# LORDS INSTITUTE OF ENGINEERING & TECHNOLOGY

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Estd. 2002

## Department of Science and Humanities

## Academic Year: 2023-24

## Year: I Semester: I

# QUESTION BANK

# ENVIRONMENTAL SCIENCE

## [U23CH102]

## [Common to CSE, CSD, CIVIL, MECH]


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Note: A question bank is versatile and flexible FAQs that cover the entire syllabus of a subject. It is used by students and teachers for learning and assessment purposes only.

**LORDS INSTITUTE OF ENGINEERING AND TECHNOLOGY [A]**
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| **Programme** | B. E I Semester | **Branch/ Section** | CSE, CSD & CIVIL |
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| **Name of the Course** | Environmental Sciences | **Subject Code:** | U21CH102 |

| S.N0 | UNIT-I SAQs | CO | BTL |
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| 1. | **Why is the study of environmental science interdisciplinary in nature?**<br><br>Environmental science is an interdisciplinary academic field that integrates physical and biological sciences (including, but not limited to, Ecology, Physics, Chemistry, Biology, Soil Science, Geology, Atmospheric Science, and Geography) into the study of the environment and the solution of environmental problems. Environmental science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems. Related areas of study include environmental studies and environmental engineering. Environmental studies incorporate more of the social sciences for understanding human relationships, perceptions, and policies toward the environment. Environmental engineering focuses on design and technology for improving environmental quality. Environmental scientists work on subjects like understanding earth processes, evaluating alternative energy systems, pollution control and mitigation, natural resource management, and the effects of global climate change. Environmental issues almost always involve interactions of physical, chemical, and biological processes. | CO1 | BTL2 |
| 2. | **How can public awareness and involvement help in efforts for environmental protection?**<br><br>Increasing population, urbanization, and poverty have generated pressure on natural resources and led to the degradation of the environment. To prevent the environment from further degradation, the Supreme Court has ordered and initiated environmental protection awareness through government and non-government agencies to take part in protecting our environment. | CO1 | BTL1 |

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| | Environmental pollution cannot be prevented by laws alone. Public participation is equally important in environmental protection.<br><br>Environmental Education (EE) is a process of learning that provides an overall perspective of knowledge and awareness of the environment. It sensitizes society to environmental issues and challenges interested individuals to develop the skills and expertise needed to provide appropriate solutions.<br><br>Both formal and informal education on the environment will give interested individuals the knowledge, values, skills, and tools needed to face environmental challenges on a local and global level. | | |
| 3. | **Elaborate on the importance and scope of environmental science.**<br><br>**IMPORTANCE OF ENVIRONMENTAL STUDIES:**<br>• We will begin to appreciate and adopt the idea of "DEVELOPMENT WITHOUT DESTRUCTION OF THE ENVIRONMENT."<br>• Knowledge about "VARIOUS TYPES OF ENVIRONMENTS & DIFFERENT ENVIRONMENTAL HAZARDS."<br>• Playing an effective role in protecting the environment by "DEMANDING CHANGES IN LAW AND ENFORCEMENT SYSTEMS."<br>**The scope of environmental studies includes:**<br><br>• Developing an awareness and sensitivity to the total environment and its related problems.<br>• Motivating people for active participation in environmental protection and improvement.<br>• Developing skills for active identification and development of solutions to environmental problems. | CO1 | BTL2 |
| 4. | **Write a short note on landslides.**<br><br>Landslides are the downward movement of a slope composed of earth materials, such as rock, soil, or artificial fills. Landslides are also called rockslides, debris slides, slumps, earthflows, or soil creep.<br>During construction of roads and mining activities, huge portions of mountainous, fragile areas are cut down and thrown into adjacent areas and streams. These land masses weaken the already fragile mountain slopes, leading to man-induced | CO1 | BTL1 |

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| | landslides.<br><br>**EFFECTS OF LANDSLIDES:**<br><br>Landslides increase the turbidity of nearby streams, thereby reducing their productivity.<br>Destruction of communication links.<br>Loss of habitat and biodiversity.<br>Loss of infrastructure and economic loss. | | |
| 5. | **Write a short note on the environmental effects of mining.**<br><br>Mineral extraction and processing in mines have a negative impact on the environment. Much risk is involved in the mining process because of high temperature, pressure variations, fire hazards, and a lack of ventilation in mines.<br>The mining process involves the removal of overburden of soil, ore extraction and transportation, crushing and grinding of ore, water treatment of ore, and storage of waste material. As a result of these activities, they cause air pollution, noise pollution, water pollution, the loss of wildlife habitat, the concentration of toxic substances in tailing ponds, and the spreading of dust.<br>People working in mines often suffer from serious respiratory problems and skin diseases.<br>Mining often causes ground subsidence, resulting in tilting of buildings, cracks in houses, buckling of roads, and bending of rail tracks.<br>The exploration process before mining involves geochemical and geophysical surveys, drilling activities which cause air pollution and noise pollution, and disturbance of all vegetation (flora) and fauna (animals) in that region.<br>Acid mine drainage (AMD), or acid rock drainage (ARD), is the outflow of acidic water from usually abandoned metal mines or coal mines. However, in other areas where the earth has been disturbed (e.g., construction sites, subdivisions, transportation corridors, etc.), it may also contribute to acid rock drainage in the environment. | CO1 | BTL1 |
| 6. | **Define and Classify Natural Resources.**<br><br>The word resource means a source of supply. Natural resources include water, air, soil, minerals, coal, forests, crops, and wildlife, among others. All these resources are classified based on quantity, quality, re-usability, human activity, and availability. Natural resources are naturally occurring | CO1 | BTL2 |

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| | substances that are considered valuable in their relatively unmodified (natural) form. The value of a natural resource is determined by the amount of material available and the demand for it. The term was introduced to a broad audience by E.F. Schumacher in his 1970s book "Small is Beautiful."<br>a) Renewable resources or inexhaustible resources: Renewable resources can maintain themselves or be replaced if managed wisely. These resources are constantly renewed in nature and are not likely to be lost due to excessive and unwise use.<br>Examples: Solar energy, Wind Energy, Hydro energy, Tidal energy, Biomass energy, Geothermal energy, etc.<br>b) Non-renewable resources or exhaustible resources: These resources, once used, are lost forever, as they are not restored. They include metallic minerals and fossil fuels. At current rates of usage, industrial metals may be depleted in less than a century, and petroleum and natural gas may be exhausted in 15-20 years.<br>Examples: Coal, Petrol, Gas, etc. | | |
| 7. | **Write the commercial and ecological uses of Forests. (Any Two from each)**<br><br>**Ecological Use:**<br>Ecologically, forests are to be considered as Earth's lungs because they consume CO2 and release O2, which is required for sustaining life on this earth. The poisonous gas CO2 is absorbed by the trees in forests, reducing global warming and helping to continue the hydrological cycle, and reducing soil erosion. Forest ecosystems are extremely good and hold a good quantity of water. Economically, forests provide timber, fodder for grazing animals, firewood (conventional fuel), bamboos, rubbers, medicines, gums, resins, food items, etc.<br>--> Watershed protection:<br>• Reducing the rate of surface run-off of water.<br>• Preventing flash floods and soil erosion.<br>• Producing prolonged gradual run-off and thus preventing the effects of drought.<br>--> Atmospheric regulation:<br>• Absorption of solar heat during evapo-transpiration.<br>• Maintaining carbon dioxide levels for plant growth.<br>• Maintaining local climatic conditions.<br>--> Erosion control:<br>• Holding soil (by preventing rain from directly washing soil away).<br>--> Land bank:<br>• Maintenance of soil nutrients and structure. | CO1 | BTL1 |

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| | **Commercial Use:**<br>• Local use - Consumption of forest produce by local people who collect it for subsistence – (Consumptive use)<br>• Food - gathering plants, fishing, hunting in the forest.<br>• Fodder - for cattle.<br>• Fuelwood and charcoal for cooking and heating.<br>• Poles - for building homes, especially in rural and wilderness areas.<br>• Timber – for household articles and construction.<br>• Fiber - for weaving baskets, ropes, nets, string, etc.<br>• Sericulture – for silk.<br>• Apiculture - bees for honey; forest bees also pollinate crops.<br>• Medicinal plants - traditionally used medicines; investigating them as potential sources for new modern drugs.<br><br>**Market use - (Productive use):**<br>• Most of the above products used for consumptive purposes are also sold as a source of income to support the livelihoods of forest-dwelling people.<br>• Minor forest produce - (non-wood products): Fuelwood, fruit, gum, fiber, etc., which are collected and sold in local markets as a source of income for forest dwellers.<br>• Major timber extraction - for construction, industrial uses, paper pulp, etc. Timber extraction is carried out by the Forest Department in India, but illegal logging continues in many of the forests in India and around the world. | | |
| 8. | **What causes a Landslide?**<br><br>**CAUSES OF LANDSLIDES:**<br>• Removal of vegetation - Deforestation in slopes creates soil erosion leading to landslides.<br>• Underground mining activities cause subsidence of the ground.<br>• Movement of heavy vehicles in areas with unstable slopes causes landslides.<br>• The addition of weight by construction on slopes causes landslides.<br>• Overexploitation of groundwater also leads to landslides. | CO1 | BTL1 |
| 9. | **Write a note on soil erosion and its control methods.** | CO1 | BTL2 |

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| | Soil erosion is the process of the removal of the superficial layer of soil. Soil erosion removes soil components and litter.<br><br>**Control methods:**<br>• Conservation till farming or no-till farming: Traditionally, land is ploughed to make a planting surface. This disturbs the soil and makes it susceptible to erosion. The no-till farming method makes minimal disturbance to the topsoil by making slits in the unploughed soil. Seeds, fertilizers, and water are injected into these slits.<br>• Contour farming: In this method, crops are planted in rows along contours of gently sloped land. Each row acts as a small dam to hold soil, thereby slowing water runoff.<br>• Terracing: In this method, steep slopes are converted into a series of broad terraces that run across the contour. This retains water for crops and reduces soil erosion by controlling runoff.<br>• Alley cropping or Agroforestry: This method involves planting crops in strips or alleys between rows of trees or shrubs that provide fruits and fuelwood. Hence, when the crop is harvested, the soil will not be eroded as the trees and shrubs remain on the ground, holding the soil particles. | | |
| 10. | **Write a note on Fertilizer-pesticide problems in agriculture with suitable examples.**<br><br>**Problems using fertilizers:**<br><br>1. Micronutrient imbalance: Chemical fertilizers used in modern agriculture contain Nitrogen, Phosphorus, and Potassium (N, P, K), which are macronutrients. Excessive use of fertilizers in fields causes a micronutrient imbalance. Example: Excessive use of fertilizers in Punjab and Haryana caused a deficiency of the micronutrient Zinc, thereby affecting the productivity of the soil.<br>2. Nitrate pollution: Excess Nitrogenous fertilizers applied in fields leach deep into the soil, contaminating the groundwater. If the concentration of nitrate in drinking water exceeds 25 mg/L, it leads to a fatal condition in newborn babies. This condition is termed "Blue Baby Syndrome."<br>**Problems in using Pesticides:**<br><br>In order to improve crop yield, pesticides are used indiscriminately in agriculture. Pesticides are of two types: | CO1 | |

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| | 1. First-generation pesticides that use Sulphur, Arsenic, Lead, or Mercury to kill pests.<br>2. Second-generation pesticides such as Dichloro Diphenyl Trichloroethane (DDT) used to kill pests cause many ill effects on humans, including cancer. | | |
| 11. | **Define Floods. What are the causes and effects of Floods?**<br><br>A flood is an overflow of water whenever the magnitude of the flow of water exceeds the carrying capacity of the channel within its banks.<br><br>**CAUSES OF FLOODS**<br>1. Heavy rainfall, melting of snow (ice), sudden release of water from dams often causes floods in the low-lying coastal areas.<br>2. Prolonged heavy rainfall can also cause the overflowing of lakes and rivers, resulting in floods.<br>3. Reduction in the carrying capacity of river channels due to the accumulation of sediments or obstructions built on floodways.<br>4. Deforestation, overgrazing, mining increase the runoff from rains, causing floods.<br>5. Removal of dense and uniform forest cover over the hilly zones leads to the occurrence of floods.<br>**EFFECTS OF FLOODS:**<br>Due to floods:<br>1. Water spreads in the surrounding areas and submerges them.<br>2. Plain surfaces get eroded and silted with mud and sand, thereby affecting cultivable land areas.<br>3. Extinction of civilization in some coastal areas also occurs. | CO1 | BTL2 |
| 12. | **Define Drought. What are the different types of Drought conditions?**<br><br>Drought is scarcity of water. Drought occurs due to:<br>• Inadequate rainfall<br>• Late arrival of rains and<br>• Excessive withdrawal of groundwater<br>Scarcity of water for normal needs of agriculture, livestock, industry, or human population may be termed drought.<br>Drought is understood as dry weather that persists long enough to produce a serious hydrological imbalance, leading to damage to plants, animals, and human life.<br><br>**TYPES OF DROUGHTS:** | CO1 | BTL2 |

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| | Droughts are classified into four types:<br>• Meteorological Drought occurs when the total amount of rainfall is less than 75% of normal rainfall. This drought will be severe if the rainfall is less than 50% of the normal rainfall.<br>• Hydrological Drought occurs when the total amount of rainfall is less than the average rainfall. It is generally associated with the reduction of the statistical average of water reserves available in sources such as aquifers, lakes, and reservoirs.<br>• Agricultural Drought occurs due to the shortage as well as the timing of overall rainfall. This form of drought reduces groundwater and reservoir levels and affects cropped plants.<br>• Socio-economic Drought occurs due to the reduction in the availability of food and social security of people in the affected areas. Socio-economic drought leads to famine. | | |
| 13. | **What are the different Fertilizer-pesticides problems?** (Any Two)<br><br>**Problems using fertilizers:**<br>• Micronutrient imbalance: Chemical fertilizers used in modern agriculture contain Nitrogen, Phosphorus, and Potassium (N, P, K), which are macronutrients. Excessive use of fertilizers in fields causes a micronutrient imbalance. For example, excessive use of fertilizers in Punjab and Haryana caused a deficiency of micronutrient Zinc, thereby affecting the productivity of the soil.<br>• Nitrate pollution: Excess Nitrogenous fertilizers applied in fields leach deep into the soil, contaminating the groundwater. If the concentration of nitrate in drinking water exceeds 25 mg/L, it leads to a fatal condition in newborn babies. This condition is termed "Blue Baby Syndrome."<br>• Eutrophication: The application of excess fertilizers in fields leads to the wash-off of nutrient-loaded water into nearby lakes, causing over-nourishment. This is called "Eutrophication." Eutrophication causes the lakes to be attacked by "algal blooms." Algal blooms use nutrients rapidly and grow fast. Their life is short, they die, and pollute water, thereby affecting aquatic life in the lake.<br>**Problems in using Pesticides:**<br>In order to improve crop yield, pesticides are used indiscriminately in agriculture. Pesticides are of two types: First-generation pesticides that use Sulphur, Arsenic, Lead, or Mercury to kill pests. | CO1 | BTL2 |

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| | Second-generation pesticides, such as Dichloro Diphenyl Trichloroethane (DDT), are used to kill pests. These pesticides are organic in nature. Although these pesticides protect our crops from severe losses due to pests, they have several side-effects as listed below:<br>• Death of non-target organisms: Several insecticides kill not only the target species but also several beneficial non-target organisms.<br>• Pesticide resistance: Some pests that survive the pesticide generate highly resistant generations that are immune to all kinds of pesticides. These pests are called "superpests."<br>• Bio-magnification: Most pesticides are non-biodegradable and accumulate in the food chain. This is called bio-accumulation or bio-magnification. These pesticides, in a bio-magnified form, are harmful to human beings.<br>• Risk of cancer: Pesticides enhance the risk of cancer in two ways. They act as a carcinogen and indirectly suppress the immune system. | | |
| 14. | **Write a note on the uses of Forest Resources.**<br>**(**Any Two)<br><br>**USES OF FOREST:**<br><br>--> Watershed protection:<br>• Reduce the rate of surface run-off of water.<br>• Prevent flash floods and soil erosion.<br>• Produce prolonged gradual run-off and thus prevent the effects of drought.<br><br>--> Atmospheric regulation:<br>• Absorption of solar heat during evapotranspiration.<br>• Maintaining carbon dioxide levels for plant growth.<br>• Maintaining the local climatic conditions.<br><br>--> Erosion control:<br>• Holding soil (by preventing rain from directly washing soil away).<br><br>--> Land bank:<br>• Maintenance of soil nutrients and structure.<br><br>--> Local use - Consumption of forest produce by local people who collect it for subsistence – (Consumptive use):<br>• Food - gathering plants, fishing, hunting from the forest. (In the past when wildlife was plentiful, people could | CO1 | BTL1 |

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| | hunt and kill animals for food. Now those populations of most wildlife species have diminished; continued hunting would lead to extinction.)<br>• Fodder - for cattle.<br>• Fuelwood and charcoal for cooking, heating.<br>• Poles - building homes especially in rural and wilderness areas.<br>• Timber – household articles and construction.<br>• Fiber - weaving of baskets, ropes, nets, string, etc.<br>• Sericulture – for silk.<br>• Apiculture - bees for honey, forest bees also pollinate crops.<br>• Medicinal plants - traditionally used medicines, investigating them as a potential source for new modern drugs.<br><br>--> Market use - (Productive use):<br>• Most of the above products used for consumptive purposes are also sold as a source of income for supporting the livelihoods of forest-dwelling people.<br>• Minor forest produce - (non-wood products): Fuelwood, fruit, gum, fiber, etc., which are collected and sold in local markets as a source of income for forest dwellers.<br>• Major timber extraction - construction, industrial uses, paper pulp, etc. Timber extraction is done in India by the Forest Department, but illegal logging continues in many of the forests of India and the world. | | |
| 15. | **What are the effects of deforestation on tribal people?**<br><br>Deforestation is the permanent destruction of indigenous forests and woodlands. The term does not include the removal of industrial forests, such as plantations of gums or pines. Deforestation has resulted in the reduction of indigenous forests to four-fifths of their pre-agricultural area. Indigenous forests now cover 21% of the earth's land surface. Deforestation refers to the loss of forest cover or the aimless destruction of trees. The clearing of forests across the earth has been occurring on a large scale for many centuries. This process involves the cutting down, burning, and damaging of forests. Currently, 12 million hectares of forests are cleared annually, and if the current rate of deforestation continues, the world's forests will vanish within the next 100 years; about 80% of the original forests on the earth have already been cleared.<br>Dam building has resulted in a wide range of human rights violations. Rehabilitation policy of the government is important and typical when most of the displaced persons are tribal | CO1 | BTL2 |

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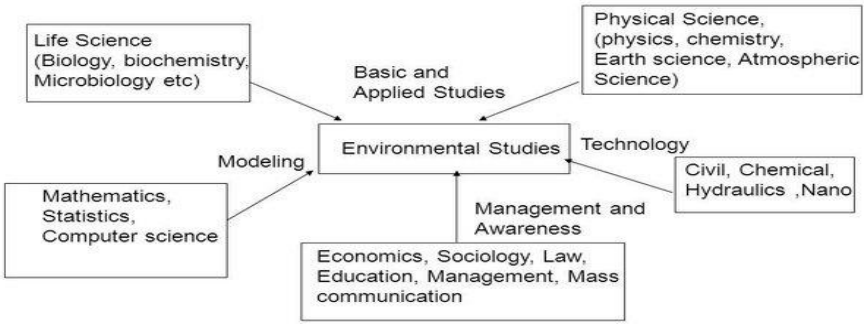
| | people. Tribal life and culture are mostly associated with the forest. | | |
| | **UNIT-I LAQs** | CO1 | **BTL** |
| 16. | **Explain in detail the multi-disciplinary nature of environmental science.**<br><br>Environmental science is an interdisciplinary academic field that integrates physical and biological sciences (including, but not limited to, Ecology, Physics, Chemistry, Biology, Soil Science, Geology, Atmospheric Science, and Geography) into the study of the environment and the solution of environmental problems. Environmental science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems. Related areas of study include environmental studies and environmental engineering.<br>Environmental studies incorporate more of the social sciences for understanding human relationships, perceptions, and policies towards the environment. Environmental engineering focuses on design and technology for improving environmental quality.<br>Environmental scientists work on subjects like the understanding of earth processes, evaluating alternative energy systems, pollution control and mitigation, natural resource management, and the effects of global climate change.<br>Environmental issues almost always involve an interaction of physical, chemical, and biological processes.<br><br>**The multidisciplinary nature of environmental science is illustrated in following diagram**<br><br>  <br> | CO1 | BTL2 |
| 17. | **What are the advantages and disadvantages of Dams?**<br><br>Dams are built across rivers to store water for irrigation, hydroelectric power generation, and flood control. The dams | CO1 | BTL1 |

built to serve more than one purpose are called "multi-purpose dams." These dams were called the "temples of modern India" by the country's first Prime Minister, Jawaharlal Nehru.
Today, there are more than 45,000 large dams around the world, which play an important role in communities and economies that harness these water resources for their economic development. Current estimates suggest some 30-40% of irrigated land worldwide relies on dams. Hydropower, another contender for the use of stored water, currently supplies 19% of the world's total electric power supply and is used in over 150 countries. The world's two most populous countries, China and India, have built around 57% of the world's large dams.

**Advantages of Dams:**

- Dams are built to control floods and store floodwater.
- Sometimes dams are used for diverting part or all of the water from a river into a channel.
- Dams are used mainly for drinking and agricultural purposes.
- Dams are built for generating electricity.
- Dams are used for recreational purposes.
- Navigation and fishery can be developed in the dam areas.

**Disadvantages of Dams:**

Dams may face problems upstream or downstream as listed below:

*Upstream problems:*

- Displacement of tribal people.
- Loss of non-forest land.
- Loss of forests, flora, and fauna.
- Landslides, sedimentation, and siltation occur.
- Stagnation and waterlogging around reservoirs retard plant growth.
- Breeding of vectors and vector-borne diseases.
- Reservoir-Induced Seismicity (RIS) causes earthquakes.
- Navigation and aquaculture activities can be developed in the dam area.

*Downstream problems:*

- Waterlogging and salinity due to overirrigation.
- Reduced water flow and silt deposition in rivers.
- Salt intrusion at river mouth.
- Since the sediments carrying nutrients get deposited in the reservoir, the fertility of the land along the river gets reduced.
- Due to structural defects or faulty design of the dam, it may cause sudden dam failure leading to collapse and

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| | destruction of life and property. | | |
| 18. | **Explain in detail the use and overutilization of surface and groundwater resources.**<br><br>Water is the most abundant, inexhaustible renewable resource. It covers 70% of the globe in the form of oceans, rivers, lakes, etc. Of this 70%, only 3% is available as freshwater. From this 3%, roughly 2% is frozen in polar ice caps, and only a fraction of the remaining 1% is used as drinking water (potable). 90% of the water is utilized for agricultural purposes in India.<br><br>**USE OF SURFACE AND GROUNDWATER:**<br>**Consumptive use:** In such uses, water is completely utilized and cannot be reused. Ex: Domestic, industrial, and irrigation.<br>**Non-consumptive use:** In such uses, water is not completely utilized and is reused. Ex: Hydropower plant.<br><br>**Other uses:**<br>• Water is used for domestic purposes like drinking, bathing, cooking, washing, etc.<br>• Water is used in commercial establishments like hotels, theaters, educational institutions, offices, etc.<br>• Almost 60-70% of freshwater is used for irrigation.<br>• 20-30% of water is used for industrial operations by refineries, iron & steel industries, paper & pulp industries, etc.<br>• Water plays a key role in sculpting the earth's surface, moderating climate, and diluting pollutants.<br><br>**OVER-UTILIZATION OF SURFACE & GROUNDWATER:**<br>The rapid increase in population and industrial growth led to severe demand on water resources. After using all available surface water resources to the maximum, human beings began using groundwater to meet their needs.<br>1. The increased extraction of groundwater far in excess of the natural recharge led to decreased groundwater levels. The erratic and inadequate rainfall caused a reduction in the storage of water in reservoirs. This also led to a decrease of groundwater.<br>2. Building construction activities seal the permeable soil zone and reduce the area for percolation of rainwater, thereby increasing surface runoff.<br>3. If groundwater withdrawal rates are higher than recharge rates, sediments in aquifers get compacted, resulting in the sinking of the overlaying land surface. This is called land subsidence, which leads to structural damage in buildings, fractures in pipes, and reverses the flow of | CO1 | BTL2 |

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| | canals, leading to tidal flooding.<br>4. Overutilization of groundwater in arid and semi-arid regions for agriculture disturbs the equilibrium of the reservoir in the region, causing problems like lowering of the water table and decreased pressure in aquifers, coupled with changes in the speed and direction of water flow.<br>5. Overutilization of groundwater in coastal areas leads to the rapid intrusion of saltwater from the sea, thereby rendering it unusable for drinking and agriculture.<br>6. Over-utilization of groundwater leads to a decrease in water levels, causing earthquakes, landslides, and famine.<br>7. Over-utilization of groundwater leads to the drying-up of dug wells as well as bore wells.<br>8. Due to the excess use of groundwater near agricultural fields, agricultural water that contains nitrogen as a fertilizer percolate rapidly and pollutes the groundwater, thereby rendering the water unfit for potable use by infants (Nitrate concentration exceeding 45 mg/L). | | |
| 19. | **Explain in detail about Forest Resources.**<br><br>Forests are one of the most important natural resources and a part of the biosphere since these are natural assets on this earth. Forests are predominantly composed of trees, shrubs, woody vegetation, etc. Approximately 1/3rd of the earth's total land area is covered by forests. Forests are important ecologically and economically. Ecologically, forests are to be considered as the earth's lungs because they consume CO2 and release O2, which is required for sustaining life on this earth. The poisonous gas CO2 is absorbed by the trees of forests and reduces global warming and helps to continue the hydrological cycle, reducing soil erosion. Forest ecosystems are extremely good and hold a good quantity of water.<br>Economically, forests provide timber, fodder to grazing animals, firewood (conventional fuel), bamboos, rubbers, medicines, gums, resins, food items, etc.<br><br>**USES OF FOREST:**<br>**Watershed protection:**<br>• Reduce the rate of surface run-off of water.<br>• Prevent flash floods and soil erosion.<br>• Produce prolonged gradual run-off and thus prevent the effects of drought.<br>**Atmospheric regulation:**<br>• Absorb solar heat during evapo-transpiration.<br>• Maintain carbon dioxide levels for plant growth.<br>• Maintain the local climatic conditions. | CO1 | BTL2 |

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| | **Erosion control:**<br>• Hold soil (by preventing rain from directly washing soil away).<br>**Land bank:**<br>• Maintain soil nutrients and structure.<br><br>**Local use - Consumption of forest produce by local people who collect it for subsistence – (Consumptive use):**<br>• Food - gathering plants, fishing, hunting from the forest. (In the past when wildlife was plentiful, people could hunt and kill animals for food. Now those populations of most wildlife species have diminished; continued hunting would lead to extinction.)<br>• Fodder - for cattle.<br>• Fuelwood and charcoal for cooking, heating.<br>• Poles - building homes, especially in rural and wilderness areas.<br>• Timber – household articles and construction.<br>• Fiber - weaving of baskets, ropes, nets, string, etc.<br>• Sericulture – for silk.<br>• Apiculture - bees for honey, forest bees also pollinate crops.<br>• Medicinal plants - traditionally used medicines, investigating them as potential sources for new modern drugs.<br><br>**Market use - (Productive use):**<br>• Most of the above products used for consumptive purposes are also sold as a source of income for supporting the livelihoods of forest-dwelling people.<br>• Minor forest produce - (non-wood products): Fuelwood, fruit, gum, fiber, etc., which are collected and sold in local markets as a source of income for forest dwellers.<br>• Major timber extraction - construction, industrial uses, paper pulp, etc. Timber extraction is done in India by the Forest Department, but illegal logging continues in many of the forests of India and the world. | | |
| 20. | **Give a detailed explanation about modern agricultural practices and their effects.**<br><br>Agriculture is an art, science, and industry of managing the growth of plants and animals for human use. Agriculture includes the preparation of soil for cultivation of crops, harvesting crops, breeding and raising livestock, dairying, and forestry. | CO1 | BTL2 |

**MODERN AGRICULTURE:**
Modern agriculture makes use of hybrid seeds of a single crop variety, technologically advanced equipment, fertilizers, pesticides, and water to produce large amounts of a single crop.

**Problems using fertilizers:**

1. **Micronutrient imbalance:** Chemical fertilizers used in modern agriculture contain Nitrogen, Phosphorus, and Potassium (N, P, K), which are macronutrients. Excessive use of fertilizers in fields causes a micronutrient imbalance. For example, excessive use of fertilizers in Punjab and Haryana caused a deficiency of micronutrient Zinc, thereby affecting the productivity of the soil.
2. **Nitrate pollution:** Excessive Nitrogenous fertilizers applied in fields leach deep into the soil, contaminating the groundwater. If the concentration of nitrate in drinking water exceeds 25 mg/L, it leads to a fatal condition in newborn babies. This condition is termed "Blue Baby Syndrome."
3. **Eutrophication:** The application of excess fertilizers in fields leads to the wash-off of nutrient-loaded water into nearby lakes, causing over-nourishment. This is called "Eutrophication." Eutrophication causes the lakes to be attacked by "algal blooms." Algal blooms use nutrients rapidly and grow fast. Their life is short, they die, and pollute water, thereby affecting aquatic life in the lake.
4. The excessive use of pesticides enters the food chain and becomes hazardous to human life.
5. A large area of fertile land has become saline in recent years due to excessive irrigation.
6. Consumption of fuel energy is more when shifting of human and animal labor to agricultural machinery. Use of fuel leads to air pollution.
7. Continuing to increase input of fertilizers, water, and pesticides eventually produces no additional increase in crop yield but slows down the productivity of the crop.
8. Due to increased irrigation, the underground aquifers are slowly and constantly becoming dry. The rate at which they are being depleted is much faster than its recharge.
9. Excessive application of chemical fertilizers can increase soil salt content. The percolation of domestic and industrial sewage also increases the salinity of the soil.
10. The stagnation of water in the soil in the upper layers causes waterlogging, which causes less oxygen availability for respiration of plants.

**Problems in using Pesticides:**

In order to improve crop yield, pesticides are used

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| | indiscriminately in agriculture. Pesticides are of two types:<br>**First-generation pesticides** that use Sulphur, Arsenic, Lead, or Mercury to kill pests.<br>**Second-generation pesticides** such as Dichloro Diphenyl Trichloroethane (DDT) used to kill pests. These pesticides are organic in nature. Although these pesticides protect our crops from severe losses due to pests, they have several side-effects as listed below:<br>• Death of non-target organisms: Several insecticides kill not only the target species but also several beneficial non-target organisms.<br>• Pesticide resistance: Some pests that survive the pesticide generate highly resistant generations that are immune to all kinds of pesticides. These pests are called "super pests."<br>• Bio-magnification: Most pesticides are non-biodegradable and accumulate in the food chain. This is called bio-accumulation or bio-magnification. These pesticides, in a bio-magnified form, are harmful to human beings.<br>• Risk of cancer: Pesticides enhance the risk of cancer in two ways.<br>• It acts as a carcinogen.<br>• It indirectly suppresses the immune system.<br>**Modern, intensive agriculture causes many problems, including the following:**<br>• Artificial fertilizers and herbicides are easily washed from the soil and pollute rivers, lakes, and watercourses.<br>• The prolonged use of artificial fertilizers results in soils with a low organic matter content, which is easily eroded by wind and rain.<br>• Dependency on fertilizers. Greater amounts are needed every year to produce the same yields of crops.<br>• Artificial pesticides can stay in the soil for a long time and enter the food chain where they build up in the bodies of animals and humans, causing health problems.<br>• Artificial chemicals destroy soil micro-organisms, resulting in poor soil structure and aeration, and decreasing nutrient availability.<br>• Pests and diseases become more difficult to control as they become resistant to artificial pesticides. The numbers of natural enemies decrease because of pesticide use and habitat loss. | | |
| 21. | **Give a detailed explanation of droughts. What are the different types of droughts?** | CO1 | BTL3 |

Drought is scarcity of water. Drought occurs due to:
inadequate rainfall
late arrival of rains and
excessive withdrawal of groundwater
Scarcity of water for normal needs of agriculture, livestock, industry, or human population may be termed as drought.
Drought is understood as dry weather, which persists long enough to produce a serious hydrological imbalance, leading to damage of plants, animals, and human life.

**TYPES OF DROUGHTS:**

Droughts are classified into four types:

1. Meteorological Drought occurs when the total amount of rainfall is less than 75% of normal rainfall. This drought will be severe if the rainfall is less than 50% of the normal rainfall.
2. Hydrological Drought occurs when the total amount of rainfall is less than the average rainfall. It is generally associated with a reduction of the statistical average of water reserves available in the source such as aquifers, lakes, and reservoirs.
3. Agricultural Drought occurs due to the shortage as well as the timing of overall rainfall. This form of drought reduces groundwater and reservoir levels. Agricultural Drought affects cropped plants.
4. Socio-economic Drought occurs due to the reduction in the availability of food and social security of people in the affected areas. Socio-economic drought leads to famine.

**CAUSES OF DROUGHT:**

1. When annual rainfall is below normal and less than evaporation, drought occurs.
2. High population also leads to drought. Population growth leads to poor land use and worsens the situation.
3. Intensive cropping patterns and over-exploitation of scarce water resources by digging wells or bore-wells for high productivity have turned drought-prone areas into deserts. For example, overexploitation of water resources for sugarcane in Maharashtra has prevented the state from drought recovery for the past 30 years.
4. Deforestation leads to desertification and drought. Deforestation exposes the topsoil to erosion by heavy rains, wind, and the sun. Thus, the top layer of soil rich in nutrients gets washed away, making the soil unproductive. Eroded soils exhibit a droughty tendency.

**EFFECTS OF DROUGHT:**

1. Drought causes hunger, malnutrition, and a scarcity of drinking water. It also degrades the quality of drinking water.

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| | 2. Drought causes widespread crop failures, leading to an acute shortage of food, thereby adversely affecting human and livestock populations.<br>3. Drought indicates the initiation of desertification.<br>4. Raw materials for agro-based industries are critically affected during drought, thereby retarding industrial and commercial growth.<br>5. Drought accelerates the degradation of natural resources.<br>6. Drought leads to large-scale migration to urban areas, thereby creating slums.<br>**DROUGHT MANAGEMENT:**<br>1. Indigenous knowledge in controlling droughts and desertification is very useful for dealing with drought problems.<br>2. Rainwater harvesting programs are very useful techniques used to conserve water and control drought.<br>3. Construction of large-capacity reservoirs is essential in drought-prone areas.<br>4. A modern irrigation technique (drip irrigation) is a very useful method to conserve water and avoid wastage.<br>5. Afforestation activities improve the potential of water in drought-prone areas.<br>6. Mixed cropping and dry farming are suitable methods that minimize the risk of crop failure in dry and drought-prone areas. | | |
| 22. | **Elaborate on renewable energy resources.**<br><br>Renewable energy sources are natural resources that can be regenerated continuously and are inexhaustible. They can be repeatedly used.<br><br>**SOLAR ENERGY:**<br>The energy that we get directly from the sun is called solar energy. Nuclear fusion occurring in the sun releases an enormous amount of energy in the form of heat and light. Several techniques are available for collecting, converting, and using solar energy.<br><br>**METHODS OF HARVESTING SOLAR ENERGY**<br>Listed below are the various devices used to harvest solar energy.<br>1. Solar cells or Photovoltaic cells or PV cells: Solar cells consist of a p-type semiconductor (Silicon doped with Boron) and n-type semiconductor (Silicon doped with Phosphorus) in close contact with each other. When solar rays fall on the top p-type semiconductor, the electrons from the valence band move to the conduction band and cross the p-type junction into the n-type semiconductor. A potential difference is created, causing an electric current | CO1 | BTL2 |

to flow. These cells are widely used in calculators, electronic watches, streetlights, water pumps, radio, and television.

2. Solar battery: When several solar cells are connected in series, it forms a solar battery. These solar batteries generate enough electricity to run water pumps, streetlights, etc. They are mainly used in remote areas where the electricity supply is a problem.
3. Solar heat collectors: Solar heat collectors consist of natural materials like stones, bricks, or materials like glass, which absorb heat during the daytime and release it slowly at night. It is generally used in cold places where houses are kept in hot condition using solar heat collectors.
4. Solar water Heaters: It consists of an insulated box, in which is painted black on the inside. It is provided with a glass lid to receive and store solar heat. The box contains a copper coil painted in black through which cold water flows in, gets heated in the copper coil, and flows into a storage tank. Finally, water from storage tanks is supplied.
5. Solar energy is currently used to power satellites, watches, calculators, etc.
6. A few applications of solar energy are: (i) solar water heater, (ii) solar cooker, (iii) solar dryer, and (v) solar refrigerator.

**WIND ENERGY:**

Wind is defined as moving air. Energy recovered from the force of the wind is called wind energy. Wind energy is harnessed using windmills.

1. Windmills: The force of blowing wind strikes the blades of the windmill, thereby causing it to rotate continuously. This rotational energy of the blades is used to drive several machines like water pumps, flour mills, and electric generators.
2. Wind farms: Several windmills joined together in a definite pattern form a wind farm. Wind farms generate large amounts of electricity.

CONDITION- The minimum speed required for the satisfactory working of a wind generator is 15 kmph.

**ADVANTAGES:**

It does not cause any air pollution.
It is very cheap.

**OCEAN ENERGY:**

The ocean can be used for generating electricity.

1. Tidal energy: Ocean tides produced by the virtue of the

gravitational force of the sun and moon possess enormous amounts of energy. Tidal energy can be harnessed by constructing a tidal barrage.

2. During high tide, seawater is allowed to flow into the reservoir of the barrage and rotate the turbine, thereby producing electricity.
3. During low tide, when sea level is low, seawater stored in the barrage reservoir is allowed to flow into the sea, thereby rotating the turbine again.
4. Ocean thermal energy: There is a large temperature difference between the surface level and deepwater level of tropical oceans. This temperature difference can be utilized to generate electricity. This energy is called ocean thermal energy. A necessary condition is that a temperature difference of at least 20C is required between surface water and deep water. The technique used here is that the relatively hot surface temperature of the ocean is used to boil a low-boiling liquid like ammonia. The high vapor pressure of the liquid formed by boiling is used to turn the blades in a turbine and generate electricity. The cool waters in the deep sea are used to cool and condense the vapor into liquid.

**Geothermal energy:**

The temperature of the earth increases at the rate of 20 - 75C per km. Down below the earth's surface, high pressure and high-temperature steam fields exist in many places. The energy harnessed from high temperature present inside the earth's surface is called geothermal energy.

1. Natural Geysers: In some places, steam comes out of the ground through cracks naturally in the form of natural geysers.
2. Artificial Geysers: Sometimes, a hole is drilled up to the hot region, and by sending a pipe in it, the steam is made to rush out through the pipe with very high pressure.

The steam coming out of natural or artificial geysers is made to rotate the turbine of a generator to produce electricity.

**BIOMASS ENERGY:**

Biomass is organic matter produced by plants or animals. It is used as a source of energy. Biomass is generally burnt for heating, cooling, and industrial purposes.

Examples: wood, crop residues, seeds, cattle dung, sewage, agricultural wastes, etc. Biomass may be converted into energy in any of the following types.

1. Biogas: Biogas is a mixture of gases such as methane, carbon dioxide, hydrogen sulfide, etc. It contains about 65% of methane gas as a major constituent. Biogas is

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| | obtained by the anaerobic fermentation of animal dung or plant wastes in the presence of water.<br>2. Biofuels: Biofuels are the fuels obtained by the fermentation of biomass. Examples are Ethanol, Methanol.<br>i. Ethanol: Ethanol can be produced by sugarcane. Its calorific value is less when compared to petrol and therefore produces much less heat than petrol.<br>ii. Methanol: Methanol can be easily obtained from ethanol or sugar-containing plants. Its calorific value is also too low when compared to gasoline and petrol.<br>iii. Gasohol: Gasohol is a mixture of ethanol and gasoline.<br>3) Hydrogen fuel: Hydrogen can be produced by thermal dissociation or photolysis or electrolysis of water. It possesses high calorific value. It is non-polluting as the product of combustion is water. | | |
| 23. | **Elaborate on non-renewable energy resources.**<br><br>Coal: Coal is a solid fossil fuel formed in several stages as buried remains of land plants that lived 300-400 million years ago and were subjected to intense heat and pressure over millions of years.<br><br>Various stages of coal:<br><br>The various stages of coal during the formation of coal from wood are: wood, peat, lignite, bituminous, and anthracite.<br><br>The carbon content of anthracite is 90%, and its calorific value is 8700 kcal. The carbon content of bituminous coal, lignite, and peat are 80%, 70%, and 60%, respectively. India has approximately 5% of the world's coal. However, it is not of good quality as it has poor heating capacity.<br><br>**Disadvantages of using coal:**<br><br>1. Burning coal produces carbon dioxide, which is the main cause of global warming.<br>2. Coal contains impurities like sulfur and nitrogen which produce toxic gases when burnt.<br><br>Petroleum: Petroleum or crude oil is a thick liquid consisting of more than 100 combustible hydrocarbons with small amounts of S, O, and N as impurities. Fossil fuels are mainly formed by the decomposition of dead plants and animals that were buried under lakes and oceans at a high temperature and pressure for millions of years. From the crude petroleum oil, various hydrocarbons are separated by fractional distillation of crude | CO1 | BTL2 |

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| | petroleum oil. At the present rate of usage, the world's crude oil reserves are expected to get over in the next 30 years.<br><br>**LIQUEFIED PETROLEUM GAS (LPG)**<br><br>The petroleum gas obtained during cracking and fractional distillation can be easily converted into liquid under high pressure as LPG. LPG is a colorless, odorless gas to which mercaptans are added to produce a foul smell that aids in detection of LPG leaks.<br><br>**NATURAL GAS**:<br><br>1. Natural gas is found above the oil in an oil well. It is a mixture of 50-90% methane and small amounts of other hydrocarbons. Its calorific value ranges between 12,000 and 14,000 kcal/m3.<br>2. Dry gas: Natural gas containing low hydrocarbons like ethane, it is called dry gas.<br>3. Wet gas: Natural gas containing high hydrocarbons like propane and butane along with methane is called wet gas.<br><br>Natural gas is formed by the decomposition of dead plants and animals buried under oceans at high temperature and pressure for millions of years.<br><br>**NUCLEAR ENERGY**:<br><br>Dr. Homi Bhabha was the father of nuclear power development in India. India has 10 nuclear reactors that produce 2% of India's electricity. Nuclear energy is produced by two types of reactions:<br><br>1. Nuclear fission: Nuclear fission is a nuclear chain reaction in which the heavy nucleus is split into lighter nuclei by fast-moving neutrons, thereby releasing a large amount of energy. Example: Fission of Uranium-235.<br>2. Nuclear fusion: Nuclear fusion is a nuclear chain reaction in which lighter nuclei are combined together at extremely high temperatures to form heavy nuclei, thereby releasing a large amount of energy. Example: Fusion of deuterium atoms to form helium with the release of a large amount of energy. | | |
| 24. | **Give a detailed explanation about the different pesticides used and their effects in modern agricultural practices.** | CO1 | BTL3 |

Agriculture is an art, science, and industry of managing the growth of plants and animals for human use. Agriculture includes preparation of soil for cultivation of crops, harvesting crops, breeding and raising livestock, dairying, and forestry.

**MODERN AGRICULTURE:**

Modern agriculture makes use of hybrid seeds of single crop variety, technologically advanced equipment, fertilizers, pesticides, and water to produce large amounts of single crop.

**Problems using fertilizers:**

- Micronutrient imbalance: Chemical fertilizers used in modern agriculture contain Nitrogen, Phosphorus, and Potassium (N, P, K), which are macronutrients. Excess use of fertilizers in fields causes micronutrient imbalance. For example, excessive use of fertilizers in Punjab and Haryana caused a deficiency of micronutrient Zinc, thereby affecting productivity of the soil.
- Nitrate pollution: Excess Nitrogenous fertilizers applied in fields leach deep into the soil, contaminating the groundwater. If the concentration of nitrate in drinking water exceeds 25 mg/L, it leads to a fatal condition in newborn babies. This condition is termed "Blue Baby Syndrome."
- Eutrophication: The application of excess fertilizers in fields leads to the wash-off of the nutrient-loaded water into nearby lakes, causing over-nourishment. This is called "Eutrophication." Eutrophication causes the lakes to be attacked by "algal blooms." Algal blooms use nutrients rapidly and grow fast. Their life is short; they die and pollute water, thereby affecting aquatic life in the lake.
- The excessive use of pesticides enters the food chain and becomes hazardous to human life.
- A large area of fertile land has become saline in recent years due to excessive irrigation.
- Consumption of fuel energy is more when shifting human and animal labor to agriculture machinery. The use of fuel leads to air pollution.
- Continuing to increase input of fertilizers, water, and pesticides eventually produces no additional increase in crop yield but slows down the productivity of the crop.
- Due to increased irrigation, the underground aquifers are slowly and constantly becoming dry. The rate at which they are being depleted is much faster than their recharge.
- Excessive application of chemical fertilizers can increase

soil salt content. The percolation of domestic and industrial sewage also increases the salinity of the soil.

- The stagnation of water in the soil in the upper layers causes waterlogging, which causes less oxygen availability for respiration of plants.

**Problems in using Pesticides:**

In order to improve crop yield, pesticides are used indiscriminately in agriculture. Pesticides are of two types:

- First-generation pesticides that use Sulphur, Arsenic, Lead, or Mercury to kill pests.
- Second-generation pesticides, such as Dichloro Diphenyl Trichloroethane (DDT), are used to kill pests. These pesticides are organic in nature. Although these pesticides protect our crops from severe losses due to pests, they have several side-effects as listed below:
- Death of non-target organisms: Several insecticides kill not only the target species but also several beneficial non-target organisms.
- Pesticide resistance: Some pests that survive the pesticide generate highly resistant generations that are immune to all kinds of pesticides. These pests are called "super pests."
- Biomagnification: Most pesticides are non-biodegradable and accumulate in the food chain. This is called bio-accumulation or biomagnification. These pesticides, in a bio-magnified form, are harmful to human beings.
- Risk of cancer: Pesticides enhance the risk of cancer in two ways. It acts as a carcinogen, and it indirectly suppresses the immune system.

Modern, intensive agriculture causes many problems, including the following:

- Artificial fertilizers and herbicides are easily washed from the soil and pollute rivers, lakes, and watercourses.
- The prolonged use of artificial fertilizers results in soils with a low organic matter content, which is easily eroded by wind and rain.
- Dependency on fertilizers: Greater amounts are needed every year to produce the same yields of crops.
- Artificial pesticides can stay in the soil for a long time and enter the food chain, where they build up in the bodies of animals and humans, causing health problems.
- Artificial chemicals destroy soil micro-organisms, resulting in poor soil structure and aeration and decreasing nutrient availability.
- Pests and diseases become more difficult to control as they become resistant to artificial pesticides. The numbers of natural enemies decrease because of pesticide

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| | use and habitat loss. | | |
| 25. | **Write a detailed note on Land as a resource and Land degradation.**<br><br>Land is a very valuable resource. It provides food, fiber, wood, medicine, and other biological materials needed for food. Soil is a mixture of inorganic materials (rocks and minerals) and organic materials (dead materials and plants). Topsoil is classified as a renewable resource as it is continuously regenerated by natural processes at a very slow rate. However, if the rate of erosion is faster than the rate of renewal, the soil becomes a non-renewable resource.<br><br>**Uses of land resources:**<br><br>• Land provides food, wood, minerals, etc.<br>• Land nurtures plants and animals that provide us food and shelter.<br>• Land may be used as a watershed or reservoir.<br>• Land acts as a dustbin for the wastes generated by modern society.<br>• Land is used for constructing buildings and industries.<br>**LAND DEGRADATION**<br><br>Land degradation is the process of deterioration of soil or loss of fertility of soil.<br><br>**EFFECTS OF LAND DEGRADATION:**<br><br>• Soil texture and structure are deteriorated.<br>• Loss of soil fertility due to the loss of valuable nutrients.<br>• Increase in waterlogging, salinity, alkalinity, and acidity problems.<br>• Loss at a social, economic, and biodiversity level.<br>**CAUSES OF LAND DEGRADATION:**<br><br>• Population: With the increase in population, more land is needed for producing food, fiber, and fuel wood, leading to increasing pressure on the limited land resources. Therefore, the land gets degraded due to overexploitation.<br>• Urbanization: Increased urbanization due to population growth reduces the agricultural land. To compensate for the loss of agricultural land, new lands comprising natural ecosystems such as forests are cleared. | CO1 | BTL2 |

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| | Therefore, urbanization leads to deforestation, which, in turn, affects millions of plant and animal species.<br>• Fertilizers and Pesticides: Increased application of fertilizers and pesticides are needed to increase farm output in new lands, thereby leading to pollution of land, water, and soil degradation.<br>• Damage to topsoil: Increase in food production generally leads to damage of topsoil through nutrient depletion.<br>• Water-logging, soil erosion, salination, and contamination of the soil with industrial waste cause land degradation. | | |
| 26. | **Explain in detail the methods of harvesting solar energy.**<br><br>**METHODS OF HARVESTING SOLAR ENERGY:**<br>Listed below are the various devices used to harvest solar energy.<br><br>1. **Solar cells or Photovoltaic cells or PV cells:** Solar cells consist of a p-type semiconductor (Silicon doped with Boron) and n-type semiconductor (Silicon doped with Phosphorus) in close contact with each other. When solar rays fall on the top p-type semiconductor, the electrons from the valence band move to the conduction band and cross the p-type junction into the n-type semiconductor. A potential difference is created, causing an electric current to flow. These cells are widely used in calculators, electronic watches, streetlights, water pumps, radio, and television.<br>2. **Solar battery:** When several solar cells are connected in series, it forms a solar battery. These solar batteries generate enough electricity to run water pumps, streetlights, etc. They are mainly used in remote areas where electricity supply is a problem.<br>3. **Solar heat collectors:** Solar heat collectors consist of natural materials like stones, bricks, or materials like glass, which absorb heat during the daytime and release it slowly at night. It is generally used in cold places where houses are kept in hot conditions using solar heat collectors.<br>4. **Solar water Heaters:** It consists of an insulated box, in which is painted black on the inside. It is provided with a glass lid to receive and store solar heat. The box contains a copper coil painted in black through which cold water flows in, gets heated in the copper coil, and flows into a storage tank. Finally, water from storage tanks is supplied.<br>5. Solar energy is currently used to power satellites, | CO1 | BTL2 |

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| | watches, calculators, etc.<br>6. A few applications of solar energy are: (i) solar water heater, (ii) solar cooker, (iii) solar dryer, and (iv) solar refrigerator. | | |
| 27. | **Explain the different National and International conflicts over water resources.**<br>Water conflict is a term describing a conflict between countries, states, or groups over access to water resources. The United Nations recognizes that water disputes result from opposing interests of water users, public or private.<br>A wide range of water conflicts appear throughout history, though rarely are traditional wars waged over water alone. Instead, water has historically been a source of tension and a factor in conflicts that start for other reasons. However, water conflicts arise for several reasons, including territorial disputes, a fight for resources, and strategic advantage.<br>These conflicts occur over both freshwater and saltwater and between international boundaries. However, conflicts occur mostly over freshwater; because freshwater resources are necessary, yet limited, they are the center of water disputes arising out of the need for potable water. As freshwater is a vital, yet unevenly distributed natural resource, its availability often impacts the living and economic conditions of a country or region. The lack of cost-effective water desalination techniques in areas like the Middle East, among other elements of water crises, can put severe pressures on all water users.<br>According to the 1992 International Conference on Water and the Environment, water is a vital element for human life, and any human activity relates somehow to water. Unfortunately, it is not a renewable resource, and in the future, it "might get worse with climate change."<br>Water conflicts occur because the demand for water resources and potable water extends far beyond the amount of water actually available. Elements of a water crisis may put pressures on affected parties to obtain more of a shared water resource, causing diplomatic tension or outright conflict.<br>Water is essential for our existence and is fast becoming scarce. Rapidly increasing population and limited water resources give rise to conflicts over water.<br>**Conflict through use:** Unequal distribution of water leads to inter-state or international disputes.<br>**Examples:**<br>**--> International conflicts:**<br>▪ Conflict over water from the Indus between India and Pakistan.<br>▪ Conflict over water from the Colorado River between Mexico and USA. | CO1 | BTL2 |

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| | ▪ Conflict over water from the Shatt-al-Arab between Iran and Iraq.<br>▪ Conflict over water from the Brahmaputra between India and Bangladesh.<br>**--> National conflicts:**<br>▪ Sharing of Cauvery water between Karnataka and Tamil Nadu.<br>▪ Sharing of Krishna water between Karnataka and Andhra Pradesh.<br>▪ Sharing of Siruveni water between Tamil Nadu and Kerala.<br>**Construction of dams or power stations:**<br>For hydroelectric power generation, dams are built across the rivers, and this initiates conflicts between the states.<br><br>**Conflict through pollution:**<br>Rivers are also used for industrial purposes. They act as reservoirs for the supply of fresh water and also are a receptor of wastewater and rubbish from the industry. Water crossing borders that has been polluted by wastes from one country develops into an international conflict.<br><br>**Management of water conflicts:**<br>• Concerted efforts are required to enforce laws that check these practices to control water pollution.<br>• To overcome the problem of sharing river water in a country, the concept of interlinking of rivers has been suggested.<br>• Rivers should be nationalized; the National Water Authority and River Basin Authority should be given power to ensure equitable distribution of basin water. | | |
| 28. | **Write a detailed note on soil conservation practices.**<br>1. Conservational till farming or no-till farming: Traditionally, land is ploughed to make a planting surface. This disturbs the soil and makes it susceptible to erosion. The no-till farming method makes minimum disturbance to the topsoil by making slits in the Un ploughed soil. Seeds, fertilizers, and water are injected in these slits.<br>2. Contour farming: In this method, crops are planted in rows along contours of gently sloped land. Each row acts as a small dam to hold soil, thereby slowing water runoff.<br>3. Terracing: In this method, steep slopes are converted into a series of broad terraces that run across the contour. This retains water for crops and reduces soil erosion by controlling runoff.<br>4. Alley cropping or Agroforestry: This method involves | CO1 | BTL1 |

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| | planting crops in strips or alleys between rows of trees or shrubs that provide fruits and fuelwood. Hence, when the crop is harvested, the soil will not be eroded as the trees and shrubs remain on the ground, holding the soil particles.<br>5. Windbreaks or shelter belts: In this technique, trees are planted in long rows along the boundary of cultivated land, which block the wind and reduce soil erosion. Windbreaks help in retaining soil moisture, supply wood for fuel, and provide habitat for birds. | | |
| 29. | **Discuss in detail about desertification.**<br><br>Desertification is a progressive destruction or degradation of arid or semi-arid lands to desert. Desertification leads to the conversion of rangelands or irrigated croplands to desert-like conditions in which agricultural productivity falls. Desertification is classified by devegetation, depletion of groundwater, salination, and soil erosion.<br><br>**EFFECTS OF DESERTIFICATION**<br>1. Almost 80% of the productive land in the arid and semi-arid regions is converted into desert.<br>2. Approximately 600 million people are threatened by desertification.<br><br>**CAUSES OF DESERTIFICATION**<br>1. Desertification: The process of denuding and degrading a forest land initiates the formation of a desert. Lack of vegetation prevents the rainfall from soaking into the ground, resulting in poor recharge of groundwater. Eventually, this results in soil erosion and loss of fertility.<br>2. Over-grazing: An increase in cattle population, coupled with repeated grazing at the same location, results in the depletion of vegetation in the area. Eventually, the land becomes loose and prone to soil erosion and the formation of a desert.<br>3. Water management: Over-utilization of groundwater, particularly in the coastal regions, results in saline water intrusion into aquifers, thereby making water unfit for irrigation.<br>4. Mining and quarrying: These activities are responsible for the loss of vegetative cover and denudation of an extensive land area, leading to desertification.<br>5. Climate change: Climate change manifests in the form of the failure of monsoons, irregular monsoons, and frequent droughts, thereby leading to desertification.<br>6. Pollution: Excessive use of fertilizers and pesticides to | CO1 | BTL2 |

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| | increase yield and the disposal of toxic wastes into the land leads to desertification. | | |
| 30. | **Elaborate on Landslides.**<br><br>Landslides are the downward movement of a slope composed of earth materials such as rock, soil, or artificial fills. Landslides are also called rockslides, debris-slides, slumps, earthflow, or soil-creep.<br>During construction of roads and mining activities, huge portions of mountainous, fragile areas are cut down and thrown into adjacent areas and streams. These land masses weaken the already fragile mountain slopes, leading to man-induced landslides.<br><br>**EFFECTS OF LANDSLIDES:**<br>1. Landslides increase the turbidity of nearby streams, thereby reducing their productivity.<br>2. Destruction of communication links.<br>3. Loss of habitat and biodiversity.<br>4. Loss of infrastructure and economic loss.<br><br>**CAUSES OF LANDSLIDES:**<br>1. Removal of vegetation - Deforestation in slopes creates soil erosion leading to landslides.<br>2. Underground mining activities cause subsidence of the ground.<br>3. Movement of heavy vehicles in areas with unstable slopes causes landslides.<br>4. Addition of weight by construction on slopes causes landslides.<br>5. Overexploitation of groundwater also leads to landslides. | CO1 | BTL2 |
| | **UNIT-II SAQs** | **CO** | **BTL** |
| 31. | **What are the components of an ecosystem? Explain with suitable examples.**<br><br>The structure refers to the various components.<br>So the structure of an ecosystem explains the relationship between the biotic (living) and abiotic (non-living) components.<br>An ecosystem has two major components:<br><br>**Biotic components:**<br>The living organisms collectively form its community called biotic components or biotic community.<br>**Examples:**<br>• Plants (producers)<br>• Animals (consumers) | CO2 | BTL1 |

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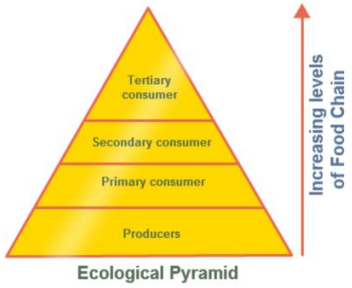
| | • Microorganisms (decomposers)<br><br>**Abiotic components:**<br>Water, soil, air, temperature, climate, salinity, pH, etc. | | |
| 32. | **Define a Food Chain. Write about its significance in an ecosystem.**<br><br>Food chains follow a single path as animals eat each other.<br>OR<br>There sequence of eating and being eaten in an ecosystem is known as the food chain.<br>**Significance:**<br>i. Energy flow and nutrient cycling takes place through them.<br>ii. They maintain and regulate the population size of different tropic levels, and thus help in maintaining ecological balance.<br>iii. They have biomagnification. The non-biodegradable materials keep on passing from one tropical level to another. At each successive tropical level, the concentration keeps on increasing. This process is known as biomagnification. | CO2 | BTL2 |
| 33. | **Define ecological Pyramids with suitable examples.**<br><br>Graphical representation of structure and function of tropic levels on an ecosystem, starting with producers at the bottom and each successive tropic levels forming the apex is known as an ecological pyramid.<br>Ecological pyramids begin with the producers at the bottom like plants and they proceed to various trophic levels like herbivores consume plants, carnivores' prey on herbivores and so on. The highest level is at the top of the food chain.<br>  <br> | CO2 | BTL2 |
| 34. | **Define Pyramid of Numbers with graphical representation of any ecosystem.**<br><br>The pyramid of numbers depicts the relationship in terms of the number of producers, herbivores and carnivores at their | CO2 | BTL2 |

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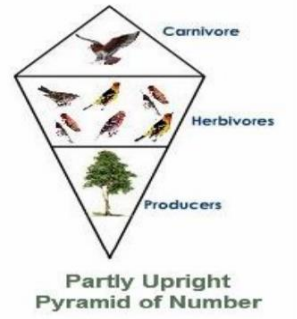
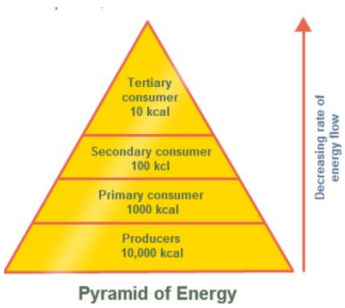
| | successive trophic levels. There is a decrease in the number of individuals from the lower to the higher trophic levels. The number of pyramids varies from ecosystem to ecosystem. There are three of pyramid of numbers:<br>• Upright pyramid of number<br>• Partly upright pyramid of number and<br>• Inverted pyramid of number<br><br>**Partly Upright pyramid of Number**<br>It is seen in the forest ecosystem where the number of producers is less in number and supports a greater number of herbivores and which in turn supports a fewer number of carnivores.<br>  <br><br>Partly Upright Pyramid of Number | | |
| 35. | **Define Pyramid of energy with suitable examples.**<br><br>The pyramid of energy or the energy pyramid describes the overall nature of the ecosystem. During the flow of energy from organism to another, there is considerable loss of energy in the form of heat. The primary producers like the autotrophs there is more amount of energy available. The least energy is available in the tertiary consumers. Thus, shorter food chain has more amount of energy available even at the highest trophic level.<br><br>• The energy pyramid is always upright and vertical.<br>• This pyramid shows the flow of energy at different trophic levels.<br>• It depicts the energy is minimum as the highest trophic level and maximum at the lowest trophic level.<br>• At each trophic level, there is successive loss of energy in the form of heat and respiration, etc.<br><br>  <br><br>Pyramid of Energy | CO2 | BTL2 |

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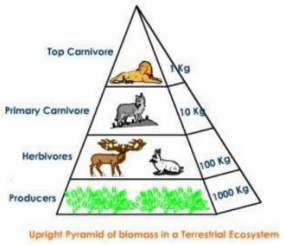
| 36. | **What is Pyramid of Biomass?**<br><br>They represent the quantitative relationships of the standing crops. In this pyramid there is a gradual decrease in the biomass from the producers to the higher trophic levels. The biomass here is the net organisms, collected from each feeding level and is then dried and weighed. This dry weight is biomass, and it represents the amount of energy available in the form of organic matter of the organisms. In this pyramid the net dry weight is plotted to that of the producers, herbivores, carnivores, etc.<br>There are two types of pyramids of biomass, they are:<br>• Upright pyramid of biomass and<br>• Inverted pyramid of biomass.<br>Upright Pyramid of Biomass This occurs when the larger net biomass of producers supports a smaller weight of consumers. Example: Forest ecosystem.<br>  <br><br>Upright Pyramid of biomass in a Terrestrial Ecosystem | CO2 | BTL1 |
| 37. | **What is ecological succession? Write its stages of development.**<br><br>In an area one community may be replaced by another community or by a series of communities.<br>Thus, the progressive replacement of one community by another till the development of stable community in a particular area is called ecological succession.<br><br>**Stages of development:**<br>i. Migration<br>ii. Colonization<br>iii. Establishment<br>iv. Competition<br>v. Stabilization<br>vi. Climax | CO2 | BTL1 |
| 38. | **What is the role of decomposers in the ecosystem?**<br><br>Decomposers: Examples Microorganisms like bacteria and fungi. Decomposers attack the dead bodies of producers and consumers and decompose them into simpler compounds. During the decomposition inorganic nutrients are released. The | CO2 | BTL1 |

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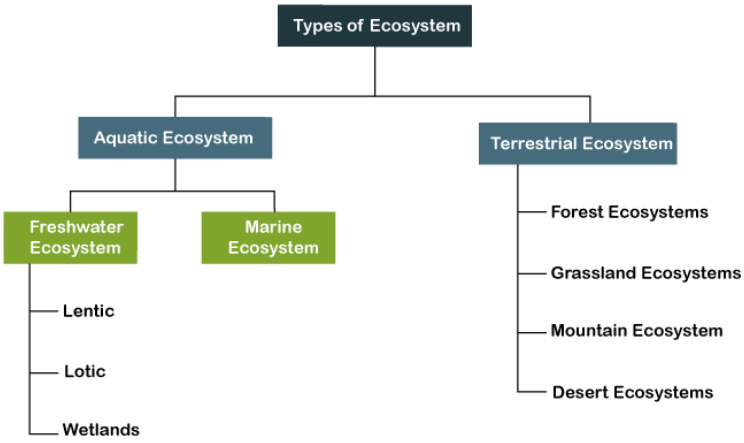
| | inorganic nutrients together with other organic substances are then utilized by the producers for the synthesis of their own food.<br><br>Role of Decomposers:<br>1. Cycling of nutrients<br>2. Conversion of complex organic compounds to simpler inorganic compounds | | |
| 39. | **What are the different types of ecosystems in nature?**<br><br>There are different types of ecosystems based on different climates, habitats, and life forms. This means that ecosystems can typically be divided into hundreds and thousands of smaller systems. However, all such types generally fall into one of the following two categories:<br>• Aquatic Ecosystem<br>• Terrestrial Ecosystem<br>• Artificial/ man-made ecosystems<br>  <br> | CO2 | BTL1 |
| 40. | **Write a note on different trophic levels of an ecosystem.**<br><br>Tropic levels ($T_1$, $T_2$, $T_3$, $T_4$, $T_5$) or feeding level<br>The various steps through which food energy passes in an ecosystem is called as tropic levels.<br>The tropic levels are arranged in the following ways<br>Were,<br>The green plants or producers represents first tropic level $T_1$,<br>The herbivores or primary consumer represents second tropic level$T_2$<br>The carnivores or secondary consumer represents third tropic level $T_3$<br>The tertiary consumer is fourth tropic level $T_4$<br>Finally, decomposers represent last tropic level $T_5$. | CO2 | BTL1 |

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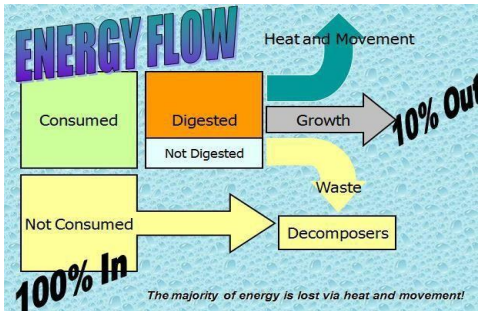
| 41. | **Define a Food Web. Write about its significance in an ecosystem.**<br><br>The interlocking pattern of various food chain in an ecosystem is known as food web.<br>**Significance of Food Web:**<br><br>1. Energy Flow from producers to next trophic level<br>2. Nutrients Cycling<br>3. Maintain population size<br>4. Biomagnification | CO2 | BTL2 |
| 42. | **What is the universal model flow of energy in ecosystem?**<br><br>The way energy flows in an ecosystem is known as energy flow. It is unidirectional. The following points are important regarding understanding energy flow in an ecosystem: i. Efficiency of producers in absorption and conversion of solar energy. ii. Using the converted energy (chemical energy – starch) by consumers iii. Total input of energy as food and its efficiency of assimilation iv. Energy lost through respiration, heat, excretion, etc. At each trophic level v. Gross production and net production Two important points to be noted about energy flow in ecosystems are:<br>i. Energy flow is unidirectional and<br>ii. There is a progressive decrease of energy as we progress along the food chain. The energy is lost as heat in metabolic activities such as respiration, hunting, etc.<br><br>  | CO2 | BTL1 |
| 43. | **Write a short note on marine ecosystem.**<br><br>**Marine Ecosystem:**<br>Marine ecosystems are usually characterized by the presence of salt content. These ecosystems have a higher salt content than the freshwater ecosystem. Moreover, they are known as the largest type of ecosystem on Earth. It usually includes all the oceans and their parts. Besides, marine ecosystems have distinctive flora and fauna, which support greater biodiversity | CO2 | BTL1 |

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| | than freshwater ecosystems. This type of ecosystem is essential for both marine and terrestrial environments.<br>In particular, this ecosystem includes salt marshes, lagoons, coral reefs, estuaries, intertidal zones, mangroves, seafloor, and deep seas. Salt marshes, mangrove forests, and sea-grass meadows are said to be among the most productive ecosystems. Coral reefs are known to provide adequate quantities of food and shelter to most marine inhabitants worldwide. | | |
| 44. | **Write a short note on river ecosystem.**<br><br>1. River ecosystems are freshwater habitats that consist of flowing water, riverbanks, and surrounding riparian zones.<br>2. They exhibit a range of physical features, including variations in water depth, velocity, and temperature, which contribute to the diverse ecological niches within the system.<br>3. River ecosystems support a wide array of plant and animal species, such as fish, amphibians, reptiles, birds, and mammals, both in the water and along the riverbanks.<br>4. These ecosystems often feature specialized organisms that are adapted to the unique challenges posed by the river's hydrological conditions.<br>5. Rivers play a crucial role in transporting nutrients, sediments, and organic matter, facilitating the cycling of materials within the ecosystem.<br>6. They provide important habitats for spawning, breeding, and feeding for many aquatic species, contributing to overall biodiversity. | CO2 | BTL1 |
| 45. | **Write a short note on grassland ecosystem.**<br><br>**Grassland Ecosystems:**<br>Grassland ecosystems are referred to as those ecosystems where the number of trees is low. These ecosystems mainly consist of grasses, shrubs, and herbs. That means grasses are the primary vegetation in these ecosystems, along with legumes that typically belong to the composite family.<br>Grassland ecosystems are commonly situated in both the tropical and temperate regions globally; however, they have distinct variations. Examples of these ecosystems include the savanna grasslands and temperate grasslands. They are home to various grazing animals, insectivores, and herbivores. | CO2 | BTL1 |
| | **UNIT-II LAQs** | CO2 | **BTL** |

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| 46. | **Explain in detail the structure and function of an ecosystem.**<br><br>An ecosystem may also be defined as the interaction of biotic and abiotic components of the environment, thereby exchanging matter and energy.<br>**Structure and function of an ecosystem:**<br>The two important aspects of an ecosystem are:<br>**Structure** and **Function.**<br>**Structure** of an ecosystem consists of:<br>• Composition of biological community (e.g., plants, animals, and microbes), biomass, life cycles, and distribution in space.<br>• Quantity, distribution, and cycling of non-living materials (macro and micronutrients, trace elements, and water).<br>• Variation of conditions like temperature, rainfall, sunlight, relative humidity, wind, and topography.<br><br>**COMPONENTS OF AN ECOSYSTEM:**<br>There are two components of an ecosystem; Living components and non-living components.<br>1. **Non-Living Components:** (Abiotic) Non-living components are the physical and chemical factors that directly or indirectly affect the living components, e.g., air, water, land, rock, etc. Non-living components are also called Abiotic components.<br>2. Physical factors include sunlight, water, fire, soil, air, temperature, etc.<br>3. Chemical factors include moisture, salinity of water, soil nutrients, oxygen dissolved in water, e<br>4. **Living Components:** Living components in an ecosystem are either producers or consumers. They are also called biotic components. Producers can produce organic components, e.g., plants can produce starch, carbohydrates, cellulose from a process called photosynthesis. Consumers are the components that are dependent on producers for their food, e.g., human beings and animals.<br>**Biotic Components are further classified into 3 main groups:**<br>• **Producers**<br>• **Consumers**<br>• **Decomposers or Reducers**<br><br>➢ **Producer (Autotrophs):** The green plants have chlorophyll, with the help of which they trap solar energy and change it into chemical energy of carbohydrates using simple inorganic compounds, namely, water and carbon dioxide. This process is known as photosynthesis. The chemical energy stored by the producers is utilized partly | CO2 | BTL2 |

by the producers for their growth and survival, and the remaining is stored in the plants for their future use. They are classified into two categories based on their source of food:

a) **Photoautotrophs:** An organism capable of synthesizing its food from inorganic substances using light as an energy source. Green plants and photosynthetic bacteria are photoautotrophs.

b) **Chemotrophs:** Organisms that obtain energy by the oxidation of electron donors in their environments. These molecules can be organic (chemoorganotrophs) or inorganic (chemolithotrophs).

- **Consumers (Heterotrophs):** The animals lack chlorophyll and are unable to synthesize their food; therefore, they depend on the producers for their food. They are known as heterotrophs (i.e., heteros = others, trophs = feeder). The Consumers are of 4 types:
  - **Primary Consumer:** (Herbivores), i.e., Animals feeding on plants, e.g., Rabbit, deer, goat, etc.
  - **Secondary Consumers:** The animals feeding on Herbivores are called as secondary Consumers or primary carnivores, e.g., Cats, foxes, snakes.
  - **Tertiary Consumers:** These are large carnivores which feed on secondary consumers, e.g., Wolves.
  - **Quaternary Consumers:** They are also called omnivores; these are the largest carnivores which feed on tertiary consumers and are not eaten up by any other animals, e.g., lion and Tiger.

- **Decomposers or Detrivores:** Bacteria and fungi belong to this category. They break down the dead organic matter of producers and consumers for their food and release to the environment the simple inorganic and organic substances. These simple substances are reused by the producers, resulting in a cyclic exchange of material between biotic and abiotic environment. Examples include Bacteria, Earthworms, Beetles, etc.

**Function of an ecosystem** consists of:

- Rate of biological energy flow (production of food in plants - photosynthesis and respiration rates).
- Rate of nutrient cycles.
- Ecological regulation (Environment regulation in the form of photoperiodism and Organism regulation in the form of nitrogen fixation by organisms).

From the trophic standpoint, an ecosystem has two components:

- **Autotrophic component**

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| | • **Heterotrophic component.**<br><br>**Autotrophic component** involves:<br>• Fixation of light energy.<br>• Use of simple inorganic substances like carbon and water.<br>• Synthesis of hexose sugars (glucose) to complex substances such as polysaccharide carbohydrates (starch), fat, and protein synthesis.<br><br>**Heterotrophic component** involves:<br>• Utilization.<br>• Rearrangement and Decomposition of complex substances.<br>• Herbivores, Carnivores and Omnivores (Phototrophs) and microconsumers (Decomposers, osmographs, and saprotrophs) comprise the heterotrophic component. | | |
| 47. | **Elaborate the different components in an ecosystem using the Forest Ecosystem as an example.**<br><br>Forest ecosystems have tall trees which support many animals and birds. The forests are found in areas undisturbed with moderate to high rainfall. The forest occupies nearly 40% of the world's land area. In India, it occupies only 19% of its total land area.<br><br>**Characteristics of Forest Ecosystem:**<br>1. Warm temperature and adequate rainfall<br>2. A number of ponds and lakes<br>3. Forest is responsible for making climate and rainfall<br>4. Forests support many wild animals and protect biodiversity<br>5. Soil is rich in organic matter and nutrients which support the growth of trees<br>6. The penetration of light is poor, so conversion of organic matter into nutrients is very fast.<br><br>Structure and Function of Forest Ecosystem:<br>1. **Abiotic Components:** Climatic Factors (Temperature, sunlight, rainfall, minerals, litter etc.,)<br>**2. Biotic Components:**<br>**Producers:** Plants absorb sunlight and produce starch through photosynthesis, trees, shrubs and ground vegetation | CO2 | BTL2 |

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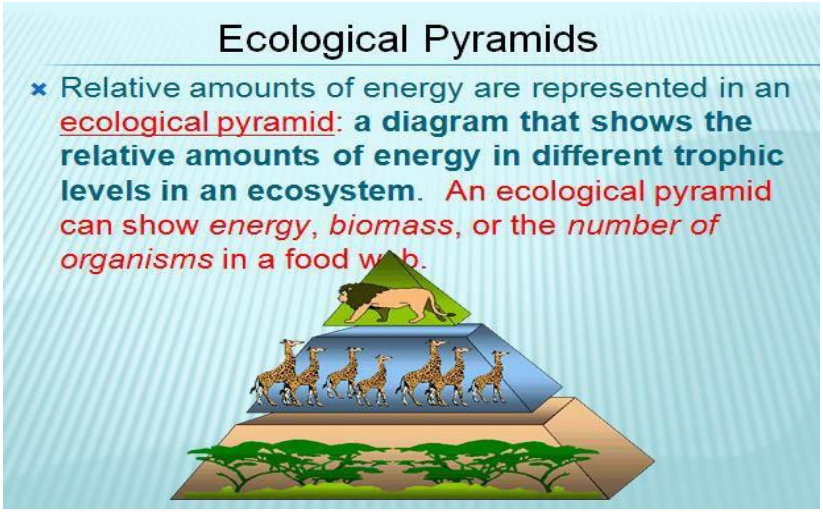
| | **Consumers:**<br>**Primary Consumers:** Directly dependent on plants for survival. Ex: Flies, insects, mice deer, squirrels etc.,<br>**Secondary Consumers:** Directly dependent on herbivores for their food. Ex: snakes, birds.<br>**Tertiary Consumers:** Dependent on primary consumers for food. Ex: Animals- Tiger, Lion.<br>**Decomposers:** Bacteria and Fungi which decompose dead plants and animal matter.<br>  <br> | | |
| 48. | **(1) What are ecological pyramids?**<br>**(2) Explain the types of ecological pyramids with an example.**<br>Graphical representation of structure and function of tropic levels on an ecosystem, starting with producers at the bottom and each successive tropic levels forming the apex is known as an ecological pyramid.<br>The concept of ecological pyramid was developed by Charles Elton; these pyramids are also known as Eltonian pyramids.<br>The pyramids are a graphical representation which depicts the number of organisms, biomass and productivity at each trophic level. All ecological pyramids begin at the bottom with the produces and proceed through different trophic levels. Ecological pyramids begin with the producers at the bottom like plants and they proceed to various trophic levels like herbivores consume plants, carnivores' prey on herbivores and so on. The highest level is at the top of the food chain. | CO2 | BTL2 |

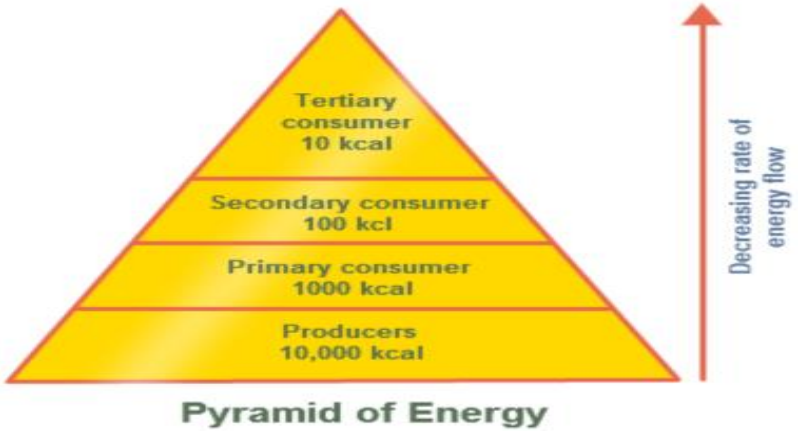



Ecological Pyramids are of three types:

i. Pyramid of numbers
**ii.** Pyramid of energy
**iii.** Pyramid of biomass

- **The pyramid of energy** or the energy pyramid describes the overall nature of the ecosystem. During the flow of energy from organism to another, there is considerable loss of energy in the form of heat. The primary producers like the autotrophs there is more amount of energy available. The least energy is available in the tertiary consumers. Thus, shorter food chain has more amount of energy available even at the highest trophic level.

- The energy pyramid is always upright and vertical.
- This pyramid shows the flow of energy at different trophic levels.
- It depicts the energy is minimum at the highest trophic level and maximum at the lowest trophic level.
- At each trophic level, there is successive loss of energy in the form of heat and respiration, etc.



Pyramid of Energy

- **Pyramid of numbers:**

The pyramid of numbers depicts the relationship in terms of the number of producers, herbivores and carnivores at their successive trophic levels. There is a decrease in the number of individuals from the lower to the higher trophic levels. The number of pyramids varies from ecosystem to ecosystem.

There are three of pyramid of numbers:

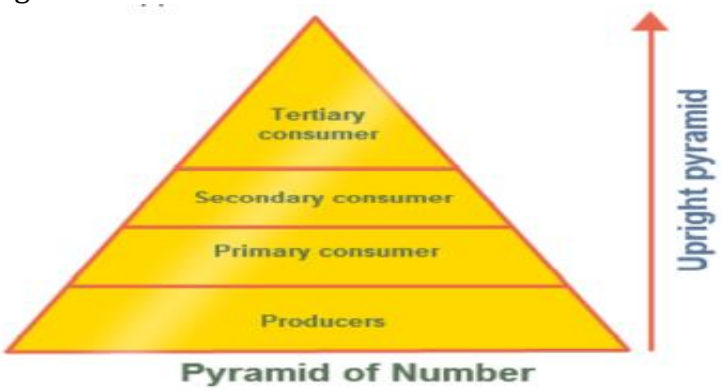
· Upright pyramid of number

· Partly upright pyramid of number and

· Inverted pyramid of number.

**Upright Pyramid of Number**

This type of pyramid number is found in the aquatic and grassland ecosystem, in these ecosystems there are numerous small autotrophs which support lesser herbivores which in turn support smaller number of carnivores and hence this pyramid is upright.



Pyramid of Number

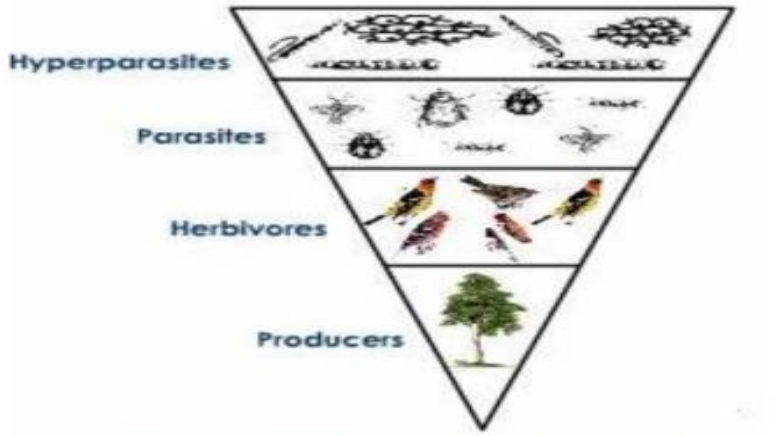
**Partly Upright pyramid of Number**

It is seen in the forest ecosystem where the number of producers is less in number and supports a greater number of herbivores and which in turn supports a fewer number of carnivores.

Partly Upright Pyramid of Number

**Inverted Pyramid of Number**

This type of ecological pyramid is seen in parasitic food chain where one primary producer supports numerous parasites which support more hyper parasites.




Inverted pyramid of number

- **Pyramid of biomass:**

The pyramid of biomass is more fundamental, they represent the quantitative relationships of the standing crops. In this pyramid there is a gradual decrease in the biomass from the producers to the higher trophic levels. The biomass here, the net organisms, collected from each feeding level and are then dried and weighed. This dry weight is biomass, and it represents the amount of energy available in the form of organic matter of the organisms. In this pyramid the net dry weight is plotted to that of the producers, herbivores, carnivores, etc.

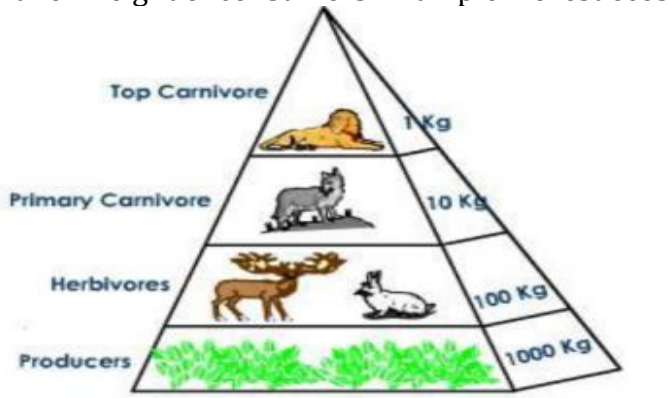
There are two types of pyramids of biomass, they are:

· Upright pyramid of biomass and

· Inverted pyramid of biomass.

**Upright Pyramid of Biomass**

This occurs when the larger net biomass of producers supports a smaller weight of consumers. Example: Forest ecosystem.




Upright Pyramid of biomass in a Terrestrial Ecosystem

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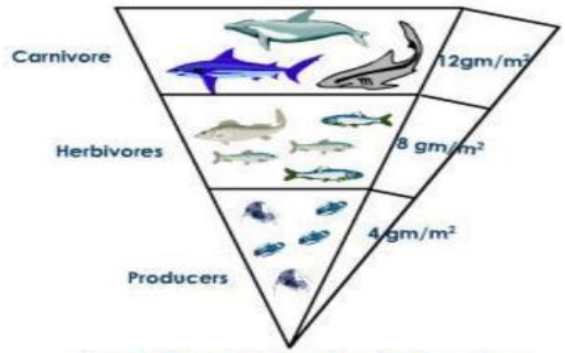
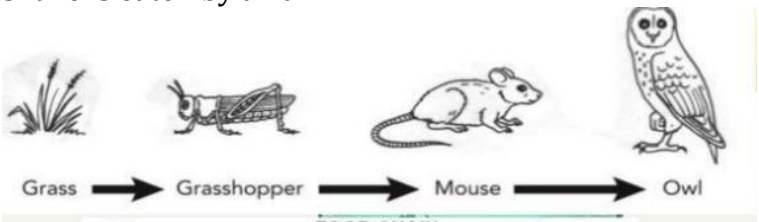
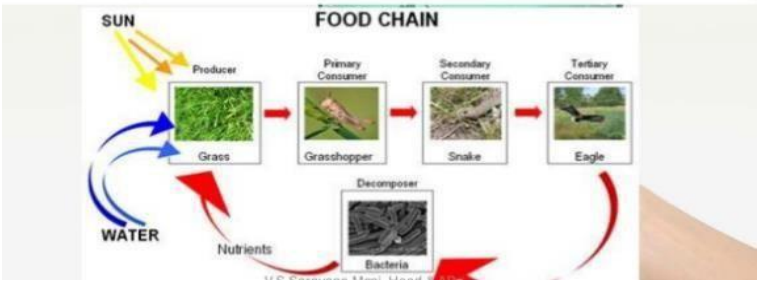
| | **Inverted Pyramid of Biomass**<br>This happens when the smaller weight of producers supports consumers of larger weight. Example: Aquatic ecosystem.<br>  <br><br>Inverted Pyramid in an Aquatic Ecosystem | | |
| 49. | **(1) Define a Food Chain and a Food Web.**<br>**(2) Write the significance of Food Chains and Food web in an ecosystem.**<br>**Food Chain:**<br>There sequence of eating and being eaten in an ecosystem is known as the food chain.<br>**OR**<br>Food chains follow a single path as animals eat each other.<br><br>Grass manufactures its food using sunlight, water, nutrients from soil and chlorophyll. The grass is eaten by a grasshopper. The grasshopper is eaten by a frog. The frog is eaten by a snake, the snake is eaten by a hawk.<br>  <br><br>  <br><br>**Types of food chain:**<br>Food chains are classified in to two types<br>1. Grazing food chain<br>2. Detritus food chain<br>**Grazing food chain:** | CO2 | BTL3 |

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| | Found in grassland ecosystem and pond ecosystem. Grazing food chains start with green plants (primary producers) and goes to decomposers food chain or detritus food chain through herbivores and carnivores.<br>**Detritus food chain:**<br>Found in grassland ecosystem and forest ecosystem. The Detritus food chain starts with dead organic matter (plants and animals) and goes to decomposers food chain through herbivores and carnivores.<br><br>**Food Web:**<br>The interlocking pattern of various food chain in an ecosystem is known as food web.<br>In a food web many food chains are interconnected, where different types of organisms are connected at different tropical levels, so that there are a number of opportunities of eating and being eaten at each tropical level.<br>Grass may be eaten by insects, rats, deer, etc. These may be eaten by carnivores (snake, tiger).<br>Thus, there is an interlocking of various food chains called the food web.<br>  <br><br>**Significance of food chain and food web:**<br>i. Energy flow and nutrient cycling takes place through them.<br>ii. They maintain and regulate the population size of different tropical levels, and thus help in maintaining ecological balance.<br>iii. They have biomagnification. The non-biodegradable materials keep on passing from one tropical level to another. At each successive tropical level, the concentration keeps on increasing. This process is known as biomagnification. | | |
| 50. | **Explain "Ecological Succession" in different stages.** | CO2 | BTL2 |

Ecological succession, also known as ecological development, refers to the process of sequential, nonseasonal, cumulative environmental changes occurring in ecosystems in a given time period. This phenomenon occurs when an area is made partial or completely devoid of vegetation either due to natural disaster (example, fires, windstorms, flood, drought, animals, landslides, erosion, earthquake, tornadoes, volcanic eruptions, hurricane) or human intervention (clear cutting, over-hunting, faming. Pollution disease, pest infestation etc).
Based on the type of successional changes, ecological successions are broadly categorized as,
i)Autogenic (self-generated) succession and
ii) Allogenic (externally generated) succession.

In an autogenic succession, the ecological succession is brought about by internal interactions, for example, succession on bare rock or sand dunes.

In an allogenic succession, the successional changes are brought about by the outside forces, such as change in environmental conditions which, in turn, influences the composition of the plant community. Example, silt deposition, changes in aquatic habitat to terrestrial habitat, increasing salinity of Great Salt Lake.

Ecological succession stops when the species achieve stable equilibrium i.e., when the changes in the species composition does not occur anymore. Then, this community is said to be a climax community.

**Example: Ecological Succession of a Lake into a Forest**

An area of deep freshwater body cannot support rooted and submerged plants because sufficient sunlight cannot reach the depths for photosynthesis to occur. Microorganisms and plankton float in the water. The shallow waters around the edges of the water body support plant material. Large amounts of sediments are carried into the lake with the flowing streams or rainwater and gets deposited in the water body. With increase in the sediment deposit, the depth of water gradually decreases.

**Stages in Ecological Succession:**

A sere is a stage in the process of succession. The different series in the succession of a water body into a forest are discussed below,

- **Stage-I: Migration:**

The insects fly from one place to another and bring spores of other creatures such as diatoms and algae. Animals like hydra, amoeba, filamentous algae and diatoms begin to reproduce sexually. Some water birds may visit the pond in the hope of food.

They may carry with them seeds of plants and eggs of animals which get stuck to their body parts like legs and feathers. If the seeds and spores germinate and grow, the community enters next seral stage, i.e., colonization.

- **Stage-II: Colonization:**

The cysts of amoeba begin to hatch to form amoebulae. They feed on bacteria. If the temperature of the region rises, algae and diatoms begin to grow quickly. During this process of immigration, new species arrive and multiply. Gradually, a community of plants and animals get established.

- **Stage-Ill: Establishment:**

Rooted submerged plants like lilies, starwort, pond- weeds, waterlilies and floating plants like duckweed begin to grow. The organic matter gradually begins to accumulate at the bottom of the water body. The depth of water further decreases. here is a great diversity of plant and animal species. The abiotic Conditions begin to improve. The plants become well established. The dead organic matter continues to accumulate at the bottom of the pond and increases the nutrient content of the water. This encourages plant growth which further traps and holds more of the incoming sediment. With further decrease in the water depth, the fully submerged plants fail to survive.

At this stage, the swamp plants such as yellow iris, branched reeds and reed mace grow well. The spear shaped leaves of these plants float above the water for effective photosynthesis. Gradually, the swamp plants die out and they are replaced by marsh plants such as water mint, brooklime and
soft rush.

- **Stage-IV: Competition:**

In this stage, the number of new species will begin to decrease gradually. The pond now becomes a swamp with damp ground all around. The initial colonizers of the area disappear through competition by the growth of young trees. Example, alder, willow. The high rate of transpiration in the trees, transfers large quantities of water from the sediment into the atmosphere. There is a decrease in the variety of plant and animal communities. The trees form a thick canopy and eradicate smaller plants like marsh plants.

- **Stage-V: Stabilization:**

In this stage, a stabilized community is formed that can survive the swamp land conditions. They include the woodland floor plants like sedges, rushes, ferns and small flowering herbs. The thick canopy of tree leaves restricts the growth of other plants.

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| | ➢ **Stage-VI: Climax:**<br>The trees will dry the wetland and growth of birch or oak trees may take place. No new species are added in this stage and the community is in equilibrium with the surrounding environment. | | |
| 51. | **Write in detail about Producers and their importance in an ecosystem.**<br><br>Producers convert water, carbon dioxide, minerals, and sunlight into the organic molecules that are the foundation of all life on Earth. Producers are plants which have the green pigment – chlorophyll: which helps the plants to synthesis their own food. Plants prepare their own food through sunlight and water through a process of photosynthesis<br><br>$6CO_2+12H_20$ à $C6H12O_6+6O_2+6H_2O$<br><br>Green plants are the original "power plants." They capture energy from the sun and combine it with inorganic, or nonliving, materials to make organic molecules. These molecules are the fuel that powers all other living things. This special ability to take power from the sun earns plants (along with certain other organisms, including algae and some bacteria) the title of "producers. This process uses the energy of sunlight to split water molecules into hydrogen and oxygen. It then combines hydrogen with carbon dioxide from the air and minerals from the soil to make glucose (a sugar) and other more complex organic molecules. Plants release oxygen as a by-product of these reactions. Producers are the foundation of every food web in every ecosystem—they occupy what is called the first tropical level of the food web. The second trophic level consists of primary consumers—the herbivores, or animals that eat plants. At the top level are secondary consumers—the carnivores and omnivores who eat the primary consumers. Ultimately, decomposers break down dead organisms, returning vital nutrients to the soil, and restarting the cycle. Another name for producers is autotrophs, which means "self-nourishers." There are two kinds of autotrophs. The most common are photoautotrophs—producers that carry out photosynthesis. Trees, grasses, and shrubs are the most important terrestrial photoautotrophs. In most aquatic ecosystems, including lakes and oceans, algae are the most important photoautotrophs. | CO2 | BTL3 |

Ecosystems where there is not enough sunlight for photosynthesis to occur are powered by chemoautotrophs—primary producers that do not use energy from the sun. Instead, they break apart inorganic chemical compounds, such as hydrogen sulfide, and use the energy released to make organic molecules. Only bacteria and certain other microorganisms are chemoautotrophs. They are much less abundant than photoautotrophs. Some live in soil, while others live deep in the ocean, around volcanic features called hydrothermal vents. Earth's climate affects producers; the abundance of photoautotrophs increases as you move from the poles toward the equator due to the warmer weather and more intense sunlight. Scientists are working to understand how global climate change may be affecting plant growth. They are also studying how primary producers might be able to moderate climate change through their ability to absorb carbon dioxide, an important greenhouse gas.

**Importance of Producers in an ecosystem:**

Producers are organisms that create food from inorganic matter. The best examples of producers are plants, lichens and algae, which convert water, sunlight and carbon dioxide into carbohydrates. Consumers are organisms that cannot create their food. Instead, they consume the food generated by producers or consume other organisms that have in turn consumed producers. Many insects and animals are consumers. Decomposers break down dead or dying organic matter. Examples of decomposers include detritus feeders such as earthworms and sowbugs, as well as some fungi and bacteria. Scavenger animals can also be thought of as decomposers.

The producers are the foundation of any ecosystem. They create the matter, or biomass, that sustains the rest of the ecosystem. Plants and lichens are the primary producers on land. Trees, shrubs, vines, grasses, mosses and liverworts are the primary producers in temperate and tropical climates. In the Arctic, where plants are not as well equipped to survive, lichens – symbiotic organisms made up of photosynthesizing algae or cyanobacteria and fungus – are the primary producers.

In the temperate and tropical zones, a food web may begin with grass, for example. The grass grows by converting energy from the sun and carbon dioxide into its tissues and stored

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| | carbohydrates. A caterpillar nibbles on the grass but ends up being eaten by a bird. A predatory cat then eats the bird. When the big cat dies, its body decomposes with the help of decomposers and provides inorganic molecules that in turn feed the plant producers in the ecosystem.<br>In the Arctic, this theoretical life web is usually shorter. Lichen grows on a rock, reindeer eat the lichen, and then when the reindeer die their bodies nourish scavengers and decomposers. Algae is a broad grouping of aquatic plants or plantlike organisms that contain chlorophyll. They are the basis of all aquatic life webs. Though algae often resemble terrestrial plants, they lack structures such as stems, leaves and roots. Furthermore, algae can range from tiny unicellular organisms like diatoms (microalgae) to large multicellular organisms like kelp (macroalgae).<br>In a marine food web, algae are the foundation. Phytoplankton, a variety of single-celled algae, are consumed by zooplankton, which are then consumed by crustaceans, fish and whales. The crustaceans, fish and whales are in turn consumed by other organisms including humans.<br><br>In any ecosystem, producers are at the base of the entire food web. All other organisms are dependent upon the food-creating activities of primary producers. | | |
| 52. | **What are decomposers?**<br>**Give their mechanism of action with different examples.**<br><br>Microorganisms like bacteria and fungi. Decomposers attack the dead bodies of producers and consumers and decompose them into simpler compounds. During the decomposition inorganic nutrients are released. The inorganic nutrients together with other organic substances are then utilized by the producers for the synthesis of their own food.<br>Role of Decomposers:<br>• Cycling of nutrients<br>• Conversion of complex organic compounds to simpler inorganic compounds.<br>Decomposers are the saprophytic microorganisms (chiefly bacteria, actinomycetes, fungi) that decompose/decay the dead organic matter of plants and animals. Decomposers are also referred as reducers, saprotrophs or microconsumers.<br>The decomposers secrete enzymes that breakdown dead plants and animals into chemical nutrients 1like carbon and nitrogen | CO2 | BTL2 |

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| | which are released to the soil, air and water. The different types of decomposers in the environment are,<br>1. **Bacteria:**<br>They are the most numerous microscopic organisms in the environment. They are ubiquitous in occurrence in the cold Antarctic region, in steamy geyser and in our stomach as well.<br>2. **Fungi:**<br>This type of decomposers organisms includes molds and yeast. Fungi breaks down the cellulose in leaves and wood while molds are responsible for rotting wood.<br>3. **Actinomycetes:**<br>These are fungi like bacteria that decompose tough plant tissues like bark, paper and stems containing cellulose, chitin and lignin.<br>Decomposers are important constituent of an ecosystem These organisms release the atoms and molecules to the environment for reuse by other members of the ecosystem, the autotrophic organisms (such as plants), thus enabling recycling of matter the nutrients are taken up by the plant and used to help the plants grow. Thus, decomposers keep matter moving between living and non-living parts of an ecosystem. Millipedes and woodlice are also called decomposers as they consume dead organic matter and contribute to the process of decomposition. From the above explanation, it may be observed that energy is utilized by plants for carrying out various metabolic activities like respiration, growth etc. A part of the energy remains unutilized and released as heat. The consumers that live on the producers are the herbivores. When the herbivores consume the plant material, the chemical energy present in the food is transferred to the animals. Part of this energy is utilized in their metabolic activities and growth and the remaining unused energy is dissipated as heat by these animals. This unused energy is lost to the environment. The carnivores live on the herbivores. The carnivores are the consumers of the second order. Some energy is again lost to the environment, some part of it is utilized in metabolic activities. Thus, it is to be observed that the transfer of energy from one organism to the other is accompanied by a decrease due to waste. | | |
| 53. | **Explain the characteristics and the structure and function of a Forest Ecosystem.**<br><br>Forest ecosystems have tall trees which support many animals and birds. The forests are found in areas undisturbed with moderate to high rainfall. The forest occupies nearly 40% | CO2 | BTL3 |

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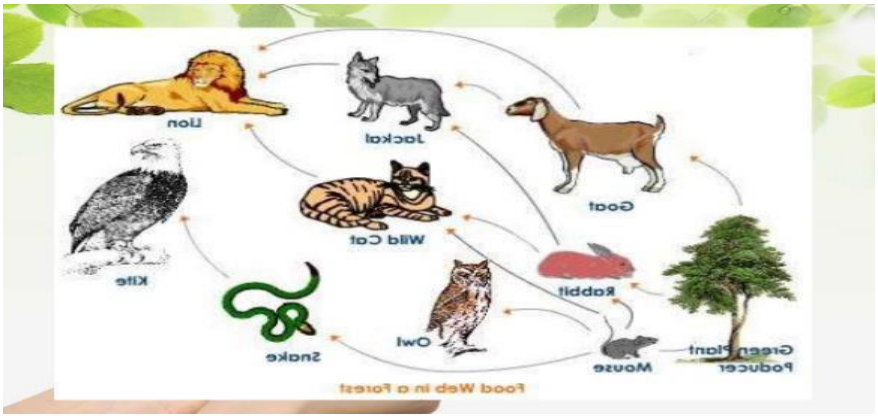
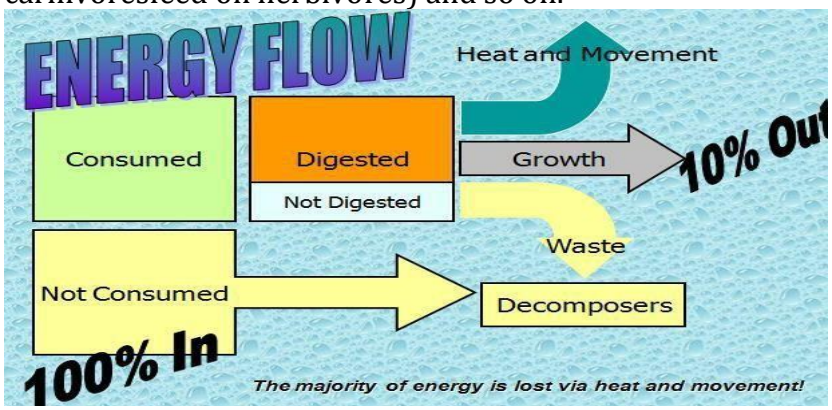
| | of the world's land area. In India, it occupies only 19% of its total land area.<br>**Characteristics of Forest Ecosystem:**<br>1. Warm temperature and adequate rainfall<br>2. A number of ponds and lakes<br>3. Forest is responsible for making climate and rainfall<br>4. Forests support many wild animals and protect biodiversity<br>5. Soil is rich in organic matter and nutrients which support the growth of trees<br>6. The penetration of light is poor, so conversion of organic matter into nutrients is very fast.<br><br>Structure and Function of Forest Ecosystem:<br>1. **Abiotic Components:** Climatic Factors (Temperature, sunlight, rainfall, minerals, litter etc.,)<br>**2. Biotic Components:**<br>• **Producers:** Plants absorb sunlight and produce starch through photosynthesis, trees, shrubs and ground vegetation<br>• **Consumers:**<br>• **Primary Consumers:** Directly dependent on plants for survival. Ex: Flies, insects, mice deer, squirrels etc.,<br>• **Secondary Consumers:** Directly dependent on herbivores for their food. Ex: snakes, birds.<br>• **Tertiary Consumers:** Dependent on primary consumers for food. Ex: Animals- Tiger, Lion.<br>• **Decomposers:** Bacteria and Fungi which decompose dead plants and animal matter.<br><br>  <br> | | |
| 54. | **What is the "Universal Model of energy Flow"** | CO2 | BTL1 |

It is a well-known fact that food energy is transferred from one trophic level to the next. The green plants manufacture food by the process of photosynthesis using the energy of the solar radiations, hence they are termed as the producers. During the photosynthetic process, atmospheric carbon dioxide is taken in by the plants to synthesize food. The oxygen released by the plants is used up by the animals for the process of respiration. The consumers live on the producers. The flow of energy in anecosystem can be represented as follows,

**Solar radiation Producers Consumers > (Herbivores and Carnivores) > Decomposers.**

It is to be observed that the flow of energy is always inonedirection, referred to as unidirectional flow of energy.

The trophic level is simply a feeding level in a food chain. The primary producers comprise the lower most trophic level consisting of plants, followed by the primary consumers (herbivores), then the secondary consumers (i.e., the carnivoresfeed on herbivores) and so on.




The figure shows a diagrammatic representation flow of energy and inorganic nutrients through the ecosystem. The flow of energy through the ecosystem is in the form of carbon- carbon bonds. The carbon-carbon bonds are broken during the process of respiration, the energy released is either utilized in various physiological activities or lost as heat to theenvironment.

The inorganic nutrients do not contain carbon-carbon bonds. A few examples of the inorganic nutrients are phosphorus in the teeth, bones and cellular membranes, the nitrogen of amino acids and the iron in the blood. The flow of nutrients through the ecosystem in the diagram is represented by broken arrows. It may be observed that the producers obtain the inorganic nutrients from the inorganic nutrient pool. The inorganic nutrients pass from one trophic level to another and ultimately upon death of the organisms, they are converted to detritus by the decomposers. The inorganic nutrients are returned to the soil

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| | from whence they came. It is to be observed that the inorganic nutrients are recycled, whereas the energy is not.<br><br>Energy is utilized by plants for carrying out various metabolic activities like respiration, growth etc. A part of the energy remains unutilized and released as heat. The consumers that live on the producers are the herbivores. When the herbivores consume the plant material, the chemical energy present in the food is transferred to the animals. Part of this energy is utilized in their metabolic activities and growth and the remaining unused energy is dissipated as heat by these animals. This unused energy is lost to the environment. The carnivores live on the herbivores. They are also referred to as consumers of the second order. Some energy is again lost to the environment and some part of it is utilized in metabolic activities. Thus, it is to be observed that the transfer of energy from one organism to the other is accompanied by a decrease due to waste. The potential energy is converted to kinetic energy and heat energy. Environmentalists are of the opinion that the transfer of energy in a variety of ecosystems follows a definite pattern referred to as 10 percent law. The energy that is available at a particular level is just 10% of the previous level. | | |
| 55. | **Write in detail about inverted ecological pyramids with suitable diagrams.**<br><br>Graphical representation of structure and function of tropic levels on an ecosystem, starting with producers at the bottom and each successive tropic levels forming the apex is known as an ecological pyramid.<br>Ecological pyramids begin with the producers at the bottom like plants and they proceed to various trophic levels like herbivores consume plants, carnivores' prey on herbivores and so on. The highest level is at the top of the food chain.<br>There are three types of ecological pyramid<br>i. Pyramid of numbers<br>ii. Pyramid of energy<br>iii. Pyramid of biomass<br>In case of pyramid of number and pyramid of biomass inverted ecological pyramid will be seen,<br>**Inverted Pyramid of Number:** This type of ecological pyramid is seen in parasitic food chain where one primary producer supports numerous parasites which support more hyper parasites. | CO2 | BTL3 |

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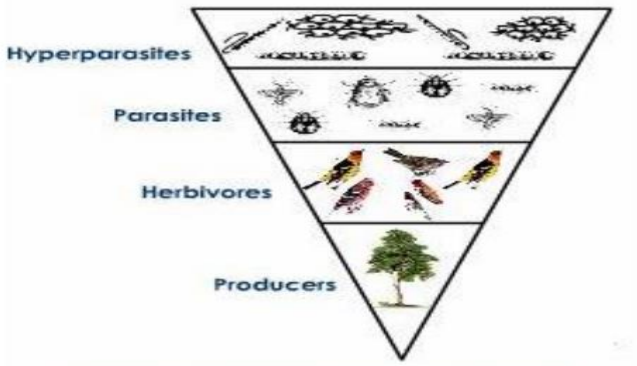
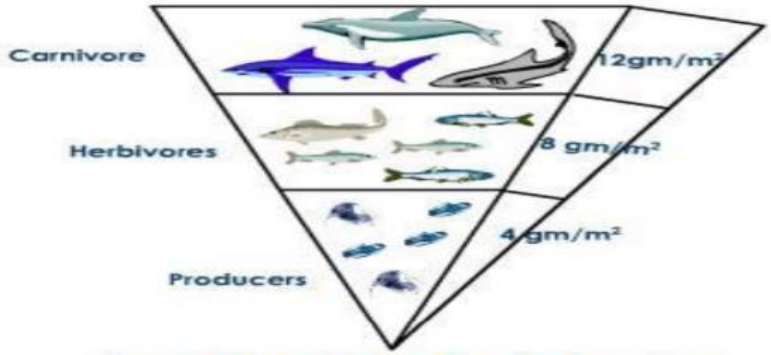
| |  <br>Inverted pyramid of number<br><br>The pyramid of biomass is more fundamental, they represent the quantitative relationships of the standing crops. In this pyramid there is a gradual decrease in the biomass from the producers to the higher trophic levels. The biomass here, the net organisms, collected from each feeding level and are then dried and weighed. This dry weight is the biomass, and it represents the amount of energy available in the form of organic matter of the organisms. In this pyramid the net dry weight is plotted to that of the producers, herbivores, carnivores, etc.<br><br>**Inverted Pyramid of Biomass** This happens when the smaller weight of producers supports consumers of larger weight. Example: Aquatic ecosystem.<br><br>  <br>Inverted Pyramid in an Aquatic Ecosystem | | |
| 56. | **Write in detail about river ecosystem.**<br><br>RIVER OR STREAM ECOSYSTEM Running water in a river or stream is usually well oxygenated as it absorbs oxygen from the air. River or stream is full of life with aquatic life.<br><br>CHARACTERISTICS:<br>1. It is fresh and freely flowing water system<br>2. Due to constant mixing of water during the flow of water in a river, the dissolved oxygen content is high | CO2 | BTL2 |

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| | 3. River's deposit large amounts of nutrients.<br><br>STRUCTURE AND FUNCTION:<br>1. Abiotic components Temperature, light, pH, nutrients, organic and inorganic compounds<br>2. Biotic components Producers: Phytoplankton, algae, water grass, aquatic mass and other amphibious· plants Consumers: Primary consumers feed on phytoplankton.<br>Ex: Water insects, Snails, · Fish. Secondary consumers feed on primary consumers. Ex: Birds and mammals. Decomposers: They decompose the dead plants and animals. Ex: Bacteria and Fungi. | | |
| 57. | **Write a detailed note on biotic and abiotic components of an ecosystem.**<br><br>Ecosystems may also be defined as the interaction of biotic and abiotic components of the environment thereby exchanging matter and energy.<br><br>**Structure and function of an ecosystem:**<br>The two important aspects of an ecosystem are<br>• Structure and<br>• Function<br><br>**Structure of an ecosystem consists of:**<br>• Composition of biological community (eg: plants, animals and microbes), biomass, life cycles and distribution in space.<br>• Quantity, distribution and cycling of non-living materials (macro and micronutrients, trace elements and water)<br>• Variation of conditions like temperature, rainfall, sunlight, relative humidity, wind and topography.<br><br>**Function of an ecosystem consists**<br>• Rate of biological energy flow (production and respiration rates)<br>• Rate of nutrient cycles<br>• Ecological regulation (Environment regulation in the form of photoperiodism andOrganism regulation in the form of nitrogen fixation by organisms)<br><br>**From the trophic standpoint, an ecosystem has two components** | CO2 | BTL2 |

- Autotrophic component and
- Heterotrophic component

Autotrophic component involves

Fixation of light energy

**Use of simple inorganic substances like carbon and water**

Synthesis of hexose sugars (glucose) to complex substances such as

polysaccharide carbohydrate (starch), fat and protein synthesis.

**Heterotrophic component involves:**

- Utilization
- Rearrangement and Decomposition of complex substances
- Herbivores, Carnivores and Omnivores (Phototrophs) and microconsumers (Decomposers, osmographs and saprotrophs) comprise the heterotrophic component.

**Energy flow in an ecosystem:**

The manner in which energy flows in an ecosystem is known as energy flow. It is unidirectional.

The following points are important with regard to understanding energy flow in an ecosystem:

i. Efficiency of producers in absorption and conversion of solar energy.
ii. Using the converted energy (chemical energy – starch) by consumers
iii. Total input of energy as food and its efficiency of assimilation
iv. Energy lost through respiration, heat, excretion, etc.at each trophic level
v. Gross production and net production

**Two important points to be noted about energy flow in ecosystems are:**

i. Energy flow is unidirectional and
ii. There is a progressive decrease of energy as we progress along the food chain. The energy is lost as heat in metabolic activities such as respiration, hunting, etc.

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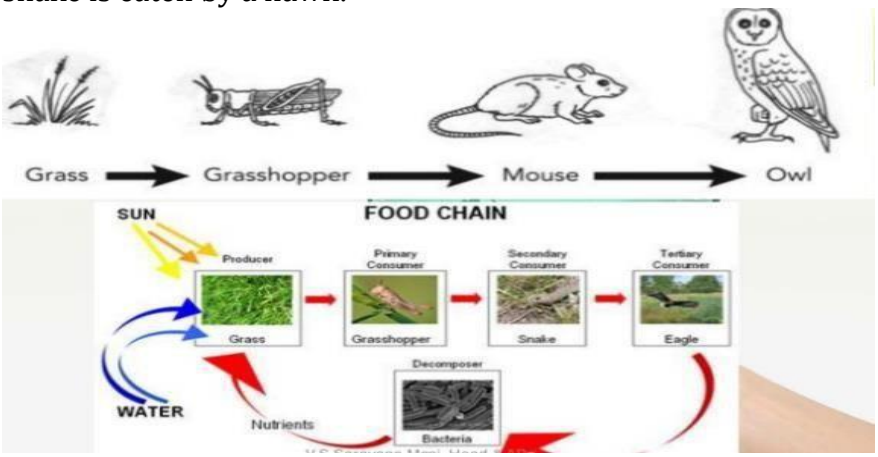
| 58. | **What are Food chains? Explain types of food chains and its significance in an ecosystem.**<br><br>**Food Chain:**<br>There sequence of eating and being eaten in an ecosystem is known as the food chain.<br>**OR**<br>Food chains follow a single path as animals eat each other.<br><br>Grass manufactures its food using sunlight, water, nutrients from soil and chlorophyll. The grass is eaten by a grasshopper. The grasshopper is eaten by a frog, the frog is eaten by a snake the snake is eaten by a hawk.<br>  <br><br>**Types of food chain:**<br>Food chains are classified in to two types<br>1. Grazing food chain<br>2. Detritus food chain<br>**Grazing food chain:**<br>Found in grassland ecosystem and pond ecosystem. Grazing food chains start with green plants (primary producers) and goes to decomposers food chain or detritus food chain through herbivores and carnivores.<br>**Detritus food chain:**<br>Found in grassland ecosystem and forest ecosystem. The Detritus food chain starts with dead organic matter (plants and animals) and goes to decomposers food chain through herbivores and carnivores.<br>**Significance of food chain:**<br>i. Energy flow and nutrient cycling takes place through them.<br>ii. They maintain and regulate the population size of different tropical levels, and thus help in maintaining ecological balance.<br>They have biomagnification. The non-biodegradable materials keep on passing from one tropical level to another. At each | CO2 | BTL3 |

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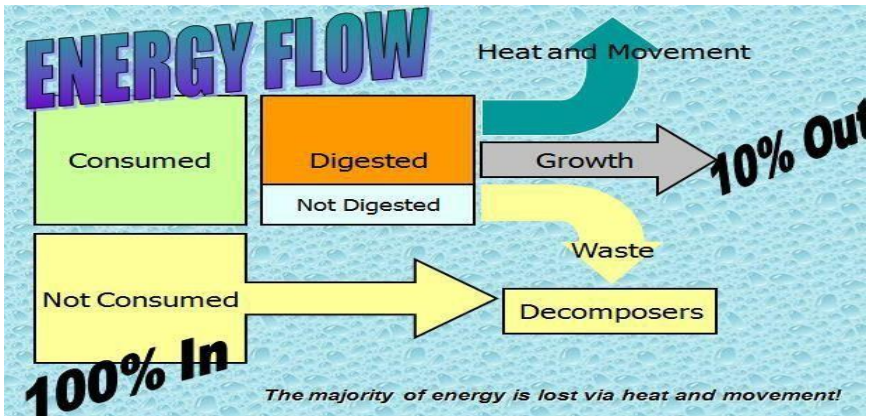
| | successive tropical level, the concentration keeps on increasing. This process is known as biomagnification. | | |
| 59. | **Write a detailed note on the energy flow in an ecosystem.**<br><br>It is a well-known fact that food energy is transferred from one trophic level to the next. The green plants manufacture food by the process of photosynthesis using the energy of the solar radiations, hence they are termed as the producers. During the photosynthetic process, atmospheric carbon dioxide is taken in by the plants to synthesize food. The oxygen released by the plants is used up by the animals for the process of respiration. The consumers live on the producers. The flow of energy in an ecosystem can be represented as follows,<br>**Solar radiation Producers Consumers > (Herbivores and Carnivores) > Decomposers.**<br><br>It is to be observed that the flow of energy is always in one direction, referred to as unidirectional flow of energy.<br>The trophic level is simply a feeding level in a food chain. The primary producers comprise the lower most trophic level consisting of plants, followed by the primary consumers (herbivores), then the secondary consumers (i.e., the carnivores feed on herbivores) and so on.<br><br>  <br><br><br>The figure shows a diagrammatic representation flow of energy and inorganic nutrients through the ecosystem. The flow of energy through the ecosystem is in the form of carbon- carbon bonds. The carbon-carbon bonds are broken during the process of respiration, the energy released is either utilized in various physiological activities or lost as heat to the environment.<br><br>The inorganic nutrients do not contain carbon-carbon bonds. A few examples of the inorganic nutrients are phosphorus in the teeth, bones and cellular membranes, the nitrogen of amino acids and the iron in the blood. The flow of nutrients through the | CO2 | BTL2 |

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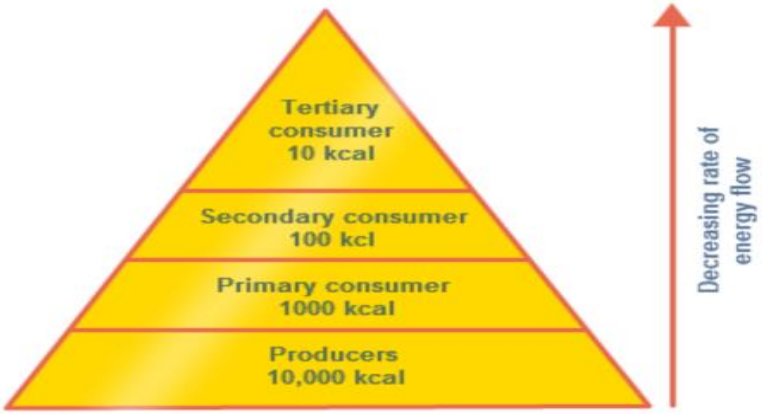
| | ecosystem in the diagram is represented by broken arrows. It may be observed that the producers obtain the inorganic nutrients from the inorganic nutrient pool. The inorganic nutrients pass from one trophic level to another and ultimately upon death of the organisms, they are converted to detritus by the decomposers. The inorganic nutrients are returned to the soil from whence they came. It is to be observed that the inorganic nutrients are recycled, whereas the energy is not.<br><br>Energy is utilized by plants for carrying out various metabolic activities like respiration, growth etc. A part of the energy remains unutilized and released as heat. The consumers that live on the producers are the herbivores. When the herbivores consume the plant material, the chemical energy present in the food is transferred to the animals. Part of this energy is utilized in their metabolic activities and growth and the remaining unused energy is dissipated as heat by these animals. This unused energy is lost to the environment. The carnivores live on the herbivores. They are also referred to as consumers of the second order. Some energy is again lost to the environment and some part of it is utilized in metabolic activities. Thus, it is to be observed that the transfer of energy from one organism to the other is accompanied by a decrease due to waste. The potential energy is converted to kinetic energy and heat energy. Environmentalists are of the opinion that the transfer of energy in a variety of ecosystems follows a definite pattern referred to as 10 percent law. The energy that is available at a particular level is just 10% of the previous level. | | |
| 60. | **Explain upright ecological pyramids with suitable examples.**<br><br>Graphical representation of structure and function of tropic levels on an ecosystem, starting with producers at the bottom and each successive tropic levels forming the apex is known as an ecological pyramid.<br>Ecological pyramids begin with the producers at the bottom like plants and they proceed to various trophic levels like herbivores consume plants, carnivores' prey on herbivores and so on. The highest level is at the top of the food chain.<br>There are three types of ecological pyramid<br>i. Pyramid of numbers<br>ii. Pyramid of energy<br>iii. Pyramid of biomass<br>Upright ecological pyramid will be seen in all the above three cases<br><br>**The pyramid of energy** or the energy pyramid describes the overall nature of the ecosystem. During the flow of energy from | CO2 | BTL3 |

organism to another, there is considerable loss of energy in the form of heat. The primary producers like the autotrophs there is more amount of energy available. The least energy is available in the tertiary consumers. Thus, shorter food chain has more amount of energy available even at the highest trophic level.

· The energy pyramid is always upright and vertical.

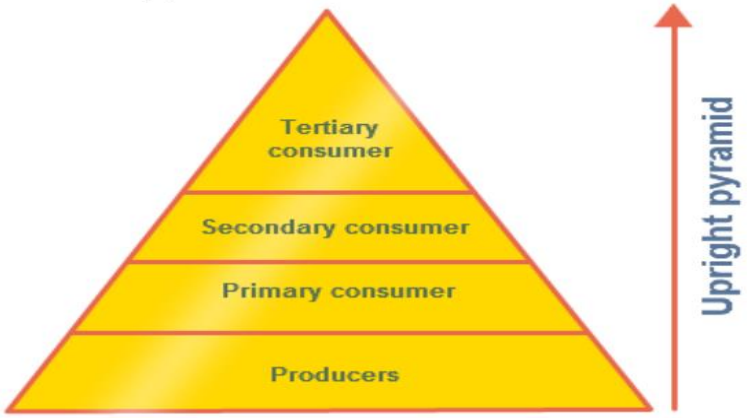
· This pyramid shows the flow of energy at different trophic levels. · It depicts the energy is minimum as the highest trophic level and is maximum at the lowest trophic level.

· At each trophic level, there is successive loss of energy in the form of heat and respiration, etc.



Pyramid of Energy

Upright Pyramid of Number This type of pyramid number is found in the aquatic and grassland ecosystem, in these ecosystems there are numerous small autotrophs which support lesser herbivores which in turn support smaller number of carnivores and hence this pyramid is upright.



Pyramid of Number

Upright Pyramid of Biomass This occurs when the larger net biomass of producers supports a smaller weight of consumers. Example: Forest ecosystem.

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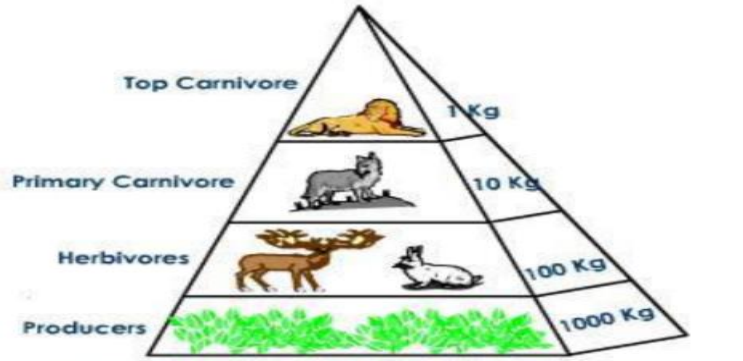
| |  <br>Upright Pyramid of biomass in a Terrestrial Ecosystem | | |
| | **UNIT-III SAQs** | **CO** | **BTL** |
| 61. | **What are the different levels of biodiversity?**<br><br>Biodiversity is defined as "the variety and variability among all groups of living organisms<br><br>and the ecosystems in which they occur."<br><br>Biodiversity is classified into three types:<br><br>1. Genetic diversity<br><br>2. Species diversity and<br><br>3. Community or Ecosystem diversity | CO3 | BTL1 |
| 62. | **What are endangered species? Give examples.**<br><br>A plant, animal or microorganism that is at immediate risk of biological extinction is called endangered species or threatened species.<br>Endangered or threatened species is one whose number has been reduced to a critical number.<br>Some of the rarest animals found in India are:<br>1. Asiatic cheetah2. Asiatic Lion3. Asiatic Wild Ass4. Bengal Fox | CO3 | BTL1 |
| 63. | **What are endemic species? Give examples.**<br><br>Species that are found only in a particular region are known as endemic species.<br>Almost 60% the endemic species in India are found in Himalayas and the Western Ghats.<br>Endemic species are mainly concentrated in:<br>1.North-East India 2. North-West Himalayas 3. Western Ghats and 4. Andaman & Nicobar Islands. | CO3 | BTL1 |

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| | Examples of endemic Flora species are:<br>1.Sapria Himalayana 2. Ovaria Lurida 3. Nepenthiskhasianaetc<br><br>Endemic fauna of significance in the western ghats are:<br>1. Lion tailed macaque 2. Nilgiri langur 3. Brown palm civet and<br>4. Nilgiri tahr | | |
| 64. | **Enlist the bio geographical areas in India.**<br><br>There are 10 biogeographical zones in India.<br><br>1. **Trans-Himalayas**<br>2. **Himalayas**<br>3. **Desert**<br>4. **Semi-arid**<br>5. **Western Ghats**<br>6. **Deccan Plateau**<br>7. **Gangetic plain**<br>8. **North-east India**<br>9. **Islands**<br>10. **Coasts** | CO3 | BTL2 |
| 65. | **Compute the value of biodiversity.**<br>Definition and estimation of the value of biodiversity is not easy. The value of biodiversity is classified into:<br><br>1. Direct Value and<br>2. Indirect Value<br><br>**Direct value of biodiversity is of two types:**<br>1. Consumptive use value and<br>2. Productive use value<br><br>**Indirect value of biodiversity is of the following types:**<br>1. non-consumptive use value<br>2. Optional value<br>3. Existence or ethical value<br>4. Information value | CO3 | BTL1 |
| 66. | **Discuss the various threats to biodiversity.**<br><br>Any disturbance in a natural ecosystem tends to reduce its biodiversity. Waste generated due to the increase in human population and industrialization spoils the environment and leads to decreased diversity in biological species. Any change in | CO3 | BTL2 |

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| | the system leads to a major imbalance and threatens the normal ecological cycle.<br>Causes for loss of biodiversity are:<br>1. Habitat loss:<br>a) Deforestation<br>b) Destruction of wetlands<br>c) Habitat fragmentation<br>d) Raw material<br>e) Production of drugs<br>f) Illegal trade<br>g) Developmental activities<br><br>2. Poaching of wildlife and<br><br>3. Man-wildlife conflicts | | |
| 67. | **List out the different conservational methods of biodiversity.**<br><br>There are two types of biodiversity conservation:<br>1. In-situ conservation and<br>2. Ex-situ conservation.<br><br>**In-situ conservation:** In-situ conservation involves protection of flora and fauna within its natural habitat. The natural habitats or ecosystems under in-situ conservation are called "protected areas".<br>1. Biosphere reserves<br>2. National parks<br>3. Wildlife sanctuaries<br>4. Gene sanctuaries<br><br>**Ex-situ conservation** involves protection of flora and fauna outside their natural habitats.<br>This type of conservation is mainly done for conservation of crop varieties and wild relatives of crops.<br><br>**Important centers of ex-situ conservation:**<br>1. Botanical gardens<br>2. Seed banks<br>3. Microbial culture collections<br>4. Tissue and cell cultures<br>5. Museums and | CO3 | BTL2 |

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| | 6. Zoological gardens | | |
| 68. | **Define "Hot Spots" and mention the areas in India which are called as "Hot Spots".**<br><br>Hotspots are biogeographic regions that are both a significant reservoir of biodiversity and are threatened with destruction. Globally there are 34 regions in the world, of which India has 4 regions.<br>They are:<br>1. The Himalayas<br>2. The Western Ghats<br>3. Indo –Burma Region and<br>4. Anadaman and Nicobar Islands. | CO3 | BTL2 |
| 69. | **Define Biodiversity. Why is it necessary to maintain Biodiversity?**<br>Biodiversity is defined as "the variety and variability among all groups of living organisms and the ecosystems in which they occur."<br><br>1.provide recreation and tourism<br>2. preserves genetic diversity of plants and animals<br>3. ensures sustainable utilization of life supporting systems on earth<br>4. is essential for conservation of ecological diversity and life supporting systems<br>5. helps maintain a stable and healthy environment<br>6. is an important source for drugs, herbs, food and other important raw material as these are derived from plants and animals. | CO3 | BTL2 |
| 70. | **List two endangered species of fauna in India.**<br>A plant, animal or microorganism that is in immediate risk of biological extinction is called endangered species or threatened specie<br>Some of the rarest animals found in India are: 1. Asiatic cheetah 2. Asiatic Lion 3. Asiatic Wild Ass 4. Bengal Fox 5. Gaur 6. Indian Elephant 7. Indian Rhinocerous 8. Marbled Cat 9. Markhor | CO3 | BTL1 |
| 71. | **Enlist the measures taken for conservation of Biodiversity.**<br>The following measures should be taken to conserve biodiversity<br>1. Illegal hunting and trade of animals and animal products should be stopped immediately 2. People-at-large should boycott purchasing coats, purse or bags made of animal skin 3. Bio-diversity laws should be strengthened. 4. Adequate crop and cattle compensation schemes must be started 5. Solar powered fencing must be provided with electric current proof trenches to prevent animals from entering fields. 6. Cropping pattern should be changed near the forest borders. 7. Adequate food and water should be made available for wild animals within forest zones. 8. Development and construction work in and around forest region must be stopped. Biodiversity is one of the important tools for sustainable development. The commercial, | CO3 | BTL 2 |

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| | medical, genetic, aesthetic, and ecological importance of biodiversity emphasizes the need for its conservation. | | |
| 72. | **What are the factors affecting endangered species?**<br>1. Human beings dispose wastes indiscriminately in nature thereby polluting the air, land and water. These pollutants enter the food chain and accumulate in living creatures resulting in death.<br>2. Over-exploitation of natural resources and poaching of wild animals also leads to their extinction.<br>3. Climate change brought about by accumulation of green houses gases in the atmosphere. Climate change threatens organisms and ecosystems and they cannot adjust to the changing environmental conditions leading to their death and extinction. | CO3 | BTL2 |
| 73. | **Write a short note on gene bank.**<br>Gene banks are a type of biorepository that preserves genetic material. For plants, this is done by in vitro storage, freezing cuttings from the plant, or stocking the seeds (e.g., in a seedbank). For animals, this is done by the freezing of sperm and eggs in zoological freezers until further need.<br>The main intention of gene banks is to conserve collections of plant genetic resources for posterity. This means that the documentation of the material must also be ensured across generations. | CO3 | BTL1 |
| 74. | **Distinguish between insitu and exsitu conservation methods.** | CO3 | BTL2 |

| In-situ Conservation | Ex-Situ Conservation |
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| This is an on-site conservation. | This is an off-site conservation. |
| It involves the natural habitats of organisms | It involves the man-made habitats. |
| It is appropriate for animals found abundantly. | It is appropriate for animals which are not found abundantly. |
| It is not suitable in case of rapid decline in the number of a species, due to any factor. | It is the best option in case of rapid decline in the number of a species, due to any factor. |
| Can be done for Wildlife and livestock conservation. | Can be done to conserve crops and their wild relatives. |
| Designation, management and monitoring of the target species, is involved in this. | Sampling, storage and transfer of target species from their natural habitats to man-made habitats, is involved in this. |

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| | It helps in maintaining the naturally ongoing processes of evolution and adaptation within the natural habitats of all the species. | It separates the animals from their naturally ongoing processes of evolution and adaptations. | |
| | Example – National parks, wildlife sanctuaries, Biosphere reserves. | Example – Zoos, Cryopreservation DNA banks, Aquariums, botanical gardens. | |
| 75. | **What are the factors affecting Biodiversity?**<br>**Factors affecting biodiversity:**<br>1. Biodiversity is disturbed by human activity.<br>2. Poaching of animals, over-exploitation of natural sources and degradation of habitats affect biodiversity.<br>3. Marine ecosystems are disturbed due to oil spills and discharge of effluents.<br>4. Climatic factors like global warming, ozone depletion and acid rain also affect biodiversity | CO3 | BTL1 |
| | **UNIT-III LAQs** | CO3 | BTL |
| 76. | **Write a note on bio geographical classification of India.**<br><br>There are 10 biogeographical zones in India. They are briefly described below:<br><br>1. Trans-Himalayas: The Trans-Himalayas is an extension of the Tibetan plateau.<br><br>2. Himalayas: The Himalayas form the northern boundary of India. The Himalayas comprisesa diverse range of biotic provinces and biomes.<br><br>3. Desert: Three kinds of deserts are found in India. They are, Desert of western Rajasthan, Desert of Gujarat and the high-altitude cold desert of Jammu & Kashmir and Himachal Pradesh.<br><br>4. Semi-arid: This zone lies in between the desert and the Deccan plateau.<br><br>5. Western Ghats: This is a mountain range that runs along the western coast of India. This ghat section covers a diverse range of biotic provinces and biomes.<br><br>6. Deccan Plateau: It is a large triangular plateau south of Narmada valley. The Satpura Mountains cover the north | CO3 | BTL2 |

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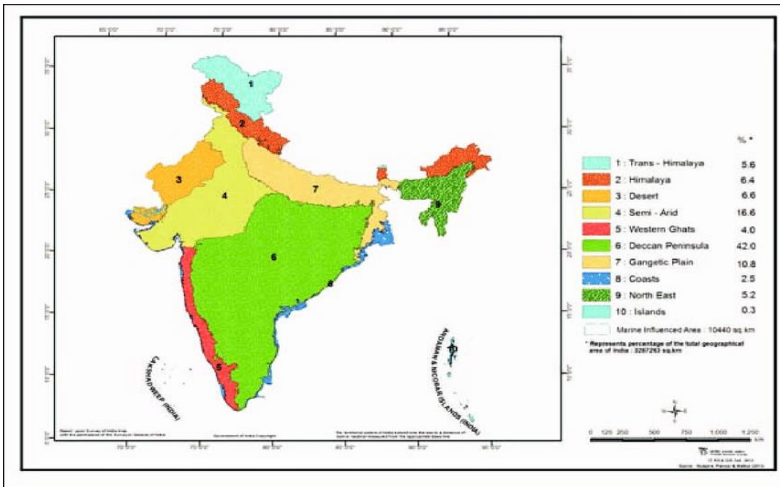
| | side, western Ghats and eastern Ghats cover the west and eastsides respectively. The plateau slopes towards east. The plateau is covered with deciduous Vegetation.<br><br>7. Gangetic plain: The Gangetic plains cover from south of the Himalayas to north of tropic of cancer. These planes were formed by the Ganges River system and are relatively homogenous. The famous 'sunder ban' forests are located in these plains.<br><br>8. North-east India: The plains and non-Himalayan hill ranges of northeastern India fall in this zone. This zone is filled with a wide variety of vegetation.<br><br>9. Islands: The Andaman and Nicobar Islands in the bay-of-Bengal is a group of 300 small and large islands. Mostly tribes live in Nicobar Islands. These islands have a highly diverse set of biomes.<br><br>10. Coasts: The Indian subcontinent is blessed with a long coastline on the east and west with distinct differences between the two.<br><br>  | | |
| 77. | **Elaborate on the various values of biodiversity.**<br><br>Definition and estimation of the value of biodiversity is not easy. The value of biodiversity is classified into:<br>1. Direct Value and<br>2. Indirect Value<br><br>Direct value of biodiversity is of two types | CO3 | BTL2 |

1. Consumptive use value and
2. Productive use value

- Consumptive use value: The consumptive use value is the value placed on nature's products that are consumed directly, without passing through a market. Some of them are firewood, food, and game meat. When direct consumption requires recreation, as in sport fishing and game viewing, the consumptive value is the whole recreational experience. Consumptive value seldom appears in national income accounts but could be easily included in measures such as GDP. It is valued from the cost if the resource was sold at market value, rather than being consumed.
  High consumptive use values on resources may lead to the following problems:
  1. Over-exploitation of wildlife in developing countries
  2. Loss of traditional controls on hunting and
  3. Loss of wildlife populations at productive levels.
  Consumptive use value benefits the communities closest to the resource if harvested sustainably and managed efficiently.
  Productive use value: Productive use value refers to products that are commercially harvested (sold in a market). Its value is estimated at the production end rather than retail end by adding an inflated cost to the finished product. Productive use value is often the only value of biological resource reflected in national income accounts and may have a major impact on the national economy. Timber, fish, honey, construction materials, mushrooms, fruits, medicinal plants and game meat sold in a market have productive use value.

- Indirect value of biodiversity: Indirect values provide economic benefits without being harvested and do not appear in GDP. However, they are crucial to other natural products which influence the GDP. These values involve functions performed by biodiversity which are not of any use. Ex: Ecological Processes etc. Direct values are often derived from indirect values because plants and animals are supported by the services provided by their environments. Many classes of plant and animal species are consumed by tribal and non-tribal communities.
  Ex:
  1. Ecological functions
  2. Flood and storm protection
  3. Waste assimilation
  4. Microclimatic functions

5. Nutrient cycles
6. Photosynthesis
7. Carbon stores
8. Soil protection, etc.

Indirect value of biodiversity is of the following types:
1. non-consumptive use value
2. Optional value
3. Existence or ethical value and
4. Information value

- Non-consumptive use value: This indirect value deals with nature's functions and services. It includes photosynthesis of plants which provides support system for other species by maintaining water cycle, regulating climate, production and protection of the soil, absorption and breakdown of pollutants, recreational, aesthetic, socio-cultural, scientific, educational, spiritual and historic values of natural environments. Recreational value is important with regard to tourism and helps the national GDP. Optional value: This refers to the potential of biodiversity that is currently known and needs to be explored. This refers to the idea that there may be several existing species that may prove to be important in future and their usefulness needs to be studied with reference to a specific problem currently plaguing society.

  Ex:

  1. The growing biotechnology field is searching for the cure for diseases like cancer and AIDS.
  3. Medicinal plants and herbs play a very important role in the economic growth of our country.

- Existence value: This is the value gained from continuous knowledge of existence. Also, this is the value that people are willing to pay to keep a species/community/ecosystem from going extinct. Examples of this are high amounts being spent on animals like pandas, whales, lions etc. Our rich heritage teaches us to worship plants, animals, rivers and mountains. Examples being the Ganga River, trees like Banyan and Peepal and plants like the Vambu, Tulsi and Vengai are worshipped. Information value: This relates to the educational, scientific, aesthetic and tourism values of biodiversity in an ecosystem.

- Aesthetic Values: Beautiful plants and animals inspire us to protect biodiversity. The most important aesthetic value of biodiversity is eco-tourism.

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| | Ex: 1. People from distant places spend time and money visiting areas where they can enjoy the aesthetic value of biodiversity. This is called eco-tourism.<br>2. The pleasant music of wild birds, beautifully coloured butterflies, colour of peacocks and colour of flowers are very important for their aesthetic value. | | |
| 78. | **What are the different conservational techniques of Biodiversity?**<br><br>There are two types of biodiversity conservation:<br>1. In-situ conservation and<br>2. Ex-situ conservation.<br><br>➢ In-situ conservation: In-situ conservation involves protection of flora and fauna within its natural habitat. The natural habitats or ecosystems under in-situ conservation are called "protected areas".<br>1. Biosphere reserves<br>2. National parks<br>3. Wildlife sanctuaries<br>4. Gene sanctuaries<br><br>Biosphere reserves cover large areas (>5000 sq.km.) They are normally used to protect species for a long time. The roles of biosphere reserves are listed below:<br>1. Long-term survival of evolving ecosystem<br>2. Protect endangered species<br>3. Protect maximum number of species and communities<br>4. Serve as site of recreation and tourism<br>May also be used for educational and research purposes Biosphere reserves function as an open system and changes in land use are not allowed. No tourism and explosive activities are allowed in biosphere reserves. A national park is an area dedicated to the conservation of wildlife along with its environment. It covers an area ranging from 100 to 500 sq.km. One or more national parks may exist within a biosphere reserve.<br><br>A national park is used for enjoyment through tourism, without affecting the environment. It is used to protect, propagate and develop wildlife. Grazing domestic animals inside national parks is prohibited All private rights and forestry activities are prohibited inside a national park | CO3 | BTL2 |

Wildlife sanctuary is an area that is reserved for the conservation of animals only.
1. It protects animals only
2. It allows operations such as harvesting of timber, collection of forest products, private ownership rights and forestry operations, provided it does not affect animals adversely

Gene sanctuary is an area where plants are conserved. Other projects for the conservation of animals are Project Tiger, Gir Lion Project, Crocodile breeding project, project elephant etc

- Advantages of in-situ conservation:

1. It is cheap and convenient
2. Species get adjusted to natural disasters like drought, floods, forest fires etc.

- Disadvantages of in-situ conservation:

1. A large surface area of earth is required to preserve biodiversity
2. Maintenance is not proper due to shortage of staff and pollution Ex-situ conservation

Ex-situ conservation involves protection of flora and fauna outside their natural habitats.
This type of conservation is mainly done for conservation of crop varieties and wild relatives of crops.
1. Ex-situ conservation involves maintenance and breeding of endangered plant and animal species under controlled conditions
2. It identifies those species that are at a high risk of extinction
3. It prefers species that are important for man in the near future among the endangered species.

- Important centers of ex-situ conservation:

1. Botanical gardens
2. Seed banks
3. Microbial culture collections
4. Tissue and cell cultures
5. Museums and
6. Zoological gardens

- Methods of ex-situ conservation:

National Bureau of Plant Genetic Resources (NPBGR) It is located in New Delhi and uses the Cryopreservation Technique to preserve agricultural and horticultural crops. Cryopreservation technique involves using liquid

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| | nitrogen at -196 C. Varieties of rice, turnip, radish, tomato, onion, carrot, chilli, tobacco have been successfully preserved for years using this technique.<br><br>National Bureau of Animal Genetic Resources (NPAGR) It is located in Karnal, Haryana and preserves the semen of domesticated bovine animals.<br><br>National Facility for Plant Tissue Culture Repository (NFPTCR) In this facility, conservation of varieties of crop plants or trees is done using tissue culture. This facility has been created within the NPBGR.<br><br>➢ Advantages of Ex-situ conservation:<br>1. Survival of endangered species is increasing due to special care and attention<br>2. In captive breeding the animals are assured of food, water, shelter and security thereby have a longer life span<br>3. It is carried-out in cases of endangered species that do not have any chance of survival in the wild<br><br>➢ Disadvantages of Ex-situ conservation:<br>1. It is an expensive method<br>2. Freedom of wildlife is lost<br>3. Animals cannot survive in the natural environment | | |
| 79. | **Discuss the various methods of conservation of animal species.**<br><br>India is the seventh largest country in the world and one of the top bio-rich nations with great diversity in the geographical and biological features. In this context, the term conservation refers to the protection, preservation, management, or restoration of biological resources as well as natural resources There is a pressing need for the conservation of biodiversity as it is being threatened due to human activities. The other reasons for conserving biodiversity include preserving the valuable natural resources for future generations and maintaining the dynamic balance of nature's complex ecosystem.<br><br>➢ Objectives:<br>The main objectives of conserving biodiversity are,<br>(i)Sustain the ecological processes and life supporting systems.<br>(ii)Preserve biological diversity for future generations.<br>(iii) Ensure the survival of many species and habitats.<br><br>➢ Types of Conservation of Biodiversity | CO3 | BTL2 |

Conservation of biodiversity can be broadly categorized into two types,
1. In-situ conservation
2. Ex-situ conservation.

- In-situ Conservation:

In-situ conservation of biodiversity refers to preserving the biological diversity within the natural habitat.
Objectives
The objectives of in-situ conservation are,
(i)Maintenance of genetic diversity of species in their natural habitat along with evolutionary adaptations to enable them to adapt to the changing environmental conditions.
(ii) Preserving the interlinked species along with the target species. (iii) Preserving the diversity of threatened species.
The measures involved in in-situ conservation of biological diversity include designating specific areas as protected sites such as national parks and wildlife sanctuaries. This enables the total diversity of life of a region from microscopic unicellular plants and animals to the giant trees and large mammals to be preserved and protected.

Wildlife Sanctuaries and National Parks in India:

India is a home to 44I wildlife sanctuaries and 80 national parks, consisting about two thousand different species of birds, 3500 species of mammals, around 30,000 species of different kinds of insects and above 15,000 varieties of plants. Some endangered species of animals and birds, especially the Asiatic Elephant, the Royal Bengal Tiger, the Snow Leopard and the Siberian Crane reside in these sanctuaries and forest reserves. The Great Himalayan National Park has more than 375faunal species, the major ones being blue sheep. Himalayan brown bear, snow leopard, Himalayan tahr, musk deer, serow, rhesus macaque, barking deer, goral, Himalayan black bear, red fox gray shrew, porcupine, pheasants, western tragopan, large Variety of insects, worms, mollusks.

The Dachigam Sanctuary has the highly endangered Hangul or the Kashmiri stag, Himalayan black bear, wild goat, leopard, musk deer, ibis, Himalayan marmot, blood pheasant, golden eagle and bearded vultures.

Integrated Protected Area System:
A protected area is an area of land and or sea meant for the protection and conservation of biological diversity. India about 8.1 million hectares of protected area comprising of 14% of country's forest regions and 4.60% of land mass.

The protected areas in India are, the whole states of Manipur, Mizoram, Arunachal Pradesh, Nagaland, Sikkim, parts of states of Uttaranchal, Jammu and Kashmir and Kashmir, Rajasthan and Himachal Pradesh

The 8,000 kms of coastline of India has five marine protected areas, Gulf of Mannar National Park, Tamil Nadu, Gul of Kutch Marine National Park and Gull of Kutch Marin Sanctuary, Gujarat, Mahatma Gandhi Marine National Park. Andaman and Nicobar Islands and Gahirmatha Sanctuary, Orissa.
The marine environment of India harbors a variety of resident and migratory wildlife whales, dolphins, olive ridley turtles, a variety of sharks, sea cucumbers, seashells, soft and hard corals, many of which are facing threat due to habitat destruction, overexploitation, commercial fishing, etc.

- Objectives

The objectives of the integrated protected area system for preservation of biodiversity are:

(a)Conservation of natural habitats.
(b) Protection and management of natural habitats and biodiversity(c)Sustainable management of protected areas.
(d) Create public awareness, both locally and nationally, about the need for conservation of protected areas.
(e)Promoting fundamental rights of indigenous communities living in and around the protected areas.
(f)Encourage sustainable tourism.
(g)Prohibition of illegal harvesting of plants and animals.
(h) Strive towards increased skills and practical application of environmental knowledge through positive environmental behavior.

Considering the vast biodiversity in the country, there is a need for more protected areas with well-developed management plans.

- ❖ Ex-situ Conservation:

Ex-situ conservation of biodiversity refers to preserving the biodiversity out of the context of their natural habitats.

- Objectives:

The objectives of ex-situ conservation are:
i)Preserve the threatened germplasm of plants and animals,
ii)Carryout research on conservation biology of indigenous and exotic flora and fauna.

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| | iii) Provide material for conservation education and display to the public.<br><br>EX- Silu conservation of biological resources can be accomplished in two ways:<br><br>(a) Conventional Method:<br>This method includes gene banks, community sec banks and ordinary seed banks.<br><br>(b) Biotechnological Method:<br>This method includes in-vitro conservation, cryopreservation, low pressure storage and low oxygen storage.<br><br>Gene Banks:<br>Genetic banks are frozen vaults meant for preserving the genetic material of thousands of different types of organisms at cryogenic temperatures to increase the shelf life of the organism's genetic material. Researchers preserve genetic information cryogenically to enable future cloning. The types of specimens frozen are sperms, eggs, hair, skin, blood of animals etc.<br><br>Sperm banks are used by doctors to freeze semen for the purpose of artificial insemination. At present, there are more than 14,000 gene banks worldwide, the most famous being the Svalbard Global Seed Vault. The deCODE project is yet another gene bank in Iceland that stores human genetic material for medical research.<br><br>Community Seed Banks:<br>The community seed banks operate on a small scale at the farming community level with less resources. The local growers retain the seed from previous harvests and exchange seeds within and between their communities.<br>In spite of all the efforts taken towards conservation of biodiversity in India, much more needs to be done as it is in our self-interest that we need to protect the biodiversity. Both ex-situ and in-situ conservation methods are considered as the appropriate way of preserving the components of biological diversity. They have an important role to play in protecting and preserving endangered species. Both these methods provide excellent research opportunities on the components of biological diversity. These measures aim to create awareness and educate the public about various components of biological diversity | | |

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| 80. | **Why should biodiversity be conserved?**<br><br>Conservation of biodiversity is vital for maintaining the Earth's environment and sustaining life on the planet. There are a number of ways in which the richness of biodiversity helps in maintaining the ecological system. Conservation of biodiversity is important for the Of survival of living beings on Earth. Hence, a lot of emphases are being given on the conservation of biodiversity these days.<br><br>**The Extinction in Biodiversity:** Due to human activities, numerous varieties of animals go extinct each year. Western Black Rhinoceros, Dodo, Tasmanian tiger, Golden Toad, Woolly Mammoth, Caribbean Monk Seal, lvory-billed Woodpecker, and Japanese Sea Lion are some of the species of animals that have gone extinct. Lemur, Mountain Gorilla, Vaquita, Sea Turtles, Amur Leopard, and Tiger are some of the species that are on the verge of extinction. Apart from these many species of plants and trees including Liriodendron, Araucaria Mirabilis, Wood Cycad and Kokia Cookie have gone extinct and many species are endangered<br><br>**Need to Conserve Biodiversity:** Earth is a beautiful planet which has given us many things which occur naturally. Natural resources, rivers, valleys, oceans, different species of animals and beautiful varieties of plants and trees are among some of these.<br><br>In today's world, we are busy developing our surroundings and spoiling our beautiful environment. Today, we have exploited most of the things that were available abundantly in nature Thus, there arises a need to conserve these natural things. Among other things, there is a serious need for the conservation of Biodiversity.<br><br>Conservation of biodiversity is important for many reasons. Here are some of the main reasons to conserve biodiversity:<br><br>**1.Process of food chain:** Different species of animals and plants serve as the source of food for other animals and living organisms. Thus, conserving biodiversity help to keep the food chain among the living organisms.<br><br>**2.Nutritional Needs:** The decline in the variety of plants | CO3 | BTL 3 |

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| | and animals would mean the decline in the variety of food we eat. So, this is likely to result in nutritional Deficiencies.<br><br>**3.Cleaner Air:** Plants and trees have a greater ability to purify the air and keep the atmosphere clean. As there is a decrease in the number and types of trees and plants, It impacts the quality of air in a negative way.<br><br>**4.Better Cultivation of Crops**: Fertility of soil is maintained by many insects, organisms and Microorganisms work on different levels. So, we have to maintain the level of microorganisms which is better for the cultivation of crops.<br><br>**5.For Medical Reasons**: For making different medicines many species of trees and plants are used so as to cure various diseases.<br><br>Conservation of biodiversity is of utmost importance. We must all make efforts to conserve biodiversity rather than contributing towards its decline. Thus, the richness of biodiversity is essential for the survival of living beings on Earth. | | |
| 81. | **Write a detailed note on Endangered species using appropriate examples.**<br><br>A plant, animal or microorganism that is at immediate risk of biological extinction is called an endangered species or threatened species.<br>In India, 450 plant species have been identified as endangered species. 100 mammals and 150 birds are estimated to be endangered.<br><br>India's biodiversity is threatened primarily due to:<br>1. Habitat destruction<br>2. Degradation and<br>3. Over exploitation of resources<br>The RED-data book contains a list of endangered species of plants and animals. It contains a list of species that are endangered but might become extinct in the near future if not protected.<br><br>Some of the rarest animals found in India are:<br>1. Asiatic cheetah<br>2. Asiatic Lion<br>3. Asiatic Wild Ass | CO3 | BTL3 |

4. Bengal Fox
5. Gaur
6. Indian Elephant
7. Indian Rhinoceros
8. Marbled Cat
9. Markhor

Extinct species are no longer found in the world. Endangered or threatened species is one whose number has been reduced to a critical number. Unless it is protected and conserved, it is in immediate danger of extinction.
Vulnerable species is one whose population is facing continuous decline due to habitat destruction or over exploitation. However, it is still abundant.
Rare species are localized within a restricted area or are thinly scattered over an extensive area. Such species are not endangered or vulnerable.

A few endangered species in the world are listed below:
1. West Virginia Spring Salamander (U.S.A)
2. Giant Panda (China)
3. Golden Lion Tamarin (Brazil)
4. Siberian Tiger (Siberia)
5. Mountain Gorilla (Africa)
6. Pine Barrens Tree Frog (Male)
7. Arabian Oryx (Middle East)
8. African Elephant (Africa)

Other important endangered species are:
1. Tortoise, Green Sea Turtle, Gharial, Python (Reptiles)
2. Peacock, Siberian White Crane, Pelican, Indian Bustard (Birds)
3. Hoolock gibbon, Lion-tailed Macaque, Capped monkey, Golden monkey (Primates)
4. Rauvolfiaserpentina (medicinal plant), Sandal wood tree, etc

Factors affecting endangered species:

1. Human beings dispose of wastes indiscriminately in nature thereby polluting the air, land and water. These pollutants enter the food chain and accumulate in living creatures resulting in death.
2. Over-exploitation of natural resources and poaching of wild animals also leads to their extinction.
3. Climate change is brought about by accumulation of greenhouses gases in the atmosphere. Climate change threatens organisms and ecosystems, and they cannot adjust to the changing environmental conditions leading to their death and extinction.

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| | An international treaty to help protect endangered wildlife is, "Convention on International Trade in Endangered Species 1975" (CITES). This treaty is now signed by 160 countries.<br>1. CITES lists 900 species that cannot be commercially traded as live specimens or wildlife products as they are in danger of extinction.<br>**2. CITES restricts the trade of 2900 other species as they are endangered.**<br><br>Drawbacks of cites:<br>1. This treaty is limited as enforcement is difficult and convicted violators get away by paying only a small fine.<br>2. Member countries can exempt themselves from protecting any listed species. | | |
| 82. | **Explain in detail the various threats to biodiversity.**<br><br>Any disturbance in a natural ecosystem tends to reduce its biodiversity. Waste generated due to the increase in human population and industrialization spoils the environment and leads to decreased diversity in biological species. Any change in the system leads to a major imbalance and threatens the normal ecological cycle.<br><br>Causes for loss of biodiversity are:<br>1. Habitat loss<br>2. Poaching of wildlife and<br>3. Man-wildlife conflict<br><br>**Habitat loss:** The loss of populations of interbreeding organisms is caused by habitat loss.<br>Factors influencing habitat loss are:<br>1. Deforestation: Loss of habitat is mainly caused by deforestation activities. Forests and grasslands are cleared for conversion into agriculture lands or settlement areas or developmental projects. Forests and grasslands are naturally home to thousands of species which disintegrate due to the loss of their natural habitat.<br>2. Destruction of wetlands: Wetlands, estuaries and mangroves are destroyed due to farming, filling and pollution that cause loss of biodiversity<br>3. Habitat fragmentation: When the habitat is divided into small and scattered patches the phenomenon is called habitat fragmentation. This leads to the disappearance of most wildlife<br>4. Raw material: To produce hybrid seeds, wild plants are used as raw materials leading to extinction of many wild plant species. | CO3 | BTL2 |

5. Production of drugs: Pharmaceutical companies collect wild plants for the production of drugs leading to extinction of several medicinal plant species.
6. Illegal trade: Illegal trade of wildlife reduces biodiversity leading to habitat loss
7. Developmental activities: Construction of dams in forest areas coupled with the discharge of industrial effluents kills birds and other aquatic life.

**Poaching of wildlife:** Poaching refers to killing animals or commercial hunting. It contributes to loss of biodiversity.
Poaching can be of two types listed below:
1. Subsistence poaching: This refers to killing animals for survival.
2. Commercial poaching: This refers to hunting animals in order to sell their products.

Factors influencing poaching:
1. Human population: Increased human population in India has led to pressure on forest resources, leading to degradation of wildlife habitats.
2. Commercial activities: Although a ban has been imposed internationally on the trade of products of endangered species, there is a continued smuggling of wildlife products. Since trading of such products is highly profitable, poachers continue to hunt endangered animals and smuggle their fur, skin and tusks to other countries.

Wildlife products include furs, horns, tusks, live specimens and herbal products. The richest source of biodiversity lies in developing nations in Asia, Africa and Latin America. Advanced countries like Europe, North America, Japan, Taiwan, Hong Kong are the major importers of wildlife products.

**Man-wildlife conflicts:**
Man-wildlife conflicts arise, when wildlife starts causing immense damage and danger to man. Under such conditions it is very difficult for the forest department officials to convince the affected villagers to gain the villagers support for wildlife conservation.
Ex:
1. In Sambalpur, Orissa, several people were killed by elephants. In retaliation, the villagers killed and injured several elephants.
2. In Mysore, elephants were killed by farmers in retaliation to the damage done by elephants to their cotton and sugarcane fields.
3. Villagers sometimes hide explosives in their fields to ward-off animals which explode when the elephants enter the fields

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| | 4. Several people were killed when leopards attacked them in Sanjay Gandhi National Park, Mumbai<br><br>Factors influencing man-animal conflicts:<br>1. Shrinking Forest cover compels wildlife to move outside the forest<br>2. Human encroachment into forest area induces a man-wildlife conflict<br>3. Injured animals have a tendency to attack man<br>4. Wild animals venture out of the forest area in search of food<br>5. Villagers set up electric wiring around their fields. This injures animals (Elephants) who suffer pain and become violent.<br>6. Cash compensation paid by the government is not enough.<br>7. Garbage near human settlements or food crops attracts wild animals. | | |
| 83. | **Elaborate on in-situ conservation method of flora and fauna with suitable examples.**<br><br>In-situ conservation:<br>In-situ conservation involves protection of flora and fauna within its natural habitat. The natural habitats or ecosystems under in-situ conservation are called "protected areas".<br>1. Biosphere reserves<br>2.National parks<br>3. Wildlife sanctuaries<br>4. Gene sanctuaries<br><br>Biosphere reserves cover large areas (>5000 sq.km.) They are normally used to protect species for a long time.<br><br>The roles of biosphere reserves are listed below:<br>1. Long-term survival of evolving ecosystem<br>2. Protect endangered species<br>3. Protect maximum number of species and communities<br>4. Serve as site of recreation and tourism<br>5. May also be used for educational and research purposes<br><br>Biosphere reserves function as an open system and changes in land use are not allowed. No tourism and explosive activities are allowed in biosphere reserves.<br>A national park is an area dedicated to the conservation of wildlife along with its environment. It covers an area ranging from 100 to 500 sq.km. One or more national parks may exist within a biosphere reserve. A national park is used for enjoyment through tourism, without affecting the environment. It is used to protect, propagate and develop wildlife. Grazing domestic | CO3 | BTL2 |

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| | animals inside national parks is prohibited. All private rights and forestry activities are prohibited inside a national park.<br><br>Wildlife sanctuary is an area that is reserved for the conservation of animals only.<br>1. It protects animals only<br>2. It allows operations such as harvesting of timber, collection of forest products, private ownership rights and forestry operations, provided it does not affect animals adversely<br><br>Gene sanctuary is an area where plants are conserved.<br>Other projects for the conservation of animals are Project Tiger, Gir Lion Project, Crocodile breeding project, project elephant etc.<br><br>Advantages of in-situ conservation:<br>1. It is cheap and convenient<br>2. Species get adjusted to natural disasters like drought, floods, forest fires etc.<br><br>Disadvantages of in-situ conservation:<br>1. A large surface area of earth is required to preserve biodiversity<br>2. Maintenance is not proper due to shortage of staff and pollution. | | |
| 84 | **Elaborate on ex-situ conservation method of flora and fauna with suitable examples.**<br>**Ex-situ conservation**<br>Ex-situ conservation involves protection of flora and fauna outside their natural habitats. This type of conservation is mainly done for conservation of crop varieties and wild relatives of crops.<br>1. Ex-situ conservation involves maintenance and breeding of endangered plant and animal species under controlled conditions<br>2. It identifies those species that are at a high risk of extinction<br>3. It prefers species that are important for man in the near future among the endangered species.<br>**Important centers of ex-situ conservation**:<br>1. Botanical gardens<br>2. Seed banks<br>3. Microbial culture collections<br>4. Tissue and cell cultures<br>5.Museums and<br>6. Zoological gardens<br>**Methods of ex-situ conservation**<br>National Bureau of Plant Genetic Resources (NPBGR) It is located in New Delhi and uses the Cryopreservation Technique to preserve agricultural and horticultural crops. Cryopreservation technique involves using liquid nitrogen at -196 C. Varieties of rice, turnip, radish, tomato, onion, carrot, chilli, tobacco have been successfully preserved for years using this technique. | CO3 | BTL2 |

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| | National Bureau of Animal Genetic Resources (NPAGR) It is located in Karnal, Haryana and preserves the semen of domesticated bovine animals. National Facility for Plant Tissue Culture Repository (NFPTCR) In this facility, conservation of varieties of crop plants or trees is done using tissue culture. This facility has been created within the NPBGR.<br>**Advantages of Ex-situ conservation**<br>1. Survival of endangered species is increasing due to special care and attention<br>2. In captive breeding the animals are assured of food, water, shelter and security thereby have a longer life span<br>3. It is carried-out in cases of endangered species that do not have any chance of survival in the wild<br>**Disadvantages of Ex-situ conservation**<br>1. It is an expensive method<br>2. Freedom of wildlife is lost<br>3. Animals cannot survive in the natural environment | | |
| 85. | **Write a detailed note on global and National efforts to preserve biodiversity.**<br>Biodiversity at Global, National and Local levels<br><br>**CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora)** is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. CITES was drafted as a result of a resolution adopted in 1963 at a meeting of members of IUCN (The World Conservation Union). The text of the Convention was finally agreed at a meeting of representatives of 80 countries in Washington, D.C., United States of America, on 3 March 1973, and on 1 July 1975 CITES entered in force. The original of the Convention was deposited with the Depositary Government in the English, French and Spanish languages, each version being equally authentic.<br><br>Widespread information about the endangered status of many prominent species, such as the tiger and elephants, might make the need for such a convention seem obvious. But at the time when the ideas for CITES were first formed, in the 1960s, international discussion of the regulation of wildlife trade for conservation purposes was something relatively new. With hindsight, the need for CITES is clear. Annually, international wildlife trade is estimated to be worth billions of dollars and to include hundreds of millions of plant and animal specimens. The trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them, including food products, exotic leather goods, wooden musical instruments, timber, tourist curios and medicines. Levels of exploitation of some animal and plant species are high and the trade | CO3 | BTL2 |

in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future.

Because the trade in wild animals and plants crosses borders between countries, the effort to regulate it requires international cooperation to safeguard certain species from over-exploitation. CITES was conceived in the spirit of such cooperation. Today, it accords varying degrees of protection to more than 37,000 species of animals and plants, whether they are traded as live specimens, fur coats or dried herbs.

CITES is an international agreement to which States and regional economic integration organizations adhere voluntarily. States that have agreed to be bound by the Convention ('joined' CITES) are known as Parties. Although CITES is legally binding on the Parties – in other words they have to implement the Convention – it does not take the place of national laws. Rather it provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that CITES is implemented at the national level. For many years CITES has been among the conservation agreements with the largest membership, with now 184 Parties.

COBD:
Signed by 150 government leaders at the 1992 Rio Earth Summit, the Convention on Biological Diversity is dedicated to promoting sustainable development. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognizes that biological diversity is about more than plants, animals and microorganisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live.

1.Global Initiatives for Biodiversity Assessment The initiative for biodiversity assessment was taken long back in 1991 with the UNEP Biodiversity Country Studies Project (consisting of bilateral and Global Environmental Facility funded studies in developing countries) implemented in cooperation with donor countries and UNDP. The preparation of it dates back to 1987. Nineteen studies have been completed and several more are in the process of completion. The approach from gene to ecosystem was initiated as a Research Agenda for Biodiversity, IUBS/SCOPE/ UNESCO, Paris (Sol brig, 1991). The agreed text of the Convention on Biological Diversity was adopted by 101 governments in Nairobi in May 1992, signed by 159 governments and the European Union at the United Nations Conference on Environment and Development (UNCED) held at Rio ENVIRONMENTAL SCIENCE : BIODIVERSITY AND

CONSERVATION 143 de Janeiro in June 1992. At present 174 governments is party to this convention. Apart from this Global Biodiversity Strategy (1992), Global biodiversity; Status of the Earth's Living Resources (1992), Caring for the Earth; A Strategy for Sustainable Living (1991), Global Marine Biological Diversity: A Strategy for Building Conservation into Decision Making (1993), Norway/UNEP Expert Conference on Biodiversity (1993) and From Genes to Ecosystems: A Research Agenda for Biodiversity (1991) are the milestones on the international biodiversity initiatives. Many more nations are engaged in developing their own National Biodiversity Strategies. Global Biodiversity Assessment (UNEP, 1995) estimates the total number of animal and plant species to be between 13 and 14 million. It further records that so far only 1.75 million species have been described and studied. Ecosystem diversity has not been even reasonably explored as yet. Hence, there seems to be wide gap of knowledge at global, regional and local levels. Till recent past biodiversity conservation was thought to be limited to saving genes, species and habitats but the implementation revolutionary policies and more awareness has led to the emergence of a framework based upon saving biodiversity, studying and most importantly using it sustainable. Reforms in the field of forestry, agriculture, technology, international trade agreement and watershed management is required. Biodiversity is directly or indirectly related to masses (researchers, government agencies, non-government agencies and private sectors) 'at all levels of development. Since we depend upon biodiversity our various activities can be linked to its usage and conservation. Therefore, trade, economics, population, land tenure, intellectual property rights and resource consumption & waste are all related to biodiversity conservation. Hence, its sustainable use can be promoted through information, ethics, knowledge and awareness.

2. Levels of Action Need for biodiversity conservation is realized by all nations of the world because their lies common interest of masses. Most of the resources do not belong to an individual, a nation or a continent. They are simply global. Each and every member on the earth has equal right over it. To limit the loss of biodiversity globally 4 major steps have been realized important at national, regional and local levels.

(i) Global Environment Facility (GEF) World bank, United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) established the GEF in 1900 on a three-year pilot basis. The GEF is expected to commit $ 400 million for the biodiversity conservation issue.

(ii) International Biodiversity Strategy Programme (IBSP) World Resources Institute (WRI), World Conservation Union (WCU),

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| | UNEP together with more than 40 Governmental and non-Governmental organizations have prepared the framework to drastically reduce the loss of biodiversity. This would serve mankind on a more sustainable basis.<br>(iii) Convention on Biological Diversity (COBD) Under the aegis of UNEP, more than 100 nations gathered during Earth Summit at Brazil. This was accomplished to work out a legal framework for Governing international financial support for biodiversity conservation,<br>• The identification of international conservation priorities and<br>• Technology transfer for conservation and use of biodiversity.<br><br>(iv) Agenda 21 Developed through a series of inter-Governmental preparatory meetings with input from a variety of non-Governmental processes including the Biodiversity Strategy Programme—AGENDA 21 provides a plan of action on a number of issues including biodiversity. | | |
| 86. | **What are the different levels of biodiversity? Explain with suitable examples.**<br>Biodiversity is defined as "the variety and variability among all groups of living organisms and the ecosystems in which they occur." There are three levels of Biodiversity<br>1. Genetic diversity<br>2. Species diversity and<br>3. Community or Ecosystem diversity<br><br>**Genetic diversity** - A species with different genetic characteristics is known as a sub-species or "genera".<br>Within individual species, there are varieties, that are slightly different from one other. These differences are due to differences in the combination of genes. Genes are the basic units of hereditary information transmitted from one generation to the other. **Examples:**<br>1. Rice varieties -All rice varieties belong to the species "oryzasativa". However there are thousands of rice varieties that show variation at the genetic level in the form of different size, shape, colour and nutrient content<br>2.Teak wood varieties: The various teak wood varieties available are - Indian teak, Burma teak, Malaysian teak etc.<br><br>**Species diversity** - A discrete groups of organisms of the same kind is known as species. Species diversity is the diversity between different species. The sum of varieties of all living organisms at the species level is known as species diversity. The biotic component is composed of a large number of species of plants, animals and microorganisms which interact with each other and with the abiotic component of the environment<br>**Examples:** | CO3 | BTL2 |

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| | The total number of species living on earth is approximately more than 2 million. However, only around 1.5 million are found and assigned scientific names.<br>**Plant species:** Apple, Mango, Wheat, Grapes, Rice etc.<br>**Animal species:** Lion, Tiger, Elephant, Deer etc.<br><br>**Community or Ecosystem diversity** - A set of biotic components (plants, animals and microorganisms) and abiotic components (soil, air, water, etc) interacting with each other is known as an ecosystem. The diversity at an ecological level or habitat level is known as ecosystem diversity.<br>**Examples:** River ecosystem Rivers include fish, aquatic insects, mussels and a variety of plants that have adapted. Ecosystem diversity is the aggregate of different environmental types in a region. It explains the interaction between living organisms and physical environment in an ecosystem. | | |
| 87. | **Why is India a Mega Diverse country? Give reasons.**<br>India has a landmass of 3.29 million square kilo meter and the second largest populated country in the world with a population of just over one billion. It is the seventh largest country in the world with great diversity in the geographical and biological features.<br>Of the 195 independent countries in the world today about 70% of the world biodiversity lies in 17 countries which include Australia, Brazil. China, Columbia, Equador, United States, South Africa, India, Indonesia, Madagascar. Malaysia, Mexico, Papua. New Guinea Peru, Philippines, Venezuela and the Democratic Republic of Congo. All these countries have been labelled as mega-diverse nations (i.e. Biologically wealthiest nations).<br>India is one of the top bio-rich nations for diverse varieties of plants and animals. This country is home to about350 varieties of mammals, 120O species of birds, 453 species ad reptiles, 45,000 plant species (including 1022 species of ferns and 1082 species of orchids) and 50,000 species of insects (including 13,000 butterflies and moths). The number of endemic plants in the country are about 18% with high degree of endemism in the flowering plants.<br>it is definitely exciting to learn that our country is one of the mega-diverse countries in the world. India is a home for a large number of wild species in 80 national parks, India is blessed with large number of tigers, one horned rhinos and elephants, over 2000 species of birds, more than 500 species of reptiles and amphibians and 30,000 species of insects.<br>The information provided by the National Bureau of Plant Genetic Resources, National Bureau of Animal Genetic Resources, Central Rice Research Institute states that genetic diversity among living species are varied. Some examples are as tabulated below,<br>Rice -50,000 varieties<br>Mango - 1000 varieties<br>Sorghum -5000 varieties<br>Pepper 500 varieties<br>Cattle -27 breeds | CO3 | BTL3 |

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| | Goats 22 breeds<br>Sheep - 40 breeds<br>Poultry-18 breeds<br>Buffalo -8 breeds<br>There is considerable reduction in the biological divers owing to humans and their activities. Hence, all efforts must focus at the following,<br>(i) Maintenance of ecological processes and life support systems<br>(ii) Preserve the genetic diversity<br>(iii) Ensure Sustainable utilization of species and ecosystem. | | |
| 88. | **What are hotspots of biodiversity?**<br>Hotspots of biodiversity are those areas which are mostly rich in endemic species and are in constant threat of overexploitation. Across the world, 18 biodiversity hotspots have been identified out of which three of them are located in India. These are the Eastern Himalayas, the Western Ghats and the hilly ranges of India Myanmar border. All the 18 hotspots Contain approximately 49,995 endemic plant species in 746,400 sq km or 0.5% of earth's land surface.<br>**1. Eastern Himalayas**<br>The Eastern Himalayas comprises Nepal, Bhutan, neighbouring states of the east and north-east India and Yunnan province in south-western China. It contains about 9000 plant Species, of which 39% of them are endemic. India has 5,800 plant species, out of which 2000 of them are endemic. The area is generally referred to as 'cradle of speciation' as it is rich in primitive flowering plants and also with species of several families of Monocotyledons, Orchidaceae, Zingiberaceae, Arecaceae, Gymnosperms and Pteridophytes. About 55 species of flowering plants are rare species.<br>Example Pitcher plant (Nepenthes khasiana). The region of eastern Himalayas is rich in rice, banana,Citrus, ginger, chilli, jute,sugarcane. It is considered as the region for origin of five palms of commercial importance coconut, arecanut, palmyra palm, sugar palm and wild date palm. Many species of tea (Thea sinensis) are cultivated in this region. The area is a rich center for diversity in mammals and aves. Two species of mammals discovered are Golden Langur from Assam- Bhutan region and Namdapha flying squirrel from Arunachal Pradesh. This region is home to more than 60% of Indian birds, 35 endemic reptilian species, 68 species of amphibians (20 species are endemic) four new species of fish and fifteen new species of beetles.<br><br>2. **Western Ghats**<br>The Western Ghats is rich in 1500 endemic species of dicotyledonous plants. The fauna in this region comprises of 315 species of vertebrates including 12 species of mammals, 13 species of birds, 89 species of reptiles, 87 species of amphibians and 104 fish species. Rare fauna include lion tailed macaque, Nilgiri langur, nilgiritah and flying squirrel and Malabar grey hornbill.<br><br>3. **Hilly Ranges of India- Myanmar Border** | CO3 | BTL1 |

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| | The third biological hotspot identified is in the hilly ranges of India Myanmar border. This region begins with the evergreen forests in the foothills of Chittagong in Bangladesh which continues through the Garo and Khasi Hills of Meghalaya, then extends through Manipur, Mizoram and Nagaland. | | |
| 89. | **Give detailed reasons for loss of biodiversity.**<br>In general terms, the word "biodiversity can be defined as the concentration of various entities such as genera ecosystem, different species and organism confined to a particular region.<br>There are numerous reasons which led to the loss of biodiversity on earth. Few of these reasons are effectively discussed below.<br><br>1. **Urbanization or Industrialization**<br>Urban areas refer to those regions of the society where the local residents have extremely high standard of life in all respects. Hence, urbanization is a process by which the standard of a given area can be enhanced. This generally happens when a given region is promoted to many developmental activities in which industrialization is said to be the prime motive. As many societies of a given country turn outs to be urbanized. people belonging to these areas do not care about various other notions such as nature and other elements.<br>Hence, with the increase in population in these areas various drastic effects such as sharing of limited supply of goods and services, vacating many forest areas, not' caring for the values of flora and faunas etc., are seen which is leading to the loss of biodiversity.<br>Rapid industrialization and urbanization are also destroying the natural habitats of flora and fauna; hence, they are becoming endangered species. Example, destruction of grasslands in India had led the black buck (Antelope cervicapra)to become an endangered species.<br><br>2. **Deforestation or Reduced Green Cover Throughout the World**<br>Man's selfishness and greed to acquire greater land was one of the major causes which led to deforestation. Deforestation refers to cutting down the forests and utilizing these lands for various other purposes like converting into agricultural lands, constructing houses etc. This may resort loss in biodiversity since the trees which were destroyed Supported many species of animal kingdom as the trees are the major source of livelihood and shelter to these animals. This depletion can lead to huge increase in pollution as trees in take harmful carbondioxide and release the oxygen during the photosynthesis process.<br>It also accounts for decrease in rainfall as the trees help to bring about the rain laden clouds. Loss of soil erosion also occurs as the roots are not present to bind the soil particles, which leads to loss of highly organic humus soil content. It also leads to decrease in the ground water table as surface-run off of water occurs, thereby the ground water resources are not replenished.<br><br>**3.Soil Degradation/Erosion, Loss of Fertility of Land** | CO3 | BTL2 |

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| | These generally occurs due to deforestation, overgrazing, large streams of running water, droughts, famines, improper tilling and Jevelling of lands, jhoom cultivation etc.<br><br>4.**Drilling, Excavations Constructions of Roads and Projects** This also causes loss of biodiversity since, drilling of land causes usage of heavy machineries which consumes gallons of fuels and at the same time releasing poisonous or harmful gases, hence polluting the earth. At certain times improper drilling of lands (during laying of roads or excavating ores) can lead to severe earthquakes causing huge loss to life and property. While implementing river valley projects, if the outcomes of projects are not analyzed scientifically, this may also cause huge loss to life and property<br>Example, The Hydel project which was used for irrigating cultivated lands and also for producing electricity created a serious impact on the ecosystems of the environment.<br><br>**5.Legal Business and Smuggling Activities**<br>The smuggling activities include illegal trade of highly valuable items such as animal skins, all types of drugs, sandal woods etc. These items can earn extremely large profits in foreign markets. These smuggling activities include killing of wild animals illegally and destruction of useful trees, hence causing huge loss of biodiversity on earth.<br>6. **Unequal Developmental Activities**<br>When we analyze the current scenario of this world, only few countries have established themselves as developed nations, whereas the other nations where poverty has its deep roots 'are referred as underdeveloped nations. Hence, this unequal globalization also accounts for loss in biodiversity since the greed of developed nations may fascinate them to exploit several natural resources of under developed nations by means of power.<br>7. **Exploitation of Natural Resources**<br>As the population is increasing terribly, the government of most of the countries started exploiting the available natural resources without analyzing the various outcomes of it in the near future. This is not restricted to only crude oil supplies but it extends itself even to other natural resources such as metals. Coal, diamonds and natural gases<br>All the above factors contribute to loss of biodiversity, hence imposing a major threat to the environment as the abiotic and biotic components of the nature are interrelated and interdependent on each other. | | |
| 90. | **Differentiate between Endangered species and Endemic species with suitable examples.**<br><br>**s.no** \| **Endangered species** \| **Endemic species** | CO3 | BTL3 |

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| | 1 | The species which are on the verge of extinction are known as Endangered species. | The species which are confined to a specific region or area are known as Endemic species. | | |
| | 2 | The population of the species is comparatively low and is declining briskly. | The population of the species as they are adapted to a region and would not be able to survive shifted to other locations. | | |
| | 3 | The examples are giant pandas, and blue whales. | The examples are the lemurs of Madagascar and the tortoises of the Galapagos | | |
| | 4 | We can take measures to save them to not go in the level of extinct. | We cannot take any measures to save them as they are extinct now. | | |
| | 5 | Restricted local distribution within the Luzon area. | Restricted local distribution within the Philippines. | | |
| | 6 | The immediate habitat is threatened by human settlement. | The habitat is affected negatively by human settlement. | | |
| | 7 | Endemic is a Philippines and is threatened due to collection mining slash-and-burn or intensive agriculture. | Indigenous in the Philippines and is threatened due to collection mining slash-and burn or intensive agriculture. | | |
| | 8 | Endangered species are these which are uncommon and exist low population. | Endemic species on the other hand are neither low populate nor uncommon | | |
| | 9 | Endangered species may move into vulnerable categories. | Endemic species are already into danger of extinction | | |
| | 10 | A species is endangered when it is facing a very high risk of extinction in the wild in the near future. | A taxon is extinct when there is no reasonable doubt that the last individual has died. | | |
| | | Ex.Giantpanda,polar bear | Ex Indian cheetah | | |
| | **UNIT-IV SAQs** | | | | **BTL** |
| 91. | **Write a short note on the health effects of toxic gases.** | | | CO4 | BTL1 |

**Carbon monoxide:**

Health effects include reduced ability of red blood cells to carry oxygen to body cells and tissues. This leads to headaches and anemia. At high levels, it causes coma, irreversible brain damage, and death.

**Nitrogen Dioxide:**

Health effects include lung irritation and damage. Environmental effects involve acid deposition leading to damage of trees, lakes, soil, and ancient monuments.

**Sulphur Dioxide:**

Health effects involve breathing problems for healthy people. Environmental effects involve reduced visibility and acid deposition on trees, lakes, soils, and monuments leading to their deterioration and adverse effects on aquatic life.

**Suspended Particulate Matter (SPM):**

Human sources for SPM include burning coal in power and industrial units, burning diesel and other fuels in vehicles, agriculture, unpaved roads, construction, etc. Health effects include nose and throat irritation, lung damage, bronchitis, asthma, reproductive problems, and cancer.

**Ozone:**

Ozone is a highly reactive gas with an unpleasant odor occurring in the stratosphere where it protects mankind from the harmful ultraviolet rays from the Sun. However, on earth, it is a pollutant. It occurs on earth due to the reaction between Volatile Organic Compounds (VOCs) and Nitrogen Oxides. It moderates the climate. Photochemical smog is a brownish smoke that frequently forms on clear, sunny days over large cities with significant amounts of automobile traffic. It is mainly due to chemical reactions among nitrogen oxides and hydrocarbons in the presence of sunlight. Health effects include breathing problems, cough, eye, nose, and throat irritation,

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<tr><td></td><td>heart diseases, reduced resistance to colds and pneumonia. Additionally, smog reduces visibility.<br><br>Lead:<br><br>Lead is a solid and highly toxic metal. Its compounds are emitted into the atmosphere as particulate matter. Human sources: Paint, Smelters (metal refineries), lead manufacture, storage batteries, leaded petrol, etc. Health effects: Lead accumulates in the body and brain leading to nervous system damage and mental retardation (especially in children), digestive, and other health problems. Lead-containing chemicals are known to cause cancer in test animals.<br><br>Chromium:<br><br>It is a solid toxic metal emitted into the atmosphere as particulate matter. Human sources: Paint, Smelters, Chromium manufacture, Chromium plating. Health Effects: Perforation of nasal septum, chrome holes, etc.<br><br>I</td><td></td><td></td></tr>
<tr><td>92.</td><td>Distinguish between primary and secondary air pollutants.<br><table><tr><th>Primary pollutants</th><th>Secondary pollutants</th></tr><tr><td>Primary pollutants are those that are directly emitted in the atmosphere in the harmful form<br>Ex: CO, NO, CO2, SO2etc</td><td>Secondary pollutants are those that are formed by reacting with other components or some basic component of the atmosphere to form new pollutants.<br>Ex: Oxides of Nitrogen (NO2 or NO3) react with moisture in the atmosphere to give nitric acid.</td></tr></table></td><td>CO4</td><td>BTL2</td></tr>
<tr><td>93.</td><td>Write the causes for soil pollution.<br><br>• Industrial wastes: These pollutants affect and alter the chemical and biological properties of soil. As a result, hazardous chemicals can enter the human food chain</td><td>CO4</td><td>BTL2</td></tr>
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| | from the soil or water, disturb the biochemical process, and finally lead to serious effects on living organisms.<br>• **Urban wastes:** Urban wastes comprise both commercial and domestic wastes consisting of dried sludge and sewage. All the urban solid wastes are commonly referred to as refuse. This refuse consists of garbage and rubbish materials like plastics, glasses, metallic cans, fibers, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles, and other discarded manufactured products.<br>• **Agricultural practices:** Modern agricultural practices largely pollute the soil. With advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides, and weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution.<br>• **Radioactive pollutants:** Radio nuclides of Radium, Thorium, Uranium, isotopes of Potassium (K-40), and Carbon (C-14) are commonly found in soil, rock, water, and air. Explosion of hydrogen weapons and cosmic radiation include neutron-proton reactions by which Nitrogen (N-15) produces C-14. This C-14 participates in the Carbon metabolism of plants, which is then transferred into animals and human beings.<br>• **Biological agents:** Soil gets a large amount of human, animal, and bird excreta, which constitute a major source of land pollution by biological agents. | | |
| 94. | **What are the control measures for air pollution?**<br><br>The atmosphere has several built-in self-cleaning processes such as dispersion, gravitational settling, flocculation, absorption, rain-washout, etc. to cleanse the atmosphere. Some measures that can be adopted in this direction are:<br>• Using unleaded petrol<br>• Using fuels with low sulphur and ash content<br>• Encouraging people to use public transport, walk, or use a cycle as opposed to private vehicles<br>• Ensure that houses, schools, restaurants, and playgrounds are not located on busy streets<br>• Plant trees along busy streets as they remove particulates, carbon dioxide, and absorb noise<br>• Industries and waste disposal sites should be situated outside the city, preferably on the downwind of the city.<br>• Catalytic converters should be used to help control emissions of carbon monoxide and hydrocarbons. | CO4 | BTL2 |

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| | Control measures in industrial centers:<br>• Emission rates should be restricted to permissible levels by each and every industry<br>• Incorporation of air pollution control equipment in the design of plant layout must be made mandatory<br>• Continuous monitoring of the atmosphere for pollutants should be carried out to know the emission levels.<br>**EQUIPMENT USED TO CONTROL AIR POLLUTION**<br>Air pollution can be reduced by adopting the following approaches:<br>• Ensuring a sufficient supply of oxygen to the combustion chamber and adequate temperature so that the combustion is complete, thereby eliminating much of the smoke consisting of partly burnt ashes and dust.<br>• To use mechanical devices such as scrubbers, cyclones, baghouses, and electrostatic precipitators in manufacturing processes. The equipment used to remove particulates from the exhaust gases of electric power and industrial plants is shown below. All methods retain hazardous materials that must be disposed of safely. Wet scrubbers can additionally reduce sulphur dioxide emissions.<br>• The air pollutants collected must be carefully disposed of. Factory fumes are dealt with chemical treatment. | | |
| 95. | **Discuss the effects of air pollution on living organisms.**<br><br>Carbon monoxide: It is a colorless, odorless gas that is poisonous to animals.<br>Health effects include the reduced ability of red blood cells to carry oxygen to body cells and tissues. This leads to headache and anemia. At high levels, it causes coma, irreversible brain damage, and death.<br>Nitrogen Dioxide: It is a reddish-brown irritating gas.<br>Health effects include lung irritation and damage. Environmental effects involve acid deposition leading to damage of trees, lakes, soil, and ancient monuments. NO2 can damage fabrics.<br>Sulphur Dioxide: It is a colorless and irritating gas.<br>Health effects involve breathing problems for healthy people.<br>Environmental effects involve reduced visibility and acid deposition on trees, lakes, soils, and monuments leading to their deterioration and adverse effects on aquatic life.<br>Suspended Particulate Matter (SPM): Includes a variety of particles and droplets (aerosols) that can be suspended in the atmosphere for short to long periods. | CO4 | BTL2 |

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| | Health effects include nose and throat irritation, lung damage, bronchitis, asthma, reproductive problems, and cancer.<br>Lead is a solid and highly toxic metal.<br>Health effects: Lead accumulates in the body and brain leading to nervous system damage and mental retardation (especially in children), digestive and other health problems. Lead-containing chemicals are known to cause cancer in test animals. | | |
| 96. | **Write a short note on composting.**<br><br>COMPOSTING:<br><br>In this method, bulk organic waste is converted into fertilizer by biological action. Separated compostable waste is dumped in underground trenches in layers of 1.5m and finally covered with earth of 20cm (about 7.87 in) and left for decomposition. Sometimes, actinomycetes are introduced for active decomposition. Within 2 to 3 days, biological action starts. Organic matter is destroyed by actinomycetes, and a lot of heat is liberated, increasing the temperature of compost by 75°C, and the refuse is finally converted into a powdery brown-colored, odorless mass called humus that has a fertilizing value and can be used in agriculture. Humus contains a lot of Nitrogen essential for plant growth apart from phosphates and other minerals.<br><br>ADVANTAGES:<br><br>Manure added to the soil increases water retention and ion-exchange capacity of the soil. This method can be used to treat several industrial solid wastes.<br><br>Manure can be sold, thereby reducing the cost of disposing of waste. Recycling can be done.<br><br>DISADVANTAGES:<br><br>Non-consumables must be disposed of separately.<br><br>The technology has caught up with the farmers and hence does not have an assured market | CO4 | BTL2 |

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| 97. | **Explain about the 3R method of waste disposal.**<br><br>Reduce - If usage of raw materials is reduced, the generation of waste also gets reduced.<br>Reuse - Refillable containers that are discarded after use can be reused. Rubber rings can be made from discarded cycle tubes, and this reduces waste generation during the manufacture of rubber bands.<br>Recycle - Recycling is the reprocessing of discarded materials into new useful products. For example, old aluminum cans and glass bottles are melted and recast into new cans and bottles. The preparation of cellulose insulation from paper and the preparation of automobile body and construction material from steel cans are other examples.<br>This method (Reduce, Reuse and Recycle), i.e., 3R's help save money, energy, raw materials, and reduce pollution. | CO4 | BTL2 |
| 98. | **What are the effects of soil pollution?**<br><br>Industrial wastes - These pollutants affect and alter the chemical and biological properties of soil. As a result, hazardous chemicals can enter the human food chain from the soil or water, disturb the biochemical process, and finally lead to serious effects on living organisms.<br>Urban wastes – Urban wastes comprise both commercial and domestic wastes consisting of dried sludge and sewage. All the urban solid wastes are commonly referred to as refuse. This refuse consists of garbage and rubbish materials like plastics, glasses, metallic cans, fibers, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles, and other discarded manufactured products.<br>Agricultural practices – Modern agricultural practices largely pollute the soil. With advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides, and weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution.<br>Radioactive pollutants - Radio nuclides of Radium, Thorium, Uranium, isotopes of Potassium (K-40), and Carbon (C-14) are commonly found in soil, rock, water, and air. The explosion of hydrogen weapons and cosmic radiation includes neutron and proton reactions by which Nitrogen (N-15) produces C-14. This C-14 participates in Carbon metabolism of plants which is then into animals and human beings. | CO4 | BTL2 |

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| | Biological agents – Soil gets a large amount of human, animal, and bird excreta which constitutes a major source of land pollution by biological agents. | | |
| 99. | **Enlist the radioactive pollutants in soil.**<br><br>Radioactive substances resulting from explosions of nuclear testing laboratories and industries, giving rise to nuclear dust, and radioactive wastes penetrate the soil and accumulate, giving rise to land/soil pollution.<br>Examples:<br>1. Radio nuclides of Radium, Thorium, Uranium, isotopes of Potassium (K-40), and Carbon (C-14) are commonly found in soil, rock, water, and air.<br>2. Explosion of hydrogen weapons and cosmic radiation includes neutron, proton reactions by which Nitrogen (N-15) produces C-14. This C-14 participates in Carbon metabolism of plants which is then into animals and human beings.<br>3. Radioactive waste contains several radio nuclides such as Strontium-90, Iodine-129, Cesium-137, and isotopes of Iron, which are most injurious. Strontium gets deposited in bones and tissues instead of calcium.<br>4. Nuclear reactors produce waste containing Ruthenium-106, Iodine-131, Barium-140, Cesium-144, and Lanthanum-140 along with primary nuclides Sr-90 with a half-life of 28 years and Cs-137 with a half-life of 30 years. Rainwater carries Sr-90 and Cs-137 to be deposited on the soil where they are held firmly with the soil particles by electrostatic forces. All the radio nuclides deposited on the soil emit gamma radiation. | CO4 | BTL2 |
| 100. | **What does the runoff water from agricultural farms contain?**<br><br>Modern agricultural practices largely pollute the soil. With the advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides, and weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution | CO4 | BTL1 |
| 101. | **Explain about the 5R method of waste disposal.** | CO4 | BTL1 |

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| | Reduce - If usage of raw materials is reduced, the generation of waste also gets reduced.<br>Reuse - Refillable containers that are discarded after use can be reused. For example, rubber rings can be made from discarded cycle tubes, reducing waste generation during the manufacture of rubber bands.<br>Recycle - Recycling is the processing of discarded materials into new useful products. For example, old aluminum cans and glass bottles are melted and recast into new cans and bottles. Preparation of cellulose insulation from paper and preparation of automobile body and construction material from steel cans are also examples of recycling.<br>Refuse - Refuse the production of plastic and stop the manufacturing of the same.<br>Refine – Refine and use non-biodegradable waste in a sustainable method. | | |
| 102. | **Enumerate various measures to control vehicular pollution.**<br><br>Some measures that can be adopted in this direction are:<br>1. Using unleaded petrol.<br>2. Using fuels with low sulphur and ash content.<br>3. Encouraging people to use public transport, walk, or use a cycle as opposed to private vehicles.<br>4. Ensure that houses, schools, restaurants, and playgrounds are not located on busy streets.<br>5. Plant trees along busy streets as they remove particulates, carbon dioxide, and absorb noise.<br>6. Catalytic converters should be used to help control emissions of carbon monoxide and hydrocarbons. | CO4 | BTL2 |
| 103. | **List the silent features of the Air Act.**<br><br>Air (Prevention and Control of Pollution) Act, 1981<br>Objectives of this act are:<br>Prevention, control and abatement of air pollution<br>Maintaining the quality of air<br><br>Important features of this act:<br><br>➢ The central board coordinates and settles disputes between state boards in addition to providing technical assistance and guidance to state boards.<br>➢ State boards may lay down standards for emissions of air pollutants from industrial units, automobiles, or other sources. | CO4 | BTL2 |

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| | ➢ State boards should examine manufacturing processes and pollution control equipment to verify if they meet standards prescribed.<br>➢ State boards can advise the state government to declare heavily polluted areas as pollution control areas and advise avoidance of burning waste products that can increase air pollution.<br>➢ The directions of the central board are mandatory on state boards.<br>➢ The operation of industrial units is prohibited in heavily polluted areas without the consent of the central board.<br>➢ Violation of this law is punishable with imprisonment for a term which may extend to three months or a fine up to Rs. 10,000 or both. | | |
| 104. | **Give a list of major sources of water pollution.**<br><br>Water pollution is any chemical, biological, or physical change in water quality that has a harmful effect on living organisms or makes water unsuitable for desired uses.<br><br>1. Infectious agents:<br>Ex: Bacteria, Viruses, Protozoa, and parasitic worms.<br>Human sources: Human and animal wastes<br>Effects: Variety of diseases<br><br>2. Oxygen-demanding wastes (Dissolved oxygen):<br>Human sources: Sewage, Animal feedlots, paper mills, and food processing facilities.<br><br>3. Inorganic chemicals:<br>Ex: Acids, lead (Pb), arsenic (As), and selenium (Se), NaCl in oceans and fluoride (F) found in some soils.<br>Human sources: Surface runoff, industrial effluents, and household cleansers.<br><br>4. Organic chemicals:<br>Ex: Oil, Gasoline, Plastics, Pesticides, Cleaning solvents, and Detergents.<br>Human Sources: Industrial effluents, household cleansers and surface runoff from farms. | CO4 | BTL2 |
| 105. | **What are the types of noise pollution?**<br><br>Noise pollution: Noise is defined as "the unwanted, unpleasant, or disagreeable sound that causes discomfort to all living beings." Sound intensity is measured in decibels (dB), that is the | CO4 | BTL1 |

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| | tenth part of the longest unit Bel. One dB is the faintest sound that a human ear can hear.<br><br>TYPES OF NOISE:<br>Environmental noise has been doubling every ten years. Noise is classified as:<br>Industrial Noise<br>Transport Noise and<br>Neighborhood noise. | | |
| | **UNIT-IV LAQs** | CO4 | **BTL** |
| 106. | **Explain the causes, effects and control measures of air pollution.**<br><br>Air pollution may be defined as the presence of one or more contaminants like dust, mist, smoke, and color in the atmosphere that are injurious to human beings, plants, and animals.<br><br>➢ Causes:<br><br>1. Rapid industrialization<br>2. Fast urbanization<br>3. Rapid growth in population<br>4. Growth of vehicles on the roads and<br>5. Activities of human beings have disturbed the natural balance of the atmosphere.<br><br>➢ Sources and common effects of common air pollutants:<br><br>• Carbon monoxide: It is a colorless, odorless gas that is poisonous to animals. It is formed by incomplete combustion of carbon-containing fuels. The source of carbon monoxide is cigarette smoking and incomplete combustion of fossil fuels (more than 77% comes from motor vehicle exhaust).<br>Health effects include reduced ability of red blood cells to carry oxygen to body cells and tissues. This leads to headache and anemia. At high levels, it causes coma, irreversible brain damage, and death.<br><br>• Nitrogen Dioxide: It is a reddish-brown irritating gas that causes photochemical smog. In the atmosphere, it gets converted into nitric acid (HNO3). It is caused by burning fossil fuels in industries and power plants.<br>Health effects include lung irritation and damage.<br>Environmental effects involve acid deposition leading to | CO4 | BTL3 |

damage of trees, lakes, soil, and ancient monuments. NO2 can damage fabrics.

- Sulphur Dioxide: It is a colorless and irritating gas that is formed by combustion of Sulphur-containing fossil fuels such as coal and oil. In the atmosphere, it is converted into Sulphuric acid, which is a major component of acid deposition.

Health effects involve breathing problems for healthy people. Environmental effects involve reduced visibility and acid deposition on trees, lakes, soils, and monuments leading to their deterioration and adverse effect on aquatic life.

- Suspended Particulate Matter (SPM): Includes a variety of particles and droplets (aerosols) that can be suspended in the atmosphere for short to long periods. Human sources for SPM include burning coal in power and industrial units, burning diesel and other fuels in vehicles, agriculture, unpaved roads, construction, etc.

Health effects include nose and throat irritation, lung damage, bronchitis, asthma, reproductive problems, and cancer. Environmental Effects include reduced visibility and acid deposition. Acid deposition may lead to damaged trees, soils, and aquatic life in lakes.

- Control measures:

The atmosphere has several built-in self-cleaning processes such as dispersion, gravitational settling, flocculation, absorption, rain-washout, etc., to cleanse the atmosphere. However, control of contaminants at their source level is a desirable and effective method through preventive or control technologies.

Some measures that can be adopted in this direction are:

- Using unleaded petrol
- Using fuels with low Sulphur and ash content
- Encouraging people to use public transport, walk, or use a cycle as opposed to private vehicles
- Ensure that houses, schools, restaurants, and playgrounds are not located on busy streets
- Plant trees along busy streets as they remove particulates, carbon dioxide, and absorb noise
- Industries and waste disposal sites should be situated outside the city, preferably on the downwind of the city.
- Catalytic converters should be used to help control emissions of carbon monoxide and hydrocarbons.

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| | ➢ Equipment used to control air pollution<br>Air pollution can be reduced by adopting the following approaches:<br><br>• Ensuring a sufficient supply of oxygen to the combustion chamber and adequate temperature so that the combustion is complete, thereby eliminating much of the smoke consisting of partly burnt ashes and dust.<br>• To use mechanical devices such as scrubbers, cyclones, bag houses, and electro-static precipitators in manufacturing processes. The equipment used to remove particulates from the exhaust gases of electric power and industrial plants are shown below. All methods retain hazardous materials that must be disposed of safely. Wet scrubbers can additionally reduce Sulphur dioxide emissions.<br>• The air pollutants collected must be carefully disposed of. The factory fumes are dealt with chemical treatment. | | |
| 107. | **Explain the causes, effects and control measures of water pollution.**<br><br>Water pollution may be defined as "the alteration in physical, chemical, and biological characteristics of water which may cause harmful effects on humans and aquatic life."<br>Pollutants include:<br><br>Sewage:<br>Industrial effluents and chemicals<br>Oil and other wastes<br>Chemicals in the air dissolve in rainwater, fertilizers, pesticides, and herbicides leached from land pollute water.<br>Infectious agents<br>Ex: Bacteria, Viruses, Protozoa, and parasitic worms.<br>Human sources: Human and animal waste.<br>Effects: Variety of diseases.<br><br>Oxygen-demanding wastes (Dissolved oxygen):<br>This degradation consumes dissolved oxygen in water.<br>Dissolved Oxygen (DO) is the amount of oxygen dissolved in each quantity of water at a particular pressure and temperature.<br>The saturated point of DO varies from 8 to 15 mg/L.<br>Ex: Organic wastes such as animal manure and plant debris that can be decomposed by aerobic (oxygen-requiring) bacteria.<br>Human sources: Sewage, Animal feedlots, paper mills, and food processing facilities. | CO4 | BTL3 |

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| | Effects: Large populations of bacteria decomposing these wastes can degrade water quality by depleting water of dissolved oxygen. This causes fish and other forms of oxygen-consuming aquatic life to die.<br><br>Inorganic chemicals:<br>Ex: Water-soluble inorganic chemicals:<br>Acids<br>Compounds of toxic metals such as lead (Pb), arsenic (As), and selenium (Se)<br>Salts such as NaCl in oceans and fluoride (F) were found in some soils.<br>Human sources: Surface runoff, industrial effluents, and household cleansers.<br>Effects: Inorganic chemicals can:<br>Make freshwater unusable for drinking and irrigation<br>Cause skin cancer and nerve damage<br>Damage nervous system, liver, and kidneys<br>Harm fish and other aquatic life<br>Lower crop yields<br>Accelerate corrosion of metals exposed to such water<br><br>Organic chemicals:<br>Ex: Oil, Gasoline, Plastics, Pesticides, Cleaning solvents, and Detergents.<br>Human Sources: Industrial effluents, household cleansers, and surface runoff from farms.<br>Effects:<br>It can threaten human health by causing nervous system damage and some cancers.<br>Harm fish and wildlife.<br><br>Plant nutrients:<br>Ex: Water-soluble compounds containing nitrate, Phosphate, and Ammonium ions.<br>Human sources: Sewage, manure, and runoff of agricultural and urban fertilizers.<br>Effects:<br>Can cause excessive growth of algae and other aquatic plants, which die, decay, deplete dissolved oxygen in water, thereby killing fish.<br>Drinking water with excessive levels of nitrates lowers the oxygen-carrying capacity of the blood and can kill urban children and infants.<br><br>Sediment:<br>Ex: Soil, silt, etc.<br>Human Sources: Land erosion. | | |

Effects:
Causes cloudy water, thereby reducing photosynthetic activity.
Disruption of aquatic food chain
Carries pesticides, bacteria, and other harmful substances
Settles and destroys feeding and spawning grounds of fish
Clogs and fills lakes, artificial reservoirs, stream channels, and harbors.

Radioactive materials:
Ex: Radioactive isotopes of Iodine, Radon, Uranium, Cesium, and Thorium.
Human sources: nuclear power plants, mining and processing of uranium and other ores, nuclear weapon production, and natural sources.
Effects: Genetic mutations, birth defects, and certain cancers.

Heat (Thermal pollution):
Ex: Excessive heat
Human sources: Water cooling of electric power plants and some types of industrial plants. Almost half of the whole water withdrawn in United States each year is for cooling electric power plants.
Effects:
Low dissolved oxygen levels thereby making aquatic organisms more vulnerable to disease, parasites, and toxic chemicals.
When a power plant starts or shuts down for repair, fish and other organisms adapted to a particular temperature range can be killed by an abrupt temperature change known as thermal shock.

- Point and non-point sources of water pollution:

- Point sources: These are pollutants that are discharged at specific locations through pipes, ditches, or sewers into bodies of surface waters.

Ex: Factories, sewage treatment plants, abandoned underground mines, and oil tankers

- Non-point sources: These pollutants cannot be traced to a single point of discharge. They are large land areas or airsheds that pollute water by runoff, subsurface flow, or deposition from the atmosphere.

Ex: Acid deposition, runoff of chemicals into surface water from croplands, livestock feedlots, logged forests, urban streets, lawns, golf courses, and parking lots.
Control measures of water pollution:
Administration of water pollution control should be in the hands of the state or central government.

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| | Scientific techniques should be adopted for environmental control of catchment areas of rivers, ponds, or streams.<br>Industrial plants should be based on recycling operations as it helps prevent disposal of wastes into natural waters but also extraction of products from waste.<br>Plants, trees, and forests control pollution as they act as natural air conditioners.<br>Trees can reduce sulfur dioxide and nitric oxide pollutants and hence more trees should be planted.<br>No type of waste (treated, partially treated, or untreated) should be discharged into any natural water body. Industries should develop closed-loop water supply schemes, and domestic sewage must be used for irrigation.<br>Qualified and experienced people must be consulted from time to time for effective control of water pollution.<br>Public awareness must be initiated regarding the adverse effects of water pollution using the media.<br>Laws, standards, and practices should be established to prevent water pollution, and these laws should be modified from time to time based on current requirements and technological advancements.<br>Basic and applied research in public health engineering should be encouraged. | | |
| 108. | **What are the amendments of the Forest Protection Act?**<br><br>Important amendments:<br>Forest departments are forbidden to assign any forest land for re-afforestation.<br>Clearance of any forest land with naturally grown trees for the purpose of re-afforestation is forbidden.<br>Diversion of forest land for non-forest uses is a cognizable offence, and the violator is punishable under the law. | CO4 | BTL3 |
| 109. | **Write salient features of water act.**<br><br>Water (prevention and control of pollution) act, 1974<br>Objectives of this act:<br>To prevent and control water pollution<br>To maintain or restore the wholesomeness of water<br>To establish boards for the prevention and control of water pollution<br>To confer on and assign to the boards, the power and functions relating to the above-mentioned.<br>Salient features of this act:<br>Establishment of central and state boards for pollution control<br>Provision of joint boards for two or more states | CO4 | BTL1 |

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| | Prohibition of the use of streams and wells for the disposal of pollutants.<br>Consent of pollution control board to open new outlets and discharges into streams and wells. | | |
| 110. | **Discuss the causes, effects and control measures of soil pollution.**<br><br>Soil pollution:<br>Soil pollution is defined as "contamination of soil by human and natural activities which may cause harmful effects on living organisms".<br><br>TYPES, EFFECTS, AND SOURCES OF SOIL POLLUTION<br>Soil pollution mainly occurs due to the following:<br>1. Industrial wastes<br>2. Urban wastes<br>3. Agricultural practices<br>4. Radioactive pollutants<br>5. Biological agents<br><br>• Industrial wastes – Disposal of Industrial wastes is the major problem for soil pollution<br>Sources: Industrial pollutants are mainly discharged from various origins such as pulp and paper mills, chemical fertilizers, oil refineries, sugar factories, tanneries, textiles, steel, distilleries, fertilizers, pesticides, coal and mineral mining industries, drugs, glass, cement, petroleum, and engineering industries, etc.<br>Effect: These pollutants affect and alter the chemical and biological properties of soil. As a result, hazardous chemicals can enter the human food chain from the soil or water, disturb the biochemical process, and finally lead to serious effects on living organisms.<br><br>• Urban wastes – Urban wastes comprise both commercial and domestic wastes consisting of dried sludge and sewage. All the urban solid wastes are commonly referred to as refuse. Constituents of urban refuse: This refuse consists of garbage and rubbish materials like plastics, glasses, metallic cans, fibers, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles, and other discarded manufactured products. Urban domestic waste, though disposed of separately from industrial waste, can still be dangerous. This happens because they are not easily degraded. | CO4 | BTL3 |

- Agricultural practices – Modern agricultural practices largely pollute the soil. With the advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides, and weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution

- Radioactive pollutants - Radioactive substances resulting from explosions of nuclear testing laboratories and industries give rise to nuclear dust radioactive wastes, penetrate the soil and accumulate giving rise to land/soil pollution.

Ex:
Radio nuclides of Radium, Thorium, Uranium, isotopes of Potassium (K-40) and Carbon (C-14) are commonly found in soil, rock, water, and air.
Explosion of hydrogen weapons and cosmic radiation include neutron, proton reactions by which Nitrogen (N-15) produces C-14. This C-14 participates in Carbon metabolism of plants which is then into animals and human beings.
Radioactive waste contains several radio nuclides such as Strontium90, Iodine-129, Cesium-137 and isotopes of Iron which are most injurious. Strontium gets deposited in bones and tissues instead of calcium.
Nuclear reactors produce waste containing Ruthenium-106, Iodine-131, Barium-140, Cesium-144 and Lanthanum-140 along with primary nuclides Sr-90 with a half-life 28 years and Cs-137 with a half-life 30 years. Rainwater carries Sr-90 and Cs-137 to be deposited on the soil where they are held firmly with the soil particles by electrostatic forces. All the radionuclides deposited on the soil emit gamma radiation.

- Biological agents – Soil gets a large amount of human, animal and bird excreta which constitutes a major source of land pollution by biological agents.

➢ Control measures of soil pollution:

- Soil erosion can be controlled by a variety of forestry and farm practices.

Ex: Planting trees on barren slopes
Contour cultivation and strip cropping may be practiced instead of shifting cultivation
Terracing and building diversion channels may be undertaken.

Reducing deforestation and substituting chemical manures by animal wastes also help arrest soil erosion in the long term.

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| | Proper dumping of unwanted materials: Excess wastes by man and animals pose a disposal problem. Open dumping is the most practiced technique. Nowadays, controlled tipping is followed for solid waste disposal. The surface so obtained is used for housing or sports fields.<br>• Production of natural fertilizers: Bio-pesticides should be used in place of toxic chemical pesticides. Organic fertilizers should be used in place of synthesized chemical fertilizers.<br>Ex: Organic waste in animal dung may be used to prepare compost manure instead of throwing it wastefully and polluting the soil.<br>• Proper hygienic condition: People should be trained regarding sanitary habits.<br>Ex: Lavatories should be equipped with quick and effective disposal methods.<br>• Public awareness: Informal and formal public awareness programs should be imparted to educate people on health hazards through environmental education.<br>Ex: Mass media, educational institutions, and voluntary agencies can achieve this.<br>• Recycling and Reuse of waste: To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products, and industrial effluents, etc should be recycled and reused.<br>Ex: Industrial waste should be properly treated at source. Integrated waste treatment methods should be adopted.<br>Ban on toxic chemicals: A ban should be imposed on chemicals and pesticides like DDT, BHC, etc which are fatal to plants and animals. Nuclear explosions and improper disposal of radioactive waste should be banned. | | |
| 111. | **Write salient features of the Forest Protection Act.**<br><br>This act provides conservation of forests and related aspects. This act covers all types of forests such as reserved forest, protected forest, and any forested land. This act was enacted in 1980, and it aims to arrest deforestation.<br>Important features of this act are:<br>The reserved forests shall not be diverted, or DE reserved without the prior permission of the central government. | CO4 | BTL1 |

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| | The land that has been notified or registered or forest land may not be used for non-forest purposes.<br>Any illegal non-forest activity within a forest area can be immediately stopped under the act.<br>Important amendments:<br>Forest departments are forbidden to assign any forest land for re-afforestation.<br>Clearance of any forest land of naturally grown trees for the purpose of re-afforestation is forbidden.<br>Diversion of forest land for non-forest uses is a cognizable offense, and the violator is punishable under law. | | |
| 112. | **What are the effects of uncontrolled dumping of solid waste?**<br>The main source of industrial waste is chemical industries, metal and mineral processing industries.<br>Ex:<br>1. Nuclear plants: It generates radioactive waste.<br>2. Thermal power plants: It produces fly ash in large quantities.<br>3. Chemical Industries: It produces large quantities of hazardous and toxic materials.<br>4. Other industries: Other industries produce packing materials, rubbish, organic wastes, acid, alkali, scrap metals, rubber, plastic, paper, glass, wood, oils, paints, dyes, etc.<br>➢ EFFECT OF IMPROPER SOLID WASTE MANAGEMENT:<br>• Due to the improper disposal of municipal solid waste on the roads and immediate surroundings, biodegradable materials undergo decomposition producing a foul smell and become a breeding ground for disease vectors.<br>• Industrial solid wastes are the sources for toxic metals and hazardous wastes that affect soil characteristics and productivity of soils when they are dumped on the soil.<br>• Toxic substances may percolate into the ground and contaminate the groundwater.<br>• Burning industrial or domestic wastes (cans, pesticides, plastics, radioactive materials, and batteries) produces furans, dioxins, and polychlorinated biphenyls that are harmful to human beings. | CO4 | BTL2 |

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| | • Solid waste management involves waste generation, mode of collection, transportation, segregation of waste, and disposal techniques. | | |
| 113. | **Define noise pollution and discuss various measures to control noise pollution.**<br><br>Noise is defined as, "the unwanted, unpleasant, or disagreeable sound that causes discomfort to all living beings."<br>Sound intensity is measured in decibels (dB), that is the tenth part of the longest unit Bel. One dB is the faintest sound that a human ear can hear.<br><br>Types of noise: Environmental noise has been doubling every ten years. Noise is classified as:<br>Industrial Noise, Transport Noise, Neighborhood noise.<br><br>1. Industrial Noise: It is a high intensity sound caused by industry machines. Sources of such noise pollution are machines from various factories, industries, and mills. The noise from mechanical saws and pneumatic drills is unbearable and a nuisance to the public.<br>The Indian Institute of Oto-Rhinolaryngology, Chennai, reported that increasing industrial pollution damages the hearing ability by at least 20%.<br>Workers in the steel industry, who work close to heavy industrial blowers, are exposed to 112 dB for eight hours and suffer from occupational pollution.<br><br>2. Transport Noise: Transport noise mainly consists of traffic noise from road, rail, and aircraft. The number of automobiles on roads like motors, scooters, cars, motorcycles, buses, trucks, and diesel engine vehicles has increased enormously in the recent past, further aggravating the problem of transport noise. Noise levels in most residential areas in metropolitan cities are hovering around the borderline due to increased vehicular noise pollution. This high level of noise pollution leads to deafening in the elderly.<br><br>3. Neighborhood noise: This type of noise includes disturbance from household gadgets and community. Common sources include musical instruments, TV, VCR, radios, transistors, telephones, and loudspeakers, etc. Statistically, ever since the industrial revolution, noise in the environment has been doubling every ten years.<br><br>➢ Effects of Noise pollution | CO4 | BTL2 |

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| | Noise pollution affects both human and animal health. It leads to:<br><br>Contraction of blood vessels Making skin pale Excessive adrenaline in the bloodstream, which is responsible for high blood pressure. Blaring sounds are known to cause mental distress Heart attacks, neurological problems, birth defects, and abortion Muscle contraction leading to nervous breakdown, tension, etc.<br><br>The adverse reactions are coupled with a change in the hormone content of blood, which, in turn, increases heartbeat, constriction of blood vessels, digestive spasms, and dilation of the pupil of the eye.<br><br>Adverse effects health, work efficiency, and behavior. Noise pollution may cause damage to the heart, brain, kidneys, liver, and may produce emotional disturbance.<br>The most immediate and acute effect of noise is impairment of hearing that diminishes some parts of the auditory system.<br>Prolonged exposure to noise of certain frequency patterns leads to chronic damage to the inner ear.<br>Impulsive noise may cause psychological and pathological disorders.<br>Ultrasonic sound can affect the digestive, respiratory, cardiovascular system and semicircular canals of the internal ear.<br>The brain is adversely affected by loud and sudden noise by jets and airplanes. People are subjected to psychiatric illness.<br>Recent reports suggest that blood is thickened by excessive noise.<br>The optical system of human beings is also affected by noise pollution.<br><br>Severe noise pollution causes:<br>Impairment of night vision and decrease in rate of color perception<br><br>➢ Control measures:<br><br>• Source control: This includes source modifications such as acoustic treatment to machines' surface, design changes, limiting operational timings, etc.<br>• Transmission path intervention: This includes containing the source inside a sound-insulating enclosure, constructing a noise barrier, or provision of sound-absorbing materials along the path. | | |

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| | • Receptor control: This includes protection of the receiver by altering the work schedule or provision of personal protection devices such as earplugs for operating noisy machinery. The measure may include dissipation and deflection methods.<br>• Oiling: Proper oiling will reduce noise from the machine.<br><br>➢ Preventive measures:<br><br>Prescribing noise limits for vehicular traffic Ban on honking (usage of horns) in certain areas, creation of silence zones near schools and hospitals. Residing buildings to make them noise-proof. Reduction of traffic density in residential areas giving preference to mass public transport system. | | |
| 114. | **Explain in detail the different methods of solid waste management.**<br><br>Rapid population growth and urbanization in developing countries have led to people generating enormous quantities of solid waste and consequent environmental degradation. The waste is normally disposed of in open dumps, creating a nuisance and environmental degradation. Solid waste causes a major risk to public health and the environment. Management of solid waste is important to minimize the adverse effects posed by their indiscriminate disposal.<br>Steps involved in solid waste management:<br>Two important steps involved in solid waste management are<br>• Reduce Reuse and Recycle of Raw Materials<br>• Discarding wastes<br>•<br>Reduce - If usage of raw materials is reduced, the generation of waste also gets reduced. Reuse - Refillable containers that are discarded after use can be reused. Rubber rings can be made from discarded cycle tubes, and this reduces waste generation during the manufacture of rubber bands. Recycle - Recycling is the reprocessing of discarded materials into new useful products.<br>Ex: Old aluminum cans and glass bottles are melted and recast into new cans and bottles. Preparation of cellulose insulation from paper. Preparation of automobile body and construction material from steel cans.<br>This method (Reduce, Reuse & Recycle), i.e., 3R's help save money, energy, raw materials, and reduce pollution.<br>Discarding wastes:<br>The following methods are adopted for discarding wastes:<br>• Landfill<br>• Incineration | CO4 | BTL2 |

- Composting

1. LANDFILL: Solid waste is placed in a sanitary landfill in which alternate layers of 80 cm (about 2.62 ft) thick refuse are covered with selected earth fill of 20 cm (about 7.87 in) thickness. After 2-3 years, solid waste volume shrinks by 25-30%, and land is used for parks, roads, and small buildings. This is the most common and cheapest method of waste disposal and is mostly employed in Indian cities.

--> Advantages: It is simple and economical. Segregation of wastes is not required. Landfilled areas can be reclaimed and used for other purposes. Converts low-lying, marshy wasteland into useful areas. Natural resources are returned to soil and recycled.

--> Disadvantages: Large area is required. Land availability is away from the town; transportation costs are high. This leads to a bad odor if the landfill is not properly managed. Landfilled areas will be sources of mosquitoes and flies, requiring the application of insecticides and pesticides at regular intervals. Causes fire hazard due to the formation of methane in wet weather.

2. Incineration: It is a hygienic way of disposing of solid waste. It is suitable if waste contains more hazardous material and organic content. It is a thermal process and very effective for detoxification of all combustible pathogens. It is expensive when compared to composting or landfilling. In this method, municipal solid wastes are burnt in a furnace called an incinerator. Combustible substances such as rubbish, garbage, dead organisms, and non-combustible matter such as glass, porcelain, and metals are separated before feeding to incinerators. The non-combustible materials can be left out for recycling and reuse.

The leftover ashes and clinkers may account for about 10 to 20%, which need further disposal by sanitary landfill or some other means. The heat produced in the incinerator during burning of refuse is used in the form of steam power for the generation of electricity through turbines. Municipal solid waste is generally wet and has a high calorific value. Therefore, it must be dried first before burning. Waste is dried in a preheater from where it is taken to a large incinerating furnace called "destructor," which can incinerate about 100 to 150 tons per hour. The temperature normally maintained in a combustion chamber is about 700C, which may be increased to 1000C when electricity is to be generated.

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| | --> Advantages: Residue is only 20-25% of the original and can be used as clinker after treatment. Requires very little space. The cost of transportation is not high if the incinerator is located within city limits. Safest from a hygienic point of view; an incinerator plant of 3000 tons per day capacity can generate 3MW of power.<br>-->Disadvantages: Its capital and operating cost is high. Operation needs skilled personnel. Formation of smoke, dust, and ashes needs further disposal, and that may cause air pollution.<br><br>3. Composting: It is another popular method practiced in many cities in our country. In this method, bulk organic waste is converted into fertilizer by biological action. Separated compostable waste is dumped in underground trenches in layers of 1.5m and finally covered with earth of 20cm (about 7.87 in) and left for decomposition. Sometimes, actinomycetes are introduced for active decomposition. Within 2 to 3 days, biological action starts. Organic matter is destroyed by actinomycetes, and a lot of heat is liberated, increasing the temperature of compost by 75C, and the refuse is finally converted into a powdery, brown-colored odorless mass called humus that has a fertilizing value and can be used in agriculture. Humus contains a lot of Nitrogen essential for plant growth, apart from phosphates and other minerals.<br>--> Advantages: Manure added to the soil increases water retention and ion-exchange capacity of the soil. This method can be used to treat several industrial solid wastes. Manure can be sold, thereby reducing the cost of disposing of waste. Recycling can be done.<br>--> Disadvantages: Non-consumables must be disposed of of separately. The technology has not caught up with the farmers and hence does not have an assured market. | | |
| 115. | **Write the aim, salient features and amendments of the Forest Conservation Act.**<br><br>Forest Conservation Act, 1980<br>This act provides conservation of forests and related aspects. This act covers all types of forests such as reserved forest, protected forest, and any forested land. This act was enacted in 1980, and it aims to arrest deforestation.<br><br>Important features of this act are:<br>-The reserved forests shall not be diverted or DE reserved without the prior permission of the central government. | CO4 | BTL2 |

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| | -The land that has been notified or registered as forest land may not be used for non-forest purposes.<br><br>-Any illegal non-forest activity within a forest area can be immediately stopped under the act.<br><br>Important amendments:<br>-Forest departments are forbidden to assign any forest land for re-afforestation.<br><br>-Clearance of any forest land of naturally grown trees for the purpose of re-afforestation is forbidden.<br><br>- Diversion of forest land for non-forest uses is a cognizable offence, and the violator is punishable under the law. | | |
| 116. | **Describe the Wildlife Protection Act in detail.**<br><br>Wildlife Protection Act, 1972<br>This act is aimed to protect and preserve wildlife. Wildlife refers to all animals and plants that are not domesticated. India has a rich wildlife heritage. It has 350 species of mammals, 1200 species of birds, and around 20,000 known species of insects. Some of them are listed as 'endangered species' in the Wildlife Protection Act. Wildlife is an integral part of our ecology and plays an essential role in its functioning. The decline in wildlife is mostly due to human actions. Animals have been hunted for ages for their skin, fur, feathers, ivory, etc. Wildlife populations are monitored regularly, and management strategies are formulated to protect them.<br>The important features of this act are:<br>-This act covers the rights and non-rights of forest dwellers.<br>-It provides restricted grazing in sanctuaries but prohibits it in national parks.<br>-It also prohibits the collection of non-timber forest.<br>-The rights of forest dwellers recognized by the forest policy of 1988 are taken away by the amended Wildlife Act of 1991. | CO4 | BTL1 |
| 117. | **Discuss the causes, effects and control measures of water pollution.**<br><br>Water pollution may be defined as “the alteration in physical, chemical, and biological characteristics of water which may cause harmful effects on humans and aquatic life.”<br>Pollutants include:<br>• Sewage<br>• Industrial effluents and chemicals<br>• Oil and other wastes | CO4 | BTL3 |

- Chemicals in the air dissolve in rainwater, fertilizers, pesticides, and herbicides leached from land pollute water.
- Infectious agents Ex: Bacteria, Viruses, Protozoa, and parasitic worms. Human sources: Human and animal wastes Effects: A variety of diseases. Oxygen-demanding wastes (Dissolved oxygen): This degradation consumes dissolved oxygen in water. Dissolved Oxygen (DO) is the amount of oxygen dissolved in each quantity of water at a particular pressure and temperature. The saturated point of DO varies from 8 to 15 mg/L. Ex: Organic wastes such as animal manure and plant debris that can be decomposed by aerobic (oxygen-requiring) bacteria. Human sources: Sewage, Animal feedlots, paper mills, and food processing facilities. Effects: Large populations of bacteria decomposing these wastes can degrade water quality by depleting water of dissolved oxygen. This causes fish and other forms of oxygen-consuming aquatic life to die.

--> Inorganic chemicals:
Ex: Water-soluble inorganic chemicals:

- Acids
- Compounds of toxic metals such as lead (Pb), arsenic (As), and selenium (Se)
- Salts such as NaCl in oceans and fluoride (F) were found in some soils. Human sources: Surface runoff, industrial effluents, and household cleansers. Effects: Inorganic chemicals can:
- Make freshwater unusable for drinking and irrigation
- Cause skin cancer and neck damage
- Damage the nervous system, liver, and kidneys
- Harm fish and other aquatic life
- Lower crop yields
- Accelerate corrosion of metals exposed to such water Organic chemicals Ex: Oil, Gasoline, Plastics, Pesticides, Cleaning solvents, and Detergents. Human Sources: Industrial effluents, household cleansers, and surface runoff from farms. Effects:
- It can threaten human health by causing nervous system damage and some cancers.
- Harm fish and wildlife.
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--> Plant nutrients:
Ex: Water-soluble compounds containing nitrate, Phosphate, and Ammonium ions. Human sources: Sewage, manure, and runoff of agricultural and urban fertilizers. Effects:

- Can cause excessive growth of algae and other aquatic plants, which die, decay, deplete dissolved oxygen in water, thereby killing fish.
- Drinking water with excessive levels of nitrates lowers the oxygen-carrying capacity of the blood and can kill urban children and infants.

--> Sediment:
Ex: Soil, silt, etc. Human Sources: Land erosion Effects:

- Causes cloudy water, thereby reducing photosynthetic activity.
- Disruption of aquatic food chain
- Carries pesticides, bacteria, and other harmful substances
- Settles and destroys feeding and spawning grounds of fish
- Clogs and fills lakes, artificial reservoirs, stream channels, and harbors.

--> Radioactive materials:
Ex: Radioactive isotopes of Iodine, Radon, Uranium, Cesium, and Thorium Human sources: nuclear power plants, mining and processing of uranium and other ores, nuclear weapon production, and natural sources. Effects: Genetic mutations, birth defects, and certain cancers.

--> Heat (Thermal pollution):
Ex: Excessive heat Human sources: Water cooling of electric power plants and some types of industrial plants. Almost half of whole water withdrawn in United States each year is for cooling electric power plants. Effects:

- Low dissolved oxygen levels, thereby making aquatic organisms more vulnerable to disease, parasites, and toxic chemicals.
- When a power plant starts or shuts down for repair, fish and other organisms adapted to a particular temperature range can be killed by an abrupt temperature change known as thermal shock.

Point and non-point sources of water pollution:
PointSource's: These are pollutants that are discharged at specific locations through pipes, ditches, or sewers into bodies of surface waters. Ex: Factories, sewage treatment plants, abandoned underground mines, and oil tankers
Non-point sources: These pollutants cannot be traced to a single point of discharge. They are large land areas or air-sheds that pollute water by runoff, subsurface flow, or deposition from the atmosphere. Ex: Acid deposition, runoff of chemicals into

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| | surface water from croplands, livestock feedlots, logged forests, urban streets, lawns, golf courses, and parking lots.<br><br>➢ Control measures of water pollution:<br><br>• Administration of water pollution control should be in the hands of the state or central government.<br>• Scientific techniques should be adopted for environmental control of catchment areas of rivers, ponds, or streams.<br>• Industrial plants should be based on recycling operations as it helps prevent disposal of wastes into natural waters but also extraction of products from waste.<br>• Plants, trees, and forests control pollution as they act as natural air conditioners.<br>• Trees can reduce sulfur dioxide and nitric oxide pollutants, and hence more trees should be planted.<br>• No type of waste (treated, partially treated, or untreated) should be discharged into any natural water body.<br>• Industries should develop closed-loop water supply schemes, and domestic sewage must be used for irrigation.<br>• Qualified and experienced people must be consulted from time to time for effective control of water pollution.<br>• Public awareness must be initiated regarding the adverse effects of water pollution using the media.<br>• Laws, standards, and practices should be established to prevent water pollution, and these laws should be modified from time to time based on current requirements and technological advancements.<br>• Basic and applied research in public health engineering should be encouraged. | | |
| 118. | **Discuss the issues involved in the enforcement of environmental legislation.**<br><br>Issues involved in enforcement of environmental legislation: Three issues that are especially important for environmental legislation are:<br><br>The precautionary principle: This principle has evolved to deal with risks and uncertainties faced by environmental management. The principle implies that an ounce of prevention is worth a pound of cure—it does not prevent problems but may reduce their occurrence and helps ensure contingency plans are made. | CO4 | BTL2 |

The polluter-pays principle: In addition to the obvious—the polluter pays for the damage caused by a development—this principle also implies that a polluter pays for monitoring and policing. A problem with this approach is that fines may bankrupt small businesses yet be low enough for a large company to write them off as an occasional overhead, which does little for pollution control.
Freedom of information: Environmental planning and management are hindered if the public, NGOs, or even official bodies are unable to get information.
Drawbacks of Wildlife Protection Act, 1972:
Since this act has been enacted just as a fallout of Stockholm conference held in 1972, it has not included any locally evolved conservation measures.
The ownership certificates for some animal articles (Ex: Leopard and Tiger skins) often serve as a tool for illegal trading.
Jammu and Kashmir have their own wildlife acts; therefore, hunting and trading of many endangered species, prohibited in other states, are allowed in Jammu and Kashmir.
The offenders of this act are not subject to any harsh fines. The fine is only Rs. 25,000 or imprisonment for up to three years.
Drawbacks of the Forest (Conservation) Act, 1980:
This act only transfers the powers from state to center to decide the conversion of reserve forests to non-forest areas.
The power has been centralized at the top, and local communities have been completely ignored from the decision-making process regarding the nature of forest areas.
Tribal people living in forests are totally dependent on forest resources. If they are stopped from exploiting forests for their livelihood, they resort to criminal activities like smuggling, killing, etc.
This law is concentrated on protecting trees, birds, and animals but not on protecting poor people.
The forest-dwelling tribal communities have a rich knowledge about forest resources, their importance, and conservation. However, their role and contribution are not acknowledged.

- Drawbacks of pollution-related acts:

- Power and authority have been given only to the central government with little power to the state government. This hinders effective implementation of the act in the states.
- The penalties imposed by this act are very small when compared to the damage caused by big industries due to pollution.
- A person cannot directly file a petition in court.

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| | • Litigation related to the environment is expensive, since it involves technical knowledge.<br>• For small industries, it is very expensive to install an individual custom-made effluent treatment plant.<br>• The position of chairman of the board of most industries is occupied by a political appointee. Hence it becomes difficult to implement the act without political interference. | | |
| 119. | **Why should we dispose of solid waste effectively?**<br><br>• Proper waste removal helps improve air and water quality, as well as reduces greenhouse gas emissions.<br>• It helps in minimizing the extraction of resources, along with reducing pollution and energy consumption associated with manufacturing new materials.<br>• One of the most significant benefits of waste management is the protection of the environment and the health of the population.<br>• When the waste is recycled, it helps turn recyclable waste into useful substances. If you do not dispose of your waste, these useful substances cannot be created.<br>• By smartly managing your waste, you also help conserve natural resources, including minerals, water, and wood. So, this is the effect of reducing, reusing, and recycling.<br>• When the waste is disposed of efficiently, the least amount of the junk reaches the landfills. By conserving space in landfills, the production of harmful substances is reduced.<br>• The composting process helps replenish the nutrients in the ground, as well as support local municipalities to save money on landfill areas.<br>• Improper waste disposal allows diseases to proliferate in the environment. Junk and waste are the perfect hosts for bacteria, and they can grow if the waste is not disposed of properly. It increases the risk of disease in humans who encounter trash. | CO4 | BTL3 |
| 120. | **Name and briefly discuss the three functional elements of solid waste management and explain why recycling is an integral part of solid waste management.**<br><br>Rapid population growth and urbanization in developing countries have led to people generating enormous quantities of solid waste and consequent environmental degradation. The waste is normally disposed of in open dumps, creating nuisance | CO4 | BTL3 |

and environmental degradation. Solid waste causes a major risk to public health and the environment. Management of solid waste is important to minimize the adverse effects posed by their indiscriminate disposal.

Steps involved in solid waste management:

Two important steps involved in solid waste management are:

- Reduce, Reuse, and Recycle of Raw Materials
- Discarding wastes

--> Reduce - If usage of raw materials is reduced, the generation of waste also gets reduced.

--> Reuse - Refillable containers that are discarded after use can be reused. Rubber rings can be made from discarded cycle tubes, reducing waste generation during the manufacture of rubber bands.

--> Recycle - Recycling is the reprocessing of discarded materials into new useful products. For example, old aluminum cans and glass bottles are melted and recast into new cans and bottles. Preparation of cellulose insulation from paper, preparation of automobile body and construction material from steel cans. This method (Reduce, Reuse & Recycle), i.e., 3R's, helps save money, energy, raw materials, and reduces pollution.

Discarding wastes:

The following methods are adopted for discarding wastes:

- Landfill
- Incineration
- Composting

➢ LANDFILL: Solid waste is placed in a sanitary landfill in which alternate layers of 80 cm thick refuse are covered with selected earth fill of 20 cm thickness. After 2-3 years, solid waste volume shrinks by 25-30%, and land is used for parks, roads, and small buildings. This is the most common and cheapest method of waste disposal and is mostly employed in Indian cities.

--> Advantages:

- It is simple and economical
- Segregation of wastes is not required
- Landfilled areas can be reclaimed and used for other purposes
- Converts slow-lying, marshy waste-land into useful areas
- Natural resources are returned to soil and recycled.

--> Disadvantages:

- Large area is required
- Land availability is away from the town, transportation costs are high
- Leads to bad odor if the landfill is not properly managed

- Landfilled areas will be sources of mosquitoes and flies requiring application of insecticides and pesticides at regular intervals
- Causes fire hazard due to the formation of methane in wet weather.

➢ Incineration: It is a hygienic way of disposing of solid waste. It is suitable if waste contains more hazardous material and organic content. It is a thermal process and very effective for the detoxification of all combustible pathogens. It is expensive when compared to composting or land-filling. In this method, municipal solid wastes are burnt in a furnace called an incinerator. Combustible substances such as rubbish, garbage, dead organisms, and non-combustible matters such as glass, porcelain, and metals are separated before feeding to incinerators. Then non-combustible materials can be left out for recycling and reuse.

The leftover ashes and clinkers may account for about 10 to 20%, which need further disposal by sanitary landfill or some other means. The heat produced in the incinerator during the burning of refuse is used in the form of steam power for the generation of electricity through turbines. Municipal solid waste is generally wet and has a high calorific value. Therefore, it has to be dried first before burning. Waste is dried in a preheater from where it is taken to a large incinerating furnace called the "destructor," which can incinerate about 100 to 150 tons per hour. The temperature normally maintained in a combustion chamber is about 700C, which may be increased to 1000C when electricity is to be generated.

--> Advantages:

- Residue is only 20-25% of the original and can be used as clinker after treatment
- Requires very little space
- Cost of transportation is not high if the incinerator is located within city limits
- Safest from a hygienic point of view; an incinerator plant of 3000 tons per day capacity can generate 3MW of power.

--> Disadvantages:

- Its capital and operating cost is high
- Operation needs skilled personnel
- Formation of smoke, dust, and ashes needs further disposal, and that may cause air pollution.

➢ Composting: It is another popular method practiced in many cities in our country. In this method, bulk organic

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| | waste is converted into fertilizer by biological action. Separated compostable waste is dumped in underground trenches in layers of 1.5m and finally covered with earth of 20cm and left for decomposition. Sometimes, actinomycetes are introduced for active decomposition. Within 2 to 3 days, biological action starts. Organic matter is destroyed by actinomycetes, and a lot of heat is liberated, increasing the temperature of compost by 75C, and the refuse is finally converted into a powdery brown-colored, odorless mass called humus that has a fertilizing value and can be used in agriculture. Humus contains a lot of Nitrogen essential for plant growth, apart from phosphates and other minerals.<br>--> Advantages:<br>• Manure added to soil increases water retention and ion-exchange capacity of soil.<br>• This method can be used to treat several industrial solid wastes.<br>• Manure can be sold, thereby reducing the cost of disposing of waste.<br>• Recycling can be done.<br>--> DISADVANTAGES:<br>Non-consumables must be disposed of separately. The technology has not caught up with the farmers, and hence does not have an assured market | | |
| | **UNIT-V SAQs** | | **BTL** |
| 121. | **What do you understand by environmental ethics?**<br><br>Environmental ethics is defined as the analysis of the human use of Earth's limited resources. Ethics is the branch of philosophy that primarily discusses issues dealing with human behavior and character. Ethics attempts to establish a basis for judging right from wrong and good from bad.<br>Environmental ethics is the branch of ethics that analyzes human use of Earth's limited resources. A growing trend is to combine the study of both ecology and economics to help provide a basis for sustainable decisions on environmental use. Environmental ethics attempts to answer questions of how human beings should relate to their environment regarding the usage of environmental resources and their treatment of other species (plant and animal). | CO5 | BTL1 |
| 122. | **How is acid rain formed?** | CO5 | BTL2 |

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| | Normally, rainwater is slightly acidic since CO2 present in the atmosphere gets dissolved in it. Because of the presence of Oxides of Nitrogen and Sulphur (NO2 and SO2) as pollutants in the atmosphere, the pH of rainwater is lowered further. This type of precipitation of water is called acid rain or acid deposition.<br><br>Formation of Acid Rain:<br>Acid rain means the presence of excessive acids in rainwater. Thermal power plants, industries, and vehicles release nitrous oxide and Sulphur dioxide into the atmosphere by burning coal and oil. When these gases react with water vapor in the atmosphere, they form acids and descend on Earth as "acid rain" through rainwater.<br><br>$SO2 + H2O = H2SO4$<br>$NO2 + H2O = HNO3$ $NO2 + H2O = HNO3$ | | |
| 123. | **State the types of disasters with examples.**<br><br>Hazards are divided into natural, or human made.<br>A natural disaster is a consequence when a natural hazard affects humans and/or the built environment. Various phenomena like earthquakes, landslides, volcanic eruptions, floods, and cyclones are all natural hazards that kill thousands of people and destroy crores of rupees of living environment and property each year. Developing countries suffer chronically from natural disasters. Asia tops the list of casualties due to natural disasters.<br>Man-made disasters are the consequence of technological or human hazards. Examples are stampedes, fires, transport accidents, oil and chemical spills, nuclear radiation, and wars. | CO5 | BTL1 |
| 124. | **Write a short note on watershed management.**<br><br>Watershed Management describes water harvesting and protects natural resources. Watershed management is a process aimed at protecting and restoring the habitat and water resources of a watershed, incorporating the needs of multiple stakeholders. A watershed is defined as the geographic area from which water in a particular stream, lake, or estuary originates. It includes the entire area of land that drains into the water body. It is supported by other systems from high points in the area, such as hills or slopes.<br>For example, the watershed of a lake would not only include the streams entering the lake but also the land that drains those streams and eventually the lake. | CO5 | BTL1 |

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| 125. | **Sketch the disaster management cycle.**<br>  | CO5 | BTL2 |
| 126. | **Define "Disaster" and give examples of manmade disasters**<br><br>A disaster can be defined as any tragic event stemming from events such as earthquakes, floods, catastrophic accidents, fires, or explosions. It is a phenomenon that can cause damage to life and property and destroy the economic, social, and cultural life of people.<br>Man-made disasters are the consequence of technological or human hazards. Examples are stampedes, fires, transport accidents, oil and chemical spills, nuclear radiation, and wars. | CO5 | BTL2 |
| 127. | **What is climate change?**<br><br>Climate change refers to the sum of all statistical weather information of the atmospheric elements, with a specified area over a long period of time. Climate never remains static but is a dynamic process and changes to a lesser or greater degree. Climate change is a common deviation from average as well as extreme temperatures. | CO5 | BTL1 |
| 128. | **Define global warming.**<br><br>Global warming is defined as the increase in temperature of Earth that causes a change in climate.<br>The last few centuries have seen an increase in industrial, agricultural, and other human activity resulting in the release of | CO5 | BTL1 |

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| | more greenhouse gases into the atmosphere. These gases cause the atmosphere to trap increasing amounts of heat energy in the Earth's surface, making the planet warmer than usual. | | |
| 129. | **Define Mitigation.**<br><br>Mitigation is defined as "sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their effects." It describes the ongoing effort at the federal, state, local, and individual levels to lessen the impact of disasters upon our families, homes, communities, and economy. | CO5 | BTL1 |
| 130. | **Write a short note on ozone layer depletion.**<br><br>Ozone is a colorless, odorless gas composed of three atoms of oxygen (O3). Ozone has the same chemical structure regardless of where it occurs and can be useful or harmful depending on where it occurs in the atmosphere. Ozone is formed naturally in the upper stratosphere when wavelengths less than 240 nm are absorbed by normal oxygen molecules which dissociate to give O atoms. The O atoms in combination with other oxygen molecules produce ozone.<br>In the stratosphere, about 19 to 30 km above the Earth's surface, ozone is constantly being produced and destroyed naturally. This production and destruction make stratosphere with ozone layer that filters the Ultra-Violet radiation from the Sun and protects life on Earth. Normally there is a fine balance between production and destruction of ozone thereby safeguarding life on Earth. | CO5 | BTL1 |
| 131. | **What are the principles of disaster management?**<br><br>The guidelines for mitigation of disasters are intended to increase public awareness in the face of the exigencies.<br>The following are the principles of disaster management:<br>(i) Solidarity; (ii) Joint responsibility; (iii) Non-discrimination; (iv) Humanity; (v) Impartiality; (vi) Neutrality; (vii) Co-operation; (viii) Territorial sovereignty; (ix) Prevention; and (x) Role of the media. | CO5 | BTL2 |
| 132. | **What are the control measures of earthquakes?**<br><br>Preventive measures can be taken to minimize the damage. Minimizing development activity (especially construction, mining, construction of dams and reservoirs) in areas known to be active seismic zones. | CO5 | BTL2 |

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| | Continuously monitoring seismic activity using 'seismographs' and alerting people regarding any recorded disturbance in advance. | | |
| 133. | **Write a short note on control measures for landslides.**<br><br>The size of the area affected by earthquake-induced landslides depends on the magnitude of the earthquake, its focal depth, the topography, and geologic conditions near the causative fault, the amplitude, frequency, composition, and duration of ground shaking.<br>Avoid construction activity in landslide occurring areas.<br>Reducing slope of hilly side.<br>Stabilizing the slope portion.<br>Increasing plantation of deep-rooted vegetation on the slope. | CO5 | BTL2 |
| 134. | **Enlist flood control methods.**<br><br>Construction of flood control dam.<br>Deepening, widening, and straightening of streams.<br>Lining of streams.<br>Banning construction of buildings in floodplains.<br>Converting floodplains into wildlife habitat, parks, and recreation areas. | CO5 | BTL2 |
| 135. | **What are the effects of acid rain?**<br><br>It can wash away plant nutrients from the soil. In addition, it makes the soil acidic and releases aluminum and copper ions which are harmful for plants.<br>When pH is less than 4.5, calcium metabolism of water is affected, resulting in reduction of diversity and population of some fish species.<br>Acid rain will cause damage to common building materials in addition to damaging statues and monuments.<br>Iron corrodes with acid rain to form rust. The cost of maintenance of iron structures is high in highly populated areas. | CO5 | BTL2 |
| | **UNIT-V LAQs** | CO5 | **BTL** |
| 136. | **What is global warming and state various effects and control measures for the same.** | CO5 | BTL2 |

Global warming is defined as the increase in temperature of Earth, that causes change in climate. The last few centuries have seen an increase in industrial, agricultural and other human activity resulting in the release of more greenhouse gases in the atmosphere. These gases cause the atmosphere to trap increasing amounts of heat energy in the Earth's surface making the planet warmer than usual. The global temperature is now 1°C higher than in 1900. Predictions of future climate indicate that by the middle of the next century, the Earth's global temperature may be 1°C to 3°C higher than what it is today. Researchers have checked through indirect evidence (tree rings, coral growth, ice cores) and confirmed that the warmest decade in the past 1000 years was from 1990 to 1999. The warmest year of the millennium was 1998.
The International Red Cross and Red Crescent have analyzed the past 33 years of natural disasters and 90% of them were weather-related. Moreover, the occurrence of these disasters has increased in the past three decades.

Effects of Global Warming:
Following are the effects of global warming:

- More heatwaves
- Expansion of desert area
- Natural fires in forest lands
- More evaporation of water from oceans and water bodies
- Melting of Icecaps in Arctic and Antarctic regions
- More cloud formation in the atmosphere
- Shorter and warmer winters coupled with longer and hotter summers
- Changes in rainfall pattern
- Rise in sea level
- Flooding and submergence of low-lying coastal areas
- Disruption in farming
- More drought
- Impact on plants, animals, and humans

Control and remedial measures:
Some of the remedial and control measures of global warming are listed below:

- Reduction in consumption of fossil fuels such as coal and petroleum
- Use of bio-gas plants
- Use of nuclear power plants
- Increasing forest cover
- Use of unleaded petrol in automobiles
- Installation of pollution controlling devices in automobiles (catalytic converter) and industries (Electrostatic Precipitators, Bag filters, Wet scrubbers etc.)

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| 137. | **Explain the impact of any disaster on the environment?**<br><br>Disasters are now recognized as one of the major contributors to underdevelopment, and underdevelopment is one of the major contributors to disaster. It has also been recognized that if disaster response is mishandled, many years of progress can be wiped out, and the chances for further progress set back.<br>Disasters can alter agricultural patterns, settlement patterns, patterns of migration, work habits, diets, and even basic family structures. If disaster management is well planned and development-oriented, a disaster can provide opportunities for accelerating the pace of development. Constructive changes can then be made.<br>All disaster-related activities are divided into distinct time periods.<br><br>Disaster management relies heavily on the use of maps and mapping techniques for the control of disasters and managing responses. The maps used vary from topographic maps, land-use maps, hazard maps, geologic maps, vegetation maps, population distribution rods, seismic maps, and hurricane tracking maps.<br><br>Schematic maps generated using computer graphics are used extensively to generate updated information about disaster situations as they develop. By monitoring stream flow and water level at an upstream location, the disaster manager can map the expected flood zone and predict threatened areas, extent of flooding, and the areas that need to be evacuated on a priority basis. Computer-generated maps are used in risk analysis, vulnerability analysis, evacuation planning, flood monitoring, damage assessment, and reconstruction planning.<br><br>Aerial photography is widely used as a tool for disaster management for both pre- and post-disaster planning activities. Aerial photographs are extensively used for hazard analysis, disaster assessment, reconstruction planning, and management.<br><br>Remote sensing is the acquisition of information about a subject that is not in direct contact with the device. Weather RADAR, weather satellites, seismographs, and sono buoys are examples of remote sensing systems.<br>Remote sensing data may be used for disaster management in the form of risk analysis and mapping, disaster warning, cyclone warning, drought monitoring, volcanoes, large-scale fires, etc.<br><br>Electronics communications are very important in disaster management. They are used for coordination and control, | CO5 | BTL3 |

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| | assessment, reporting, monitoring, scheduling logistics, reunification, and tracing separated families.<br>The Disaster management cycle illustrates the ongoing process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability, or the prevention of disasters during the next iteration of the cycle. The complete disaster management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.<br><br>The disaster cycle or the disaster life cycle consists of the steps that emergency managers take in planning for and responding to disasters. Each step in the disaster cycle correlates to part of the ongoing cycle that is emergency management. This disaster cycle is used throughout the emergency management community, from the local to the national and international levels.<br><br>The first step of the disaster cycle is usually considered to be preparedness. Prior to a disaster's occurrence, emergency managers will plan for various disasters that could strike within the area of responsibility.<br><br>The second stage in the disaster cycle is response. Imminently prior to a disaster, warnings are issued, evacuations or shelter in place occur, and necessary equipment is placed at the ready.<br><br>After the immediate response phase of the disaster cycle has been completed, the disaster turns toward recovery, focusing on the longer-term response to the disaster. During the recovery phase of the disaster cycle, officials are interested in cleanup and rebuilding. During the recovery phase, lessons learned are collected and shared within the emergency response community.<br><br>The mitigation phase of the disaster cycle is almost concurrent with the recovery phase. The goal of the mitigation phase is to prevent the same disaster-caused damage from occurring again.<br><br>Finally, using the lessons learned from the response, recovery, and mitigation phases of the disaster, the emergency manager and government officials return to the preparedness phase and revise their plans and their understanding of the material and | | |

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| | human resources needs for a particular disaster in their community. | | |
| 138. | **Explain the impact of disasters on the environment, infrastructure, and development?**<br><br>IMPACT OF DISASTERS ON ENVIRONMENT, INFRASTRUCTURE & DEVELOPMENT:<br><br>Disasters are now recognized as one of the major contributors to underdevelopment, and underdevelopment is one of the major contributors to disaster. It has also been recognized that if disaster response is mishandled, many years of progress can be wiped out, and the chances for further progress set back. Disasters can alter agricultural patterns, settlement patterns, patterns of migration, work habits, diets, and even basic family structures. If disaster management is well planned and development-oriented, a disaster can provide opportunities for accelerating the pace of development. Constructive changes can then be made.<br>All disaster-related activities are divided into distinct time periods.<br><br>Disaster management relies heavily on the use of maps and mapping techniques for the control of disasters and managing responses. The maps used vary from topographic maps, land-use maps, hazard maps, geologic maps, vegetation maps, population distribution rods, seismic maps, and hurricane tracking maps.<br><br>Schematic maps generated using computer graphics are used extensively to generate updated information about disaster situations as they develop. By monitoring stream flow and water level at an upstream location, the disaster manager can map the expected flood zone and predict threatened areas, extent of flooding, and the areas that need to be evacuated on a priority basis. Computer-generated maps are used in risk analysis, vulnerability analysis, evacuation planning, flood monitoring, damage assessment, and reconstruction planning.<br><br>Aerial photography is widely used as a tool for disaster management for both pre- and post-disaster planning activities. Aerial photographs are extensively used for hazard analysis, disaster assessment, reconstruction planning, and management.<br><br>Remote sensing is the acquisition of information about a subject that is not in direct contact with the device. Weather RADAR, | CO5 | BTL3 |

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| | weather satellites, seismographs, and sono buoys are examples of remote sensing systems.<br>Remote sensing data may be used for disaster management in the form of risk analysis and mapping, disaster warning, cyclone warning, drought monitoring, volcanoes, large-scale fires, etc.<br><br>Electronics communications are very important in disaster management. They are used for coordination and control, assessment, reporting, monitoring, scheduling logistics, reunification, and tracing separated families.<br>The Disaster management cycle illustrates the ongoing process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability, or the prevention of disasters during the next iteration of the cycle. The complete disaster management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.<br><br>The disaster cycle or the disaster life cycle consists of the steps that emergency managers take in planning for and responding to disasters. Each step in the disaster cycle correlates to part of the ongoing cycle that is emergency management. This disaster cycle is used throughout the emergency management community, from the local to the national and international levels.<br><br>The first step of the disaster cycle is usually considered to be preparedness. Prior to a disaster's occurrence, emergency managers will plan for various disasters that could strike within the area of responsibility.<br>The second stage in the disaster cycle is response. Imminently prior to a disaster, warnings are issued, evacuations or shelter in place occur, and necessary equipment is placed at the ready.<br><br>After the immediate response phase of the disaster cycle has been completed, the disaster turns toward recovery, focusing on the longer-term response to the disaster. During the recovery phase of the disaster cycle, officials are interested in cleanup and rebuilding. During the recovery phase, lessons learned are collected and shared within the emergency response community. | | |

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| | The mitigation phase of the disaster cycle is almost concurrent with the recovery phase. The goal of the mitigation phase is to prevent the same disaster-caused damage from occurring again.<br><br>Finally, using the lessons learned from the response, recovery, and mitigation phases of the disaster the emergency manager and government officials return to the preparedness phase and revise their plans and their understanding of the material and human resources needs for a particular disaster in their community. | | |
| 139. | **Define flood. Enumerate effects and measures taken to mitigate disasters?**<br><br>Increased rainfall or rapid snow melting causes more flow of water in the streams. This excess water flow in a stream covering the adjacent land is called a flood. Floodplain is defined in terms of a flood frequency. Flood frequency is referred to as a 10-year flood, 100-year flood, etc. A 10-year flood at any point in a stream is that discharge of water which may be expected to occur on average once in 10 years. Floodplains are generally fertile, flat, and easily formed.<br><br>CAUSES OF FLOOD:<br>• Heavy rainfall<br>• Construction of buildings in a floodplain<br>• Removing vegetation<br>• Paving roads and parking areas<br>• Deforestation<br>• Urbanization<br>• Earthquakes<br><br>EFFECTS OF FLOOD:<br>• Erosion of topsoil and vegetation<br>• Damage and loss to land, house, and property<br>• Spread of endemic waterborne diseases<br>• Interruption of basic facilities of the community such as highways, railways, telephone, electricity, and day-to-day essentials<br>• Silting of reservoirs and dams<br><br>FLOOD CONTROL:<br>• Construction of flood control dam<br>• Deepening, widening, and straightening of streams<br>• Lining of streams | CO5 | BTL3 |

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| | • Banning of construction of buildings in floodplains<br>• Converting floodplains into wildlife habitat, parks, and recreation areas. | | |
| 140. | **Write a detailed note on disaster management methodology.**<br><br>Disaster management relies heavily on the use of maps and mapping techniques for the control of disasters and managing responses. The maps used vary from topographic maps, land-use maps, hazard maps, geologic maps, vegetation maps, population distribution rods, seismic maps, and hurricane tracking maps.<br><br>Schematic maps generated using computer graphics are used extensively to generate updated information about disaster situations as they develop. By monitoring stream flow and water level at an upstream location, the disaster manager can map the expected flood zone and predict threatened areas, extent of flooding, and the areas that need to be evacuated on a priority basis. Computer-generated maps are used in risk analysis, vulnerability analysis, evacuation planning, flood monitoring, damage assessment, and reconstruction planning.<br><br>Aerial photography is widely used as a tool for disaster management for both pre- and post-disaster planning activities. Aerial photographs are extensively used for hazard analysis, disaster assessment, reconstruction planning, and management.<br><br>Remote sensing is the acquisition of information about a subject that is not in direct contact with the device. Weather RADAR, weather satellites, seismographs, and sono buoys are examples of remote sensing systems.<br><br>Remote sensing data may be used for disaster management in the form of risk analysis and mapping, disaster warning, cyclone warning, drought monitoring, volcanoes, large-scale fires, etc.<br><br>Electronics communications are very important in disaster management. They are used for coordination and control, assessment, reporting, monitoring, scheduling logistics, reunification, and tracing separated families. | CO5 | BTL2 |
| 141. | **Write a detailed note on global warming and its consequences.** | CO5 | BTL2 |

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| | The temperature of Earth has gotten warmer by one degree Celsius. It is because the amount of energy needed to augment this temperature even by one degree Celsius is huge.<br><br>Each year, breaking the record for experiencing the hottest day, month, or year. The worrying temperature has gone as far as 54 degrees Celsius. Moreover, the frequent and intense extreme weather events are also due to that only. Forest fires, droughts, floods, and more natural disasters are becoming more and more common. For instance, the Amazon Rainforest fire being the latest one.<br><br>The melting of ice caps and glaciers is also a result of global warming only. All this melted ice just creates a rise in the water volume of the oceans. The sea levels are increasing. Moreover, the warmer the temperature gets, the more the mass of the water expands. It poses a great threat to low-lying islands and coastal cities.<br><br>Our oceans are becoming warmer and acidifying. As these water bodies absorb most of the excess heat as well as carbon dioxide, they have become more acidic. This, in turn, also results in coral bleaching. In addition, it also drives stronger storms. This rising acidity poses a great threat to aquatic life and disrupts their food chain. | | |
| 142. | **Write about the significance of environmental ethics for sustainable environment quality.**<br><br>Environmental ethics is defined as the analysis of the human use of Earth's limited resources.<br>Ethics is the branch of philosophy that primarily discusses issues dealing with human behavior and character. Ethics attempts to establish a basis for judging right from wrong and good from bad.<br><br>Environmental ethics is the branch of ethics which analyzes human use of Earth's limited resources. A growing trend is to combine the study of both ecology and economics to help provide a basis for sustainable decisions on environmental use.<br><br>Environmental ethics attempts to answer questions of how human beings should relate to their environment regarding the usage of environmental resources and their treatment of other species (plant and animal). | CO5 | BTL2 |

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| | A few conflicts that arise from environmental policies deal with the rights of individuals versus those of the state and rights of private property owners versus those of a community. | | |
| 143. | **Discuss the causes, effects, and control measures of ozone layer depletion?**<br><br>Ozone Depletion Potential (ODP): The ozone depletion potential of a compound is defined as the measure of its ability to destroy stratospheric ozone.<br><br>It may be defined as the ratio of the total amount of ozone destroyed by a particular agent to the amount of ozone destroyed by the same mass of CFC-11.<br><br>The ODP of CFC-11 is always taken as 1.0.<br><br>ODP is a relative measure with CFC-11 taken as a standard reference. Therefore, if the ODP of a compound is 0.5, it is roughly half as 'bad' as CFC-11.<br><br>Factors affecting ODP<br><br>Nature of the halogen (Bromine containing halocarbons usually have much higher ODPs than hydrocarbons. This is because Bromine is an effective ozone destruction catalyst than Chlorine).<br>The number of chlorine or bromine atoms in a molecule.<br>Molecular mass and<br>Atmospheric lifetime.<br><br>Dobson Unit: Dobson Unit (DU) is the scale for measuring the total amount of ozone occupying a column overhead.<br><br>One Dobson Unit (1 DU) is defined as 0.01 mm (about 0 in) at 0°C and 1 atmospheric pressure. If the ozone layer thickness when compressed to 0°C and 1 atmosphere pressure is about 5 mm, the average amount of ozone would be about 500 DU.<br><br>Harmful effects of ozone layer depletion:<br><br>The ozone layer protects all life forms on Earth from the Sun's | CO5 | BTL3 |

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| | harmful UV radiation. Any significant decrease in the amount of ozone in the stratosphere results in the amount of UV radiation reaching the Earth's surface leading to harmful effects on all living organisms.<br><br>Effects on human health:<br>Reddening of skin in sunshine (Sunburn)<br>Skin cancer<br>Reduction in the body's immunity to disease<br>Eye disorders like cataracts and blindness.<br><br>Other living organisms:<br>UV rays are particularly harmful to small plants and animals living in the sea called 'plankton'. Plankton forms the base of the ocean food chain.<br>UV rays damage certain crops like rice, which is the staple food for many people in the world.<br>UV radiation can damage polymers used in paint, clothing, and other materials. | | |
| 144. | **Define disasters and discuss the various types of disasters?**<br><br>A disaster is a natural or man-made hazard resulting in an event of substantial extent causing significant physical damage or destruction, loss of life, or drastic change to the environment. A disaster can be defined as any tragic event stemming from events such as earthquakes, floods, catastrophic accidents, fires, or explosions. It is a phenomenon that can cause damage to life and property and destroy the economic, social, and cultural life of people.<br><br>Hazards are divided into natural, or human made:<br><br>A natural disaster is a consequence when a natural hazard affects humans and/or the built environment. Various phenomena like earthquakes, landslides, volcanic eruptions, floods, and cyclones are all natural hazards that kill thousands of people and destroy crores of rupees of living environment and property each year. Developing countries suffer chronically from natural disasters. Asia tops the list of casualties due to natural disasters. | CO5 | BTL2 |

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| | Man-made disasters are the consequence of technological or human hazards. Examples are stampedes, fires, transport accidents, oil and chemical spills, nuclear radiation, and wars. | | |
| 145. | **Discuss disaster management in India with the help of a flow chart?**<br><br>India, due to its geographical locations and geological formations, is a highly disaster-prone country. Its long coastline, snow-clad high peaks, high mountain ranges, and the perennial rivers in the north all combine to add to this problem. India, which has only two per cent of the total geographical area, must support 16 per cent of the total world population. Naturally, there is tremendous pressure on the natural resources, which directly or indirectly leads to the occurrence of disasters, namely floods, droughts, landslides, earthquakes, etc.<br><br>India has faced several disasters, ranging from floods, earthquakes, cyclones, tsunami, droughts, landslides. A few recent disasters faced by India include the Uttar Kasha earthquake in UP in 1991, Later earthquake in Maharashtra in 1993, Chama earthquake in Gujarat, super cyclone in Orissa in 1999, Buhl earthquake in Gujarat in 2001, Tsunami in 2004, and Mumbai-Gujarat flood in 2005. Besides, India has a bad experience of technology-related tragedy in the form of the gas tragedy in Bhopal in 1984. India also faced the problem of Plague in Gujarat.<br><br>India has set up a disaster management unit in the center called the National Disaster Management Authority (NDMA - http://www.ndmindia.nic.in/) under the Ministry of Home Affairs, where several disasters are handled by different units. The website lists a central contact for information regarding any disaster in the country. | CO5 | BTL2 |
| 146. | **Mention water conservation through rainwater harvesting and watershed method.**<br><br>The production, development, and efficient management of water resources for beneficial use are called water conservation.<br>Rainwater harvesting<br>Watershed management<br>Rainwater Harvesting | CO5 | BTL3 |

Rainwater Harvesting (RWH) is the process of collecting, conveying, and storing water from rainfall.

The following methodologies are adopted for rainwater harvesting:

- Roof Rainwater Harvesting
- Land-based Rainwater Harvesting
- Watershed-based Rainwater Harvesting
- For Urban & Industrial Environment
- Roof & Land-based RWH
- Public, Private, Office & Industrial buildings
- Pavements, Lawns, Gardens & other open spaces

Broadly, there are two ways of harvesting rainwater:
--> Surface runoff harvesting: In urban areas, rainwater flows away as surface runoff. This runoff could be caught and used for recharging aquifers by adopting appropriate methods.
Rooftop rainwater harvesting: It is a system of catching rainwater where it falls. In rooftop harvesting, the roof becomes the catchment, and the rainwater is collected from the roof of the house/building. It can either be stored in a tank or diverted to an artificial recharge system. This method is less expensive and very effective and if implemented properly helps in augmenting the groundwater level of the area.

--> Watershed management:
A watershed is defined as the geographic area from which water in a particular stream, lake, or estuary originates. It includes the entire area of land that drains into the water body. It is supported from other systems by high points in the area such as hills or slopes.
Ex: The watershed of a lake would not only include the streams entering the lake but also the land that drains those streams and eventually the lake.
Watershed management is a process aimed at protecting and restoring the habitat and water resources of a watershed, incorporating the needs of multiple stakeholders.

Impacts of human beings on a watershed:
The activities of human beings have the following impacts on a watershed:

Altering water course: The water course is altered by changing the contour of the land and adding stormwater systems.
Adding pollution sources: The type of pollutant absorbed and carried by stormwater depends on the land use. During stormwater impounded in a parking area might pick up litter, road salt, motor oil and carry these pollutants to a local stream.

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| | In agricultural fields, rainwater might wash fertilizers and soil into a stream. Melting snow might wash fertilizers and pesticides into the lawn of suburban homes.<br>Urbanization: Urbanization has impacted local resources in more ways than one can imagine. It has resulted in a change in the flow and constituents of water flowing into a watershed. Urbanization has changed both the surface and groundwater. Urban areas have replaced trees, plants, and shrubs with impervious surfaces like roads, rooftops, parking lots, and other hard surfaces. These impervious surfaces prevent water from seeping into the ground, thereby increasing surface runoff. This leads to increased flooding after storms and reduced flow in streams and rivers during dry seasons.<br>Scouring of channels: Erosion of stream banks and scouring of channels occur due to an increase in volume. Sediment in eroded stream banks clogs the gills of fish and light needed by aquatic plants. Sediment settles in stream channels, lakes, and reservoirs, thereby increasing flooding and requiring dredging to clear streams or lakes for boating. | | |
| 147. | **Discuss disaster management framework in India?**<br><br>DISASTER MANAGEMENT IN INDIA:<br><br>India, due to its geographical locations and geological formations, is a highly disaster-prone country. Its long coastline, snow-clad high peaks, high mountain ranges, the perennial rivers in the north, all combine to add to this problem. India, which has only two per cent of the total geographical area, must support 16 per cent of the total world population. Naturally, there is tremendous pressure on natural resources, which directly or indirectly leads to the occurrence of disasters, namely floods, droughts, landslides, earthquakes, etc.<br><br>India has faced several disasters, ranging from floods, earthquakes, cyclones, tsunami, drought, landslides. A few recent disasters faced by India include Uttar Kasha earthquake in UP in 1991, Later earthquake in Maharashtra in 1993, Chama earthquake in Gujarat, super cyclone in Orissa in 1999, Buhl earthquake in Gujarat in 2001, Tsunami in 2004, and Mumbai-Gujarat flood in 2005. Besides, India has a bad experience of a technology-related tragedy in the form of the gas tragedy in Bhopal in 1984. India also faced the problem of Plague in Gujarat.<br><br>India has set up a disaster management unit in the center called the National Disaster Management Authority (NDMA - | CO5 | BTL2 |

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| | http://www.ndmindia.nic.in/) under the Ministry of Home Affairs, where several disasters are handled by different units. The website lists a central contact for information regarding any disaster in the country. | | |
| 148. | **Describe the methodology for disaster management?**<br><br>Disaster management relies heavily on the use of maps and mapping techniques for the control of disasters and managing responses. The maps used vary from topographic maps, land-use maps, hazard maps, geologic maps, vegetation maps, population distribution rods, seismic maps, and hurricane tracking maps.<br><br>Schematic maps generated using computer graphics are used extensively to generate updated information about disaster situations as they develop. By monitoring stream flow and water level at an upstream location, the disaster manager can map the expected flood zone and predict threatened areas, extent of flooding, and the areas that need to be evacuated on a priority basis. Computer-generated maps are used in risk analysis, vulnerability analysis, evacuation planning, flood monitoring, damage assessment, and reconstruction planning.<br><br>Aerial photography is widely used as a tool for disaster management for both pre- and post-disaster planning activities. Aerial photographs are extensively used for hazard analysis, disaster assessment, reconstruction planning, and management.<br><br>Remote sensing is the acquisition of information about a subject that is not in direct contact with the device. Weather RADAR, weather satellites, seismographs, and sono buoys are examples of remote sensing systems.<br><br>Remote sensing data may be used for disaster management in the form of risk analysis and mapping, disaster warning, cyclone warning, drought monitoring, volcanoes, large-scale fires, etc.<br><br>Electronics communications are very important in disaster management. They are used for coordination and control, assessment, reporting, monitoring, scheduling logistics, reunification, and tracing separated families. | CO5 | BTL2 |
| 149. | **Write short notes on disaster mitigation and management?** | CO5 | BTL2 |

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| | Mitigation is defined as "sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their effects." It describes the ongoing effort at the federal, state, local, and individual levels to lessen the impact of disasters upon our families, homes, communities, and economy. The mitigation phase of the disaster cycle is almost concurrent with the recovery phase. The goal of the mitigation phase is to prevent the same disaster-caused damage from occurring again.<br><br>Finally, using the lessons learned from the response, recovery, and mitigation phases of the disaster, the emergency manager and government officials return to the preparedness phase and revise their plans and their understanding of the material and human resources needs for a particular disaster in their community.<br><br>Disaster management relies heavily on the use of maps and mapping techniques for control of disasters and managing responses. The maps used vary from topographic maps, land-use maps, hazard maps, geologic maps, vegetation maps, population distribution rods, seismic maps, and hurricane tracking maps.<br><br>Schematic maps generated using computer graphics are used extensively to generate updated information about disaster situations as they develop. By monitoring stream flow and water level at an upstream location, the disaster manager can map the expected flood zone and predict threatened areas, extent of flooding, and the areas that need to be evacuated on a priority basis. Computer-generated maps are used in risk analysis, vulnerability analysis, evacuation planning, flood monitoring, damage assessment, and reconstruction planning.<br><br>Aerial photography is widely used as a tool for disaster management for both pre- and post-disaster planning activities. Aerial photographs are extensively used for hazard analysis, disaster assessment, reconstruction planning, and management.<br><br>Remote sensing is the acquisition of information about a subject that is not in direct contact with the device. Weather RADAR, weather satellites, seismographs, and sono buoys are examples of remote sensing systems.<br>Remote sensing data may be used for disaster management in the form of risk analysis and mapping, disaster warning, cyclone warning, drought monitoring, volcanoes, large-scale fires, etc.<br><br>Electronics communications are very important in disaster management. They are used for coordination and control, | | |

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| | assessment, reporting, monitoring, scheduling logistics, reunification, and tracing separated families. | | |
| 150. | **Mention the objectives of rainwater harvesting.**<br><br>1. It provides self-sufficiency to water supply.<br>2. It reduces the cost for pumping groundwater.<br>3. It provides high-quality water, soft and low in minerals.<br>4. It improves the quality of groundwater through dilution when recharged.<br>5. It reduces soil erosion and flooding in urban areas.<br>6. The rooftop rainwater harvesting is less expensive and easy to construct, operate, and maintain.<br>7. In deserts, RWH is the only relief.<br>8. In saline or coastal areas and islands, rainwater provides good-quality water. | CO5 | BTL2 |

**Course Faculty** **Course Coordinator**

**HOD Chemistry** **Dean 1st Year**