gabion structures or a percolation pond.

Some of the examples of rainwater harvesting and artificial recharge of ground water are as follows:

- In Jawaharlal University, Delhi, four check dams are made to trap the water and there is 0.8 to 1.0 m increase in water table after recharging the groundwater.
- In Maharashtra, after the drought of 1971-72, more than 7000 percolation tanks are made and they had converted the drought affected area in greenland.

6.5 WATERSHED MANAGEMENT

The term *watershed* describes an area of land that drains down slope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers, which become progressively larger as the water moves on downstream, eventually reaching an estuary and the ocean. Other terms used interchangeably with watershed include *drainage basin* or *catchment basin*. Watersheds can be large or small. Every stream, tributary, or river has an associated watershed, and small watersheds join to become larger watersheds. It is relatively easy to delineate watersheds using a topographic map that shows stream channels.

The area of watershed decreases due to natural or artificial (man-made) activities. These activities include overgrazing, deforestation, mining activity, industrialization, shift cultivation, natural and artificial fires and soil erosion etc. Whenever there is any change in hydrological cycle, it causes degradation in watershed.

Watershed management is defined as *the rotational utilisation of land and water resources for optimum production that causes minimum damage to the natural resources*. The watershed management is required because it —

1. Increases the productivity of soil as it reduces the rate of soil erosion, soil degradation and moisture retention.
2. Increase the rural development as the stored water can be utilised for beneficial development activities like domestic water supply, irrigation, hydro-power generation.

3. Reduces the rate of occurrence of natural disasters like floods, droughts and landslide.

Methods of watershed management: there are various methods which are developed to increase the watershed area considering benefit to local population and sustainability. They are

1. Water harvesting;
2. Mechanical measures by constructing check dams, terracing, contour cropping etc;
3. Scientific mining;
4. Increasing afforestation and agro-forestation (crop planting); and
5. Public participation.

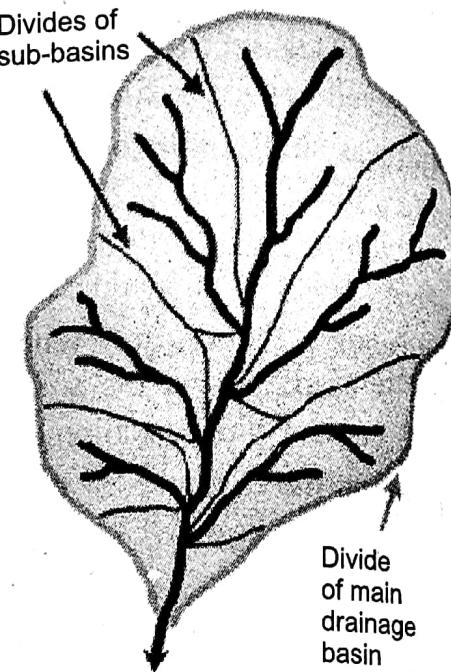


Fig. 6.1

6.6 RESETTLEMENT AND REHABILITATION: ITS PROBLEMS AND CONCERNs

Resettlement is the transportation of people (as a family or colony) to a new settlement (as after an upheaval of some kind). **Rehabilitation** is the restoration of someone to a useful place in society.

The development projects (construction of dams, mining operations etc.) and industrialisation causes the displacement of human population from their native place. These developments raise the quality and standard of living of the people in country and development projects are planned to bring benefits to the society.

Besides this very often, the native people of the project site are directly affected. The native people are generally the poorest of the poor, under-privileged tribal people. The various activities those causes the displacements of the native people are:

- Displacement due to construction of dams.
- Displacement due to mining operation.
- Displacement due to creation of Nation Park and Wildlife Sanctuaries.
- Displacement due to natural and man-made disasters.

Problems Concerning Displacement

1. The displacement people lose their identity and intimate link with environment.
2. There is loss of social and cultural activities of tribal people due to displacement.
3. The tribal communities and joint families often face the disintegration problem due to resettlement in different places.

4. Displaced people lose their land, jobs, homes and properties, which leads to social isolation and increases poverty.
5. Due to insufficient knowledge of the local people about plants and animals, displaced people face problems in adjustment in a new place.

Resettlement objectives: The overall objective of resettlement and rehabilitation is to ensure that the affected production base will be restored, the affected labor force will be re-employed, and income and livelihood of affected people will be improved or at least restored to their previous levels before resettlement.

At present, the rural population of project impact area is mainly engaged in agricultural actives, with most of their income coming from planting, economic trees, and animal husbandry. According to the actual production and living standard among affected villages, and the approved economic and social development plans for the relevant counties, the target of resettlement and rehabilitation is set as follows:

1. The resettler's grain production level will be self-sufficient after resettlement.
2. The income per capita shall be recovered to the standard before resettlement.
3. The affected public infrastructures, school, hospitals, social welfare level, natural environment and traffic condition etc. shall be improved after resettlement.

Resettlement guideline: The basic resettlement policy is to respect the wishes of affected people and maintain their current production and living traditions. Based on consultation of local affected peoples, the economic rehabilitation should be based on developing replaced farming resources within their own townships and villages. Planting should focus on economic rehabilitation strategies by developing new farmland, improving the remaining farmland in the affected villages, supplemented by developing various other income generation opportunities in the project areas. In other words, the resettlement and rehabilitation strategy should first to reestablish the physical production bases for the affected persons, which will provide a long-term development potential by fully utilising local land resources.

Resettlement principle: A number of resettlement and rehabilitation principles have been developed for the project.

1. The resettlement plan will be based on detailed inventory for land acquisition and houses demolition, and adopted compensation standards and subsidies.
2. The resettlement shall be combined with the local development, resource utilisation and economic growth as well as environment protection. Considering the local conditions, a practical and feasible resettlement plan should be developed to restore or improve their economic production and create basic conditions for long-term development.
3. The resettlement plan should be based on the principle "Beneficial to the production and convenient for living".

4. The reconstruction standard and scale shall be based with the principle of recovery to the original standard and original scale. Combining the local development, the cost for enlarging the scale, raising standard and future plan shall be solved independently by local government and relevant department.
5. Making overall plans and taking all factors into consideration, correctly handling the relations between the state, collective and individual.
6. Fully utilise local natural resource, build water conservancy facility, develop new farmland, improve land quality, and strengthen agricultural strength and make the resettler living standard reach or exceed the original level step-by-step.
7. Resettlement plan will include measures to improve basic livelihood and assist relocation and rehabilitation for those vulnerable persons and extremely poor individuals affected by the project.

CASE STUDY

The Upper Krishna Project

The Krishna River, which has a catchment area of 235,700 square kilometres and a length of 1,248 kilometres, is one of the three main rivers on the Indian subcontinent. It originates in the Western Ghats at 1,337 metres above mean sea level (MSL) and flows east through Maharashtra, Karnataka, and Andhra Pradesh. The soils of the river valley are generally fertile and can provide good crop yields through irrigation. The Upper Krishna Project (UKP), which will eventually irrigate more than half a million hectares, is vital to the future of agriculture in the drought-prone regions of northern Karnataka. The multi-phase, multi-stage project started in 1962 and is still not close to completion. The primary focus of this case study is the Narayanpur Dam.

Narayanpur is a composite dam consisting of a 10 kilometre-long earth-filled structure and a central cement section 1,023 metres long and 31 metres high. It lies in a flat, broad valley; small changes in elevation therefore flood large parcels of land. The reservoir is 60 kilometres long, covers approximately 132 square kilometres (28.5 of which was submerged before Bank involvement), and has a volume of 1.072 billion cubic metres.

The Upper Krishna Project is the largest resettlement operation the World Bank has ever supported. It contains many resettlement components. According to the most recent estimates, construction of Narayanpur dam affected 90 villages, required the resettlement of approximately 5,100 households, and submerged at least part of the lands of another 1,433 households. Families in this part of Karnataka average six people, and the socio-economic survey determined that Narayanpur Reservoir affects 36,306 people.

Physical relocation of the families affected by Narayanpur did not go according to plan. Half the resettlement sites were to be completed by 1978, the rest by 1980. Resettlement began in 1978 although it proceeded more slowly

than originally envisioned as dam construction and reservoir filling also lagged. By June 1979, only 7 per cent of the land had been acquired, 12 per cent of the compensation for buildings had been paid, and 12 per cent of the new resettlement villages had been completed. Many families did not move until the last possible moment after the reservoir began filling in 1982, sometimes under police coercion. Filling of the reservoir was delayed and not completed for another 17 years, although 100 square kilometres of the reservoir were filled within 8 years. By the time Karnataka Irrigation Project (KIP) closed in 1986, only 2,925 families (18,000 people) had been resettled. This left a backlog of 3,500 families (21,000 people) at Narayanpur.

The Tehri Project

The Project Tehri Project, one of the largest and most controversial large dams in India, consisting of Tehri and Koteswar dam, is under construction in the Ganga River basin for almost 25 years in the Northern Himalayan state of Uttarakhand. The Tehri dam, situated in outer Himalaya, Uttar Pradesh, was sanctioned in 1972. The project will adversely affect over 100,000 people. The experience with resettlement in India has been dismal. According to a number of studies, including the WCD (World Commission on Dams) India Country Study, at least 75% of some 40 million people displaced for large dams in India over the past five decades, have never been resettled.

The EIA for the project from 1990, estimates 97,000 people to be displaced by the project, but current data of Tehri Hydro Development Corporation adds up to only about 67,500. Large numbers of affected people are obviously not even included in the Resettlement and Rehabilitation (R&R) package. No socio-economic base studies were done. Land is available for only a minority of PAPs (Project Affected Persons) and that land is of questionable quality or already belongs to other communities. No information, participation or accountability mechanisms exist. To top things off corruption and nepotism are rampant in the entire R&R process.

NO PROGRESS IN LAND FOR R&R SINCE 1997 one of the most shocking aspects of R&R process is that if one looks at closely, in FOUR YEARS between March 1997 and March 2001, the project authorities have achieved practically no progress in acquiring land for resettlement of the affected people.

PROGRESS OF RURAL R&R SO FAR:

- Over 70% of the rural families are yet to receive basic allotment of Resettlement benefits.
- Over 90% of those who are called "Partially Affected Families" are yet to be given resettlement benefits.
- Over 57% of fully affected families are yet to be given land, the basic minimum resettlement facility. Also, the figures above do not include many other affected people.
- Over 93% of Ex-gratia is yet to be paid.

Jharia coal field

The displacement caused due to mining is a complex one as it cannot always be termed as development induced as sometimes they may be to avert disasters that may arise due to unsafe ground condition by the past or ongoing mining activities and/or to protect environment. A typical example of such unique form of displacement caused due to mining is the case of Jharia Coalfield (Jharkhand). Because of unscientific and irregular development, extraction and abandonment of mine workings throughout Jharia Coalfield (JCF), it is facing the brunt of mine fire and subsidence. It has more than 70 mine fires spread over an area of about 17 sq km. Apart from this, an area of about 35 sq km has subsided in JCF due to mining damaging overlying settlements, water bodies, roads, railway tracts and other establishments. JCF is also the most disaster prone mining belt in India. Majority of the disasters are caused by fire, explosion and inundation. All these negative impacts of mining in JCF is not only restricting proper and economic mining of coal seams but is also endangering the habitation over the subsided lands, underground coal bearing and fire affected areas. Apart from this, the environment of the region is deteriorating day-by-day posing health hazards for its inhabitants. The places from where people are to be moved comprise many rural as well as urban settlements including Jharia town. So, for an all round sustainable development of the coal mining industry in JCF, there is an urgent need of an appropriate R&R policy. If immediate action is not taken in JCF, then the coal industry here will soon cease to exist, resulting in loss of millions of tons of high-grade coal, livelihood and property of thousands of people in due course of time.

This issue has drawn national attention since mid 1980's. On 19th August 1992, a discussion was held in Lok Sabha on fire and subsidence problems in Jharia and Raniganj coalfields. The prospect and viability of displacement of the people from the risk zones were also questioned. On 13th December 1996, the issue of fire and subsidence in JCF was once again raised in Lok Sabha. Honorable President, Dr. A.P.J. Abdul Kalam had showed concern when he visited Jharia in 2001 and asked the State Government to submit a proposal to safeguard Jharia. A high level committee on subsidence and fire headed by Secretary (Coal) cautioned in 2002 that there is need for immediate resettlement of people from the most endangered areas of Jharia and Raniganj coalfields failing which there may be a major human disaster.

Sardar Sarovar Project: The **Narmada Dam Project**, known officially as the Sardar Sarovar Project (SSP), is a project involving the construction of a series of large hydroelectric dams on the Narmada River in India. On 13 March 2004, the Narmada Control Authority (NCA) allowed the raise of the Sardar Sarovar dam height to 110 m. At least 12,000 families in Madhya Pradesh will face submergence and displacement without any resettlement while at least 1500 tribal families in Maharashtra are in their villages and 2000 oustees (the people to be displaced by the reservoir) are yet to be declared as oustees and resettled and no proper resettlement has been planned for them.

6.7 ENVIRONMENTAL ETHICS

Environmental ethics is the discipline that studies the moral relationship of human beings to, and also the value and moral status of, the environment and its non-human contents. It all depends on how we think and act.

Environmental ethics or environmental philosophy considers the relationship between human beings and the natural environment. It exerts influence on a large range of disciplines including law, sociology, theology, economics and geography. There are many ethical decisions that human beings make with respect to the environment. For example:

- Should we continue to clear cut the forests for the sake of human consumption?
- Should we continue to make gasoline powered vehicles, depleting fossil fuel resources while the technology exists to create zero-emission vehicles?
- What environmental obligations do we need to keep for future generations?
- Is it right for humans to knowingly cause the extinction of a species for the (perceived or real) convenience of humanity?

We have to follow eco-centric view i.e. 'Nature has provided us with all the resources for leading a beautiful life and she nourishes us like a mother, we should respect her and nurture her' instance of Anthropocentric view, which says 'Man is all powerful and the supreme creature on this earth and man is the master of nature and can harness it as his will'.

Environmental ethics can provide us the guidelines for putting our beliefs into action and help us decide what to do when faced with crucial situation. Some important ethical guidelines known as earth ethics or environmental ethics are as follows:

- The earth should exist for the benefit of humanity and we should love and respect the earth.
- Humans should have any ethical obligations with respect to the natural world. We should celebrate the turning of its seasons.
- We should not have the right to take all the earth's resources for our own use.
- We should not hold ourselves above other living things and have no right to drive them to extinction. Other species have an intrinsic right to exist.
- We should believe on various religions and should follow what they say about humanity's relationship to the rest of the living world.
- We should be grateful to the plants and animals which nourishes us by giving us food.
- We should consume the material goods in moderate amount so that all may share the earth's precious treasure of resources. We should not waste our resources on destruction weapons.

- We should not steal from future generation their right to live in a clean and safe planet by polluting it.

6.8 CLIMATIC CHANGES

The **climate** is commonly considered to be the weather averaged over a long period of time, typically 30 years. Somewhat more precisely, the concept of "climate" also includes the statistics of the weather — such as the degree of day-to-day or year-to-year variation expected. The Intergovernmental Panel on Climate Change (IPCC) glossary definition is: *Climate in a narrow sense is usually defined as the "average weather", or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind.*

The main causes for climatic changes are:

6.8.1 Global Warming

Global warming is a term used to describe the trend of increases in the average temperature of the earth's atmosphere and oceans that has been observed in recent decades. The scientific opinion on climate change, as expressed in the UN Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report in 2001 and explicitly endorsed by the national science academies of the G8 nations in 2005, is that the average global temperature has risen $0.6 \pm 0.2^\circ\text{C}$ since the late 19th century, and that it is likely that "most of the warming observed over the last 50 years is attributable to human activities". The increased volumes of carbon dioxide and other greenhouse gases released by the burning of fossil fuels, land clearing and agriculture, and other human activities, are the primary sources of the human-induced component of warming. The natural greenhouse effect keeps the earth about 33°C warmer than it otherwise would be; adding carbon dioxide to a planet's atmosphere, with no other changes, will make that planet's surface warmer.

The **greenhouse effect** is a warming of the earth's surface and lower atmosphere that tends to intensify with an increase in atmospheric carbon dioxide. The atmosphere allows a large percentage of the rays of visible light from the sun to reach the earth's surface and heat it. A part of this energy is reradiated by the earth's surface in the form of long-wave infrared (IR) radiation, much of which is absorbed by molecules of carbon dioxide and water vapour in the atmosphere and which is reflected back to the surface as heat. This is roughly analogous to the effect produced by the glass panes of a greenhouse, which transmit sunlight in the visible range but hold in heat. The trapping of this infrared radiation causes the Earth's surface and lower atmospheric layers to warm to a higher temperature than would otherwise be the case. An increase in atmospheric concentrations of other trace gases such as chlorofluorocarbons (Freons), nitrous oxide, and meth-

ane, due again largely to human activity, may also aggravate greenhouse conditions and the IR active gases responsible for the effect are likewise referred to as **greenhouse gases**. They are mainly

$$\text{CO}_2 - 52\%, \text{CH}_4 - 24\%, \text{N}_2\text{O} - 18\%, \text{CFC's} - 6\%$$

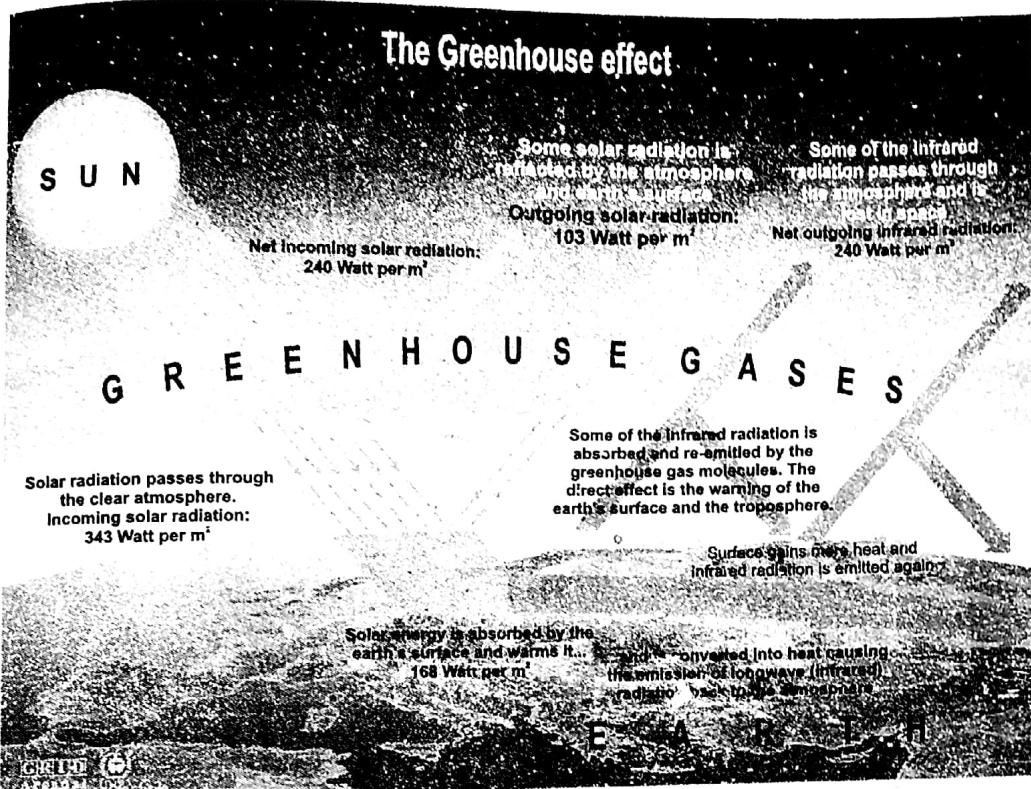


Fig. 6.2

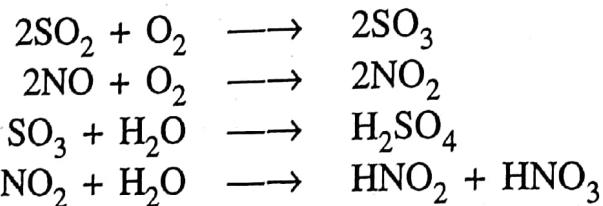
Impact of Greenhouse effect

- Such global warming would cause the polar ice caps and mountain glaciers to melt rapidly and result in appreciably higher coastal waters.
- The increase in global temperatures is expected to result in other climatic changes including rises in sea level and changes in the amount and pattern of precipitation.
- The rise in global temperature would also produce new patterns and extremes of drought and rainfall, seriously disrupting food production in certain regions.
- Effect on human health.
- Effects on agriculture.

6.8.2 Acid Rain

Acid rain is one of the most dangerous and widespread forms of pollution. Sometimes called "the unseen plague," acid rain can go undetected in an area for years. Technically, acid rain is rain that has a larger amount of acid in it than what is normal. The acidity of rain in parts of Europe and North America has dramatically increased over the past few decades. It is now common in many places for rain to be ten to seventy times more acidic than unpolluted rain. Many living and non-living systems become harmed and damaged as a result of acid rain.

Causes of acid rain: Acid rain is caused by smoke and gases that are given off by factories and cars that run on fossil fuels. When these fuels are burned to produce energy, the sulphur that is present in the fuel combines with oxygen and becomes sulphur dioxide; some of the nitrogen in the air becomes nitrogen oxide. These pollutants go into the atmosphere, react with rainwater and form acid and produce acid rain. The main reactions are as follows:



The pH of natural rain water is near about 5.6 but the presence of H_2SO_4 and HNO_3 lowers down its pH below 5.6

Effect on environment: Acid rain is an extremely destructive form of pollution, and the environment suffers from its effects. Forests, trees, lakes, animals and plants suffer from acid rain. Trees are extremely important natural resource. They provide timber, regulate local climate, and forests are homes to wildlife. Acid rain can make trees lose their leaves or needles. The needles and leaves of the trees turn brown and fall off. Trees can also suffer from stunted growth; and have damaged bark and leaves, which makes them vulnerable to weather, disease, and insects. Lakes are also damaged by acid rain.

Effect on architecture: Architecture and artwork can be destroyed by acid rain. Acid particles can land on buildings, causing corrosion. When sulphur pollutants fall off the surfaces of buildings (especially those made out of sandstone or limestone), they react with the minerals in the stone to form a powdery substance that can be washed away by rain. This powdery substance is called **gypsum**. Acid rain can damage buildings, stained glass, railroad lines, airplanes, cars, steel bridges, and underground pipes.

Effect on human: Humans can become seriously ill, and can even die from the effects of acid rain. One of the major problems that acid rain can cause in a human being is respiratory problems. Many can find it difficult to breathe, especially people who have asthma. Asthma, along with dry cough, headaches and throat irritations can be caused by the sulphur dioxides and nitrogen oxides from acid rain. Acid rain can be absorbed by both plants (through soil and/or direct contact) and animals (from things they eat and/or direct contact). When humans eat these plants or animals, the toxins inside of their meals can affect them. Brain damage, kidney problems, and Alzheimer's disease has been linked to people eating "toxic" animals/plants.

6.8.3 Ozone Layer Depletion

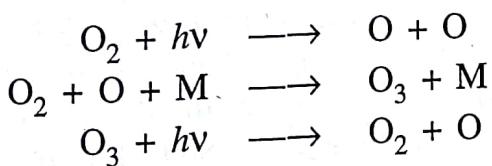
The term **Ozone depletion** is used to describe two distinct, but related, observations: a slow, steady decline, of about 3% per decade, in the total amount of ozone in the earth's stratosphere during the past twenty years, and a much larger, but seasonal, decrease in stratospheric ozone over the earth's polar regions during the

same period. (The latter phenomenon is commonly referred to as the "ozone hole".) The detailed mechanism by which the polar ozone holes form is different from that for the mid-latitude thinning, but the proximate cause of both trends is believed to be catalytic destruction of ozone by atomic chlorine and bromine. The primary source of these halogen atoms in the stratosphere is photo-dissociation of chlorofluorocarbon (CFC) compounds, commonly called Freons, and bromofluorocarbon compounds known as halons, which are transported into the stratosphere after being emitted at the surface. Both ozone depletion mechanisms strengthened as emissions of CFCs and halons increased.

Since the ozone layer prevents most harmful UVB wavelengths (270-315 nm) of ultraviolet light from passing through the Earth's atmosphere, observed and projected decreases in ozone have generated worldwide concern, leading to adoption of the Montreal Protocol banning the production of CFCs and halons as well as related ozone depleting chemicals such as carbon tetrachloride and trichloroethane (also known as methyl chloroform). It is suspected that a variety of biological consequences, including, for example, increases in skin cancer, damage to plants, and reduction of plankton populations in the ocean's photic zone, may result from the increased UV exposure due to ozone depletion.

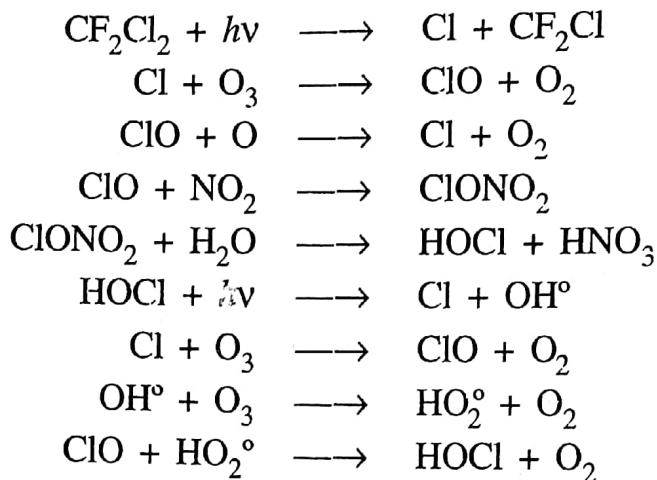
Ozone Creation

Three forms (or allotropes) of oxygen are involved in the ozone-oxygen cycle. Oxygen atoms, O, or atomic oxygen, oxygen molecules, O₂ and ozone, O₃. Ozone is formed in the stratosphere when oxygen molecules photo-dissociate after absorbing an ultraviolet photon whose wavelength is shorter than 240 nm. This produces two oxygen atoms. The atomic oxygen then combines with O₂ to create O₃. Ozone molecules strongly absorb UV light between 310 and 200 nm, following which ozone splits into a molecule of O₂ and an oxygen atom. The oxygen atom then joins up with an oxygen molecule to regenerate ozone. This is a continuing process which terminates when an oxygen atom "recombines" with an ozone molecule to make 2O₂ molecules. Prior to the beginning of the depletion trend, the amount of ozone in the stratosphere was kept roughly constant by a balance between the rates of creation and destruction of ozone molecules by UV light.



Ozone destruction: Ozone can be destroyed by a number of free radical catalysts, the most important of which are hydroxyl (OH[•]), nitric oxide (NO) and atomic chlorine (Cl) and bromine (Br). All of these radicals have both natural and anthropogenic (man-made) sources. At the present time, most of the OH[•] and NO in the stratosphere is of natural origin, but human activity has dramatically increased the chlorine and bromine. These elements are found in certain stable organic compounds, especially chlorofluorocarbons (CFCs), which may find their way to the stratosphere without being destroyed in the troposphere. Once in the stratosphere, the Cl and Br atoms are liberated from the parent compounds by

the action of ultraviolet light, and can destroy ozone molecules in a catalytic cycle. In this cycle, a chlorine atom reacts with an ozone molecule, taking an oxygen atom with it (forming ClO) and leaving a normal oxygen molecule. A free oxygen atom then takes away the oxygen from the ClO, and the final result is an oxygen molecule and a chlorine atom, which then re-initiates the cycle. The chemical short hand for these reactions are:



For this mechanism to operate, there must be a source of O atoms, which is primarily the photo-dissociation of O₃.

A single chlorine atom would keep on destroying ozone for up to two years (the time scale for transport back down to the troposphere), were it not for reactions that remove them from this cycle by forming reservoir species such as hydrochloric acid and chlorine nitrate. On a per atom basis, bromine is even more efficient than chlorine at destroying ozone, but there is much less bromine in the atmosphere at present. As a result, both chlorine and bromine contribute significantly to the overall ozone depletion.

CASE STUDY

Antarctica ozone hole

In the area over Antarctica, there are stratospheric cloud ice particles that are not present at warmer latitudes. Reactions occur on the surface of the ice particles that accelerate the ozone destruction caused by stratospheric chlorine. Polar regions get a much larger variation in sunlight than anywhere else, and during the 3 months of winter spend most of time in the dark without solar radiation. Temperatures stay close around or below -80°C for much of the winter and the extremely low antarctic temperatures cause cloud formation in the relatively "dry" stratosphere. These Polar Stratospheric Clouds (PSC's) are composed of ice crystals that provide the surface for a multitude of reactions, many of which speed the degradation of ozone molecules. This phenomenon has caused documented decreases in ozone concentrations over Antarctica.

In fact, ozone levels drop so low in spring in the Southern Hemisphere that scientists have observed what they call a "hole" in the ozone layer. The ozone destruction process requires conditions cold enough for stratospheric clouds to

form. Once these stratospheric clouds form the process can take place, even in warmer conditions.

It was first noticed by a research group from The British Antarctic Survey in the 1970's. Joseph Farman, Brian Gardiner and Jonathan Shanklin, are the BAS scientists who discovered the Antarctic ozone hole. In the 1980's the first measurements of this loss were actually documented. In October 1984, when the British first reported their findings, ozone levels were about 35 per cent lower than the average for the 1960s.

6.8.4 Nuclear Accidents and Holocausts

Leakage of radioactive substances from nuclear power plants always has disastrous impacts on human society. Although nuclear power plants are designed in a way that there is no leakage of radioactive material from them. However, no nuclear power plant is 100% leakage proof. There are high chances of nuclear accident at any stage of nuclear cycle in the nuclear reactor and atomic power plant. Such accidents release large amount of radioactive isotopes like Uranium-235, Iodine-131 etc. which may reach the human body directly or indirectly and have acute and chronic effects.

CASE STUDY

Chernobyl nuclear disaster

About 130 km north of Kiev, in what is now the Ukraine, is located the Chernobyl nuclear power plant. At this plant the worst reactor disaster to ever occur took place on 26 April 1986. It happened largely because normal reactor operations were suspended; an experiment was to take place in the reactor. As a result, normal safety guidelines were disregarded, and the accident occurred.

The effects of the disaster at Chernobyl were very widespread. The World Health Organization (WHO) found that the radiation release from the Chernobyl accident was 200 times that of the Hiroshima and Nagasaki nuclear bombs combined. 30 lives were directly lost during the accident or within a few months after it. The radiation released has also had long-term effects on the cancer incidence rate of the surrounding population. According to the Ukrainian Radiological Institute over 2500 deaths resulted from the Chernobyl incident. The WHO has found a significant increase in cancer in the surrounding area.

Nuclear holocaust in Japan

On the morning of 6 August, 1945 the United States Army Air Forces dropped the nuclear weapon on Hiroshima, followed three days later by the detonation of the bomb over Nagasaki, Japan. It is estimated that the number of casualties caused by the bombings is huge and falls between 100,000 and 200,000. Most of the casualties were civilians.

6.9 WASTELAND RECLAMATION

Ecologically unproductive lands suffering from environmental deterioration are known as wastelands. More than half of our country's geographical area is estimated to be wasteland. Maximum wasteland areas in our country lie in Rajasthan followed by Madhya Pradesh and Andhra Pradesh. The wasteland can be classified into two types:

Culturable wasteland: These include water logged and marsh land, areas rendered barren after Jhom cultivation, sandy areas, gullied areas, degraded forest land and industrial wastelands etc.

Unculturable wasteland: These include snow covered areas; glacial areas barren rocky area, steep slopes.

Wasteland reclamation is the conversion of wasteland into land suitable for use of habitation or cultivation. Some important reclamation practices are:

- By land development and leaching which washes out the excess amount of salt.
- By removing excess of water by surface drainage and sub-surface drainage.
- By selecting tolerant crops and crop rotations.
- By proper irrigation practices.
- By gypsum addition which decreases the amount of sodium in soil.
- By the addition of green-manure, fertilisers and bio-fertiliser.
- Afforestation programmes.

Wasteland reclamation and development in our country falls under the purview of Wasteland Development Board, which works to fulfill the following objectives:

1. To improve the physical structure and quality of the marginal soil.
2. To improve the availability of good quality water for irrigating these lands.
3. To prevent the soil erosion, flooding and landslides.
4. To conserve the biological resources of the land for sustainable use.

6.10 CONSUMERISM AND WASTE PRODUCT

Consumerism is a term used to describe the effects of equating personal happiness with purchasing material possessions and consumption. It is often associated with criticisms of consumption starting with Karl Marx and Thorstein Veblen, but can actually be traced back to the first human civilisations. In economics, *consumerism* can also refer to economic policies that place an emphasis on consumption, and, in an abstract sense, the belief that the free choice of consumers should dictate the economic structure of a society.

Today's consumption is undermining the environmental resource base. It is exacerbating inequalities. And the dynamics of the consumption-poverty-inequality-environment nexus are accelerating. If the trends continue without change — not redistributing from high-income to low-income consumers, not shifting from

polluting to cleaner goods and production technologies, not promoting goods that empower poor producers, not shifting priority from consumption for conspicuous display to meeting basic needs — today's problems of consumption and human development will worsen.

... The real issue is not consumption itself but its patterns and effects.

... Inequalities in consumption are stark. **Globally, the 20% of the world's people in the highest-income countries account for 86% of total private consumption expenditures—the poorest 20% a minuscule 1.3%.** More specifically, the richest fifth:

- Consume 45% of all meat and fish, the poorest fifth 5%.
- Consume 58% of total energy, the poorest fifth less than 4%.
- Have 74% of all telephone lines, the poorest fifth 1.5%.
- Consume 84% of all paper, the poorest fifth 1.1%.
- Own 87% of the world's vehicle fleet, the poorest fifth less than 1%.

We consume a variety of resources and products today, having moved beyond basic needs to include luxury items and technological innovations to try to improve efficiency. Such consumption beyond minimal and basic needs is not necessarily a bad thing in and of itself, as throughout history we have always sought to find ways to make our lives a bit easier to live. However, increasingly, there are important issues around consumerism that need to be understood. For example:

- How are the products and resources we consume actually produced?
- What are the impacts of that process of production on the environment, society, on individuals?
- What are the impacts of certain forms of consumption on the environment, on society, on individuals?
- Which actors influence our choices of consumption?
- Which actors influence how and why things are produced or not?
- What is a necessity and what is a luxury?
- How do demands on items affect the requirements placed upon the environment?
- How do consumption habits change as societies change?
- Businesses and advertising are major engines in promoting the consumption of products so that they may survive. How much of what we consume is influenced by their needs versus our needs?
- Also influential is the very culture of today in many countries, as well as the media and the political institutions themselves. What is the impact on poorer nations and people on the demands of the wealthier nations and people that are able to afford to consume more?
- How do material values influence our relationships with other people?
- What impact does that have on our personal values?
- And so on.

Just from these questions, we can likely think of numerous others as well. We can additionally, see that consumerism and consumption are at the core of many, if not most societies. The impacts of consumerism, positive and negative are very significant to all aspects of our lives, as well as our earth (Environment). But equally important to bear in mind in discussing consumption patterns is the underlying system that promotes certain types of consumption and not other types.

“Over” population is usually blamed as the major cause of environmental degradation, but the above statistics strongly suggests otherwise. As we will see, consumption patterns today are not to meet everyone’s needs. The system that drives these consumption patterns also contribute to inequality of consumption patterns.

Effects of consumerism: Because consumption is so central to many economies, and even to the current forms of globalisation, its effects therefore are also seen around the world. How we consume, and for what purposes drives how we extract resources, create products and produce pollution and waste. Issues relating to consumption hence also affect environmental degradation, poverty, hunger, and even the rise in obesity that is nearing levels similar to the “official” global poverty levels. Political and economic systems that are currently promoted and pushed around the world in part to increase consumption also lead to immense poverty and exploitation. Much of the world cannot and do not consume at the levels that the wealthier in the world do.

Consumerism has been related both to the increase in the population size as well as increase in our demand due to change in lifestyle. In the modern society our needs have multiplied and so consumerism of resources has also multiplied.

We are beginning to get just a hint of how wasteful our societies are. Sugar, beef, and bananas are just the tip of the iceberg in terms of examples of wasted industry and waste structured within the current system. Not only are certain wasteful job functions unnecessary as a result, but the capital that employs this labour is therefore a wasteful use of capital. As a result, we see waste and misuse of the environment, as well as social and environmental degradation increasing. Our industries may be efficient for accumulating capital and making profits, but that does not automatically mean that it is efficient for society.

6.11 ENVIRONMENTAL LEGISLATION

India is the first country in the world to have provisions for the protection and conservation of environment in its constitution. On 5 June 1972, environment was first discussed as an item of international agenda in the UN Conference on Human Environment in Stockholm and thereafter 5th June is celebrated all over the world as World Environmental Day.

The provisions for environmental protection in the constitution were made in 1976 through 42 amendment under the Article 48A and Article 51A (g). Thus our constitution includes environmental protection and conservation as one of our fundamental duties. Some of the important acts passes by the Government of India are discussed here:

6.11.1 Wildlife (Protection) Act, 1972

(53 of 1972) [9th September 1972]

An Act to provide for the protection of wild animals, birds and plants and for matters connected therewith. It extends to the whole of India except the State of Jammu and Kashmir. It shall come into force in a State or Union Territory to which it extends, on such date as the Central Government may, by notification, appoint, and different dates may be appointed for different provisions of this act or for different States or Union Territories. The major activities and provisions in the act can be summed up as follows:

1. It provides for the appointment of wildlife advisory board.
2. Protection of some endangered species.
3. The Chief Wild Life Warden may permit any person to hunt such animal, if any wild animal has become dangerous to human life or is so disabled or diseased as to be beyond recovery in writing and stating the reasons and any wild animal killed or wounded in defense of any person shall be Government property.
4. Chief Wild Life Warden may grant a permit to any person in writing stating the reasons on payment of such fee that is prescribed for the purpose, of education, scientific research, scientific management, collection of specimens, collection or preparation of snake-venom for the manufacture of life-saving drugs.
5. No person shall willfully pick, uproot, damage, destroy, acquire or collect any specified plant from any forest land and any area specified or notification by the Central Government.
6. No person shall cultivate a specified plant except under and in accordance with a license granted by the Chief Wild Life Warden or any other officer authorized by the State Government in this behalf.
7. Every licence granted under this section shall specify the area in which and the conditions, if any, subject to which the licensee shall cultivate a specified plant.
8. The act provides the declaration of sanctuary and National Parks.
9. There is restriction on entry in sanctuary, The Chief Wild Life Warden may, on application, grant to any person a permit to enter or reside in a sanctuary for all or any of the following purposes, namely investigation or study of wild life, photography, scientific research, tourism and transaction of lawful business with any person residing in the sanctuary.
10. It provides for legal powers to officers and punishment to offenders. Any person who contravenes any provision of this act or any rule or order made who commits a breach of any of the conditions of any license or permit granted under this act, shall be guilty of an offence against this Act, and shall, on conviction, be punishable with imprisonment for a term which may punishable with imprisonment for a term which shall not be less than one

year but which may extend to seven years and also with fine which shall not be less than five thousand.

11. This act gives the power of Central Government and State Government to make rules.

6.11.2 Forest (Conservation) Act, 1980 with Amendments Made in 1988

An act to provide for the conservation of forests and for matters connected therewith or ancillary or incidental thereto. It extends to the whole of India except the State of Jammu and Kashmir. It shall be deemed to have come into force on the 25th October 1980.

Under Section 2: Restriction on the Dereservation of Forests or Use of Forest Land for Non-forest Purpose

Notwithstanding anything contained in any other law for the time being in force in a State, no State Government or other authority shall make, except with the prior approval of the Central Government, any order directing —

- (i) that any reserved forest (within the meaning of the expression "reserved forest" in any law for the time being in force in that State) or any portion thereof, shall cease to be reserved;
- (ii) that any forest land or any portion thereof may be used for any non-forest purpose;
- (iii) that any forest land or any portion thereof may be assigned by way of lease or otherwise to any private person or to any authority, corporation, agency or any other organization not owned, managed or controlled by Government;
- (iv) that any forest land or any portion thereof may be cleared of trees which have grown naturally in that land or portion, for the purpose of using it for reafforestation.

Explanation: For the purpose of this section, "non-forest purpose" means the breaking up or clearing of any forest land or portion thereof for —

- (a) the cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticultural crops or medicinal plants;
- (b) any purpose other than reafforestation.

But does not include any work relating or ancillary to conservation, development and management of forests and wildlife, namely, the establishment of check-posts, fire lines, wireless communications and construction of fencing, bridges and culverts, dams, waterholes, trench marks, boundary marks, pipelines or other like purposes.

Under Section 3: Constitution of Advisory Committee

The Central Government may constitute a committee consisting of such number of persons as he may deem fit to advise that government with regard to —

- (i) the grant of approval, under Section 2; and

- (ii) any other matter connected with the conservation of forests which may be referred to h by the Central Government.

Under Section 3A: Penalty for Contravention of the Provisions of the Act

Whoever contravenes or abets the contravention of any of the provisions of Section 2, shall be punishable with simple imprisonment for a period which may extend to fifteen days.

Under Section 3B: Offences by the Authorities and Government Departments

- Where any offence under this act has been committed:

- by any department of government, the head of the department; or
- by any authority, every person who, at the time the offence was committed, was directly in charge of, and was responsible to, the authority for the conduct of the business of the authority as well as the authority. Shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly.

Under Section 4: Power to make Rules

- The Central Government may, by notification in the Official Gazette, makes rules for carrying out the provisions of this act.

Under Section 5: Repeal and Saving

- The Forest (Conservation) Ordinance, 1980 is hereby replaced.
- Notwithstanding such repeal, anything done or any action taken under the provisions of the said Ordinance shall be deemed to have been done or taken under the corresponding provisions of this act.

Some amendments are made in forest Act in 1992:

- Cultivation of tea, coffee, rubber are included under non-forestry activity.
- Exploration and survey of National Park and wildlife sanctuaries are totally prohibited.

6.11.3 The Water (Prevention and Control of Pollution) Act, 1974 [Act No. 6 of 1974]

An act to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water for the establishment, with a view to carrying out the purposes aforesaid, of Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith

It applies in the first instance to the whole of the States of Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tripura and West Bengal and the Union Territories; and it shall apply to such other State which adopts this Act by resolution passed in that behalf under clause (1) of article 252 of the Constitution.

It shall come into force at once in the States of Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tripura and West Bengal and in the Union Territories, and in any other State which adopts this Act under Clause (1) of Article 252 of the Constitution on the date of such adoption and any reference in this act to the commencement of this act shall, in relation to any State or Union Territory, means the date on which this act comes into force in such State or Union Territory.

The Water Act was enacted by Parliament Act, 1974 purpose to provide for the prevention of control of water pollution and the maintaining or restoring of wholesomeness of water. Water pollution is defined as 'such contamination of water, or such alteration of physical, chemical or biological properties of water, or such discharge as is likely to cause a nuisance or render the water harmful or injurious to public health and safety or harmful for any other use or to aquatic plants and other organism or animal life'. As on day, it is applicable in all the states of India. The relevant provisions of this Act are given as below:

Under Section 16: Functions of Central Board

1. Subject to the provisions of this act, the main function of the Central Board shall be to promote cleanliness of streams and wells in different areas of the States.
2. In particular and without prejudice to the generality of the foregoing function, the Central Board may perform all or any of the following functions, namely:
 - (a) Advise the Central Government on any matter concerning the prevention and control of water pollution;
 - (b) Coordinate the activities of the State Boards and resolve disputes among them;
 - (c) Provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution;
 - (d) Plan and organise the training of persons engaged or to be engaged in programs for the prevention, control or abatement of water pollution on such terms and conditions as the Central Board may specify;
 - (e) Organise through mass media a comprehensive programme regarding the prevention and control of water pollution;
 - (f) Collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control and prepare manuals, codes or guides relating to treatment and disposal of sewage and trade effluents and disseminate information connected therewith;
 - (g) Lay down, modify or annul, in consultation with the State Government concerned, the standards for a stream or well: Provided that different standards may be laid down for the same stream or well or for different streams or wells, having regard to the quality of water, flow characteristics of the stream or well and the nature of the use of the water in such stream or well or streams or wells;

- (h) Plan and cause to be executed a nation-wide programme for the prevention, control or abatement of water pollution;
 - (i) Perform such other functions as may be prescribed.
- 3: The Board may establish or recognise a laboratory or laboratories to enable the Board to perform its functions under this section efficiently, including the analysis of samples of water from any stream or well or of samples of any sewage or trade effluents.

Under Section 17: Functions of State Board

1. Subject to the provisions of this Act, the functions of a State Board shall be
 - (a) To plan a comprehensive programme for the prevention, control or abatement of pollution of streams and wells in the State and to secure the execution thereof;
 - (b) To advise the State Government on any matter concerning the prevention, control or abatement of water pollution;
 - (c) To collect and disseminate information relating to water pollution and the prevention, control or abatement thereof;
 - (d) To encourage, conduct and participate in investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution;
 - (e) To collaborate with the Central Board in organising the training of persons engaged or to be engaged in programmes relating to prevention, control or abatement of water pollution and to organise mass education programmes relating thereto;
 - (f) to inspect sewage or trade effluents, works and plants for the treatment or sewage and trade effluents and to review plans, specifications or other data relating to plants set up for the treatment of water, works for the purification thereof and the system for the disposal of sewage or trade effluents or in connection with the grant of any consent as required by this act;
 - (g) Lay down, modify or annul effluent standards for the sewage and trade effluents and for the quality of receiving waters (not being water in an inter-State stream) resulting from the discharge of effluents and to classify waters of the State;
 - (h) To evolve economical and reliable methods of treatment of sewage and trade effluents, having regard to the peculiar conditions of soils, climate and water resources of different regions and more specially the prevailing flow characteristics of water in streams and wells which render it impossible to attain even the minimum degree of dilution;
 - (i) To evolve methods of utilisation of sewage and suitable trade effluents in agriculture;
 - (j) To evolve efficient methods of disposal of sewage and trade effluents on land, as are necessary on account of the predominant conditions of

- scant stream flows that do not provide for major part of the year the minimum degree of dilution;
- (k) To lay down standards of treatment of sewage and trade effluents to be discharged into any particular stream taking into account the minimum fair weather dilution available in that stream and the tolerance limits of pollution permissible in the water of the stream, after the discharge of such effluents.
- 1. To make, vary or revoke any order —
 - (i) For the prevention, control or abatement of discharge of waste into streams or wells;
 - (ii) Requiring any person concerned to construct new systems for the disposal of sewage and trade effluents or to modify, alter or extend any such existing system or to adopt such remedial measures as are necessary to prevent control or abate water pollution;
 - (m) To lay down effluent standards to be complied with by persons while causing discharge of sewage or sullage or both and to lay down, modify or annul effluent standards for the sewage and trade effluents;
 - (n) To advise the State Government with respect to the location of any industry the carrying on of which is likely to pollute a stream or well;
 - (o) To perform such other functions as may be prescribed or as may, from time to time be entrusted to it by the Central Board or the State Government.
- 2. The Board may establish or recognise a laboratory or laboratories to enable the Board to perform its functions under this section efficiently, including the analysis of samples of water from any stream or well or of samples of any sewage or trade effluents.

Under Section 18: Powers to give Directions

In the performance of its functions under this Act —

- (a) The Central Board shall be bound by such directions in writing the Central Government may give to it; and
- (b) Every State Board shall be bound by such directions in writing as the Central Government or the State Government may give to it:

Under Section 19: The entire National Capital Territory of Delhi has been declared as water pollution prevention control area.

Under Section 21: Officials of DPCC can take samples of the water effluent from any industry stream or well or sewage sample for the purpose of analysis

Under Section 23: Officials of the state boards can enter any premises for the purpose of examining any plant, record, register etc. or any of the functions of the Board entrusted to him.

Under Section 24: No person shall discharge any poisonous, noxious or any polluting matter into any stream, or well or sewer or on land.

Under Section 25: No person shall without the previous consent to establish shall

- , (a) Establish or take any step to establish any industry, operation or process or any treatment and disposal system for any extension or addition thereto, which is likely to discharge sewage or trade effluent into a stream or well or sewer or on land; or
- (b) Bring into use any new or altered outlet for the discharge of sewage or
- (c) Begin to make any new discharge of sewage.

Under this section the state board may grant consent to the industry after satisfying itself on pollution control measures taken by the unit or refuse such consent for reasons to be recorded in writing.

Under Section 27: A state board may from time to time review any condition imposed by it on the person under Sections 25 and 26 and may vary or revoke that condition.

Under Section 28: Any person aggrieved by the order made by the State Board under Sections 25, 26 or Section 27 may within thirty days from the date on which the order is communicated to him, prefer an appeal to such authority (referred to as the appellate authority) as the State Government may think fit to constitute (in case of NCT of Delhi Appellate authority under this section is Financial Commissioner, Delhi Administration).

Under Section 33: The State Board can direct any person who is likely to cause or has caused the pollution of water in street or well to desist from taking such action as is likely to cause its pollution or to remove such matters as specified by the Board through court.

Under Section 33A: DPCC can issue any directions to any person, officer or authority, and such person, officer or authority shall be bound to comply with such directions. The direction includes the power to direct:

- (i) The closure, prohibition of any industry.
- (ii) Stoppage or regulations of supply of electricity, water or any other services.

Under Section 43: Whoever contravenes the provisions of Section 24 shall be punishable with imprisonment for a term which shall not be less than one year and six months but which may extend to six years with fine.

Under Section 45: If any who has been convicted of any offence under Section 24, or Section 25 or Section 26 is again found guilty of an offence involving a contravention of the same proviso shall be on the second and on every subsequent conviction be punishable with imprisonment for a term which shall not less than two years but which may extend to seven years with fine.

Under Section 45A: Whoever contravenes any of the provisions of this act or fails to comply with any order or direction given under this act, for which no penalty has been elsewhere provided in this act, shall be punishable with imprisonment which may extend to three months or with fine which may extend to ten thousand rupees or with both.

6.11.4 The Air (Prevention and Control of Pollution) Act, 1981

[Act No. 14 of 1981]

An Act to provide for the prevention, control and abatement of air pollution, for the establishment, with a view to carrying out the aforesaid purposes, of Boards, for conferring on and assigning to such Boards, powers and functions relating thereto and for matters connected therewith

Whereas decisions were taken at the United Nations Conference on the Human Environment held in Stockholm in June 1972, in which India participated, to take appropriate steps for the preservation of the natural resources of the earth which, among other things, include the preservation of the quality of air and control of air pollution; And whereas it is considered necessary to implement the decisions aforesaid insofar as they relate to the preservation of the quality of air and control of air pollution.

In the act, air pollution has been defined as 'the presence of any solid, liquid or gaseous substance (including noise) in the atmosphere in such concentration as may be or tend to be harmful; to human beings or any other living creatures or plant or property or environment.' Noise pollution has been inserted ad pollution in the Act in 1987.

The Air (Prevention and Control of Pollution) Act divided in the following components:

1. Short Title, Extent, Commencement and Definitions.
2. Components of Central and State boards for the prevention and control of air pollution.
3. *Powers and functions of boards:* The Functions of Central Board, Functions of State Boards and Power to give Directions are given under the Sections 16, 17 and 18 respectively.
4. *Prevention and Control of Air Pollution:* The Power to declare Air Pollution control areas, power to give Instructions for ensuring standards for emission from automobiles and power to put the restrictions on use of certain industrial plants are mentioned under the Sections 19, 20 and 21 respectively.
5. Fund, accounts and Audit.
6. Penalties and Procedure.
7. *Miscellaneous:* The power of state government to supersede state board, power of Central Government to make rules and power of State Government to make rules describes under the Section 47, Sections 53 and 54 respectively.

Under Section 16: Functions of Central Board

1. Subject to the provisions of this act, and without prejudice to the performance of its functions under the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974), the main functions of the Central Board shall be to improve the quality of air and to prevent, control or abate air pollution in the country.

2. In particular and without prejudice to the generality of the foregoing functions, the Central Board may—
 - (a) Advise the Central Government on any matter concerning the improvement of the quality of air and the prevention, control or abatement of air pollution;
 - (b) Plan and cause to be executed a nation-wide programme for the prevention, control or abatement of air pollution;
 - (c) Coordinate the activities of the State Boards and resolve disputes among them;
 - (d) Provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of air pollution and prevention, control or abatement of air pollution;
 - (e) Plan and organise the training of persons engaged or to be engaged in programmes for the prevention, control or abatement of air pollution on such terms and conditions as the Central Board may specify;
 - (f) Organise through mass media a comprehensive programme regarding the prevention, control or abatement of air pollution;
 - (g) Collect, compile and publish technical and statistical data relating to air pollution and the measures devised for its effective prevention, control or abatement and prepare manuals, codes or guides relating to prevention, control or abatement of air pollution;
 - (h) Lay down standards for the quality of air;
 - (i) Collect and disseminate information in respect of matters relating to air pollution;
 - (j) Perform such other functions as may be prescribed.
3. The Central Board may establish or recognise a laboratory or laboratories to enable the Central Board to perform its functions under this section efficiently.
4. The Central Board may—
 - (a) Delegate any of its functions under this act generally or specially to any of the committees appointed by it;
 - (b) Do such other things and perform such other acts as it may think necessary for the proper discharge of its functions and generally for the purposes of carrying into effect the purposes of this act.

Under Section 17: Functions of State Boards

1. Subject to the provisions of this act, and without prejudice to the performance of its functions, if any, under the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974), the functions of a State Board shall be—
 - (a) To plan a comprehensive programme for the prevention, control or abatement of air pollution and to secure the execution thereof;

- (b) To advise the State Government on any matter concerning the prevention, control or abatement of air pollution;
- (c) To collect and disseminate information relating to air pollution;
- (d) To collaborate with the Central Board in organising the training of persons engaged or to be engaged in programmes relating to prevention, control or abatement of air pollution and to organise mass-education programme relating thereto;
- (e) To inspect, at all reasonable times, any control equipment, industrial plant or manufacturing process and to give, by order, such directions to such persons as it may consider necessary to take steps for the prevention, control or abatement of air pollution;
- (f) To inspect air pollution control areas at such intervals as it may think necessary, assess the quality of air therein and take steps for the prevention, control or abatement of air pollution in such areas;
- (g) To lay down, in consultation with the Central Board and having regard to the standards for the quality of air laid down by the Central Board, standards for emission of air pollutants into the atmosphere from industrial plants and automobiles or for the discharge of any air pollutant into the atmosphere from any other source whatsoever not being a ship or an aircraft:
Provided that different standards for emission may be laid down under this clause for different industrial plants having regard to the quantity and composition of emission of air pollutants into the atmosphere from such industrial plants;
- (h) To advise the State Government with respect to the suitability of any premises or location for carrying on any industry which is likely to cause air pollution;
- (i) To perform such other functions as may be prescribed or as may, from time to time, be entrusted to it by the Central Board or the State Government;
- (j) To do such other things and to perform such other acts as it may think necessary for the proper discharge of its functions and generally for the purpose of carrying into effect the purposes of this act.

2. A State Board may establish or recognise a laboratory or laboratories to enable the State Board to perform its functions under this section efficiently.

Under Section 18: Power to give directions

In the performance of its functions under this Act —

- (a) The Central Board shall be bound by such directions in writing as the Central Government may give to it; and
- (b) Every State Board shall be bound by such directions in writing as the Central Board or the State Government may give to it.

Provided that where a direction given by the State Government is inconsistent with the direction given by the Central Board, the matter shall be referred to the Central Government for its decision.

Under Section 19: The State Government may, after consultation with the State Board, by notification in the Official Gazette, declare in such manner as may be prescribed, any area or areas within the State as air pollution control area or areas for the purposes of this act.

Under Section 20: With a view to ensuring that the standards for emission of air pollutants from automobiles laid down by the State Board. The State Government shall, in consultation with the State Board, give such instructions as may be deemed necessary to the concerned authority in charge of registration of motor vehicles under the Motor Vehicles Act, 1939 (4 of 1939), and such authority shall contained in that act or the rules made there under be bound to comply with such instructions.

Under Section 21: Subject to the provisions of this section, no person shall, without the previous consent of the State Board, establish or operate any industrial plant in an air pollution control area.

Under Section 24: Subject to the provisions of this section, any person empowered by a State Board shall have a right to enter at all reasonable times in any place for the purpose of performing any of the functions of the State Board entrusted to him or for the purpose of determining whether any such functions are to be performed or whether any provisions of this Act or the rules made there under or any notice, order, direction or authorisation served, made, given or granted under this act is being or has been complied with.

Under Section 25: For the purposes of carrying out the functions entrusted to it, the State Board or any officer empowered to get any information (including information regarding the types of air pollutants emitted into the atmosphere and the level of the emission of such air pollutants) from the occupier or any other person carrying on any industry or operating any control equipment or industrial plant and for the purpose of verifying the correctness of such information, the State Board or such officer shall have the right to inspect the premises where such industry, control equipment or industrial plant is being carried on or operated.

6.11.5 The Environmental (Protection) Act, 1986

[23rd May 1986]

The Act comes into force on 19 November 1986, the birth anniversary of our late Prime Minister Mrs. Indira Gandhi, who was a pioneer of environmental protection issues in our country.

An act to provide for the protection and improvement of environment and for matters connected therewith:

WHEREAS the decisions were taken at the United Nations Conference on the Human Environment held at Stockholm in June 1972, in which India participated, to take appropriate steps for the protection and improvement of human environment;

AND WHEREAS it is considered necessary further to implement the decisions aforesaid in so far as they relate to the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property;

It extends to the whole of India. It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint and different dates may be appointed for different provisions of this act and for different areas. This act gives the definitions of

- (a) "environment" includes water, air and land and the interrelationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property;
- (b) "environmental pollutant" means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment;
- (c) "environmental pollution" means the presence in the environment of any environmental pollutant;
- (d) "hazardous substance" means any substance or preparation which, by reason of its chemical or physico-chemical properties or handling, is liable to cause harm to human beings, other living creatures, plant, micro-organism, property or the environment.

Silent Features of EPA, 1986

1. Subject to the provisions of this act, 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 the environment and preventing controlling and abating environmental pollution. Central Government have the power for such measures may include measures with respect to all or any of the following matters, namely:

- (a) planning and execution of a nation-wide programme for the prevention, control and abatement of environmental pollution;
- (b) laying down standards for the quality of environment in its various aspects;
- (c) laying down standards for emission or discharge of environmental pollutants 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;
- (d) restriction of areas in which any industries, operations or processes or class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards;
- (e) laying down procedures and safeguards for the prevention of accidents which may cause environmental pollution and remedial measures for

- (f) laying down procedures and safeguards for the handling of hazardous substances; examination of such manufacturing processes, materials and substances as are likely to cause environmental pollution;
 - (g) carrying out and sponsoring investigations and research relating to problems of environmental pollution;
 - (h) inspection of any premises, plant, equipment, machinery, manufacturing or other processes, materials or substances and giving, by order, of such directions to such authorities, officers or persons as it may consider necessary to take steps for the prevention, control and abatement of environmental pollution;
 - (i) establishment or recognition of environmental laboratories and institutes to carry out the functions entrusted to such environmental laboratories and institutes under this act;
 - (j) collection and dissemination of information in respect of matters relating to environmental pollution;
 - (k) preparation of manuals, codes or guides relating to the prevention, control and abatement of environmental pollution;
 - (l) 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.
2. The Central Government may appoint officers with such designation as it thinks fit for the purposes of this act and may entrust to them such of the powers and functions under this act as it may deem fit. The officers appointed shall be subject to the general control and direction of the Central Government or, if so directed by that government, also of the authority or authorities.
3. Notwithstanding 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.
4. The Central Government may, by notification in the Official Gazette, make rules in respect of all or to protect and improve environment.
5. In particular, and without prejudice to the generality of the foregoing power, such rules may provide for all or any of the following matters, namely:
- (a) the standards of quality of air, water or soil for various areas and purposes;
 - (b) the maximum allowable limits of concentration of various environmental pollutants (including noise) for different areas;
 - (c) the procedures and safeguards for the handling of hazardous substances;
 - (d) the prohibition and restrictions on the handling of hazardous substances in different areas;
 - (e) the prohibition and restriction on the location of industries and the carrying on process and operations in different areas;

- (f) the procedures and safeguards for the prevention of accidents which may cause environmental pollution and for providing for remedial measures for such accidents.
6. No person carrying on any industry, operation or process shall discharge or emit or permit to be discharged or emitted any environmental pollutants in excess of such standards as may be prescribed.
7. No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed.
8. Where the discharge of any environmental pollutant in excess of the prescribed standards occurs or is apprehended to occur due to any accident or other unforeseen act or event, the person responsible for such discharge and the person in charge of the place at which such discharge occurs or is apprehended to occur shall be bound to prevent or mitigate the environmental pollution caused as a result of such discharge.
9. Subject to the provisions of this section, any person empowered by the Central Government in this behalf shall have a right to enter, at all reasonable times with such assistance as he considers necessary, any place for the purpose of performing any of the functions of the Central Government entrusted to him;
10. The Central Government or any officer empowered by it in this behalf shall have power to take, for the purpose of analysis, samples of air, water, soil or other substance from any factory, premises or other place in such manner as may be prescribed.

Environmental (Protection) Rule, 1986: For the purpose of protecting and improving the quality of the environment and preventing the abating pollution, standards have been specified under Schedules I-IV of Environmental (Protection) Rule, 1986 for emission of gaseous pollutant and discharge of effluent/waste.

Under the Environmental (Protection) Rule, 1986, an amendment was made in 1994 for Environmental Impact Assessment (EIA) of various development projects. There are 29 types of project which required clearance form the Central government before establishing.

Other requires clearance form the SPCB. The proposed project or expansion activity proponent has to provide EIA report, risk assessment report, No Objection Certificate (NOC) from SPCB, commitment regarding availability of water and electricity.

EPA, 1984 has also made provision for environmental audit as a means of checking whether or not a company is complying with the environmental laws and regulations.

6.11.6 Issues Involved in the Enforcement of Environmental Legislations

There are certain drawbacks of the acts due to which the government has faces different problems in their enforcement. They are discussed as below:

- The offenders of the Wildlife (Protection) Act are not subjected to vary harsh punishment. The offender can be fined of Rs. 25,000 or imprisoned for 3 years or both which is not enough to deal with the poachers and wildlife traders.
- The Jammu and Kashmir state has its own Wildlife Act which does not follow the Central Wildlife Act and hunting and trading of several endangered species which are prohibited in other states are allowed in J&K. As a result the wildlife traders can get wildlife articles illegally from other state.
- In Wildlife (Protection) Act the ownership certificates for animal articles (like tiger, leopard skin etc.) are permissible which very often serve as a tool for illegal trading.
- Since the Chairmen and Members of the Board are often drawn either from forest services or administrative services, they don't have technical background in pollution control and they find difficulties in providing proper guidance to their subordinate.
- To enforce the punishment to the polluters the State Pollution Control Board has to file a case in the lower court and due to insufficient availability of time and over work load the lower courts are not able to solve the cases on time and it result a number of cases pending for years.
- Due to lack of the sufficient equipments the Pollution Control Boards are not able to investigating, suggesting for remedial measure and monitoring the implementation wherever required.
- The pollution Control Boards are expected to function as statutory autonomous bodies, but due to over dependence on the government for their existence they can not function properly.
- Due to insufficient funds the Pollution Control Boards are not able to pursue the legal actions.

6.12 PUBLIC AWARENESS

Education has been the utmost priority of any civilised society since the ages and will remain same for all eternity. The rise and fall of the human race depends largely on the quality of education being provided through the available modes and agencies. Environmental Education is a process of recognising values and clarifying concepts in order to develop skills and added tools necessary to understand and appreciate the interrelationship among man, his culture and his bio-physical surrounding. It creates an overall perspective, which acknowledges the fact that natural environment and man-made environment are interdependent. Its main objective is to improve public awareness and understanding of environmental issues with a view to promote the conservation and wide use of nature and natural resources.

The Ministry of Environment and Forests (MoEF), Government of India, has been interacting with the Ministry of Human Resource Development (MHRD), NCERT, State Departments of Education etc. to ensure that environmental components are adequately covered at the school levels by infusion into the school

curricula at various levels. The Ministry has also taken an initiative to educate people through a structural course on environment education and it presently working out a framework for environmental appreciation courses in consultation with IGNOU. (Source: MoEF)

Environmental Education, Awareness and Training plays a significant role in encouraging and enhancing people's participation in activities aimed at conservation, protection and management of the environment, essential for achieving sustainable development.

CASE STUDY

In Punjab, the environment education at the primary school in the state is adequate, where the syllabus designed by Punjab State Education Board is based on NCERT syllabus. For the primary classes, a project "Environment Education in school system" has been undertaken by Punjab Education Department, which is been implemented by the Ministry of Environment and Forests, Government of India with the financial aid from the World Bank. Various activities are being undertaken to strengthen the Environment Education, which includes the development of educational material like Greening of Books of Classes VI, VII and VIII (Hindi, Punjabi, Science and Social Studies), development of Environment Education programmes and also Trainings are being organised for educational administrators, Teachers and NGO's.

Non-formal education in the state is also being prompted by the department of environment through PSCST and Punjab Pollution Control Board. Under this Programme, important environment days are celebrated from time-to-time, environmental workshop are conducted and competition, seminars, lectures and Public Camps on Environment awareness are organised. A number of NGOs of the state have been actively participating in National Environment Awareness campaign organised by MoEF, GoI.

SUMMARY

Sustainable development is defined as 'meeting the needs of the present without compromising the ability of future generation to meet their own need'. The necessary conditions for achieving sustainable development are social equity, economical equity and ecological security. The objective of sustainable development is to bring benefits to all.

Now a day the world is facing the problem of energy supply because of increasing population and industrialization. Whereas on one hand the energy demand is increasing at a faster rate on the other hand the conventional energy sources are fast exhaustive. It has created a wide gap between demand and supply.

Water conservation is the management technique which eliminates the wastage of water or maximizes efficiency of its use. The water can be conserve by adopting the strategies of decreasing run-off losses, reducing evaporation losses, by storing water in soil and by reusing water.

Rain Water Harvesting is a method of utilizing rain water for domestic and agricultural use by capturing and storing the rain water above the ground or charge the underground for its later use.

Rain water harvesting is essential because it increases the supply of surface water and decreases run-off losses. Rainwater can be mainly harvested by storing of rainwater on surface and recharging ground water.

The watershed describes an area of land that drains down slope to the lowest point. Watershed management is defined as the rotational utilization of land and water resources for optimum production that causes minimum damage to the natural resources. The watershed management is required because it increases the productivity of soil, helps in beneficial development activities and reduces the rate of occurrence of natural disasters.

Resettlement is the transportation of people (as a family or colony) to a new settlement (as after an upheaval of some kind). Rehabilitation is the restoration of someone to a useful place in society. The various development projects, settlement of National parks/Wildlife sanctuaries and disasters are the main causes of resettlement and rehabilitation.

Environmental ethics are the relationship between human beings and the natural environment. Environmental ethics can provide us the guidelines for putting our beliefs into action and help us decide what to do when faced with crucial situation.

Climate is the statistical description over a period of time ranging from months to thousands or millions of years. The main causes for climatic changes are global warming, acid rain, ozone depletion and nuclear accidents. **Global warming** is a term used to describe the trend of increases in the average temperature of the Earth's atmosphere and oceans. **Acid rain** is rain that has a larger amount of acid in it than what is normal.

The **Ozone depletion** is a slow, steady decline in the total amount of ozone in the earth's stratosphere. Leakage of radioactive substances due to any natural of man-made activity which has disastrous impacts on human society is known as **Nuclear accidentis**.

Ecologically unproductive lands suffering from environmental deterioration are known as waste lands. The waste land can be classified into two types named culturable wasteland and un-culturable wasteland. **Wasteland reclamation** is the conversion of wasteland into land suitable for use of habitation or cultivation.

Consumerism refers to economic policies that place an emphasis on consumption, and the belief that the free choice of consumers should dictate the economic structure of a society. Consumerism has been related both to the increase in the population size as well as increase in our demand due to change in life-style. In the modern society our needs have multiplied and so consumerism of resources has also multiplied.

India is the first country in the world to have provisions for the protection and conservation of environment in its constitution. On 5 June 1972, environment war first discussed as an item of international agenda in the UN Conference on Human Environment in Stockholm and thereafter 5th June is celebrated all over the world as World Environmental Day.

The provisions for environmental protection in the constitution were made in 1976 through 42 amendment under the article 48-A and Article 51-A (g). Some of the important Acts passes by the Government of India are Wildlife (protection) Act, 1972, Forest (Conservation) Act, 1980, The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981 and The Environmental (Protection) Act, 1986.

DESCRIPTIVE TYPE QUESTIONS

1. Explain the concept of sustainable development. What are the major obstacles in the path of sustainable development in India? [5 Marks](UPTU 2006)
2. Define Sustainable development. What are its key components and measures for sustainable development?
3. What is watershed? Critically discuss the objectives and practices of watershed management.

4. What is rainwater harvesting? What are the major objectives for rainwater harvesting?
Explain some methodologies for harvesting the rainwater.
5. What do you understand by the term water conservation? Discuss the measures to conserve water. [5 Marks](UPTU 2006)
6. Explain water conservation, global warming, acid rain and ozone layer depletion.
7. What are the problems and concern related to rehabilitation and resettlement issues?
8. What are wastelands? What are culturable wastelands? Name and discuss the various methods of wasteland reclamation. [5 Marks](UPTU 2005)
9. What is 'Rain-Water Harvesting'? Name and discuss in brief the types of rainwater harvesting. [5 Marks](UPTU 2006)
10. Briefly discuss the objectives of Resettlement and Rehabilitation policy. [5 Marks](UPTU 2006)
11. Discuss the significance of rain water harvesting and watershed management.
12. Discuss briefly the environmental ethics and related issues with their solutions. [5 Marks](UPTU 2005)
13. Discuss the phenomenon of 'Greenhouse Effect'. What are its effects? What remedial measures you suggest?
14. What is acid rain? What are the causes and effects of acid rain? How can be problem be overcome?
15. What is ozone hole? What are the causes of ozone hole formation. Discuss the effects of ozone hole layer depletion and its remedial measures. [5 Marks](UPTU 2006)
16. Briefly discuss the salient features of Environment (Protection) Act, 1986. [5 Marks](UPTU 2006)
17. Briefly discuss the salient features of the Forest (Conservation) Act, 1980. [5 Marks](UPTU 2006)
18. How do you define pollution as per Water (Prevention and Control of Pollution) Act 1974? What are the salient features of the Act?
19. Write down the major highlights of Wildlife Protection Act of India. [5 Marks](UPTU 2006)

SHORT QUESTIONS WITH ANSWERS

- Q. 1.** What do you understand by environmental ethics?

Ans. Environmental ethics or environmental philosophy considers the relationship between human being and the natural environment. It exerts influence on a large range of disciplines including law, sociology, theology, economics and geography. There are many ethical decisions that human beings make with respect to the environment.

- Q. 2.** Differentiate between Eco-centric and Anthropogenic world view.

Ans. According to Eco-centric view 'Nature has provided us with all the resources for leading a beautiful life and she nourishes us like a mother, we should respect her and nurture her' whereas Anthropocentric view says 'Man is all powerful and the supreme creature on this earth and man is the master of nature and can harness it as his will'.

Q. 3. What is nuclear holocaust? What are its impacts on man?
A. Nuclear Holocaust is the use

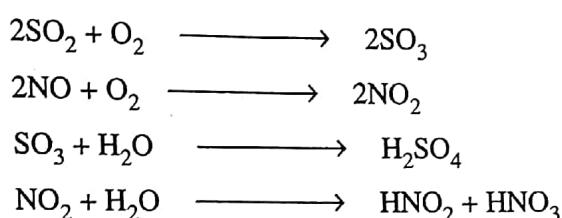
Ans. Nuclear Holocaust is the concept of the eradication of the human race through the means of Nuclear war. Nuclear war or atomic war, is war in which nuclear weapons are used. In the history of nuclear weapons, only twice were nuclear arms used in war (the atomic bombing of Hiroshima and Nagasaki), and only by one side in the confrontation. In a Nuclear Holocaust, potentially, the majority of human life on Earth would either be killed outright or die due to fallout effects and/or disease.

Q.4. ‘Consumerism and waste generation are interrelated’ Comment on this statement.

Ans. We consume a variety of resources and products today having moved beyond basic needs to include luxury items and technological innovations to try to improve efficiency. But there is increase in our demand due to change in life-style, we are shifting to new innovative things from the older one and therefore waste is increasing as the consumerism.

Q. 5. Name the gases and reactions causing acid rain

Ans. Acid rain is caused by oxides of sulphur and oxides of nitrogen, when these pollutants reach into the atmosphere, react with rain water and form acid. The main reactions are as follows



Q. 6. How ozone layer does protect us?

Ans. Ultraviolet (UV) radiations emitted from the Sun are harmful to the skin and is the main cause of sunburn; excessive exposure can also cause genetic damage, resulting in problems such as skin cancer. the ozone layer absorb most of the harmful UV wavelengths (270-315 nm) and protect us.

Q.7. Write Short notes on

Ans. shots notes

- (i) The term **Ozone depletion** is a slow, steady decline, of about 3% per decade, in the total amount of ozone in the earth's stratosphere during the past twenty years and seasonal decrease in stratospheric ozone over the earth's polar regions during the same period.
 - (ii) Rain Water Harvesting is a method of utilizing rain water for domestic and agricultural use by capturing and storing the rain water, above the ground or charge the underground for its later use. This happens naturally in open rural areas. Rainwater harvesting is not providing useful for poor and scanty rainfall region but also for the rich ones.

Q.8. Discuss the salient features of the

- (i) Wildlife (protection) Act, 1972
 - (ii) Water (Prevention and Control of Pollution) Act, 1974
 - (iii) Environment (Protection) Act, 1986

Ans. See Article 6.11

Q. 9. Write short notes on

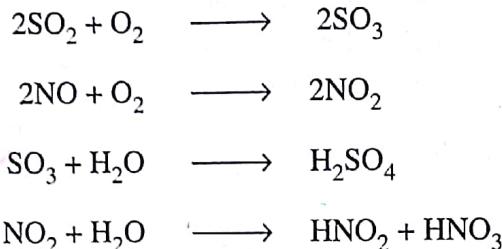
- | | |
|--|---|
| (i) Wasteland reclamation
(iii) Sustainable development | (ii) Population explosion
(iv) Acid rain |
|--|---|

Ans. Short notes

- Short notes**

 - (i) Ecologically unproductive lands suffering from environmental deterioration are known as waste lands. **Wasteland reclamation** is the conversion of wasteland into land suitable for use of habitation or cultivation.
 - (ii) When the population of any community increases at an alarming rate, this situation is known as **population explosion**.

- (iii) **Sustainable development** is defined as ‘meeting the needs of the present without compromising the ability of future generation to meet their own need’. The idea of sustainable development was conceived in early 1970’s, when the need was felt to preserve our natural resources as they were depleting at a very faster rate.
 - (iv) Acid rain is caused by oxides of sulphur and oxides of nitrogen, when these pollutants reach into the atmosphere, react with rain water and form acid. The main reactions are as follows.



Q. 10. Write short notes on the definition and objectives of the following programme.

- (i) Sustainable development
 - (ii) Rainwater harvesting
 - (iii) Watershed management

Ans. Short notes

- (i) **Sustainable development** is defined as ‘meeting the needs of the present without compromising the ability of future generation to meet their own need’. The idea of sustainable development was conceived in early 1970’s, when the need was felt to preserve our natural resources as they were depleting at a very faster rate.
 - (ii) **Rain Water Harvesting** is a method of utilizing rain water for domestic and agricultural use by capturing and storing the rain water, above the ground or charge the underground for its later use. This happens naturally in open rural areas. Rainwater harvesting is not providing useful for poor and scanty rainfall region but also for the rich ones.
 - (iii) The term watershed describes an area of land that drains down slope to the lowest point. **Watershed management** is defined as the rotational utilization of land and water resources for optimum production that causes minimum damage to the natural resources.

MULTIPLE CHOICE QUESTIONS

1. Sustainable development will not aim at
 - (a) Social economic development which optimize the economic and societal benefits available in the present, without spoiling the likely potential for similar benefits in the future.
 - (b) Reasonable and equitable distributed level of economic well being that can be perpetuated continually.
 - (c) Development that meets the need of the present without compromising the ability of future generation to meet their own needs.
 - (d) Maximizing the present day benefits through increased resource consumption.
 2. Which of the following is not a method for water conservation?
 - (a) Rainwater harvesting
 - (b) Ground water extraction
 - (c) Improving irrigation efficiency
 - (d) Avoiding water wastage
 3. In India a major cause of large scale displacement of people is
 - (a) forest fires
 - (b) development projects such as dams
 - (c) earthquake
 - (d) war
 4. Which of the following is not a 'green house gas'?
 - (a) Oxygen
 - (b) Carbon dioxide
 - (c) Chlorofluoro carbons
 - (d) Methane

5. Greenhouse effect is related to
 (a) Green trees on house
 (c) Grasslands
 (b) Global warming
 (d) Greenery in country
6. Global Warming could affect
 (a) climate
 (c) melting of glaciers
 (b) food production
 (d) all of the above
7. Which of the following gases contributes maximum to the 'Greenhouse effect' on earth?
 (a) Carbon dioxide
 (c) Chlorofluoro carbons
 (b) Methane
 (d) Freon
8. Which of the following is not a solution of global warming
 (a) Reducing fossil fuel consumption
 (c) Deforestation
 (b) Planting more trees
 (d) None of the above
9. Ozone layer is present in
 (a) Troposphere
 (c) Stratosphere
 (b) Mesosphere
 (d) Thermosphere
10. Formation of hole in Ozone is maximum over
 (a) India
 (c) Europe
 (b) Antarctica
 (d) Africa
11. Which of the following statements about ozone is true?
 (a) Ozone is a major constituent of photochemical smog.
 (b) Ozone protects us from the harmful UV radiation of sun.
 (c) Ozone is highly reactive.
 (d) All of the above.
12. The primary cause of acid rain around the world is
 (a) Carbon dioxide
 (c) Carbon monoxide
 (b) Sulphur dioxide
 (d) Ozone
13. Ozone layer thickness is measured in
 (a) Millimeter
 (c) Decibels
 (b) Centimeter
 (d) Dobson units
14. Chernobyl Nuclear Disaster occurred in the year
 (a) 1984
 (c) 1986
 (b) 1985
 (d) 1987

Match the Following Terms

Match the terms of Column I with the appropriate terms of Column II

Column II

- | Column I | Column II |
|----------------------------------|---|
| (i) Earth Summit | (a) Ozone hole |
| (ii) Kyoto protocol | (b) 1986 |
| (iii) Antarctica | (c) Rio de Janeiro |
| (iv) Kautilaya | (d) Japan |
| (v) Environment (Protection) Act | (e) World's first forest conservation programme |

Fill in the Blanks

- The management of rainfall and resultant runoff is called
- The thinning of stratospheric ozone layer during the spring time is called
- The global warming contributes to rise in sea level due to of ocean and melting of
- The active chlorine catalytically destroy by converting it into
- The World Environment Day is celebrated on

ANSWERS

Multiple Choice Questions

- | | | | | | | |
|---------------|---------------|----------------|----------------|----------------|----------------|----------------|
| 1. (d) | 2. (b) | 3. (b) | 4. (a) | 5. (b) | 6. (d) | 7. (a) |
| 8. (c) | 9. (c) | 10. (b) | 11. (d) | 12. (b) | 13. (d) | 14. (c) |

Match the Following Terms

- (i) c (ii) d (iii) a (iv) e (v) b

Fill in the Blank

- | | |
|---------------------------------------|-------------------------|
| 1. Watershed Management | 2. Ozone hole |
| 3. Thermal expansion; glaciers | 3. Ozone; Oxygen |
| 5. June 5 | |

