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Chapter

Environmental Science

1.1. WHAT IS ENVIRONMENTAL SCIENCE

The term 'Environment' is very commonly and worldwide accepted and has different meaning in different disciplines. In environment engineering the environment is where we live and can be divided into two types: natural environment and artificial or manmade environment. The natural environment encompasses all living and non-living things occurring naturally in the area. The manmade environment refer to where every activity controlled by human. These activities include physical, chemical and biological condition.

Our ancient people learnt to live with five elements of nature, the "earth", "water", "air", "light" and "cosmos" and actually worshipped them in reality and symbolically. We get lots of information about the relationships between man and nature and the human behaviours and indebtedness towards nature. Perhaps they were more aware and ecofriendly as compared to us. It is believed that even the cutting of branches could make his son invalid. Hindu homes worship peepal tree (*Ficus religiosa*) off widowhood; they worship of god Coconut tree (*Cocus nucifera*) is believed to be a symbol of fecundity and so Hindu women who nurse the desire to get a son worship coconut trees and eat coconut fruits as a "divine gift".

Do you ever think about why and when environment came into existence if you go to 60 years back in history there were neither name of environmental science nor need of environment science. But what happens now a days that environment becomes a prime concern in government policies and public awareness. Answer is very simple that man becomes more and more selfish and he has exploited his natural resources in a manner that in a few next years it will become disappear from the earth as a result number of problems such as global warming or green house effects, El-Nino, deforestation, climate change, acid rain, water pollution, air pollution, soil pollution, thermal pollution, radiation pollution, ozone layer depletion etc. have been recognise. It must be remembered that if you disturb nature in one or another way definitely it will response you later or sooner. Our earth or blue planet is the only planet of the solar system which has the life supporting environment in this universe. In the past 30 years, there was the public and academic interest in environmental problems. This increasing interest has led to the birth of a new discipline called Environmental Science.

The concept of environment is not easy to define as it seems, perhaps it is one of the broad subject of the world and related to all other subjects viz. botany, zoology, chemistry, physics, statistics, mathematics, engineering, biotechnology, sociology, forestry, agriculture etc. The

term Environment is derived from the French word *Environner* which means “**Surrounding**” in which the organisms live and consists of sunlight, temperature, water, air, soil and water which the basic requirements of all flora and fauna. Each and every living organism has its specific surrounding or environment which constantly interacts and remains fully adapted. There was a time when environment used to only describe the physical world surrounding to us including air, water, soil and rocks etc. Gradually it was realized that enormous variety of plants, animals and micro-organisms present on this earth, also including human beings are an integral part of the environment.

The term “environment” according to Alan Gilpin (1976) in his book entitled “Dictionary of Environmental Terms” is the region, surroundings or circumstances in which anything exists; everything external to the organisms. The environment or an organism according to him includes:

(i) The purely physical or abiotic milieu in which it exists, e.g. geographical location, climatic conditions, and terrain.

(ii) The organic or biotic milieu including non-living organic matter and all other organisms, plants and animals in the region including the particular population to which the organism belongs.

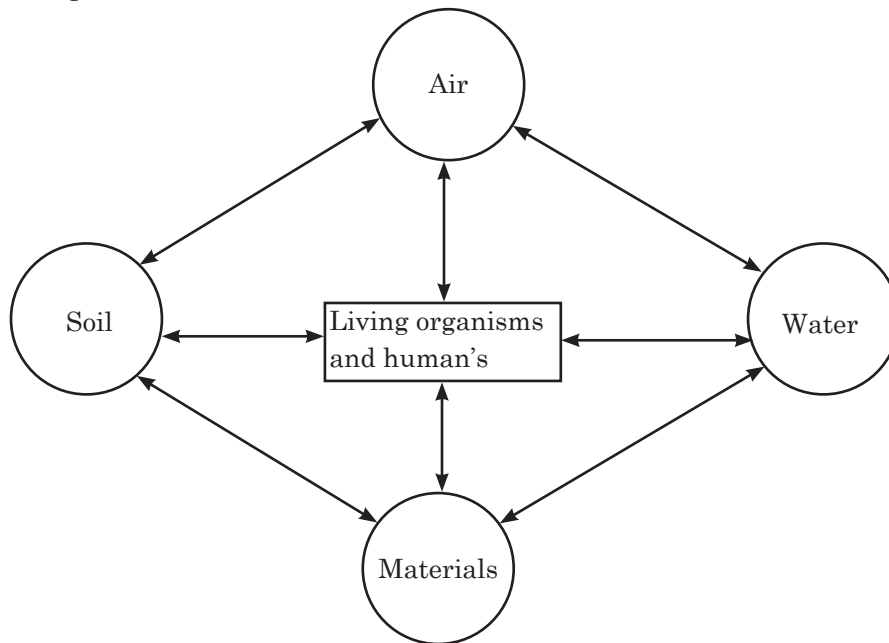


Fig.1.1 showing the concept of environment consists of air, water, land, living organisms and materials surrounding us and their interaction.

1.2. DEFINITIONS OF ENVIRONMENTAL SCIENCE

In simple words the definitions of environment are as follows:

1. According to Environmental (Protection) Act, 1986 of India, “The sum total of water, air and land and the inter-relationship that exist among them and with the human beings, other living organisms and materials”.
2. “Sum total of conditions which surround man at a given point in space and time”.
3. “The sum total of all conditions which influence the development and life of organisms”.

4. “The physical, chemical and biological conditions surrounding an organism known as environment”.

1. **Physical Conditions** includes sunlight, temperature, pressure, soil etc.
2. **Chemical Conditions** includes water, oxygen, nitrogen, sulphur, phosphorus, carbon dioxide, pH, minerals etc.
3. **Biological or biotic conditions** includes
 - (i) Neutralisms
 - (ii) Negative Interaction
 - (iii) Positive Interaction
 - (iv) Both Positive and Negative Interaction

A. Sunlight: Light coming from the sun is an important ecological factor with regards to organisms. This is the radian energy of the sun. The radiant energy of the sun is not uniformly distributed either in space or in time. Solar radiation with a wavelength ranging from 390 milli microns ($m \mu$) and 700 $m \mu$ is infrared. About 50% of the solar energy is infrared radiation.

UV (ultra violet) – 100-390 $m \mu$ (absorbed by ozone layer)

Visible- 390-700 $m \mu$ (comprise about 50% of total solar energy)

Infra red - 700 $m \mu$ (comprise about 50% of total solar energy)

It is known that all the green plants present on the earth indeed utilize about 0.02% of the total visible light reaching the surface of the earth. Much of the visible light reaches to earth surface is return back by reflection.

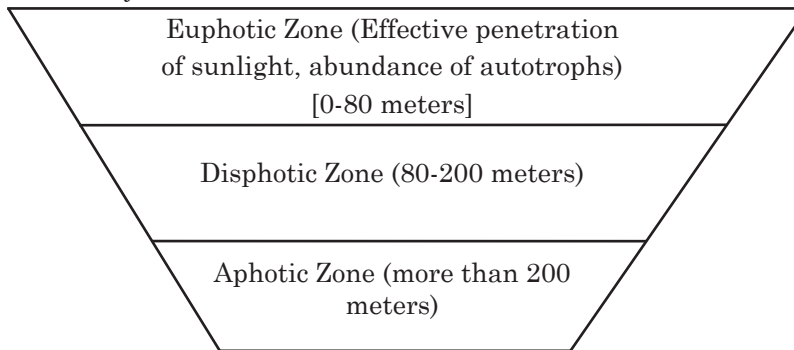


Fig 1.2. Classification of water body according to light penetration

B. Temperature: Temperature is the most essential, significant and obvious parameters as compared to other factors by affecting various activities of plants and animals. It has profound effect on the metabolic activities of plants and their distribution. It is well known fact that at every 10°C higher temperature accelerates the metabolic rates by 100%. It penetrates into every region of the biosphere and profoundly influences all forms of life by exerting its action through increasing or decreasing some of the vital activities of organism, like behaviour, metabolism, reproduction and death. Normal life activities go on smoothly at a specific temperature or at a specific range of temperatures. This is called the **optimum temperature**.

The body temperature of many animals corresponding to the environment. They are called cold-blooded or *poikilothermic* animals e.g.-all animals except birds and mammals. On the other hand, birds and mammals regulate their body temperature and are called warm-blooded or *homeothermic* or *endothermic* animals.

C. Pressure: The pressure also effects in various ways. Pressure becomes reduced with increasingly altitude. With increase of 300 meters in altitude, there is reduction in pressure about 25 mm Hg. However in case of aquatic medium, pressure increase with depth. At every 10 meters in depth in aquatic medium, there is increase in pressure about 760 mm Hg (or 1 atmospheric pressure). Tremendous pressure exists in the deep seas below 2000 meters.

Do your ever think what is the method to determine the height of particular area. If you go to any place and looks for height of particular area you easily find but do you ever think about how the height of particular area is determined. Answer is simple

$P = h \times d \times g$ where p denotes pressure, h=height, d=density and g=gravitation force.

So $h = P/d \times g$

D. Soil: soil factor is also called edaphic factor. Soil as an ecological factor is of great significance. Soil is not only a factor of the environment of organisms but is produced by them as well. According to Sunder Lal Bahuguna (well known environmentalist from India) state that the eternal truth that soil and water are the two basic capitals of humankind and natural forest are the mothers of rivers and the factories for manufacturing soil.

E. Water: About three-fourth of the earth's surface (71%) is covered with hydrosphere, the main component of which is water. Water is one of the main agent in pedogenesis (soil formation) and is the medium for several different ecosystems. Indeed water is the most essential component of life. Plants in relation to water can be classified into three groups and these are *Hydrophytes*, *Mesophytes* and *Xerophytes*. Hydrophytes are aquatic plants, inhabiting water or very wet soil, such as water lilies, pond-weeds, rice, Hydrilla, Vallisneria and cat-tails, etc. *Mesophytes* reside in areas with moderate water and include cultivated crops, garden vegetables, ferns and mosses. *Xerophytes* on the other hand, grow in arid and semi-arid regions. e.g. cactus etc.

F. Atmospheric Gases: Air consist mainly of oxygen (20%), CO₂ (0.03%), nitrogen (70%). The concentration of oxygen in atmosphere about 20.94% [2,09,400 parts per million (ppm)] by volume. Both animals and plants take oxygen from atmosphere and water as dissolved oxygen. Few species of parasites, anerobic metabolism takes place in the absence of oxygen known as *anerobic*. However those species of organisms take place in the presence of oxygen known as *aerobic*. The nitrogen is required by the organisms for the synthesis of proteins, nucleic acids and other nitrogenous compounds. The CO₂ is liberated into the environment by plants and animals during the process of respiration. The same carbon dioxide can once again be utilized by green plants. Thus we see the carbon of CO₂ is an important integrated in the process of photosynthesis.

G. pH or Hydrogen ion concentration : pH is a quantitative expression for relatively acidity or alkalinity of a particular solution depending upon the concentration of Hydrogen ions (H⁺) or hydroxye ions (OH⁻) respectively. The pH scale ranges from 0 to 14. The pH 7 is considered as neutral (water), a pH of less than 7 is acidic and a pH of more than 7 is alkaline.

H. Biological Conditions:

- (i) Neutralisms
- (ii) Negative Interaction
- (iii) Positive Interaction
- (iv) Both Positive and Negative Interaction

(i) **Neutralisms:** When two or more species of organisms comes in contact with each other and both species are not affected by each other in known as neutralisms. For examples, parrot and squirrels living in a forest for good example of neutralism, as neither serves as food for the others nor has any direct interaction while inhabit the same tree.

(ii) **Negative Interaction:** In this condition both of species adversely affected to each other.

(iii) **Positive Interaction:** In this type of interaction both species derived benefits from each other without creating adverse effects.

(iv) **Both Positive and Negative Interaction:** In such type of interaction one species gets beneficial effects but other species not harm.

During 1950's environment becomes popular among the common people due to environmental tragedies like, London Smog, 1952 which killed about 4000 people, Photochemical Smog, Minamata disease in Japan etc. Environmental studies deals with every issue that affects an organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impacts on its integrity. It includes all the physical and biological surrounding and their interactions with each others. Environmental studies provide an approach towards understanding the environment of our planet and the impact of human life upon the environment. Indeed environment is a global in nature. Its components include biology, geology, chemistry, physics, engineering, biotechnology, history, sociology, health, anthropology, economics, statistics, computers and philosophy.

Environmental science is the study of the interactions between the physical, chemical, and biological components of the natural world, including their effects on all types of organisms and how humans impact their surroundings. Environment is everything that affects an organism during its lifetime. In turn, all organisms, including people, affect many components in their environment.

The environmental ethic is a diverse scientific, social, and political movement. An environmentalist is someone who actively works to preserve the environment from destruction or pollution.

Types of Environment:

Environment can be divided into two following categories and these are as follows:

1. **Natural Environment**
2. **Man Made or Artificial of Anthropogenic Environment**

1. **Natural Environment:** As name indicating natural means natural here is no interference of human activities or in other words it is free from interference of any human activities. This operates through self regulating mechanism, called **homeostatic environment mechanism**, i.e., any change in natural ecosystem brought about by natural process is counter balance by changes in other component of the environment. Thus there exists a reciprocal relationship among various components of the environment. These components are air, water, soil, radiation, land, forest, wild life, noise, timber, living space, flora and fauna etc.

e.g. These includes forest, river, desert, grassland, mountain etc.

2. **Man Made or Artificial of Anthropogenic Environment:** There is no doubt that man is at apex in ecosystem as compared to other living organisms on this earth. He has changed everything according to his comfort and this has led to formation of another environment is called anthropogenic or artificial or manmade environment. This type of environment can't run without the interference of human activities. Increased technologies and population explosion are destroying the natural environment and this type of environment is more frequently surrounding to us as compared to natural environment. Infact we are surrounding by artificial environment.

- a. Agriculture land
- b. Housing
- c. Dam buildings
- d. Space laboratories
- e. Aquarium
- f. Green House

a. Agriculture Land: Agriculture land shows the great examples of this categories as in agriculture land farmers tries to control and altered the physicals, chemicals and biological conditions by adding fertilizers, watering, removing unwanted weeds and grasses, uses of pesticides, insecticides.

b. Housing: House is the other example of this environment where human controlled temperature by using AC, water cooler or fans. Electricity for removing darkness and so on.

c. Dams and Building: This is another example of this category where man tries to control the flow and direction of water streams by constructing building to get electricity but these dams also brings some detrimental effects on fishes, phytoplankton's, zooplanktons, diatoms and other aquatic animals etc.

d. Space Laboratories: It also shows the artificial environment as there everything is control by man as per their needs.

e. Aquarium: In aquarium we try to control all over. We regularly change water, provide oxygen by using aerator or any such type of devices, gives food everyday to fishes and also control water temperature artificially.

f. Green House: This is another best example of manmade environment where man control physicals, chemicals and biological conditions of environment as per requirement.

1.3. WHAT IS THE DIFFERENCE BETWEEN ENVIRONMENT AND ECOLOGY

Ecology and environmental science are often viewed as synonymous, which means those environmentalists are frequently considered as ecologists. Indeed ecology is one the disciplines of a much broader area of action covered by environmental science. Environmental science is not ecology though that discipline may be included. Ecologists are interested in the interactions between some kind of organisms and its surroundings. Most ecological research and training does not focus on environmental problems except as those problems impact the organism of interest. Environmental scientists may or may not include organisms on their field of view. They mostly focus on the environmental problem which may be purely physical in nature. For *e.g.* Acid deposition can be studied as a problem of emissions and characteristic of the atmosphere without necessarily examining its impact on organisms.

Ecology is the scientific study of the distribution and abundance of living organisms and how the distribution and abundance are affected by interactions between the organisms and their environment. The environment of an organism includes both physical properties, which can be described as the sum of local abiotic factors such as sunlight, climate, and geology, and biotic factors, which are other organisms that share its habitat.

Environmental science is the study of physical or virtual environment of objects; and in Nature, it is the study of interactions among physical, chemical, and biological components of the environment. It is an interdisciplinary science overlapping the categories in Natural sciences, Engineering sciences and Social sciences. In nature, Environmental science focuses on pollution and degradation of the environment related to human activities and their impact

on biodiversity and sustainability. As an interdisciplinary field, environmental science also applies knowledge from economics, law and social sciences. It can be applied to cyberspace environment also.

1.4. SCOPE OF ENVIRONMENTAL SCIENCE

Now a days there are number of problems due to environment degradation which affects human life directly or indirectly. Therefore environment science plays a significant role in solving these problems. As we know the total population of India is more than 1.21 billion and you will surprise to know that each year we are adding the number of people which is equivalent to total population of India. In simple words we are creating new Australia every year. The major areas in which the role of environmental scientists are of vital importance are natural resources, ecosystems, biodiversity and its conservation, environmental pollution, social issues and environment human population and environment. No doubt there is tremendous scope of environmental science in various fields. According to WHO (World Health Organization) one-quarter of total world population suffering from diseases worldwide due to environmental factors.

The scope of environment can be realized from the fact that The Government of India, in the sixth Five Year Plan (1980-85) had formed the following policy.

“It is imperative that we use our renewable resources of water, soil, air and vegetation to sustain our economic development. Over exploitation of these is visible in soil erosion, floods, deforestation, siltation, floral and wild-life resources. The depletion of these resources tends to be irreversible and since the whole population depends on these natural resources to meet their basic needs i.e., fuel, fodder and land, it has meant deterioration in their standard of life.”

However in Eleventh Five-Year Plan (2007–2012) of India the following objectives have been considered for environment and these are as follows:

1. Increase forest and tree cover by 5 percentage points.
2. Attain WHO (World Health Organization) standards of air quality in all major cities by 2011–12.
3. Treat all urban waste water by 2011–12 to clean river waters.
4. Increase energy efficiency by 20%.

There is tremendous scope of environmental science and some of these scopes are as follows.

1. Conservation of natural resources
2. Conservation of biodiversity
3. Control of environmental pollution
4. Stabilization of human population and environment
5. Research and development
6. Ecosystem Structure and function
7. Environmental management
8. Environmental consultancy
9. Environmentalist
10. Environmental Journalism
11. Industry
12. Teaching

13. Green advocacy
14. Green marketing's
15. Research fellowship

1. Conservation of natural resources: Natural resources include forest, water, minerals, soil, wildlife, fuel, etc. The major factor responsible for degradation of natural resource is ever increasing of population. It is estimated by the year of 2025 the total population of India will reach about 1,692 and number one in world. As we know that all the natural resource present on this earth is limited. Therefore conservation and maintenance of natural resource is very important as they play a significant role for maintaining the balance of environment. In this regard environment plays very good role for achieving the sustainability of these natural resources. Actually our natural resources similar to money in a bank. If we use it rapidly, the capital will be reduced to zero. On the other hand, if we use only the interest, it can sustain us over the longer term.

Former Egyptian Foreign Minister and former Secretary-General of the United Nations Boutros Ghali, who forecast, "The next war in the Middle East will be fought over water, not politics"; his successor at the UN, Kofi Annan, who in 2001 said, "Fierce competition for fresh water may well become a source of conflict and wars in the future," and the former Vice President of the World Bank, Ismail Serageldin, who said the wars of the next century will be over water unless significant changes in governance occurred. Daily water use per person is about 600 liters in residential areas of North America and 250-350 liters in Europe whereas per capita water use per day in sub Sahara region is a mere in 10 liters. In India it is about 50 liters per day. One flush of a western toilet uses as much water as the average person in the developing world uses for a whole days washing, drinking, cleaning and cooking. According to one estimates that woman in Africa and Asia walk an average distance of 6 km a day to collect water.

According to estimation of the **Central Ground Water Board of India** that the reservoir of underground water will dry up entirely by 2025 in many as fifteen states in India' if the present level of exploitation and misuse of underground water continues. By 2050, when more than 50 percent of the Indian population is expected to shift to the cities, fresh drinking water is expected to get very scare. Future wars between of within nations will be fight on the issue of water. **Centre for Science and Environment (CSE)** said that in parts of the capital city, the groundwater level is dropping by 10 meters (33 feet) each year. In 1995, World Bank vice president Ismail Serageldin predicted an acute water shortage for the new millennium: "If the wars of this century were fought over oil, the wars of the next century will be fought over water."

You will be surprised to know that Jaisalmer in the west of Rajasthan of India the last town before the border with Pakistan is in one of the driest areas in the world. Yet 100 years ago it was India's major trading centre. It had twice the population it has today, and 15 times more camels. It survived on a traditional water-harvesting system. But now society has become indifferent as it thinks that water is the responsibility of the government that collects taxes.

2. Conservation of Biodiversity: Biodiversity is the short form of biological diversity and it is the combination of two words "Bio" and "Diversity". Bio means living organism and Diversity means variety or variability. So the variety and variability among living organisms is known as biodiversity. Biological diversity or biodiversity plays a very significant role for sustaining the ecological balance of the environment thus it becomes very important to conserve the biodiversity. By using environment science we can conserve biodiversity.

3. Control of Environmental Pollution: Numbers of environmental pollution have been recognized and many other are yet to be identified. Man has altering nature according to his comfort without any thinking. We all know about polythene bags when it came to existence than anyone did not think that it will become one of the terrible problems for our nature and society as it takes 200 years to degrade. By the help of environmental science it is very simple to identify and prevent the pollution which being emitted into surrounding. Environmental science plays a vital role for preventing, minimizing and control of environmental pollutants.

4. Stabilization of human population and environment: It is most important and most challenging task of the current world. Every year **World Population Day** is celebrated on July 11 every year to raise awareness of global population issues among common peoples. The event was established by the Governing Council of the UNDP (United Nations Development Programme) in 1989. The world population on July 9, 2012, was estimated to have been 7,025,071,966. Current projections show a continued increase in population (but a steady decline in the population growth rate), with the global population expected to reach between 7.5 and 10.5 billion by 2050.

Table 1: Showing the population of different nations

COUNTRY POPULATION (MILLIONS) Year 2011	COUNTRY POPULATION (MILLIONS) Year 2025
China 1,346	India 1,692
India 1,241	China 1,313
United States 312	Nigeria 433
Indonesia 238	United States 423
Brazil 197	Pakistan 314
Pakistan 177	Indonesia 309
Nigeria 162	Bangladesh 226
Bangladesh 151	Brazil 223
Russia 143	Ethiopia 174
Japan 128	Philippines 150

India has the second largest population in the world, with 1.24 billion people comprising 623.7 million males and 586.5 million females, according to the provisional 2011 Census report. In the last ten years, 181 million people were added and, since 1947, the population of India has more than tripled. Interestingly, the addition of 181 million people to the population during 2001-11 is slightly lower than the total population of Brazil, the fifth most populous country in the world. Significantly, the growth is slower compared to the previous decade. India accounts for 17.5 percent of the world population. It is clear by the year of 2025 we will become world leader. In spite of this we don't have any rule and regulation to control ever increasing population.

Table 2: Comparison of Indian states population with other countries

Population of Indian States Compared to a Few Countries in the World (in millions)			
Indian State	Population	Country	Population
Uttar Pradesh	200	Brazil	194
Maharashtra	112	Japan	128
Bihar	104	Mexico	107
West Bengal	91	Philippines	92
Andhra Pradesh	85	Germany	82
Madhya Pradesh	73	Turkey	75
Tamil Nadu	72	Iran	73
Rajasthan	69	Thailand	68
Karnataka	61	United Kingdom	62
Gujarat	60	Italy	60

Source: Census, Government of India/World Bank

During 2001-11, as many as 25 States/UTs of with a share of about 85 percent of the country's population registered an annual growth rate of less than 2 percent, while 15 States/UTs have grown by less than 1.5 percent per annum. The number of such States/UTs was only 4 during the previous decade, the report said. India has more than 50 percent of its population below the age of 25 and more than 65 percent below the age of 35.

More population means more pressure on our existing natural resources and already these are under tremendous pressure and any further increase in population definitely there will be disastrous effects on earth.

5. Research and Development: No doubt there is increase public awareness regarding environmental concern. There is increasing demand for skilled environmental scientists. They can play important role in examining and controlling various environmental problems by applying appropriate research methods or by developing new technologies without crating any adverse impacts. Various institutes, universities, consultancy and NGO offering opportunity for the environment researchers and some of these are as follows:

(1) Biodiversity Conservation: It is supposed that we know only about five percent of microorganisms. India is home to most diversify of organisms and is amongst the biodiversity hot spots of the world.

(2) Rehabilitation of Wastelands (3) Eco-farming (4) Sustainable Energy (5) Water Management and Conservation (6) Bioremediation (7) Pollution Abatement (8) Waste Management

6. Ecosystem Structure and Function: Ecosystem mainly includes the study of biotic and abiotic components and also interaction among biotic and biotic components.

7. Environmental Management: We cannot stop the Industrialization as it is the essential for any country growth and development. With the establishment of industries there is also settlement of urbanization. With help of environmental management we can find alternatives for environment to gain development without creating adverse impacts on given areas.

8. Environmental Consultancy: There are several hundred consultancies in India which providing jobs opportunity to environment science students. Many government bodies, industries and NGOs (Non-Governmental Organizations) are engaging environmental consultants for systematically studying and tackling environmental problems.

9. Environmentalists: Environmentalist identifies the causes and effects of given environmental problems of locally and globally concerns. To combat this problems environmentalist plays a key role and also provides platform for environmental awareness among common people.

10. Environmental Journalist: Environment becomes now a days at top priorities at our society. Of course there are great opportunities in various TV channels, Radio, Leading newspapers and magazines for reporting and to creating awareness. Indeed environmental journalism is an emerging field which helps in bringing environmental problems to public notice.

11. Industries: It is directives from Honourable Supreme Court of India to that in each industry there should be at least on environmental officer in each industry to monitor, check and analyse the environmental pollutants which are being emitted into atmosphere or water bodies. Graduates and postgraduates students from environmental science are eligible for jobs in these industries. Most industry have a separate environmental research and developmental section which governs the impact that their industry on the environment.

12. Teaching: According to Honourable Supreme Court of India it is compulsory to teach environmental science at graduation level otherwise bachelor degree will not be awarded to students. Thus we see there are vast opportunities in degrees and engineering colleges and almost all the universities as well.

13. Green Advocacy: India must be credited for having made significant provisions in its constituents and for having enacted over 200 laws for the protection and improvement of environment. **Article 48A** of the Indian constitution states that the State shall endeavour to protect and improve the environment and to safeguard forest and wildlife of the country. According the **Article 51-A**, clause (g) it is the fundamental duty of every citizen to protect and improve the natural environmental including forests, lakes, rivers, wildlife, lakes, rivers, wildlife and to compassion for all living creature is one of the 10 fundamental duties of every citizen of the country. We have number of environmental acts for the conservation of environment such as Air (Prevention and Control of Pollution) Act 1981, Forest (Conservation) Act 1980, Water (Prevention and Control of Pollution) Act 1974, Environmental (Protection) Act 1986, Biodiversity Act 2002, Wildlife Protection Act 1972, etc. With the increase emphasis on implementing various Acts and Laws related to environment there are need for environmental lawyers, who should be able to plead the case related to above laws.

14. Green Marketing's: Today's there is an increasing emphasis on marketing goods that are environmental friendly. Such products have ecomark or ISO 14000 certification. No doubt that there will be great opportunity and demands for environmental managers and environmental auditors in coming years.

15. Research Fellowship: A tremendous scope and future exists in the field of environment sciences. Researchers may avail fellowships from UGC, ICMR, CSIR, DST, MoEF, DBT, Nehru Memorial Fund, K.S. Krishnan Research Associate-ship etc. Researcher can also go for overseas fellowships like DAAD (German), Belgian Government Fellowships and other fellowships under bilateral programs, for pursuing doctorate and postdoctoral studies.

1.5. SEGMENTS OF ENVIRONMENT

The environment has four segments of the environment and these are as follows

1. Lithosphere means soil
2. Hydrosphere means moisture or water
3. Atmosphere means air
4. Biosphere means study of living things

While the meaning of sphere is region or area.

1. Lithosphere: From the stand point of environment of life on earth, it is the crust that is of prime significance. Lithosphere not only supplies most mineral nutrients to all animals but it also forms the sand base of soil specially required by terrestrial plants and by numerous substrate animals. The earth is a cooled, spherical, solid planet of solar system, which rotates on its axis and revolves around the sun at a certain constant distance. The solid component of earth is called lithosphere. It includes the study of soil or rocks which contain soil. Earth crust is called lithosphere. Lithosphere consists of different layers, viz. crust, mantle, outer core and inner core. The core is the central fluid or vaporised sphere having diameter of about 2500 kms from the centre and is possible composed to Nickel-Iron. The mantle extends about 2900 kms above the core. This is in molten state. The outer most solid zone of the earth is called crust which is about 8 to 60 kms above the mantle.

For all practical purpose, the soil covering the rocks (which result from physical, chemical and biological process during weathering) is also considering to be an important part of the lithosphere. The word soil is derived from a Latin word 'solum' meaning earthy materials in which plant grow. The soil mainly consists of complex mixture of inorganic and organic matter. The inorganic and inorganic mineral constituents include complex mixture of silicates of Na, K, Ca, Al and Fe; Oxides of Fe, Mn and Ti and Carbonates of Ca and Mg. The organic matter, which constitutes not more than about 5% of the soil, mainly determines the productivity of the soil. Organic matter of biologically active components such as polysaccharides, nucleotides, organo-phosphorus and organo-sulphur, sugar and humic materials.

2. Hydrosphere: The HYDROSPHERE (from the Greek hydro-water, moisture) is the aqueous shell which includes all the natural waters-the waters of 'ocean', 'seas', 'lakes' and 'rivers', which cover more than 70 percent of the Earth's surface and also the 'underground waters', suffusing the rock of the Earth. In the Northern Hemisphere continents take up 39.3 percent and oceans and seas 60.7 percent, whereas in Southern Hemisphere to the share of the continents fall merely 19.1 and that of the oceans-80.9 percent of the area. This is the reason why the Northern Hemisphere is called *Continental Hemisphere* and the Southern Hemisphere is called as *Oceanic Hemisphere*.

About $\frac{3}{4}$ of the earth surface (71%) is covered with hydrosphere. The main component of hydrosphere is water. The term hydrosphere refers to ocean, water vapour, the lakes, the rivers, water in soil, ground water, surface water, ice caps and glaciers. The hydrosphere plays an important role in the circulation of nutrients within various component of environment. As much as 99.3% of the earth's all water lies in ocean and ice caps. But the remaining less than 1% water present in atmosphere, lakes, stream, soil, reservoir, rivers etc.

No life can exist without water. Many of us, who accustomed to receiving fresh water by simply opening a tap, perhaps do not realize how precious this natural resources is. Over the past three million years, the earth's surface has experienced repeated large periods of glaciation, separated by short warm interglacial periods. During the peak glaciation approximately 47 million sq. km area was covered by glaciers, three times more that present ice cover over the earth.

How much is where!

And you thought, after the oceans. It's the rivers that contain the most water. Looks like you were wrong, as rivers contain only about 0.0001 percent of overall water content in our earth, as this chart tell us.

- Oceans-97.21 percent
- Icecaps, Glaciers-2.14 percent
- Ground water-0.61 percent
- Fresh water-0.61 percent
- Inland seas-0.008 percent
- Soil moisture-0.005 percent
- Atmosphere-0.001

Over 70% of the human body is made up of water. A human being may survive without food for several days but water deprivation can kill a person within a matter of hours. Life is, therefore, tied to water, as it is tied to air and food. And food is indeed tied to water.

3. Atmosphere: The total weight of the atmosphere is about 4.5 to 5×10^{15} metric tonnes. The atmosphere has broadly three categories like major, minor and traces compounds.

Major components- N_2 (78.09%), O_2 (20.94%) and water vapour (0.1 to 5%).

Minor components- Argon (0.93%), CO_2 (0.32%).

Trace components- Neon, Helium, Methane, Krypton, Nitrous Oxides, Xenon, SO_2 , NO_2 , NH_3 , CO , O_3 and I_2 .

Atmosphere has four segments troposphere, stratosphere, mesosphere and thermosphere.

ionosphere	Exosphere (More than 500 km)
	Thermosphere (85-500 km) Negative (-) Lapse Rate Mesopause
	Mesosphere (50-85 km) Positive (+) Lapse Rate Stratopause
	Stratosphere (11-50 km) Negative (-) Lapse Rate
	Troposphere (0-11km) Positive (+) Lapse Rate

O_3 Layer [where concentration of ozone is 10 ppm (parts per million)]

1. **Troposphere:** It extends up to 11 km above from the earth surface. The troposphere accounts over 70% of atmosphere mass. Troposphere contains most of the water, cloud and particulate matter of the atmosphere.

2. **Stratosphere:** It is above the troposphere. It shows negative lapse rate. O_3 layer present in this region and it is very important regions as if any pollution reaches there it may be global hazard like ozone hole. It is less disturb as compared to troposphere, actually silent in nature support the molecules and particulates in the region for long residence region.

3. **Mesosphere:** This is the region above the stratosphere and extends between 50 to 85 km height from the earth surface. The temperature of this region ranges from $-2^\circ C$ to $-92^\circ C$.

4. **Thermosphere:** This region immediately above the mesopause, where the temperature raised with the increasing altitude exhibiting negative lapse rate. Temperature in this region in the ranges -92°C to 1200°C .

(4) Biosphere

Biosphere word consist of two word bio and sphere, bio means living organisms and sphere means region. The term 'biosphere' was first used by the Australian geologist **Eduard Suess** in 1857. All the living things on this earth together with the part of non living environment in which and with which they interact is known as biosphere. Infact biosphere is the region where up to life exists in any form viz. bacteria, virus, insects, birds, ants, all the plants, butterfly, elephant, tiger etc. It includes the region of lithosphere, hydrosphere and atmosphere.

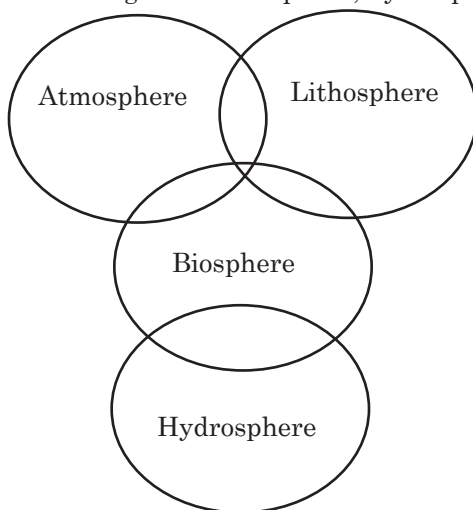


Fig. 1.3

Fig. 1.3 Showing association of the biosphere with other environment segments viz. atmosphere, lithosphere and hydrosphere.

It is known that the region of biosphere in air extends up to 6 km elevation in atmosphere from earth surface and however in hydrosphere it is 10 km. Living organisms require inorganic metabolites from each of these subdivisions of the biosphere. The hydrosphere supplies water, the lithosphere supplies all necessary minerals and the atmosphere supplies oxygen, nitrogen and carbon dioxide.

1.6. MULTIDISCIPLINARY OF NATURE OF ENVIRONMENTAL SCIENCE

As name indicates multidisciplinary nature means multiple in disciplines actually we are surrounding by environment and there is no doubt that environmental science is one of the biggest subject of the world. Indeed it associates with all other subjects such as physics, chemistry, toxicology, botany, forestry, zoology, sociology, statistics, microbiology, natural science, toxicology, biology, political science, history, ethics, ecology, atmospheric science, oceanography, economics, engineering, computer science, biotechnology, geology, biochemistry, civil engineering, biotechnology, hydraulics, chemical engineering, nanotechnology etc. The environment includes land or soil, flowing water, ground water, standing water, glaciers, springs, salty water of sea, atmosphere and natural resource such as sun, wind, fossil fuels (coal, oil and natural gas), and biodiversity.

Physics: Physics is also link with environmental science in various ways for example the first law of thermodynamics states that energy neither be created nor destroy but it can change from one form to another form. However the second law of thermodynamics states that during energy transformations large part of energy is degraded into heat or dissipates itself. The implication of these two laws can be seeing easily when we study energy flow in ecosystem as there is a reduction of energy at each trophic level of ecosystem. Moreover in physics we study the various physical factors of the environment such as sunlight, temperature, wind velocity, atmospheric pressure etc. so with the help of physics we can carry research and implement various techniques in direction to help our environment.

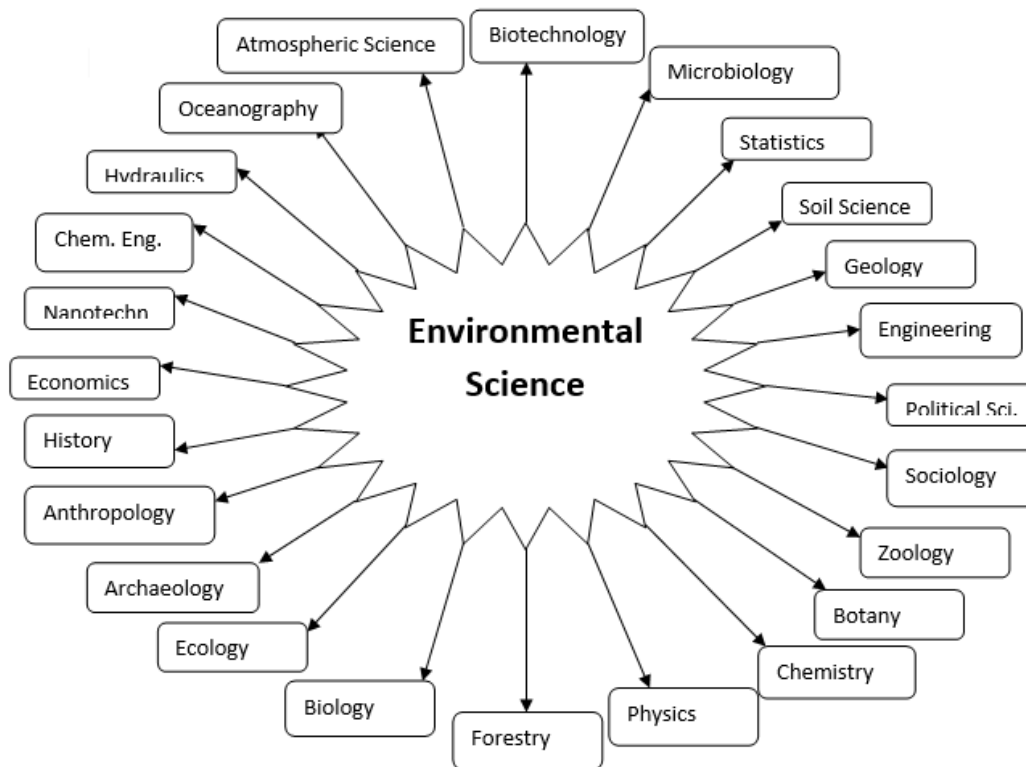


Fig. 1.4 Showing the multidisciplinary nature of environmental science.

Chemistry: In chemistry we study the composition, nature of various pollutants which may cause adverse impacts on surroundings leading to health hazardous to organisms and actually chemistry provides better scopes to implements various methods to combat these problems. By medium of chemistry science we study the various global problems such as acid rain, ozone layer depletion, global warming, climate changes, excessive uses of pesticides and industrial effluents from industries etc. There is close connection between environment and chemistry.

Toxicology: The word toxicology is derived from two Greek words: toxikon, meaning arrow (poison) and logos, meaning study or discourse. Toxicology is the quantitative and quantitative study of the adverse or toxic effects of chemical and other anthropogenic materials or xenobiotics on organisms. Toxicology scientists applies expert knowledge to the study of adverse effect so chemicals.

Botany: Botany refers to the study of plants and vegetations belonging to different families. As we know these plants play a very significant role for maintaining the ecological balance on this planet.

Zoology: In zoology we study the evolution of species belongs to the different parts of the world, their abundance and current status of the animals. All these organisms grow in natural environment. So we say there is very close connection between environment and zoology.

Sociology or Social Science: In sociology we study the social problems that prevalence to human being and some these problems also results from the unsystematic and excessive exploitation of natural resources. So we can say by the use of help of social science one can find the alternatives to tackle this problems.

Geography: Geography includes the living and non-living natural resources, their types and their utilization by human being. Geography can play better role for policy maker. Policy maker apply geography to obtain the distribution of natural resources, composition of natural resources and conservation methods for natural resources. It also helps to understanding the adverse impacts of urbanization and industrialization on natural environment.

Political Science: Now a day's environment is prime concern on various nations' political agenda. After Stockholm Summit, 1972 there are consideration increases in public concern about the environmental conservation. The Convention on Wetlands, Ramsar, 1971, sites of natural or cultural value (the World Heritage Convention, 1972), or the protection of species migrating between sites (the Convention on Migratory Species, 1983). A significant milestone was reached in 1992 with the Convention on Biological Diversity, the first global, comprehensive treaty to place environmental, social and economic objectives on an equal footing.

Kyoto protocol (The Kyoto Protocol was initially adopted on 11 December 1997 in Kyoto, Japan, and entered into force on 16 February 2005. As of September 2011, 191 states have signed and ratified the protocol), Montreal Protocol (The Montreal Protocol on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion. The treaty was opened for signature on September 16, 1987, and entered into force on January 1, 1989, followed by a first meeting in Helsinki, May 1989. Since then, it has undergone seven revisions, in 1990 (London), 1991 (Nairobi), 1992 (Copenhagen), 1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), and 1999 (Beijing). It is believed that if the international agreement is adhered to, the ozone layer is expected to recover by 2050. The two ozone treaties have been ratified by 197 states and the European Union making them the most widely ratified treaties in United Nations history. These are the examples of international political concerns about the environment protection.

Soil Science or Pedology: The main application of pedology or soil science is to understand the sources, effects and control soil pollution which is being result from various activities.

Statistics: Statistics is very essential because there is vast application of statistics in environmental science. To understand the environment of living organisms and its management statistics plays important role. Perhaps there will not be any single area where there is use of statistics in not implemented.

Microbiology: In microbiology we study the micro organisms which play a vital role for maintaining ecological balance on this earth. Microbiology also includes the study of

pathogens which are responsible for various diseases. The study of decomposers also comes under microbiology and these decomposers are essential constituents of every ecosystem.

Thus we see that environmental science is multidisciplinary in nature which has been created to promote the study to natural surroundings, prevent degradation of these surroundings and to improve the existing natural environmental conservation.

1.7. IMPORTANCE OF ENVIRONMENTAL SCIENCE

As you know we are living in 21st century we have been successfully reached to moon and mars and also try to reach other planets in spite of we are surrounding number of problems which poses threat to our existence on this planet. We have been polluting our blue planet's (The Earth), depleting its resources very fast and generating a lot of waste for which we need to find places to store but it should be remember we don't have any method or device which can develop or built land. Now the question arises as we know all the facts about the environment concern while why we have been doing these things? The answer is simple as human being becomes more selfish and ever increasing population of human being which is now more than 7 billion (7,025,071,966) on July 9, 2012 and all of these people need food, water, clothing, shelter and other things as us. Hence, having more than 7 billion people on Earth, as compared to 5.2 billion people during 1990, and having many people with a high standard of living, means that we humans will pollute a lot, deplete a lot, and build up huge amounts of waste that need to be stored. There are many environmental issues which are directly or indirectly related to not only to India but also to rest of the world such as air pollution, water pollution, solid waste pollution, thermal pollution, radiation pollution, noise pollution etc.

In 1896 the Swedish scientist Svante Arrhenius had predicted that human activities would interfere with the way the sun interacts with the earth, resulting in global warming and climate change. His prediction has become true and climate change is now disrupting global environmental stability. The last few decades have seen many treaties, conventions, and protocols for the cause of global environmental protection. There are number of problems which are being faced by human being and some of these are as follows.

- | | |
|--|---------------------------------|
| (1) Population stabilization | (2) Ozone layer depletion |
| (3) Global warming or green house effect | (4) Loss of biodiversity |
| (5) Climate change | (6) Acid rain |
| (7) Deforestation | (8) Water pollution |
| (9) Air pollution | (10) Noise pollution |
| (11) Thermal pollution | (12) Desertification |
| (13) Wild life protection | (14) Water conservation |
| (15) Radiation pollution | (16) Change in land use pattern |
| (17) Soil pollution | (18) El-Nino |
| (19) Marine pollution | |

1. **Population Stabilization:** In current time this is one of biggest challenge of the world and every environmental problem is directly and indirectly related this problem. If we control, manage and stabilize human population than every other problems related to environment may be solve automatically.

2. **Ozone Layer Depletion:** Ozone hole is often confused by some people with global warming (Green house effect) though ozone does contribute to the green house effect. Ozone hole first detected by F. Sherwood Rolland and other co-workers Mariyo Molina and Paul Cruston. They discovered ozone hole in 1995 and awarded with Nobel Prize in chemistry (section) for

this achievement. Ozone layer was first discovered by two French scientists Charles Forby and Henry Buson in 1913.

Ozone is present in all altitudes mainly in the stratosphere of the atmosphere from 16 to 40 km elevation from the earth surface, protects humans, flora and fauna from the harmful effects of UV-B radiation of the sun. Without it the life will become impossible on this earth. The use of chlorofluorocarbons (CFCs) and other ozone-depleting substances (ODS) are responsible for destroys the stratospheric ozone layer, creating a major potential health hazard.

Ozone hole was first noticed in 1979 over Antarctica where ozone hole dropped by 30%. CFC (Chlorofluorocarbon) was prime suspect for causing O₃ (ozone) molecules in the stratosphere. It was established that one molecule of CFC is capable of destroying one lakh molecules of ozone. Depletion of ozone layer may cause of several adverse impacts are as follows

- Loss of immunity
- More eye cataracts
- Crop damage threatening human food supply
- Increase of melanoma and non-melanoma skin cancers
- Loss of immunity
- Adverse effect of plastic
- Harm to phytoplankton on ocean surface affecting the entire food chain
- Skin cancer

3. Global Warming: The term greenhouse effect was first coined by J. Fourier in 1827, use 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 small amount of CO₂ and water vapour and trace amount of ozone, nitrous oxide, methane and chlorofluorocarbon play a very significantly role for determining the average thus it climates commonly these gases known as greenhouse gases.

The term global warming or greenhouse effect used to indicate a heat trapping process caused by greenhouse gases these gases are transparent to incoming solar radiations but don't not allow the infrared radiation's emitted from the earth's surface to escape the atmosphere causing the heat to get trapped. The result of this phenomenon is a long-term rise in the average temperature of the Earth as a whole known as global warming.

4. Loss of biodiversity: Biodiversity refers to the variety and variability of living organism present on this earth. The number of species of plants, animals, microorganisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs are all a part of a biologically diverse earth. Biologically rich and unique habitats are being destroyed, fragmented and degraded due to problems caused by increasing human population, resource consumption and pollution. Biology loss is now one of the world's most pressing crises. Biodiversity has three levels, (i) genetic, (ii) species, and (iii) community and ecosystems. It is now believed that human activity is changing biodiversity and causing massive extinctions.

5. Climate Change: Climate refers to characteristics weather conditions at a place or a region on earth. Weather is defined as the condition of the atmosphere at a particular place and time. It is characterized by parameters such as temperature, humidity, rain and wind. It should be member that the climate is vary place to place. Infact climate represents the state of atmosphere over a longer period (normally 35 years) of time. In simple terms shifting or altering in normal seasonal patterns (temperature, rainfall etc.) of the area is known as

climate change. Climate change is a symptom of a sick earth. Our planet is suffering because of the way human activities are destroying and changing the surface of the Earth. One of the biggest reasons for climate change is global warming. Climate change is now widely recognized. According to one estimate the global mean warming of $0.45 \pm 0.15^\circ\text{C}$ has been recorded over the last about years and for India the mean temperature has gone up by nearly 0.2 to 0.3°C during last 40 year.

6. Acid Rain: The term acid rain was first used by Robert Angus in 1872. Rain is that is more acidic than normal rain because it contains sulphuric acid and nitric acid derived from oxides of sulphur (SO_x) and oxides of nitrogen (NO_x) in the atmosphere. Sulphuric acid (H_2SO_4) is the major contributor (60-70%) to acid precipitation. HNO_3 rank second (30-40%) and HCl rank third.

7. Deforestation: Deforestation means forest destruction. There are number of cause of deforestation such as population, overgrazing, agriculture, indiscriminate felling of trees and over exploitation of land resources. The devastating in India includes water, soil and wind erosion, estimated to cost near about 170 billion rupees every year. According to one estimate India losing about 6,000 million ton of top soil annually due to water erosion in the absence of trees.

8. Water Pollution: Water is prime necessity of life, unique substance and allowing pollutants to settle out (through the process of sedimentation) or break down, or by diluting the pollutants to a point where they are not in harmful concentrations. When the water is no longer pure and contains bacteria or chemical impurities known as water pollution. All these impurities decrease and lower the quality of the water and can have serious effects on the marine life. Water pollution happens in oceans, rivers, lakes, and even in fresh water and water reservoirs. There are number of sources responsible for water pollution and these are as follows municipal waste water, littering in the water, sewage, excessive use of fertilizers washed away in waters, thus affecting the marine life, oil spills from tankers and ships in waters, chemicals reaching or washing away in waters or water supplies. As a result decrease in drinking water, decrease in quality of water and serious harm to marine life.

9. Air Pollution: Entry of pollutants into atmosphere is air pollution. The World Health Organization (WHO) defines air pollution as "Substances put into air by the activity of mankind into concentration sufficient harmful impact on his health, vegetation, property or interference in the enjoyment of his health". The main source of air pollution in India is automobile and industrialization. Adult man consumes near about 22 kg oxygen in a day and thinks about how much oxygen consume in one year and entire life. Examples of air pollutants are oxides of nitrogen, oxides of sulphur, photochemical smog, PAN (Peroxyacetylnitrate), ozone, SPM (Suspended particulate matter) and RSPM (Respirable suspended particulate matter) etc.

10. Noise Pollution: Unwanted sound dumped into atmosphere leading to health hazard. The noise is physical form of pollutant. Noise level of 80 dB (decibels) or more for more than 8 hours a day increases tension and changes in breathing patterns. However 120 dB can cause many adverse biochemical changes.

11. Thermal Pollution: Thermal means heat as name indicates. The term thermal pollution has been used to indicate the detrimental effects of heated effluents discharge by various power plants. It denotes the impairment of quality and deterioration of aquatic and terrestrial environment. Various industrial plants like thermal, atomic, unclear, coal fired, oil field generator, factories and mill utilize water for cooling purposes. The heated effluents are

discharge at a temperature 8 to 10°C, which may often kill both aquatic plants and animals. Apart human no other animal in this world have facilities as human. Actually if we look for month or date we go to calendar but think about organism they don't any calendar or any other facilities as we have. Everything is based on temperature in natural environment or ecosystem. Fish and other aquatic organisms started to lay eggs in early days due to temperature variation result offspring is starting to die due to lack of foods.

12. Desertification: In simple words desertification means spreading of desert. In other words desertification process is leading to desert formation. The main reasons of desertification are deforestation, overgrazing, excessive use of fertilizers, improper management of agriculture land.

13. Wild life protection: Wild life protection is also an important issue in India. But there is good information about forest and wildlife in India. During the last 20 years, India has reversed the deforestation trend. Specialists of the United Nations report India's forest as well as woodland cover has increased. A 2010 study by the FAO (Food and Agriculture Organization) ranks India amongst the 10 countries with the largest forest area coverage in the world (the other nine being Russian Federation, Brazil, Canada, United States of America, China, Democratic Republic of the Congo, Australia, Indonesia and Sudan). India is also one the top 10 countries with the largest primary forest coverage in the world, according to this study. From 1990 to 2000, FAO finds India was the fifth largest gainer in forest coverage in the world; while from 2000 to 2010, FAO considers India as the third largest gainer in forest coverage.

14. Water Conservation: As we know there are ever growing population and our current resources are under tremendous pressure. According to the UNDP's Human Development Report 2006 rightly focuses on one of the most serious problems facing humanity today — the global water crisis. Near about 120 crores of people (20% of the global population) spreads across 40 countries do not have access to safe water. There is no more fresh water on earth today than there was 2000 year ago when population was 3% of its current size. In the past 100 years, the world population was tripled but water use by humans has multiplied six fold.

Daily water use per person is about 600 liters in residential areas of North America and Japan and 250-350 liters in Europe whereas per capita water use per day in sub Sahara region is a mere in 10 liters. India is about 50 liters per day. One flush of a western toilet uses as much water as the average person in the developing world uses for a whole days washing, drinking, cleaning and cooking. India which has 16 percent of the world's population, 2.45 percent of the worlds land area and 4 percent of the worlds water resources already has a grave drinking water crisis. A study by the World Bank indicates that per capita availability of water, which was in the order of 5000 cubic meter per year at the time of independence, has drastically come down to 2000 cubic meter per year at present. Estimation of the Central Ground Water Board that the reservoir of underground water will dry up entirely by 2025 in many as fifteen states in India in the present level of exploitation and misuse of underground water continues. By 2050, when more than 50 percent of the Indian population is expected to shift to the cities, fresh drinking water is expected to get very scare. A new categories refugee is expected to emerge around that time: the water migrants. Future wars between of within nations will be fought on the issue of water.

Woman in Africa and Asia walk an average distance of 6 km a day to collect water.

More than 20% of the world's known-10,000- fresh water fish species have become extinct, been threatened or endangered in recent year decades. India boasts the world's second largest

population with more than 1.34 billion people. Its population is more than 3.5 times the size of that of the United States. However, India is only one-third of the physical size of the US.

15. Radiation Pollution: It is different from other pollutions, not only affect critically the individuals but also brings physiological changes in the subsequent generation.

16. Change in Land Use Pattern: Land use refers to the uses of land for different purposes such as includes wildlife habitat, forest agriculture, settlement of industry and planning of urbanization etc. It plays a vital role for many planning and management activities concerned with the surface of the earth. As the population is increasing very fast and there will be requirement of housing, industry, markets, recreation parks or gardens etc.

This problem is directly related to the growing population. Change in landuse patter in India is common practice as agriculture land is being used and converting into urbanization and industrialization as a result.

17. Soil Pollution: Like other pollution, soil is also equally important for living organisms. It supports plants on which all other living organisms depend. Therefore, the study of soil pollution is very important. Any substance that reduces and contaminated the soil productivity is called soil pollutant. There are number of sources of soil pollution and some of these are as follows oil spills, sewage and waste dumping, the mishandling of solid waste, deforestations, pesticides, algaecides, insecticides, fungicides and use of other chemicals.

18. El-Nino: El-Nino is a metrological phenomena marked by higher water temperature and lower atmospheric pressure. It is usually originates in central and eastern pacific oceans and disrupts global climate pattern. This is not a regular event as it takes place once every five year on the average but when it occurs, the anchovy fish die due to the shortage of food, followed by birds the normally fed off the anchovy. This has disastrous effect on Peruvian economy, these birds deposits dung around their nesting sites which is harvested by Peruvian and sold as a very rich fertilizer.

19. Marine Pollution: Marine pollution is defined as “the discharge of wastes substance into the sea resulting in harm to living resources, hazards to human health, hindrance of fishery and impairment of quality for used of sea water”. Marine pollution can change physical, chemical and biological condition of the sea water.

MULTIPLE QUESTIONS

1. The term environment is derived from which language
(a) Greek Word (b) French Word
(c) English Word (d) Roman Word
2. India has the largest population in the world
(a) First (b) Second
(c) Third (d) Fourth
3. The Biosphere consists of the following
(a) (A) Lakes (b) (B) Soils
(c) (C) Solid sediments (d) (D) All of the above
4. A relatively dense layer of band which is found in the thermosphere is known as?
(a) Troposphere (b) Mesosphere
(c) Stratosphere (d) Ionosphere

5. Moho or Mohorovicici discontinuity separates the following
 - (a) Crust from Mantle
 - (b) Atmosphere from Biosphere
 - (c) Crust from Core
 - (d) Mantle from crust
6. Gutenberg discontinuity marks the boundary between
 - (a) Biosphere and lithosphere
 - (b) Crust and Mantle
 - (c) Mantle and inner core
 - (d) Mantle and outer core
7. What percentage of the earth surface is covered with hydrosphere?
 - (a) 30%
 - (b) 40%
 - (c) 51%
 - (d) 71%
8. Which is most abundant gas into the atmosphere after nitrogen?
 - (a) Carbon dioxide
 - (b) Carbon monoxide
 - (c) Oxygen
 - (d) Argon
9. Who proposed the term biosphere
 - (a) A.G. Tansley
 - (b) E.P. Odum
 - (c) Eduard Suess
 - (d) Robert Angus
10. Pedology related to
 - (a) Water
 - (b) Soil
 - (c) Air
 - (d) None of these

SHORT ANSWER TYPE QUESTIONS

1. Define environments.
2. Discuss the scope of environment.
3. Write a note on the importance of environment studies.
4. Write a note on the need of public awareness about environment.
5. Write a note on physical environment.
6. Write a note on biological environment.

QUESTIONS

1. What is Environment? Discuss the scope of Environment.
2. Describe the importance of environment studies.
3. "The need for public awareness about environment is of vital importance." Discuss.
4. Define the term environment and discuss the various types of environment.