UNIT 1

INTRODUCTION TO ENVIRONMENTAL STUDIES

1.1 ENVIRONMENT :

Environment is a complex of many variables, which surrounds man as well as the living organisms. Environment includes water, air and land and the interrelation ships which exist among and between water, air, land and human beings and other living creatures such as plants, animals and micro-organisms. She suggested that environment consists of an inseparable whole system constituted by physical, chemical, biological, social and cultural elements, which are interlinked individually and collectively in myriad ways. The natural environment consist of four interlinking systems namely, the atmosphere, the hydrosphere, the lithosphere and the biosphere. These four systems are in constant change and such changes affect by human activities and vice versa

In its broadest sense, environment includes water, air, soil, flora and fauna. In 1972, Stockholm Declaration also "especially representative samples of natural ecosystems" were included in the definition. The term "environment" could be said to cover "all those elements which in their complex inter-relationships form the framework, setting and living conditions for mankind, by their very existence or by virtue of their impact".

The word **'environment'** is derived from the French word 'environ' which means to encircle or surround. In simple words 'environment' is the surrounding of an organism, which includes air, water, land and its resources, flora & fauna and their interrelationships.

ENVIRONMENTAL SCIENCE, ENVIRONMENTAL ENGINEERING, ENVIRONMENTAL STUDIES :

- **Environmental science :**

Environmental science can be defined as the scientific study of earth, air, water, living organisms and the man with his impact on environment.

It is the study of both biotic and abiotic components of the environment.

- **Environmental Engineering :**

Environmental engineering can be defined as the application of engineering principles, for the protection and enhancement of the quality of the environment, public health and public welfare.

For example,

The Environmental engineer plans, designs, constructs and operate sewage treatment plant, water treatment plant, industrial effluent treatment plant, air pollution control equipments, etc.

- **Environmental studies :**

It can be defined as the branch of study concerned with environmental issues. It has a broader coverage than environmental science and includes the Social aspects of environment also. It deals with science where necessary, but in such a Language that can be understood by a non scientist also. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on the Environment. It includes various disciplines of science, social science, law and Engineering.

SCOPE OF ENVIRONMENTAL STUDIES :

The scope of environmental studies is very broad based and it includes a large number of areas and aspects. It has a direct relevance to every section of the society.

The scope of environmental studies in various fields is given below :

1. Natural resources - their conservation and management.

   Example

   - Forest resources
   - Water resources
   - Land resources

Environmental studies also incorporates science subjects like physics, chemistry, geography, geology, history, maths etc. In addition, it is also an important part of applied sciences for example genetics, biotechnology, and many more. Further more, environmental studies is also required in management skills like, pollution control, resource management, remote sensing etc.

2. Ecology and Ecosystem
3. Conservation of biodiversities,

   Example

   - Genetic diversity
   - Species diversity
   - Ecosystem diversity
   - Landscape diversity, etc.

4. Environmental pollution and control

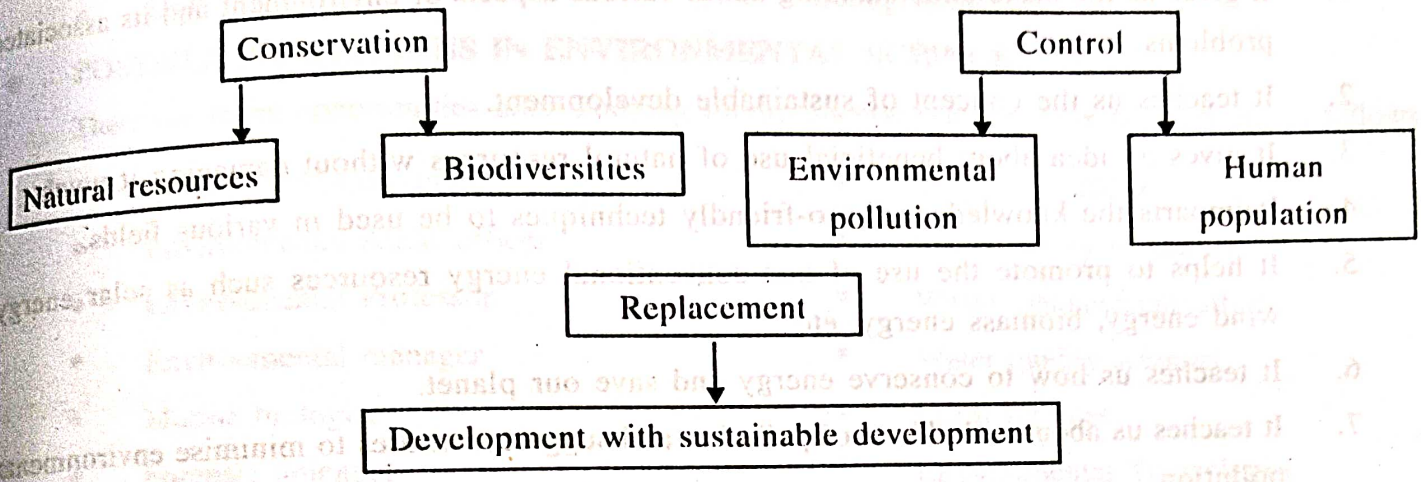
   Example

   - air pollution
   - water pollution
   - soil pollution
   - solid waste pollution
   - noise pollution
   - thermal pollution, etc.

5. Control of human population
6. Social issues related to development and environment

Example,

- Green revolution
- Industrialization
- Sustainable development, etc.
- Urbanization
- Economic growth



[FIG. 1.1 SCOPE OF ENVIRONMENTAL STUDIES]

• IMPORTANCE OF ENVIRONMENTAL STUDIES :

Environmental studies is a multidisciplinary subject. The information gained through the study of various disciplines gives us a holistic view of the environment for sustaining life on the Earth.

The unlimited exploitation of nature (environment) by mankind for the sake of development has threatened the survival of not just human beings but also all other living organisms. Human beings are suffering from various health problems. The number of living species has decreased, a large number are threatened, and many are even extinct.

Today, India is one amongst the top 10 industrialized countries in the world and the ever-increasing pollution levels is affecting all living organisms in its evironment. People around the world are enjoying economic growth at the cost of *'quality of human life'*. So, there is extreme need to save our environment by following a suitable developmental policy. This necessiates the knowledge of our environment, its components and the different issues affecting the environment.

Environmental studies is important because it deals with the most basic or routine issues like,

- Safe and clean drinking water
- Clean and fresh air
- Healthy food
- Hygienic living conditions
- Fertile land
- Sustainable development, etc.

- **Objectives of Environmental Education :**
  - To increase awareness and sensitivity towards the environment among the people.
  - To increase the knowledge pentaining to environment.
  - To improve attitude towards the environment.
  - To acquire skills for solving environmental problems.
  - To increase participation and to develop a sense of responsibility.

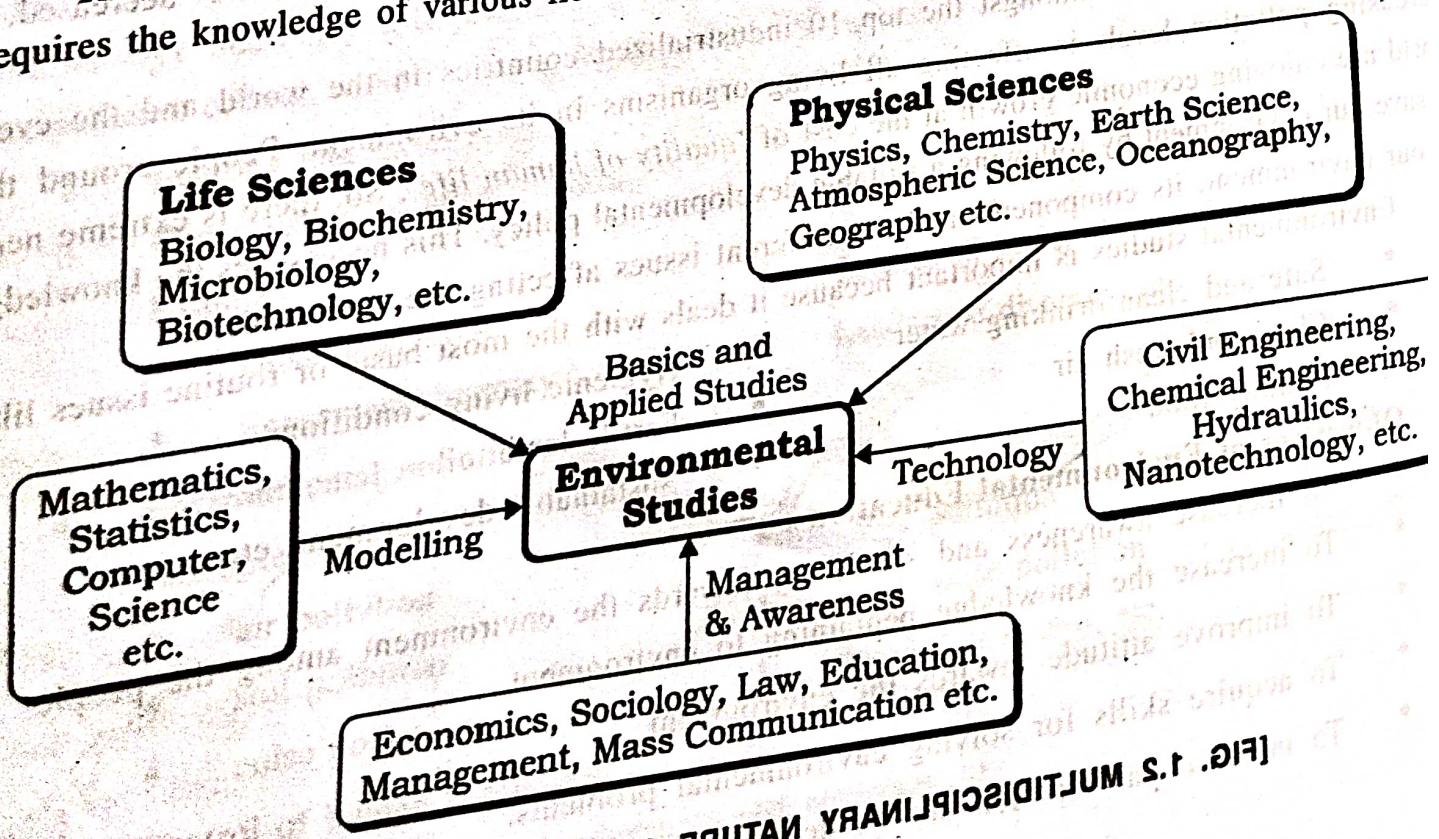
- **Importance of Environmental Education :**

The objective of environmental education is to make public aware about environmental problems, and importance of environment protection. Environmental education is important from the following view points.

1. It gives us the basic understanding about various aspects of environment and its associated problems.
2. It teaches us the concept of sustainable development.
3. It gives an idea about beneficial use of natural resources without damaging it much.
4. It imparts the knowledge of eco-friendly techniques to be used in various fields.
5. It helps to promote the use of non-conventional energy resources such as solar energy, wind energy, biomass energy, etc.
6. It teaches us how to conserve energy and save our planet.
7. It teaches us about bad effects of pollution and suggest measures to minimise environmental pollution.
8. It helps us to understand about ecological imbalance and various ways to maintain ecological balance.
9. It gives the knowledge about interdepedency of man and nature.
10. It develops skills to identify environmental problems and their solutions.

1.2 MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES :

The environment is everybody's concern. An understanding of the working of the environme requires the knowledge of various fields.



[FIG. 1.2 MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL

Environment study covers many some of them are, fields :

- Life sciences
- Mathematics
- Economics
- Law
- Physical sciences
- Civil engineering
- Sociology
- Management, etc.

- **POSSIBLE PROFESSIONS IN ENVIRONMENTAL SCIENCE :**

There are many opportunities after studying Environmental science some of them are as follows :

- Environmental consultant
- Environmental Audit officer
- Environmental Professor
- Environmental manager
- Marine biologist
- Forensic Scientist
- Nature conservation officer
- Recycling officer
- Sustainability consultant
- Waste management officer
- Water quality scientist
- Legal services
- Environmental Toxicologist
- Environmental Health & Safety Officer

1.3 COMPONENTS OF ENVIRONMENT :

The environment has two parts :

1. Biotic part
2. Abiotic part

1. Biotic part :

Biotic part is made up of all living organisms which includes,

- Plants
- birds
- animals
- micro-organisms

2. Abiotic Part :

This part is also called **physical environment**. It is the non-living component of environment. It includes,

- light, water, air
- temperature, humidity
- minerals, soil, etc.

"The biotic and abiotic components of an environment are together known as the biome environment".

- **Categories of Environment :**

The environment can be divided into two categories :

1. Natural environment
2. Man-made environment

1. Natural environment :

It is the environment gifted by God and is operated by self regulation mechanism.

The natural environment comprises of 4 spheres :

(i) Biosphere : Space occupied by life

(ii) Atmosphere : Space occupied by air

(iii) Lithosphere : Space occupied by solid

(iv) Hydrosphere : Space occupied by water

2. Man-made environment (Anthropogenic environment) :

It is the environment created by man through modifications in natural environment for fulfilling his needs.

It includes anthropogenic (human related) ecosystems - interactions among and between humans (socio - economic), other living organisms (biotic) and abiotic factors.

It also includes physical structures like :

- Dams, canals
- Roads
- Vehicles
- Power plants, industries
- buildings

➥ The four basic components of physical environment are :

1. Atmosphere
2. Hydrosphere
3. Lithosphere
4. Biosphere

1. Atmosphere :

The earth's atmosphere is an envelope of gases, water vapour and subatomic particles extending up to 2000 feet above the ground surface. The gases include nitrogen, oxygen, argon, carbon dioxide, traces of carbon monoxide, oxides of sulphur, nitrogen and hydrocarbon, etc. The concentration of these gases decreases with an increase in altitude. The bulk of these gases are present within the atmospheric band that stretches up to 5 km above the earth.

The atmosphere may extend up to a height of about 80 km. It is transparent, colourless and tasteless.

The composition of atmosphere is given in Table 1.1.

Table 1.1 Composition of atmosphere

Sr. No.	Names of gases	Concentration by % Volume	Category in atmosphere gases
1.	Nitrogen (N_2)	78.09	
2.	Oxygen (O_2)	20.95	Major gases
3.	Argon (Ar)	0.93	
4.	Water vapours	0.1	
5.	Carbon dioxide (CO_2)	0.032	
6.	Neon (Ne)	0.0018	Minor gases
7.	Methane (CH_4)	0.0002	
8.	Helium (He)	0.0005	
9.	Ozone (O_3), CO, H_2,	Concentration	
10.	NH_3, NO, NO_2,	by % Volume	
11.	SO_2 and H_2S	less then 0.000006	Trace gases

Atmosphere is very important layer on the Earth surface, and life on Earth is not possible without the atmosphere. The atmosphere protects the Earth's biosphere by absorbing a major portion of the electromagnetic radiation and most of the cosmic rays. The atmosphere also absorbs infra-red radiation and thereby maintains the temperature of the Earth at life sustaining levels. It provide us oxygen and sunlight to live.

At a given place, short term variations like hourly, daily and weekly variations in the properties of atmosphere (such as sun radiations, temperature, humidity, rainfall, wind and clouds) is termed as weather. When the **weather** remains almost constant for very long duration like that of seasonal variations, it is called **climate.**

- **Structure of Atmosphere :**

The atmosphere can be sub-divided into five regions as given below :

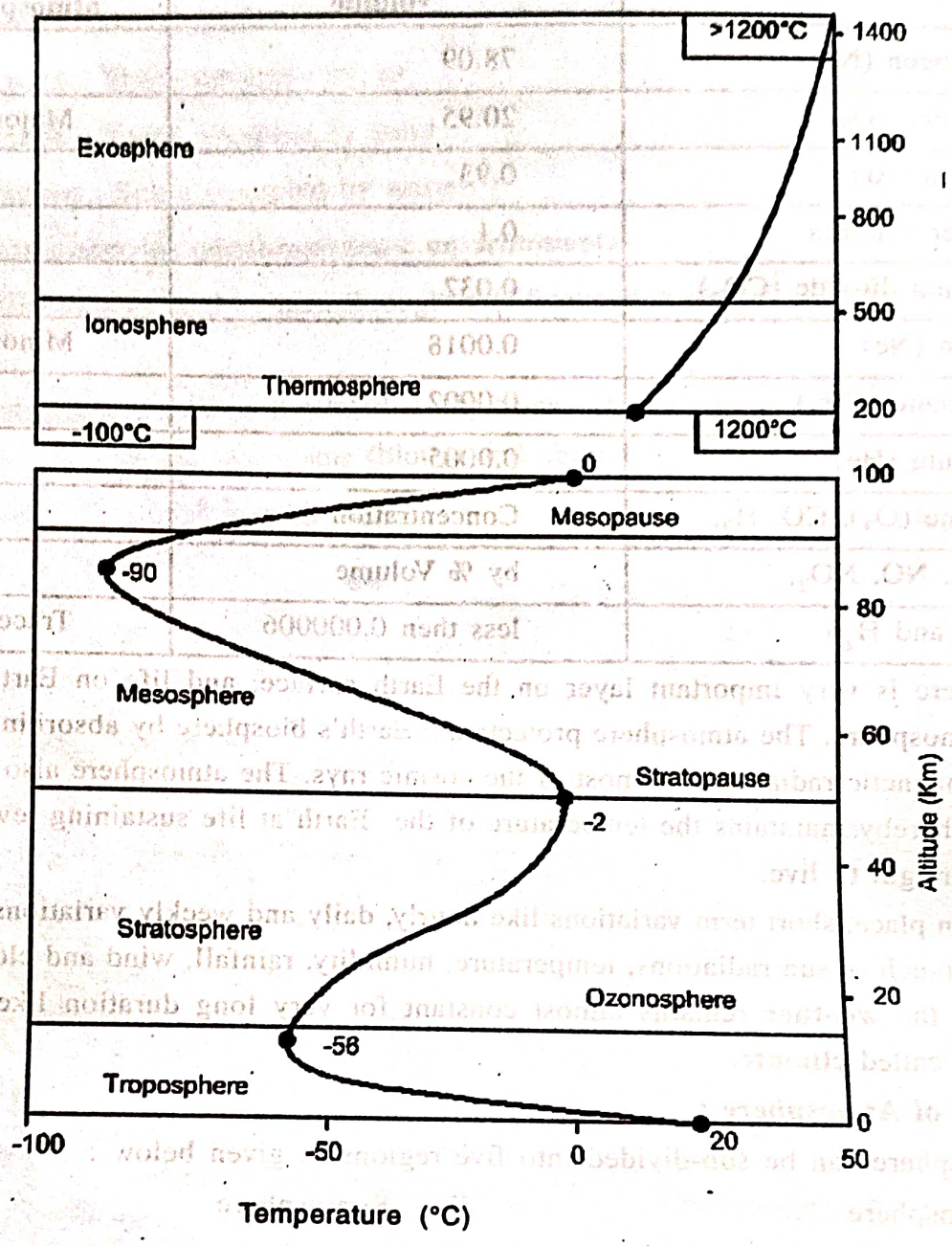
i. Troposphere
ii. Stratosphere
iii. Mesosphere
iv. Thermosphere
v. Exosphere

(i) Troposphere :

It is the lower most layer of atmosphere in which most living organisms exist. It extends up to **8 km** at the poles and **16 km** at equator.

It contains 70% of the atmosphere's mass. The density of the troposhere decreases with altitude. The air near the ground level is heated by the radiation from the Earth. The changes of temperature with altitude is known as lapse rate. The temperature decreases uniformly with altitude, which is known as negative lapse rate.

The cold layer (–56°C) at the top of the troposphere, which shows a temperature inversion, that is, a negative to positive lapse rate, is known as **tropopause.**



[FIG. 1.3 (a) TEMPERATURE PROFILE OF ATMOSPHERE]

(ii) Stratosphere :

A stable layer of atmosphere above troposphere is called stratosphere. It extends about 50 – 55 km above the surface of the Earth.

Stratosphere is known for the presence of **ozone** which is found at around 20 km from ground. This layer of ozone is called ozonosphere and acts as a protective layer against the harmful effects of ultra violet radiations on living organisms.

The layer separating stratosphere from mesosphere is called **stratopause.** It is following positive lapse rate by increasing the temperature at higher altitude.

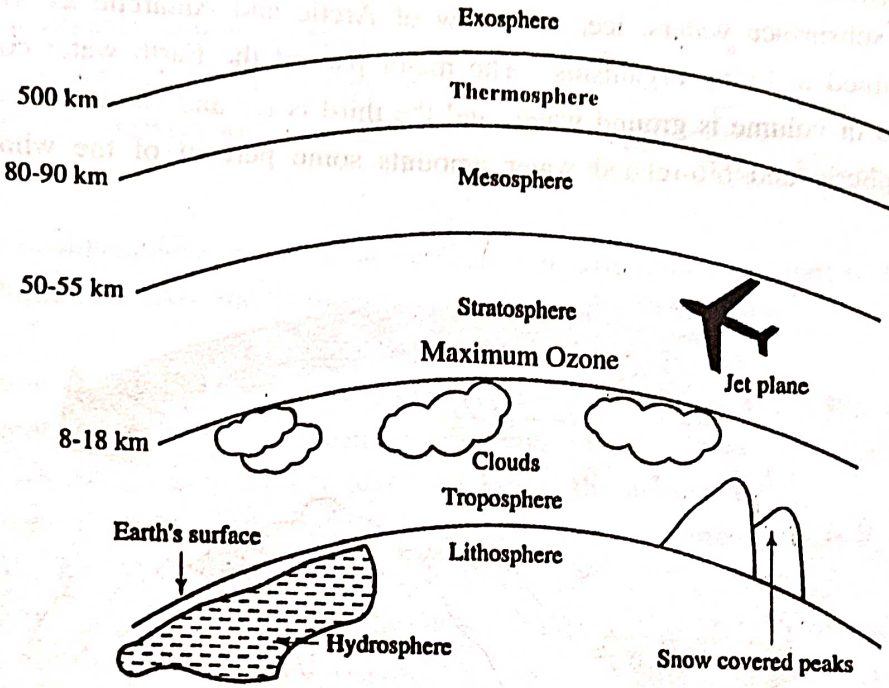
(iii) Mesosphere :

It exists over stratosphere and in this layer, temperature decreases with altitude (negative lapse rate). The *mesopause* separates the mesosphere from the thermosphere.

This layer is very special as all sound waves as well as short radio waves coming from earth are reflected from this layer.

(iv) Thermosphere :

After mesosphere, thermosphere starts and extends up to **500 km** above Earth's surface. Temperature rises in this zone with altitude and this trend continues further. So it has positive lapse rate.



[FIG. 1.3 (b) EARTH'S ATMOSPHERE]

Ionisation of elements like oxygen and nitric oxide take place in the upper most portion of layer. Therefore, the upper layer of thermosphere is also called **ionosphere.**

(v) Exosphere :

The uppermost layer of the atmosphere is called exosphere. This extends up to a height of about 1600 km and gives way to interplanetary space. In this layer very high temperature (> 1200 °C) is found.

2. Hydrosphere :

All types of water resources, namely the oceans, seas, rivers, lakes, ponds, reservoirs, polar ice caps, glaciers, ground water and water vapour are collectively known as the **hydrosphere.**

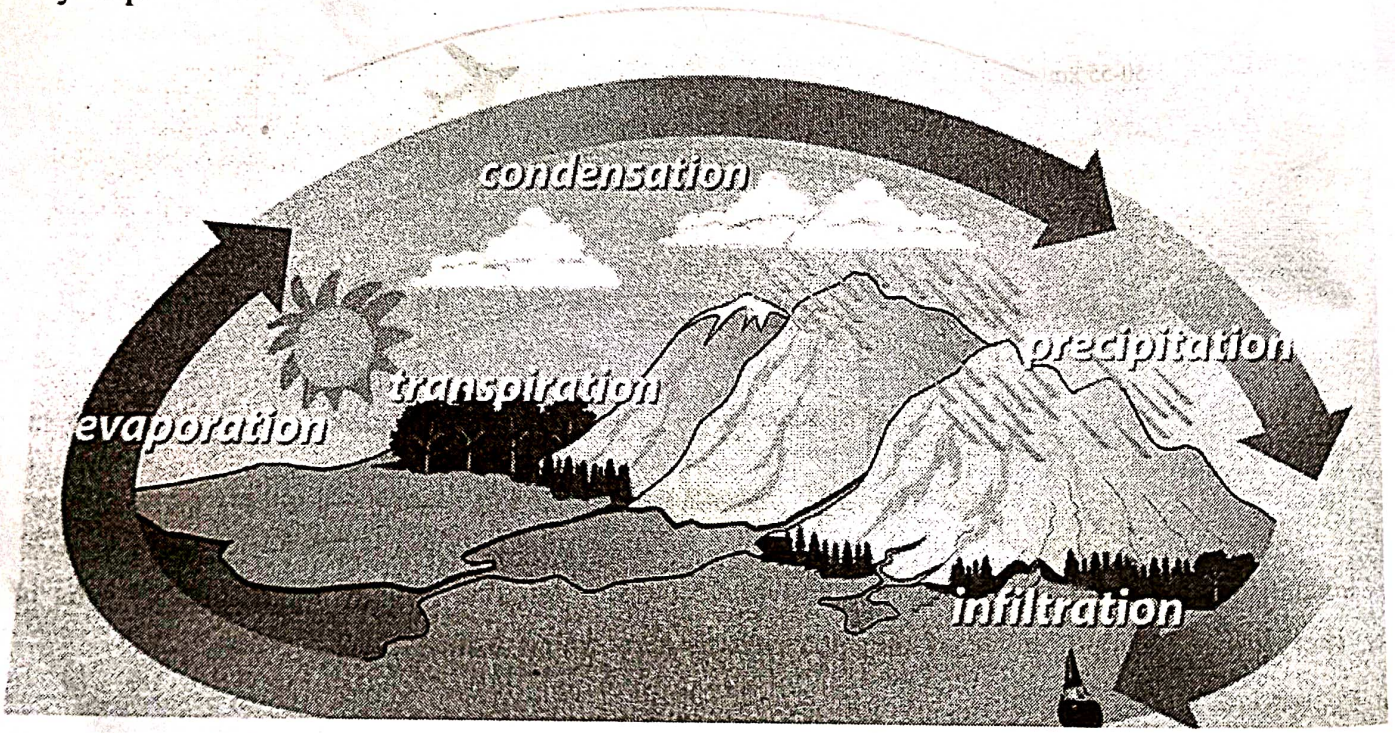
The hydrosphere is an important part of the earth's surface. About 70% of the earth's surface is covered with water. The northern hemisphere is dominated by land surface, while the southern hemisphere is almost entirely occupied by water bodies (oceans).

The distribution of water is as under :

97 %	.....	oceans and seas
2.0 %	.....	in ice caps at polar regions
0.75 %	.....	as ground water
0.25 %	.....	lakes, ponds, rivers, streams

Total quantity of water available on the earth surface is about 1.4 billion km^3 and if this amount is spread over the earth surface, then it will form 2.5 km deep water mass.

Hydrosphere is a discontinuous water shell of the Earth between atmosphere and solid Earth crust (lithosphere), including oceans, seas and water surface on the land. In broader sense the hydrosphere composition includes subsurface waters, ice, and snow of Arctic and Antarctic as well as atmospheric water and water contained in living organisms. The major part of the Earth water concentrates in seas and oceans, the second in volume is ground water, and the third is ice and snow of Arctic and Antarctic. Surface water, atmospheric and bio-related water amounts some percent of the whole volume of the hydrosphere water



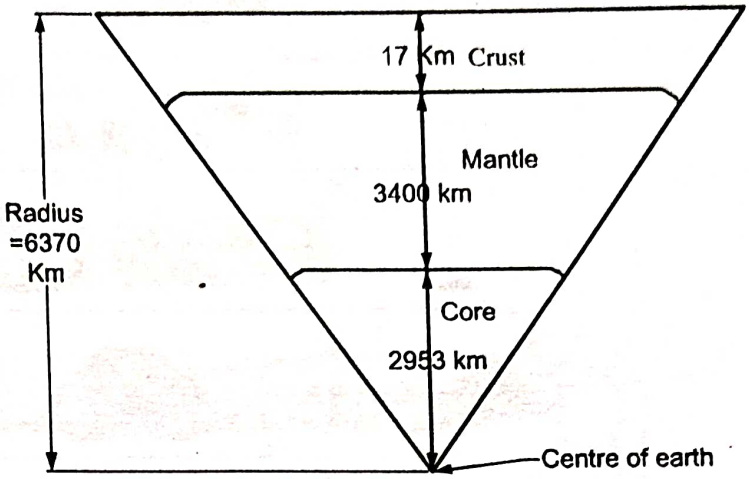
[FIG. 1.3 (c) HYDROSPHERE]

The components of the hydrosphere, including the cryosphere and atmosphere, as well as the biosphere, participate in the global hydrologic cycle. Annually the amount of precipitations falling on the ground is equal to that of water evaporated in total from the surface of land and oceans. In general cycle of water the atmospheric water is the most mobile form.

3. Lithosphere :

The upper layer of the Earth's crust is called **lithosphere**. It is made up of soil, minerals, rocks and other organic as well as inorganic matter.

Rocks are subjected to continuous physical, chemical and biological weathering. Plants grow and decay on the soil covering the rocks. Soil is the major component of the lithosphere. The organic matter in soil is decomposed by micro-organisms thus forming biomass. This biomass is mixed with the soil fauna. The major components of soil are air, water, minerals, and organic matter obtained from weathering of the parent rock. Soil plays a vital role in supplying nutrients to the plant kingdom.



[FIG. 1.3 (d) LITHOSPHERE]

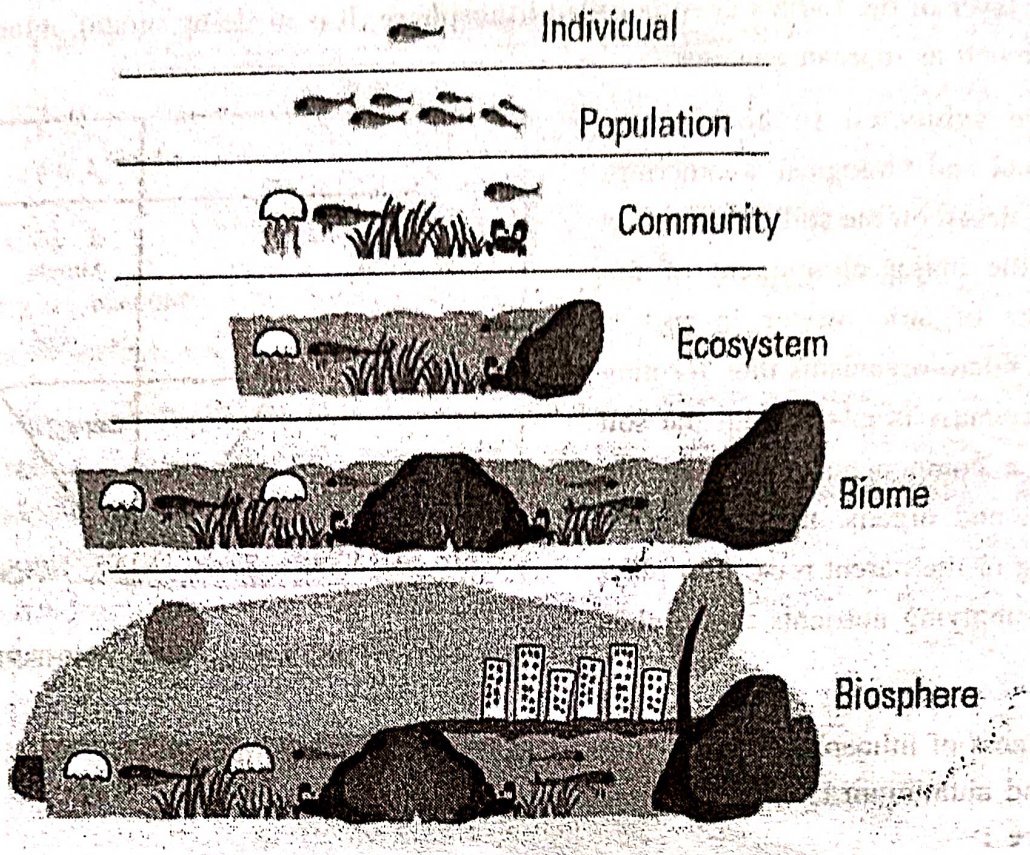
The thickness of lithosphere ranges from 64 to 96 km. The uppermost part of the lithosphere is rich in silica (Si) and aluminium (Al) and is therefore, known as the **SiAl layer.**

4. Biosphere :

It is that portion of Earth's surface, hydrosphere and atmosphere where life exists. Biosphere is a biological environment where living organisms interact with physical environment, e.g. soil, water and air. It extends from the lowest sea bed level to about 24 km of the atmosphere.

From the bottom of the sea level to the surface of the earth, whether it is desert, grass land, hills, wells, rivers, lakes or even sky where the birds and other small creatures are existing are included in biosphere. Every living organism gets all basic resources from the biosphere i.e. air, water food and sunlight, etc. and simultaneously the waste in the form of solid, liquid or gases produced by it are discharged into the biosphere. Biosphere has a capacity to absorb, convert or dilute the waste and make it useful once again to the next generation of organism.

It is otherwise known as the life layer, it refers to all organisms on the earth's surface and their interaction with water and air. It consists of plants, animals and micro-organisms, ranging from the tiniest microscopic organism to the largest whales in the sea. Biology is concerned with how millions of species of animals, plants and other organisms grow, feed, move, reproduce and evolve over long periods of time in different environments. Its subject matter is useful to other sciences and professions that deal with life, such as agriculture, forestry and medicine. The richness of biosphere depends upon a number of factors like rainfall, temperature, geographical reference etc. Apart from the physical environmental factors, the man made environment includes human groups, the material infrastructures built by man, the production relationships and institutional systems that he has devised. The social environment shows the way in which human societies have organized themselves and how they function in order to satisfy their needs



[FIG. 1.3 (e) BIOSPHERE]

INTERACTION AMONG COMPONENTS OF ENVIRONMENT :

Two major components of environment are biotic and abiotic.

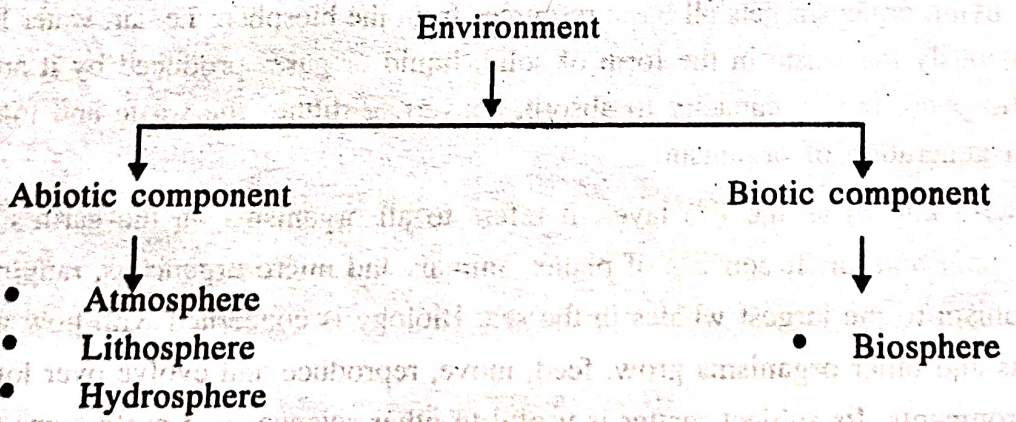
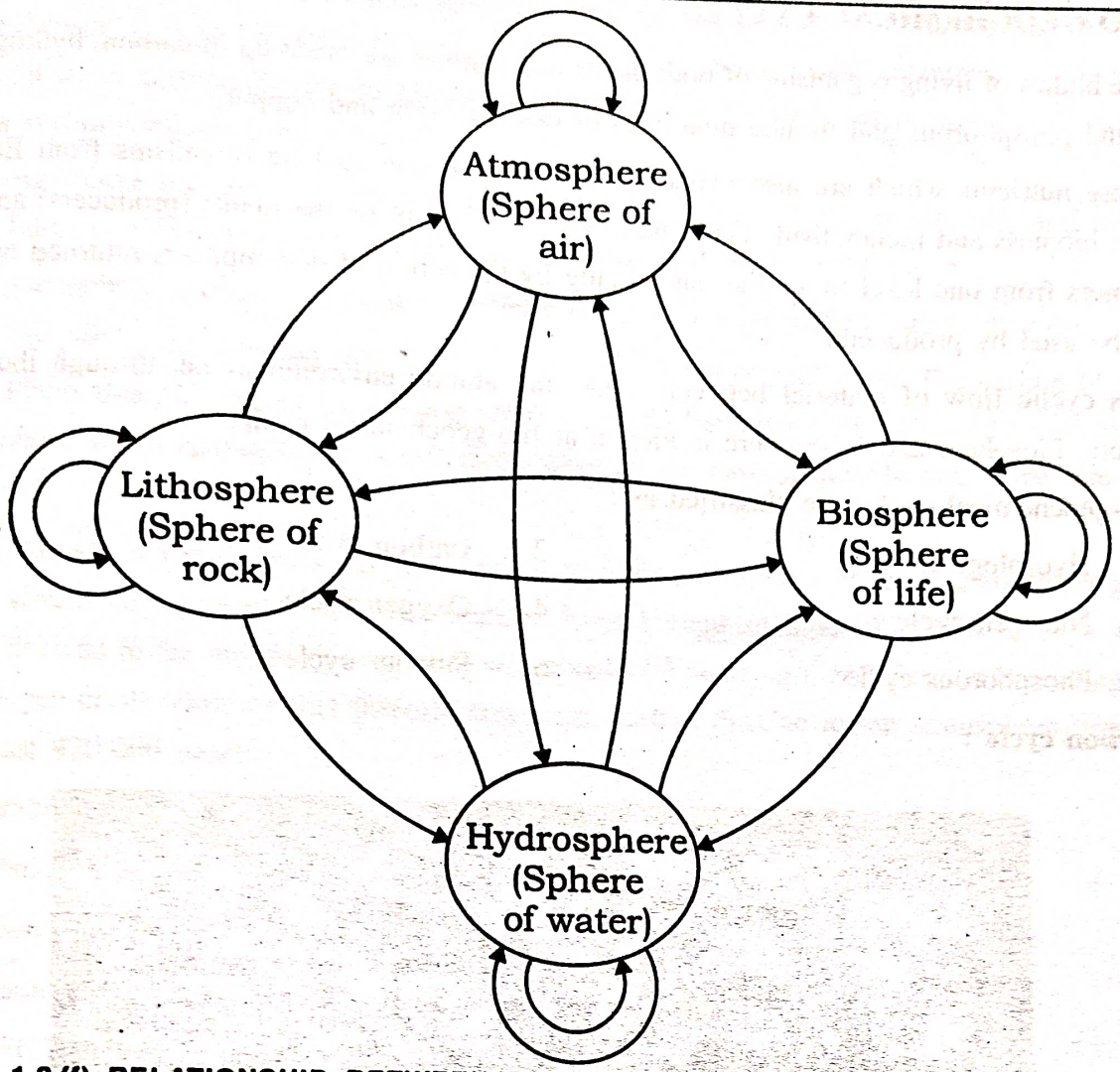


Fig. 1.3 (f) shows a schematic representation of the four environmental components and their interrelationship. The circles represent the spheres and the curved arrows indicate the flow path of matter. All the spheres have two way linkage to other sphere including itself which represent the transfer of matter from one sphere to other, or within itself without leaving that sphere.

The atmosphere may be considered as a transport component that moves substances from atmospheric sources to the receptors. Its storage capacity is small compared to the other spheres but it has greater capacity for spatially redistributing matter.



[FIG. 1.3 (f) RELATIONSHIP BETWEEN DIFFERENT COMPONENTS OF ENVIRONMENT]

The hydrosphere has two subcomponents i.e. rivers and oceans. The river system collects the substances within the watershed and delivers them to the second subcomponent that is ocean.

The lithosphere is composed of soil particles and rocks. Within the soil, biochemical reactions by microorganisms are responsible for most of the chemical changes of matter. However, soil and rocks are mainly storage components for deposited matter.

All the components of environment are interrelated with each other. Any change in one of the components affect other components also. For example, changes in the temperature of atmosphere, cause changes in the rate of evaporation, humidity in atmosphere and after saturation of humidity when rainfall takes place, it affects lithosphere as flood may occur causing erosion of earth. This also affects the biosphere as different types of plants grow differently according to the amount of rainfall they receive.

Lithosphere is almost static component of environment while atmosphere and hydrosphere are dynamic components of environment. Different types of movements in air due to wind and storms and movements of river water as well as ocean water cause changes on the land surface and thus affect the lithosphere.

1.4 BIO-GEOCHEMICAL CYCLES :

The bodies of living organisms of both plants and animals are made up of carbon, hydrogen, nitrogen, oxygen and phosphorous and minute quantities of calcium, iron and copper.

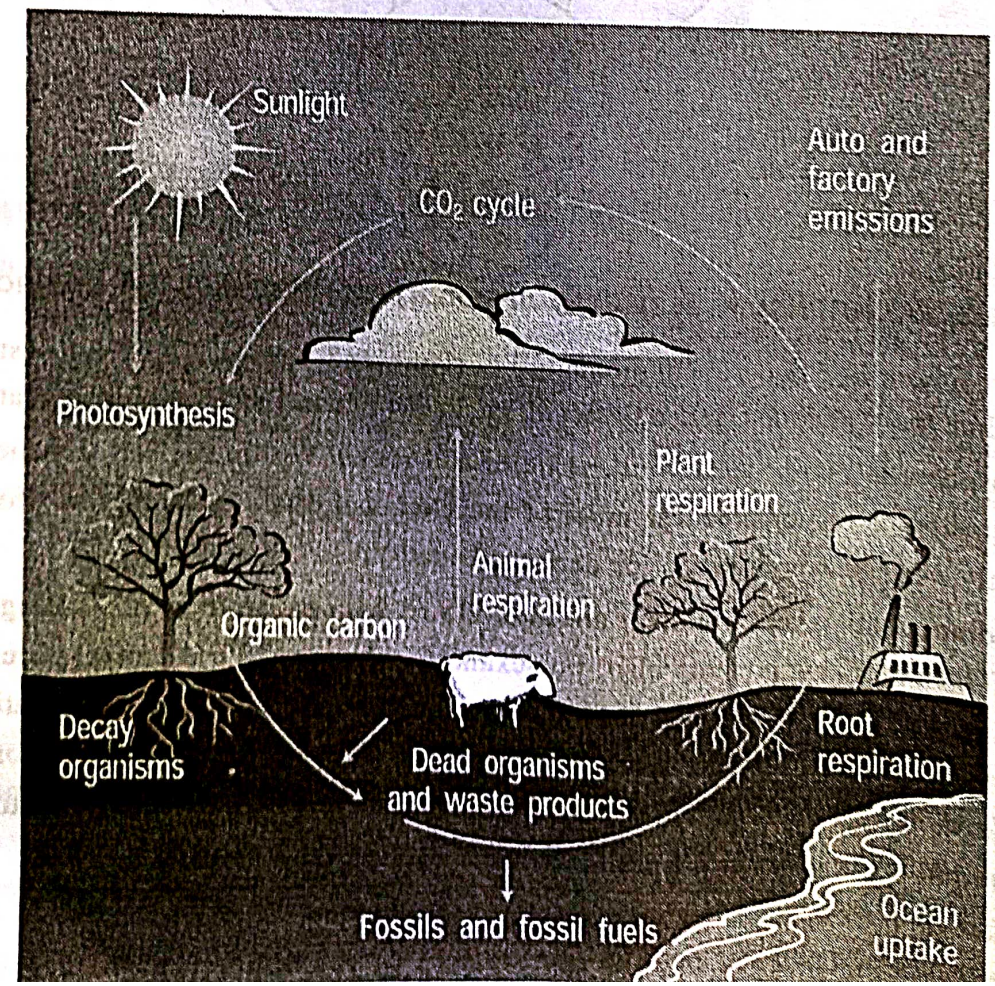
These nutrients which are also called biogeochemical are used by organisms from Earth for their growth of biomass and metabolism. These nutrients are taken in by the plants (producers) and transferred to consumers from one level to another and finally by the action of decomposers returned back to soil/or water to be used by producers.

This cyclic flow of material between biotic and abiotic environment i.e. through the atmosphere, hydrosphere, biosphere and lithosphere is known as bio-geochemical cycle.

Bio-geochemical cycles are classified as :

1. Hydrological cycle
2. Carbon cycle
3. Nitrogen cycle
4. Oxygen cycle
5. Phosphorous cycle
6. Sulphur cycle

1.4.1 Carbon cycle :



Carbon is one of the most essential compounds for all organisms. It is the building block of all organic substances. It is one of the primary elements forming human tissues and is essential for plants as well. In biotic form, it is in the form of carbohydrates, lipids, amino acids, enzymes and hormones. In abiotic form, it is as carbon dioxide in air and carbonates and bicarbonates in water and as carbonate rocks, fossils and minerals in lithosphere.

All living things are made of carbon. Carbon is also a part of the ocean, air, and even rocks. Because the Earth is a dynamic place, carbon does not stay still. It is on the move !

In the atmosphere, carbon is attached to some oxygen in a gas called carbon dioxide.

Plants use carbon dioxide and sunlight to make their own food and grow. The carbon becomes part of the plant. Plants that die and are buried may turn into fossil fuels made of carbon like coal and oil over millions of years. When humans burn fossil fuels, most of the carbon quickly enters the atmosphere as carbon dioxide.

Carbon dioxide is a greenhouse gas and traps heat in the atmosphere. Without it and other greenhouse gases, Earth would be a frozen world. But humans have burned so much fuel that there is about 30% more carbon dioxide in the air today than there was about 150 years ago, and Earth is becoming a warmer place. In fact, ice cores show us that there is now more carbon dioxide in the atmosphere than there has been in the last 420,000 years.

The carbon is found on the planet in the following forms :

- As organic molecules in living and dead organisms.
- As carbon dioxide in the atmosphere.
- As organic matter in soils.
- As fossil fuel in sedimentary rock deposits such as limestone, dolomite, chalk, etc.
- In oceans as dissolved atmospheric CO_2 in water and as calcium carbonate shells in marine organisms.
- The carbon is circulated through the biosphere by the carbon cycle as shown in fig. 1.4.1.
- The atmosphere contains about 0.032% of carbon dioxide gas by volume.

Plants absorb carbon from the atmosphere as CO_2 through photosynthesis.

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6O_2 + \text{energy}$$

In this process plants release oxygen.

- From plants, this carbon goes to animals as carbohydrates through food and from animals to different micro-organisms. Decomposers decompose the dead organic matter while carbon returns to the atmosphere as carbon dioxide (CO_2).
- By respiration of living beings, CO_2 returns to the atmosphere.
- On burning of fossil fuels (coal, petroleum, natural gas) carbon is released to the atmosphere.
- By volcanic eruptions and forest fires.

- Oceans are the richest source of carbon where it is stored as carbonate and bicarbonate ions and an exchange with the atmosphere occurs continuously. The ocean regulates the atmospheric CO_2 level to 0.032% despite the photosynthesis uptake.

Thus the carbon content is maintained by the exchange of carbon dioxide between the atmosphere and organisms, and atmosphere and the ocean.

1.4.2 Nitrogen cycle :

Nitrogen and its compounds are essential constituents of protein which is the building block of all living organisms. Atmosphere contains about 78% of nitrogen which is in molecular form and cannot be used directly by living organisms. Therefore it is to be fixed or combined with other elements like carbon, hydrogen and oxygen to convert into usable form to plants. This process of making atmospheric nitrogen available for plants is called 'nitrogen fixation'.

The nitrogen cycle consists of the following steps :

1. Nitrogen fixation
2. Ammonification
3. Nitrification
4. Denitrification

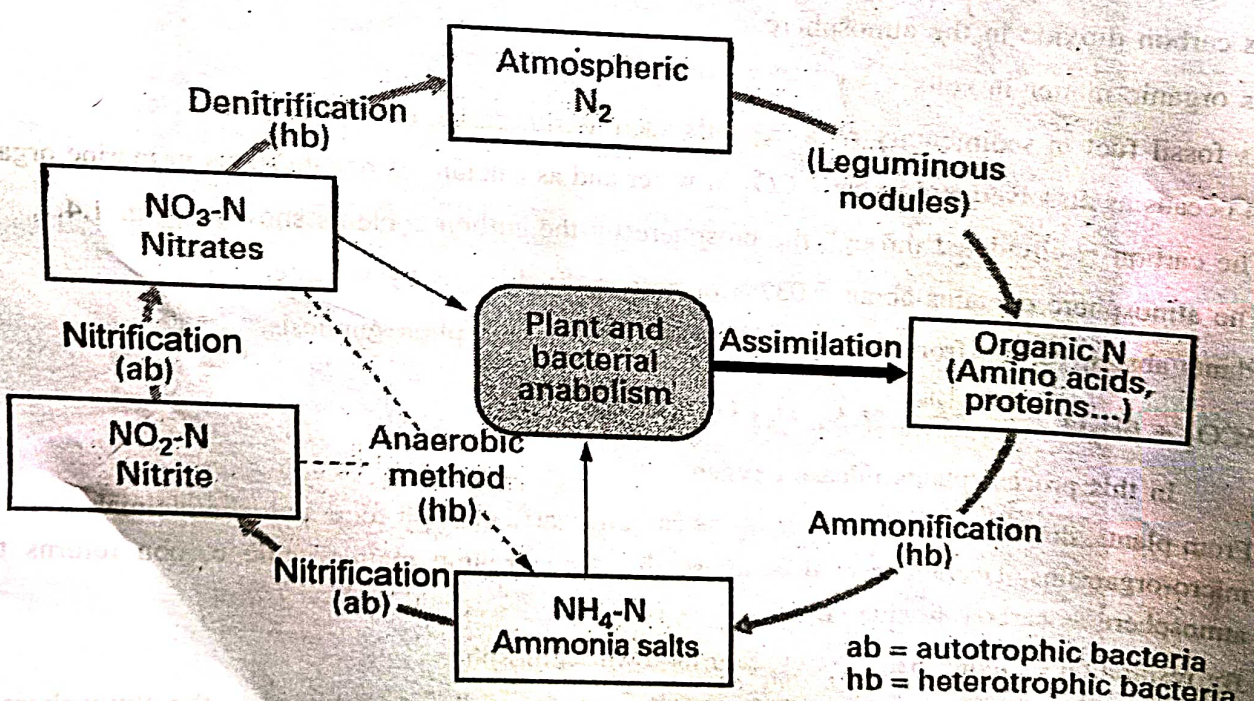
1. Nitrogen fixation :

Nitrogen fixation is achieved by :

(i) atmospheric thunderstorms and lightning

(ii) certain free-living bacteria and blue green algae

(iii) industrial processes.



[FIG. 1.4.2 NITROGEN CYCLE]

- Atmospheric thunderstorms and lightning convert gaseous nitrogen to nitrates and it reaches the soil through precipitation and is used by plants.

  N_2 and O_2 are converted to nitrogen oxide (NO).
- Leguminous plants such as beans, pea and so on contain nodules in their roots where symbiotic bacteria live. These bacteria can fix atmospheric nitrogen as ammonium ion, which is further oxidised by certain bacteria to form nitrates and nitrites.
- Ammonia is used as fertilizer after its conversion to urea and ammonium nitrate. Such fertilizers are also added to the soil to replace the nitrogen that has been removed during harvesting.

2. Ammonification :

Dead organic matter of plants and animals are decomposed by the decomposers to form ammonia and the process is called ammonification.

3. Nitrification :

Nitrifying bacteria convert the ammonia into nitrites, then into nitrates, the process is called nitrification.

In an aerobic medium, organic nitrogen matter converts into ammonia salts (ammonification) which in turn convert into nitrites and then into nitrates by consuming oxygen. Nitrification encompasses these two reactions :

- **nitritation** is caused by the action of nitrous bacteria : Nitrosomonas, Nitrosocystis, Nitrosospira, Nitrosoglea ..., which converts ammonia salts to nitrite.
- **nitratation** is caused by the action of nitric bacteria : Nitrobacter, Nitrocystis, Bactoderma, Macroderma ..., It helps to form nitrates from nitrite.

All these bacteria are autotrophic and strictly aerobic. These bacteria use the energy produced when ammonia and nitrites are oxidised to reduce the mineral carbon released by either carbon dioxide or by carbonates.

In order to achieve a complete reaction, 4.6 mg of oxygen are required for every mg of nitrogen to be oxidised according to the following simplified reaction :

In reality, oxidation of all the nitrogen ammonia is not continued up to the nitrate stage (formation of intermediate organic compounds that make up the bacterial mass) and, in practice, only 4.2 mg of oxygen are required for every mg of nitrogen to be oxidised.

Nitrification tends to deplete the oxygen contained in waterways in the same way as organic pollution assimilation. On the other hand, these nitrates constitute a stock of oxygen that can be released through denitrification when reduction conditions re-occur (anoxic). These are not the conditions that one could hope for in rivers; however, these conditions prevail in sediments and these reactions play an important part when waterways recharge aquifers.

4. Denitrification :

Ultimately, nitrogen leaves the soil through a process called **'denitrification'.**

The denitrifying bacteria convert ammonia and NH_4^+ ions back into nitrogen gas and nitrous oxi (N_2O) gas. These gases enter into the atmosphere to begin the nitrogen cycle again.

- **Human interference with Nitrogen cycle :**

The human interference with nitrogen cycle is summarised as follows :

(i) Release of large amount of nitric oxide (NO) due to fuel burning.

(ii) Release of nitrous oxide (N_2O) due to application of commercial inorganic fertilizers an anaerobic conversion of dung.

(iii) Release of large amount of nitrogen from soil and plants due to deforestation.

The release of nitrogen causes significant impacts such as :

- Acid rain
- Acidification of lakes
- Corrosion of metals
- Deterioration of building materials.

1.5 SUSTAINABLE DEVELOPMENT :

Sustainable development is defined as a form of development of progress that meets the needs o the present without compromising the ability of future generations to meet their own needs.

Sustainable development is a process of betterment of life in all the sectors like economic, social educational, health, sanitation, food and housing, national security, etc. It means, every generation should keep air, water and soil, pure and unpolluted as possible, so that the next future generation is not jeopardized of their needs. Although, it is difficult thing, it can be achieved through proper environmental management.

The idea of sustainable development was strongly supported by Earth Summit 1992, held at Rio de Janerio, Brazil. It was the largest environmental conference attracting 30,000 people and more than 100 heads of states. UN general assembly asked for a report on progress made towards sustainable development.

Sustainable Development should be a part and parcel of national development plan of each country. It can be achieved by keeping the folowing poins in consideration :

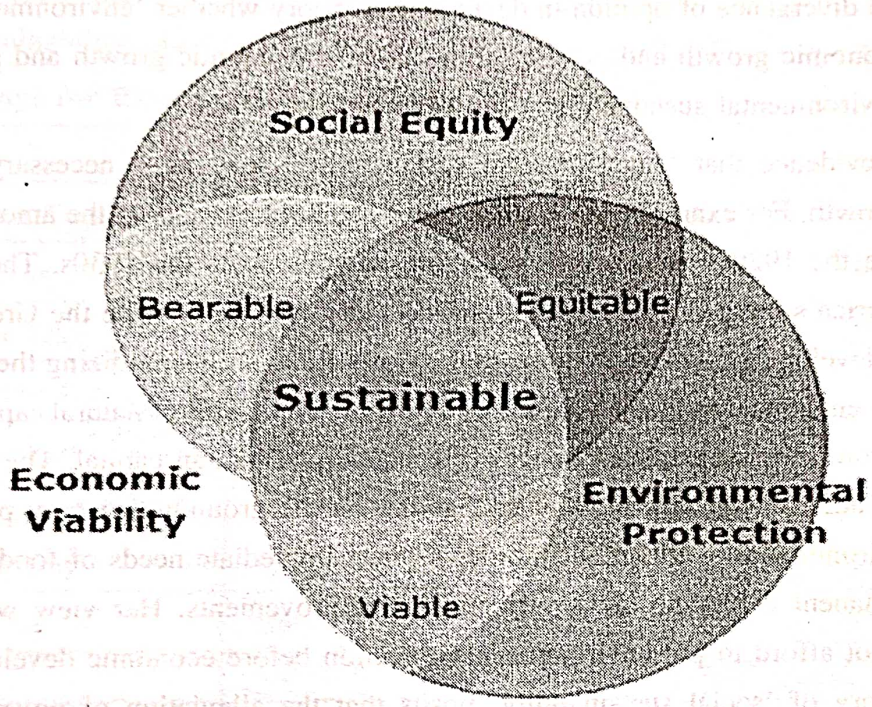
1. Controlling population explosion.
2. Enhancing the conservation of natural resources like water, soil, forest and energy.
3. Minimising waste production by performing recycling and reuse.
4. Enhancing the use of non-conventional energy sources like solar, wind, wave and biomass energy.
5. Use of clean production technologies.
6. Providing housing, education and health care to poor people, particularly in rural areas.
7. Encouraging the empowerment and education of women.
8. Development of industrial pollution control methods to reduce level of pollution.
9. By marking strategies for eradication of poverty.
10. Arranging tree plantation programs.

1.5.1 Concepts of Sustainability :

Sustainable devlopment, or sustainability, is defined by the World Wildlife Fund for Nature (WWF) as an economic activity that meets the needs of the present generation without compormising the ability of future generations to meet their needs.

It is the ability to be sustained, supported and confirmed. The quality of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological balance.

Sustainability is most often defined as meeting the needs of the present without compromising the ability of future generations. It has three main pillars : economic, environmental and social. These three pillars are informally referred to as people, planet and profits.



[FIG. 1.5.1 CONCEPTS OF SUSTAINABILITY]

1. Economic Sustainability :

'Economic sustainability' implies a system of production that satisfies present consumption levels without compromising future needs. The 'sustainability' that 'economic sustainability' seeks is the 'sustainability' of the economic system itself. The notion of 'economic sustainability' was originated by Hicks. Traditionally, economists, assuming that the supply of natural resources was unlimited, placed undue emphasis on the capacity of the market to allocate resources efficiently. They also believed that economic growth would bring the technological capacity to replenish natural resources destroyed in the production process. Today, however, a realization has emerged that natural resources are not infinite. The growing scale of the economic system has strained the natural resource base. This has caused many commentators, such as Goodland, to question the feasibility of uncontrolled growth and exponential consumption.An economic system designed in light of the theory of 'economic sustainability' is one constrained by the requirements of 'environmental sustainability'. It restrains resource use to ensure the

'sustainability' of natural capital. It does not seek to achieve 'economic sustainability' at the cost of 'environmental sustainability'. In the literature of sustainable development, it has become commonplace to call for supplanting the prevailing doctrine of economic growth with a new doctrine of economic for pursuing a form of qualitative growth rather than quantitative growth.

2. Social Sustainability :

In the most basic sense, 'social sustainability' implies a system of social organization that alleviates poverty. In a more fundamental sense, however, 'social sustainability' establishes the nexus between social conditions such as poverty and environmental decay. This theory of social organization identifies a negative linkage between sustained colonization, sustained poverty levels, and sustained natural resource exploitation. There is a divergence of opinion in development theory whether 'environmental sustainability' is a prerequisite of economic growth and poverty alleviation, or economic growth and poverty alleviation are needed before 'environmental sustainability' can even be addressed.

There is some evidence that 'environmental sustainability' may be a necessary pre-condition of sustained economic growth. For example, the United States has been expanding the amount of its land area covered by trees since the 1920s and actively managing its soils since the 1930s. These measures have greatly improved America's productivity in paper products and foodstuffs since the Great Depression. On the other hand, some developing countries, for example, Costa Rica, are jeopardizing their long-term socio-economic prospects by engaging in rapacious resource depletion. Net losses of natural capital in these nations imperil social gains from improvements in financial, technical and human capital. The latter position was defended by the late Indian Prime Minister Indira Gandhi, on the grounds that very poor countries must accept temporary environmental degradation in order to meet immediate needs of food and shelter before they can pursue permanent economic and environmental improvements. Her view was that developing countries simply cannot afford to put environmental protection before economic development. In contrast to this view, the theory of 'social sustainability' posits that the alleviation of poverty need not entail environmental decline. It aims to alleviate poverty within the existing resource base of a society. Social sustainability in planning practice. The theory of 'social sustainability' calls for economic growth constrained by the requirements of social equity. In order to link these, an enabling environment must be created that optimizes resource use, prioritizes resource allocation, and fosters equitable resource distribution.

3. Environmental development :

'Environmental sustainability' requires maintaining natural capital as both a provider of economic inputs called 'sources' and an absorber called 'sinks' of economic outputs called 'wastes'. At the 'source site', harvest rates of resources must be kept within regeneration rates. At the 'sink site', waste emissions from industrial production must be controlled so as to not exceed the capacity of the environment to assimilate them without impairment. It has become commonplace for 'sustainable development' or 'sustainability' to be defined strictly in terms of 'environmental sustainability'. This misconception holds that what is wrong with the contemporary pattern of international development is simply that it is destroy-

ing the environment. This view is superficial in the extreme, however, for it ignores the market forces and social inequalities that are driving environmental degradation. Goodland 1995 has identified the overlap among economic, social, and environmental 'sustainability', particularly the strong linkage between 'economic sustainability' and 'environmental sustainability'. It is fitting that unprecedented attention has been given to 'environmental sustainability' in recent years, given the fact that development theory has focused on matters of economic underdevelopment and poverty alleviation in developing countries, and was late in responding to unprecedented threats to the global environment. Nonetheless, it would be mistaken to conflate the doctrine of 'sustainable development' into one of achieving 'environmental sustainability'. The protection of natural systems represents not an overarching panacea for achieving economic vitality and social justice, but a necessary component of an entire system for achieving economic, social and environmental 'sustainability', in which economic reforms and social reforms are as important.

- **Important Days for Environmental Awareness :**

Name	Date	Name	Date
World Wetlands Day	February 2	World Environment Day	June 5
International Polar Bear Day	February 27	World Oceans Day	June 8
World Wildlife Day	March 3	World Population Day	July 11
Global Recycling Day	March 18	International Tiger Day	July 29
World Sparrow Day	March 20	World Lion Day	August 10
International Day of Forests	March 21	World Elephant Day	August 12
World Planting Day		National Honey Bee Day	August 22
World Water Day	March 22	International Day for Preservation of Ozone Layer	September 16
Earth Day	April 22		
Endangered Species Day	Third Friday of May	Sustainability Day	Fourth Wednesday of October
		World Soil Day	December 5

: MULTIPLE CHOICE QUESTIONS :

Q. 1 MCQs

1. The 'world environment day' is celebrated on

   (a) 15th June (b) 5th June (c) 5th January (d) 15th February

2. Short term properties of the atmosphere at a given place and time is referred as,

   (a) Climate (b) Microclimate (c) Season (d) Weather

3. Which of the following is an expel of impact of the development activities on hydrosphere ?

   (a) air pollution (b) soil pollution (c) noise pollution (d) water pollution

4. Ozone present in 'ozonosphere' protect us from
   (a) Infrared radiation (b) Ultraviolet radiations
   (c) Visible radiations (d) None of these

5. Environmental degradation is due to
   (a) rapid industrialization (b) urbanization
   (c) developmental works (d) all of the above

6. Atmosphere has major constituents of
   (a) nitrogen, oxygen, Argon (b) carbon dioxide, Nitrogen
   (c) Ozone, Methane, Nitrogen (d) Nitrogen, Oxygen, Ozone

7. The range of temperature variations in troposphere is
   (a) 200C to -560C (b) -560C to - 20C (c) -20C to 900C (d) -900 to 12000C

8. Ozonosphere exists in
   (a) Stratosphere (b) Troposphere (c) Ionosphere (d) Hydrosphere

9. The biggest pollutant receptor or sink on the earth is
   (a) Biosphere (b) Atmosphere (c) Lithosphere (d) Hydrosphere

10. The least pollutant receptor or sink on the earth is
    (a) Hydrosphere (b) Atmosphere (c) Lithosphere (d) None of these

11. The ambient lapse rate is
    (a) -50C per km (b) -9.80 per km (c) -6.50C per km (d) None of these

12. Lithosphere consists of
    (a) Crust (b) Mantle (d) Core (d) All of these

13. The layer of atmosphere which provides the ideal site for flying of jet planes is
    (a) Thermosphere (b) Stratosphere (c) Mesosphere (d) Troposphere

14. The outer soil crust of the earth is known as
    (a) Hydrosphere (b) Exosphere (c) Lithosphere (d) Mesosphere

15. Earth day is celebrated on....
    (a) 5th June (b) 12th May (c) 22nd April (d) 22nd May

16. A zone consisting of land, water and air which support life on earth is
    (a) Biosphere (b) Atmosphere (c) Lithosphere (d) Hydrosphere

17. Biosphere contains an important species which protects life on earth is
    (a) Oxygen (b) Ozone (c) Nitrogen (d) Hydrosphere

18. Which is not true ?
    (a) Lithosphere include the crust and the uppermost mantle

(b) Lithosphere underlies the stratosphere

(c) Lithosphere provides timber

(d) Lithosphere is broken into tectonic plates

19. The range of temperature variation in mesosphere is .....

(a) 200C to -560C (b) -20C to -900C (c) -560C to -20C (d) -900C to 12000C

20. Environmental degradation is due to

(a) Rapid industrialization (b) onset of different development work

(c) fast urbanization leading to deforestation (d) All of the above

21. In the atmosphere the layer above the troposphere is

(a) Stratosphere (b) Exosphere (c) Mesosphere (d) Thermosphere

22. Which of the following is not a component of physical environment ?

(a) Atmosphere (b) Hydrosphere (c) Ionosphere (d) Thermosphere

23. Troposphere has altitude range

(a) 11-50 km (b) 0-11 km (c) 20-80 km (d) 80-200 km

24. Hydrosphere denotes

(a) Water (b) plants (c) rocks and soil (d) organisms

25. Lithosphere means

(a) Air (b) Water (c) Rocks and soil (d) organisms

26. A zone consisting of land, water and air which support life is called

(a) biosphere (b) atmosphere (c) lithosphere (d) hydrosphere

27. The immediate surrounding of plants and animal is

(a) Macroclimate (b) Microclimate (c) Environment (d) Atmosphere

28. Place occupied by an organism in relation to environment is

(a) Habit (b) Habital (c) Edaphic (d) all of the above

29. Hourly and weekly change in temperature and pressure ec. Refer to

(a) Weather (b) Climate (c) nature (d) both (a) and (b)

30. Solid earth crust is known as

(a) Stratosphere (b) Hydrosphere (c) Lithosphere (d) Atmosphere

: SHORT QUESTIONS :

Q. 2 Short questions :

1. Define the term 'environment'.
2. Define environmental science.

3. Define environmental engineering.
4. What is biosphere ?
5. What is ozone layer ?
6. What are the different spheres of atmosphere ?
7. What are the constituents of atmosphere ?
8. How water is distributed on the earth ?
9. Define 'environment degradation.
10. What is anthropogenic environment ?

: LONG QUESTIONS :

Q. 3. Long questions :

1. What are the components of environment? Explain by drawing sketch.
2. Give composition of atmosphere.
3. Define : environment science, environment studies.
4. Outline the scope of environment studies.
5. What is importance of environment studies?
6. Discuss multidisciplinary nature of environmental studies.
7. Define the terms :
   - Biosphere
   - Lithosphere
   - Ozone layer
8. Write short-note on :
   - Hydrosphere
   - Lithosphere
   - Biosphere
9. Describe interation between the components of environment.
10. What is biogeochemical cycle ? Explain carbon cycle with sketch.
11. Explain nitrogen cycle with neat sketch.

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