

.....Q.No. 1 which is compulsory.

Q.1. Attempt any five of the following:

(5×5 = 25)

(a) How is geothermal energy harnessed? Discuss its merits and limitations.

Ans. A geothermal heat pump can extract enough heat from shallow ground anywhere in the world to provide home heating, but industrial applications need the higher temperatures of deep resources. The thermal efficiency and profitability of electricity generation is particularly sensitive to temperature. The more demanding applications receive the greatest benefit from a high natural heat flux, ideally from using a hot spring. The next best option is to drill a well into a hot aquifer. If no adequate aquifer is available, an artificial one may be built by injecting water to hydraulically fracture the bedrock. This last approach is called hot dry rock geothermal energy in Europe, or enhanced geothermal systems in North America. Much greater potential may be available from this approach than from conventional tapping of natural aquifers.

Advantages of Geothermal Energy

1. It is a renewable source of energy.
2. By far, it is non-polluting and environment friendly.
3. There is no wastage or generation of by-products.
4. Geothermal energy can be used directly. In ancient times, people used this source of energy for heating homes, cooking, etc.

5. Maintenance cost of geothermal power plants is very less.
6. Geothermal power plants don't occupy too much space and thus help in protecting natural environment.

7. Unlike solar energy, it is not dependent on the weather conditions.

Disadvantages of Geothermal Energy

1. Only few sites have the potential of Geothermal Energy.
2. Most of the sites, where geothermal energy is produced, are far from markets or cities, where it needs to be consumed.
3. Total generation potential of this source is too small.
4. There is always a danger of eruption of volcano.
5. Installation cost of steam power plant is very high.
6. There is no guarantee that the amount of energy which is produced will justify the capital expenditure and operations costs.
7. It may release some harmful, poisonous gases that can escape through the holes drilled during construction.

Q.1.(b) Discuss sources and effects of marine pollution.

Ans. Sources :

1. Oil may enter the marine through oil spills due to tankers accidents, tank cleaning at sea, waste disposal, runoff and oil exploration.
2. Sewage adds small amount of suspended particle and contribute large amt. of nutrient.
3. Solid enters live plastics, nets, nylon ropes pollute the ocean life.
4. Toxic chemicals enter the ocean through food chain.

furization (FGD).

Q.2(b) What are conventional and non-conventional energy sources? Discuss the importance of green fuels as an alternate source of energy. 6

Ans. Conventional Sources of Energy

(i) The sources of energy which have been in use for a long time, e.g., coal, petroleum, natural gas and water power.

(ii) They are exhaustable except water.

(iii) They cause pollution when used, as they emit smoke and ash.

(iv) They are very expensive to be maintained, stored and transmitted as they are carried over long distance through transmission grid and lines.

Non-Conventional Sources of Energy

(i) The resources which are yet in the process of development over the past few years. It includes solar, wind, tidal, biogas, and biomass, geothermal.

(ii) They are inexhaustible.

(iii) They are generally pollution free.

(iv) Less expensive due to local use and easy to maintain.

Green fuel is believed by some to be more environmentally friendly than the widely-used fossil fuels that power most of the world. Recent technological innovations have created the fields of advanced biofuels, which focus on non-food sources and waster renewal as energy. green fuel is free from pollution-causing attributes.

Q.3(a) What are the various physical and chemical processes adopted for treatment of hazardous waste?

6.

Ans. Chemical and other methods of treatment of hazardous wastes: The selection of a treatment process for a wastewater stream depends on among other factors the nature of the waste, desired characteristics of the output stream.

Chemical Oxidation and reduction: Oxidation reduction methods provide another important chemical treatment alternative for hazardous wastes. One important chemical redox treatment involves the oxidation of cyanide wastes from metal finishing industry, Iron (II) in solution can be precipitated as ferric hydroxide by oxidation.

Ozonolysis: Ozone is a very powerful oxidising agent. Ozone in conjunction with UV radiation has been shown effective for the destruction of polychlorinated phenols and pesticides.

Acid-base neutralisation: Hazardous wastes are categorised as corrosive when their solution pH is less than 2 or more than 12.5. Such wastes can be chemically neutralised. Generally acidic wastes are neutralised with slaked lime $[\text{Ca}(\text{OH})_2]$ in a continuously stirred chemical reactor. Lime is least expensive and is widely used for treating acidic wastes. Alkaline wastes may be neutralised by adding sulphuric acid. It is a relatively inexpensive acid. Alkaline wastes can also be neutralised by bubbling gaseous carbon dioxide forming carbonic acid. The advantage of CO_2 is that it is often readily available in the exhaust gas from any combustion process at the treatment site.

Chemical precipitation: This technique can be applied to almost any liquid waste stream containing a precipitable hazardous constituent. By properly adjusting pH, the solubility of toxic metals can be decreased, leading to the formation of a precipitate that can be removed by settling and filtration. Quite often lime $[\text{Ca}(\text{OH})_2]$ or caustic soda is used for precipitation of the metal ions as metal hydroxides.

Hydrolysis: Hydrolysis treatment can be given to those hazardous waste constituents which are very reactive with water. Examples of those substances are halides, carbide, hydride, alkoxide, and active metal.

Ion exchange: Ion exchange is judged to have some potential for the application of interest in situations where it is necessary to remove dissolved inorganic species. One example for this is the use of anion exchanges for the removal of anionic nickel cyanide complex and chromate ions from waste solutions.

Thermal treatment methods: Thermal incineration is a process that uses high-temperature thermal oxidation to convert a waste to a less bulky, less toxic or less noxious material. It can be considered as a volume-reduction process in that many of the component elements of organic materials, including the most common ones (carbon, hydrogen and oxygen) are converted wholly or partially to gaseous form, leaving only the non combustible inorganic volume.

Q.1. (d) Discuss the problems of salinity and water logging.

Ans. Salinisation is a process that results in an increased concentration of soluble salts in soil and water. Of these salts, sodium chloride, or table salt, is the most common. Salinity is the state of soils that have a high concentration of such salts. Primary salinisation is when salts accumulate in the soil and groundwater of an area over a long period of time due to natural processes.

Impacts of salinity: High soil salinity adversely affects plant growth of both native and introduced crop and pasture species. This is due to the toxicity of the salt ions, as well as the general osmotic effect of the soil around the roots of the plant, which reduces the ability of the plant to absorb water from the soil.

- Increased salinity poses a significant threat to the health and wellbeing of many ecosystems, and to biodiversity as a whole. It can destroy remnant vegetation, leading to the disappearance of animal species that are dependent upon this vegetation for habitat.
- High salinity not only makes the soil chemically toxic for plants, but it also affects the soil's physical properties.
- Saline soils are also prone to erosion as a result of the death of vegetation that would otherwise have stabilised them.
- Highly saline water is quite unpalatable for humans and stock. It can also be toxic, due to the presence of particular ions (manganese and sulphate ions) causing gastrointestinal irritation in livestock, and it can interfere with reproduction and contaminate milk products.

Adverse Effect of Water Logging

1. Depletion of oxygen in root zone and increase of CO₂ due to water logging. An aerobic condition adversely affects micro-organisms while harmful organisms proliferate and restrict the plant growth.
2. Physical or chemical and biological activities in the soil are disturbed due to low temp as a result of water logging. Thus pest and diseases infestation problem arises.
3. Water logging makes field operations difficult or impossible.
4. The adverse effects of water logging get accelerated when the capillary water brings salts from lower horizon of soil or they are present in the ground water used for irrigation.
5. Water logging adversely affect the soil water plant relationship there by creating ecological imbalance.

UNIT-I

Q.2. (a) Describe the various threats to Biodiversity.

Ans. 1. Climate change: Manmade climate change speeds up the process, without affording ecosystems and species the time to adapt. For example, rising ocean temperatures and diminishing Arctic sea ice affects marine biodiversity and can shift vegetation zones, having global implications. (5)

2. Deforestation and habitat loss: Deforestation is a direct cause of extinction and loss of biodiversity. An estimated 18 million acres of forest are lost each year, due in part to logging and other human practices, destroying the ecosystems on which many species depend.

3. Overexploitation: Overhunting, overfishing and over-harvesting contribute greatly to the loss of biodiversity, killing off numerous species over the past several hundred years. Poaching and other forms of hunting for profit increase the risk of extinction; the extinction of an apex predator — or, a predator at the top of a food chain — can result in catastrophic consequences for ecosystems.

4. Pollution: From the burning of fossil fuels (releasing dangerous chemicals into the atmosphere and, in some cases, depleting ozone levels) to dumping 19 billion pounds of plastic into the ocean every year, pollution completely disrupts the Earth's ecosystems. While it may not necessarily cause extinction, pollutants do have the potential to influence species' habits.

5. Invasive species: The introduction of non-native species into an ecosystem can threaten endemic wildlife (either as predators or competing for resources), affect human health and upset economies.

Q.2. (b) What are the major global environmental problems?

(4)

Ans. 1. Population: Without a doubt the biggest issue facing the environment is over population of humans. The world's population has tripled in the last 60 years placing stress on every aspect of the environment.

2. Climate changes: Majority of climate scientists believe that human activities are currently affecting the climate. It is too late to undo the damage that climate change has done to the environment. At this stage the best we can do is regulate the further impact upon the environment by developing more environmentally friendly methods of energy production by reducing the mining and burning of fossil fuels.

3. Loss of Biodiversity: The loss of biodiversity on the planet can be directly related to the behaviors of human beings. Humans have destroyed and continue to destroy the habitats of species on a daily basis.

4. Pollution: Pollution of air, water and soil by chemical compounds that take many years to break down. Most of these chemicals are the bi-products of our modern lifestyle and are created by industry and motor vehicle exhaust.

5. Global Warming: Climate changes like global warming is the result of human practices like emission of Greenhouse gases. Global warming leads to rising temperatures of the oceans and the earth's surface causing melting of polar ice caps, rise in sea levels and also unnatural patterns of precipitation such as flash floods, excessive snow or desertification.

6. Natural Resource Depletion: Natural resource depletion is another crucial current environmental problem. Fossil fuel consumption results in emission of Greenhouse gases, which is responsible for global warming and climate change. Globally, people are taking efforts to shift to renewable sources of energy like solar, wind, biogas and geothermal energy.

Q.2. (c) How does the nutrients and the energy flow from one organism to the other?

(3.5)

Ans. Energy cannot cycle. As it moves up each trophic level or up the food chain large amounts are lost. Energy transfer is very inefficient. So it starts with the producers (plants) then the herbivores eat the plants and energy is lost as heat. Then the next group eat the herbivores and more is lost and so on.... By the time it reaches the top almost all is gone and the remainder will be lost again primarily as heat.

Q.4. (b) What are the causes and consequences of deforestation?

(6.5)

Ans. Causes of Deforestation

1. Agricultural Activities: Due to overgrowing demand for food products, huge amount of trees are fell down to grow crops and for cattle gazing.

2. Logging: Apart from this, wood based industries like paper, match-sticks, furniture etc also need a substantial amount of wood supply. Wood is used as fuel both directly and indirectly, therefore trees are chopped for supplies. Firewood and charcoal are examples of wood being used as fuel. Some of these industries thrive on illegal wood cutting and felling of trees.

3. Urbanization: Further on order to gain access to these forests, the construction of roads are undertaken; here again trees are chopped to create roads. Overpopulation too directly affects forest covers, as with the expansion of cities more land is needed to establish housing and settlements. Therefore forest land is reclaimed.

4. Desertification of land: Some of the other factors that lead to deforestation are also part natural and part anthropogenic like Desertification of land. It occurs due to land abuse making it unfit for growth of trees.

5. Mining: Oil and coal mining require considerable amount of forest land. Apart from this, roads and highways have to be built to make way for trucks and other equipment. The waste that comes out from mining pollutes the environment and affects the nearby species.

6. Forest Fires: Hundreds of trees are lost each year due to forest fires in various portions of the world. This happens due to extreme warm summers and milder winters. Fires, whether causes by man or nature results in huge loss of forest cover.

Effects of Deforestation

1. Climate Imbalance: Deforestation also affects the climate in more than one ways. Trees release water vapor in the air, which is compromised on with the lack of trees. Trees also provide the required shade that keeps the soil moist. This leads to the imbalance in the atmospheric temperature further making conditions for the ecology difficult.

2. Increase in Global Warming: With constant deforestation the ratio of green house gases in the atmosphere has increased, adding to our global warming woes.

3. Soil Erosion: Also due to the shade of trees the soil remains moist. With the clearance of tree cover, the soil is directly exposed to the sun, making it dry.

4. Floods: When it rains, trees absorb and store large amount of water with the help of their roots. When they are cut down, the flow of water is disrupted and leads to floods in some areas and droughts in others.

5. Wildlife Extinction: Due to massive felling down of trees, various species of animals are lost. They lose their habitat and forced to move to new location. Some of them are even pushed to extinction. Our world has lost so many species of plants and animals in last couple of decades.

Q.5. (a) Explain the consequences of over exploitation of surface water resources. What are the techniques for water harvesting for conservation? (6)

Ans. Over Exploitation of Ground Water:

1. Subsidence: It results in the sinking of overlying land surface. The common problems associated with it include structural damage in buildings, fracture in pipes, reversing the flow of sewers and canals and tidal flooding.

2. Lowering of water table: It is not advisable to do excessive mining as it would cause a sharp decline in future agricultural production, due to lowering of water table.

3. Water logging: When excessive irrigation is done with brackish water it raises the water table gradually leading to water logging and salinity problems.

Over Exploitation of Surface Water: Surface water is mainly misused, due to which its quality and quantity both degrades. Since lakes, ponds, rivers, sea are used for dumping industrial and sewage wastes, dead bodies, solid wastes etc. hence their quality degrades, which give rise to many environmental, ecological and health problems.

The methods of ground water harvesting mainly are:

Refer Q.1. (b) of Second Term Examination 2015.

Q.5. (b) What are wind mills? What are the merits and demerits of wind energy? (6)

Ans. A windmill is a mill that converts the energy of wind into rotational energy by means of vanes called sails or blades. Most modern windmills (some people call them wind turbines by the way) have three blades. And most modern windmills rotate clockwise. Windmills are computer controlled. One of the main jobs is to keep the windmill facing the wind. To do this the computer monitors the direction and speed of the wind using instruments on top of the windmill. The blades of a windmill are aerodynamically optimised to make the most of the energy in the wind and turn it into rotational energy, making the blades spin round. These blades are connected to a generator. The payback of a modern windmill (the time it takes to get back the energy used to manufacture and install each windmill) is between 6 and 9 months – depending on location (some places are more windy than others). After that, for perhaps another 20 to 25 years, windmills bring a big net gain of clean energy and avoided carbon emissions.

Advantages Of Wind Energy

1. Wind Energy is an inexhaustible source of energy and is virtually a limitless resource.
2. Energy is generated without polluting environment.
3. This source of energy has tremendous potential to generate energy on large scale.
4. Like solar energy and hydropower, wind power taps a natural physical resource.
5. Windmill generators don't emit any emissions that can lead to acid rain or greenhouse effect.
6. Wind Energy can be used directly as mechanical energy.

7. In remote areas, wind turbines can be used as great resource to generate energy.
8. In combination with Solar Energy they can be used to provide reliable as well as steady supply of electricity.

9. Land around wind turbines can be used for other uses, e.g. Farming.

Disadvantages Of Wind Energy

1. Wind energy requires expensive storage during peak production time.
2. It is unreliable energy source as winds are uncertain and unpredictable.
3. There is visual and aesthetic impact on region.
4. Requires large open areas for setting up wind farms.
5. Noise pollution problem is usually associated with wind mills.
6. Wind energy can be harnessed only in those areas where wind is strong enough and weather is windy for most parts of the year.
7. Usually places, where wind power set-up is situated, are away from the places where demand of electricity is there. Transmission from such places increases cost of electricity.
8. The average efficiency of wind turbine is very less as compared to fossil fuel power plants. We might require many wind turbines to produce similar impact.
9. It can be a threat to wildlife. Birds do get killed or injured when they fly into turbines.
10. Maintenance cost of wind turbines is high as they have mechanical parts which undergo wear and tear over the time.

UNIT-IV

Q.8. Explain the following terms:-

Q.8. (a) Disaster Management steps for an Earthquakes.

Ans. Disaster management (or emergency management) is the creation of plans through which communities reduce vulnerability to hazards and cope with disasters.

Disaster management does not avert or eliminate the threats; instead, it focuses on reducing the impact of disasters on people and their environment.

creating plans to decrease the effect of disasters. Failure to create a plan could lead to human mortality, lost revenue, and damage to assets.

The first and the foremost is to restructure the National Policy on disaster management reflecting the holistic approach involving **prevention, mitigation and preparedness** in **pre-disaster phase** with appropriate additional funding, along with the so far existent policy of the **post-disaster relief and rehabilitation** under crisis management.

Creation of awareness for disaster reduction is urgently needed amongst policy makers, decision makers, administrators, professionals (architects, engineers and others at various levels) financial institutions (banks, insurance, house financing institutions) and NGOs and voluntary organizations.

Creating awareness for improving preparedness amongst the communities, using media, school education, and the network of the building centre.

Appropriate amendments in the legislative and regulatory instruments (state laws, master plans, development area plan rules, building regulations and bye-laws of local bodies) along with **strengthening of the enforcement mechanisms** at different levels.

Capacity building at local and regional levels for undertaking rapid-assessment surveys and investigations of the nature and extent of damage in post disaster situations.

Conducting micro-zonation surveys of large urban areas falling in the disaster prone regions and preparing appropriate preparedness and mitigation plans on an urgent basis.

To ensure use of disaster resistant construction techniques in all housing and other buildings to be undertaken under the Central and State schemes.

Making mandatory, the use of disaster resistant codes and guidelines related to disaster resistant construction in the houses and buildings in all sectors of the society by law and through incentives and disincentives.

To create a suitable institutional mechanism at national/state level to advise and help the existing disaster relief set up in formulation and updating of short and long range action plans for the preparedness, mitigation and prevention of natural disasters. (the mechanisms suggested are establishment of a National Scientific and Technical Committee at Central level and Natural Disaster Mitigation Centres at State levels).

To promote the study of natural disaster prevention, mitigation and preparedness as subjects in architecture and engineering curricular.

To create detailed database on hazard occurrences, damage caused to buildings and infrastructure and the economic losses suffered and ensure its accessibility to interested researchers for effective analysis of costs of disasters and benefits of mitigative actions.

To devise appropriate policy instrument and funding support for urgent disaster preparedness and prevention actions in high risk areas including upgrading the resistance of existing housing and related structures and systems.

To include R&D work in disaster preparedness, mitigation and prevention as a *thrust area* so that adequate funds are earmarked for the schemes of R&D organizations as well as the concerned Central Ministries and State Governments.

Q.1.(g) What are the consequences of population growth?

The consequences are:

• Overuse of Resources:

Rapid population growth tends to overuse the country's natural resources.

- It increases the pressure of population on land;

• it leads to rise in costs of consumption goods because of the scarcity of the cooperant factors to increase their supplies

• Due to high growth in population, the requirements of the people increased at a tremendous rate and consequently, the natural resources were unexpectedly over exploited.

• Urbanization is a result of growth of population in urban areas. As a country develops from primarily an agricultural to an industrial economy, large-scale emigrational rural residents to towns and cities takes place.

and in the same way, there is increase in the size of the cities, settlements and establishment of industries in or around the cities.

- The global warming, which is caused by emission of toxic gases and enhancement of greenhouse gases in the atmosphere, is consequence of overpopulation

• Water is not much useful for drinking and other purposes in the cities because of high pollution. Similarly, air pollution has given birth to many diseases.

• Poverty and malnutrition is a growing and common phenomenon in the underdeveloped countries. High growth rate of population and comparatively low production of crops has enhanced the situation of poverty, malnutrition and famine in these countries.

Q.1.(h) Explain OTEC (Ocean Thermal Energy conversion) process in brief.

Ans. Ocean Thermal Energy Conversion (OTEC) uses the temperature difference between cooler deep and warmer shallow or surface ocean waters to run a heat engine and produce useful work, usually in the form of electricity. However, the temperature differential is small and this impacts the economic feasibility of ocean thermal energy for electricity generation. The most commonly used heat cycle for OTEC is the Rankine cycle using a low-pressure turbine.

Advantages

Eco-friendly

Minimal maintenance costs compared to other power production plants

Provide air conditioning to buildings within the OTEC plant

Fresh water-first by-product is fresh water. A small 1 MW OTEC is capable of producing some 4,500 cubic of fresh water per day, enough to supply a population of 20,000 with fresh water

• Open cycle OTEC systems can produce desalinated water which is very important in third-world countries

• Chilled soil agriculture-cold seawater flowing through underground pipes, chills the surrounding soil. Thereby allowing many plants evolved in temperate to be grown in subtropics due to temp. difference in the plant roots in cool soil and plant leaves in warm air.

Q.2. (c) What do you understand by ecological succession?

Ans. Ecological succession is the gradual process by which ecosystems change and develop over time. Nothing remains the same and habitats are constantly changing.

- The species living in a particular place gradually change over time as does the physical and chemical environment within that area.
- Succession takes place because through the processes of living, growing and reproducing, organisms interact with and affect the environment within an area, gradually changing it.
- Each species is adapted to thrive and compete best against other species under a very specific set of environmental conditions. If these conditions change, then the existing species will be outcompeted by a different set of species which are better adapted to the new conditions.
- Change in the plant species present in an area is one of the driving forces behind changes in animal species. This is because each plant species will have associated animal species which feed on it. The presence of these herbivore species will then dictate which particular carnivores are present.
- Succession occurs on many different timescales, ranging from a few days to hundreds of years.

There are two main types of succession, primary and secondary.

Primary succession is the series of community changes which occur on an entirely new habitat which has never been colonized before. For example, a newly quarried rock face or sand dunes.

Secondary succession is the series of community changes which take place on a previously colonized, but disturbed or damaged habitat. For example, after felling trees in a woodland, land clearance or a fire.

Q.4.(b)(ii) Surface and subsurface mining

Ans. Surface mining is used where the ore or material to be extracted is located fairly close to the surface. The overlying ground cover is removed, the material is mined, and the ground cover is ordinarily replaced. Surface mining is done by removing (stripping) surface vegetation, dirt, and if necessary, layers of bedrock in order to reach buried ore deposits. Techniques of surface mining include

Open-pit mining which consists of recovery of materials from an open pit in the ground, quarrying or gathering building materials from an open pit mine, strip mining which consists of stripping surface layers off to reveal ore/seams underneath, and mountaintop removal, commonly associated with coal mining, which involves taking the top of a mountain off to reach ore deposits at depth. Most (but not all) placer deposits, because of their shallowly buried nature, are mined by surface methods.

Landfill mining, finally, involves sites where landfills are excavated and processed.

Subsurface mining is used where the material is in veins deep beneath the surface, or obstructed (by rock layers, water tables, or other strata) in a way that make surface access impractical. Early mines used existing caves, but technology has brought increasingly deep and complex drilling to reach veins of coal or metal ores. Sub-surface mining consists of digging tunnels or shafts into the earth to reach buried ore deposits. Ore, for processing, and waste rock, for disposal, are brought to the surface through the tunnels and shafts. Sub-surface mining can be classified by the type of access shafts used, the extraction method or the technique used to reach the mineral deposit.

Drift mining utilizes horizontal access tunnels, slope mining uses diagonally sloping access shafts and shaft mining consists of vertical access shafts. Mining in hard and soft rock formations require different techniques.

..... crop period the crop yield is reduced considerably.

Q.5.(a) What are the alternative energy resources? Differentiate between renewable and non renewable natural resources? (5)

Ans. Alternative energy encompasses all those things that do not consume fossil fuel. They are widely available and environment friendly. They cause little or almost no pollution. There have been several alternative energy projects running in various countries to reduce our dependence on traditional fossil fuels.

Solar energy is one the alternative energy source that is used most widely across the globe. Solar energy can be extracted either by Solar Thermal or using Photovoltaic (PV) Cells.

Wind Energy is one of the energy sources that have been in use for a very long time and for centuries. Many of the wind turbines can capture much power all at once before feeding it to the power grid. This is commonly known as wind farms and has been in use for many years all round the world.

Geothermal energy means energy drawn or harnessed from beneath the earth. It is completely clean and renewable. Geothermal energy has been in used since last several years. The boiling water then produces steam which is captured by geothermal heat pumps. The steam turns the turbines which in turn activates generators.

The energy of the moving water can then be captured and called as hydroelectric power. Hydroelectric power stations capture the kinetic energy of moving water and give mechanical energy to turbines. The moving turbines then convert mechanical energy into electrical energy through generators. Dams around the world have been built for this purpose only. Hydropower is the largest producer of alternative energy in the world.

Biomass Energy

This is the process by which an alternative energy is generated through conversion of biological materials and wastes into forms that can be used as energy sources for heating, power generation and transportation.

Comparison between Renewable and Non-Renewable Resources:

	Renewable Resources	Nonrenewable Resources
Definition	A resource which can be replenished or reused. It means it will never run out	This type of resource cannot be replenished
Example	Water, crops, wind, solar, geothermal	Coal, Petroleum, natural gas, etc.
Advantages	<ul style="list-style-type: none">• Operating cost is low• Clean• No harm for the environment• Sun, wind, ocean energy, etc. are available in abundant quantity and are free to use.• These sources have low carbon emission and therefore are considered to be more environmental friendly.	<ul style="list-style-type: none">• They are cheap and easy to use• Known for their efficiency• Ability to produce a lot of energy in short period of time. <p>Little or no competition</p>
Disadvantages	<ul style="list-style-type: none">• Not very efficient in producing energy in a massive scale.• They can be noisy.• They are expensive to build	<ul style="list-style-type: none">• They will eventually run out.• Not clean.• They are threatening to the environment

Q.5.(b)(ii) Hydrothermal energy

Ans. Hydrothermal energy is the process of obtaining heat or energy from a body of water. "Heat", in this case should not be associated with high temperature it may be with geothermal energy) but rather a relative heat content or relative temperature difference. The abundance of this renewable energy source was testimony to the eminent ocean energy. The energy flowing through the surface layer of the tropic ocean is about 10,000 times greater than the energy used by human societies. As such it is the only energy resource on Earth that is large enough to replace fossil fuel.

Ocean thermal energy conversion (OTEC), the prior art, is a subset of what is conceived as hydrothermal energy. Whereas OTEC (also known as hydrothermal power generation), focuses on electrical power generation from ocean temperature differences, hydrothermal energy offers a more comprehensive utilization of the natural resources. The water resources may be transported to and from the source and collected

for utilization on the surface on floating platforms or from shore-based applications. The shore-based applications may involve laying down pipes into the water source, or using drilling techniques, such as tunnel boring or directional drilling, also known as drilled hydrothermal energy. There are many uses of this energy

They are:

1. Hydrothermal cooling
2. Hydrothermal power generation
3. Fresh water production
4. Hydrothermal fuel generation
5. Hydrothermal water treatment
6. Cold water agriculture and mariculture
7. Hydrothermal health centers
8. Increased atmospheric carbon absorption

Q.6. (c) Waste water treatment.

Ans. Human activities generate a tremendous volume of sewage and wastewater that require treatment before discharge into waterways. The water must then be purified before it is considered fit to drink.

Water purification. To purify water for drinking, a number of processes are conducted to reduce the microbial population and maintain that population at a safe level.

First, the solid matter is allowed to settle out in a **sedimentation tank**. Flocculating materials such as alum are used to drag microorganisms to the bottom of the tank. Water is filtered through either a **slow sand filter** or a **rapid sand filter**.

Sewage treatment. Sewage treatment involves a more complex set of procedures than are needed for water purification because the volume of organic matter and the variety of microorganisms are much greater.

The first treatment, or **primary treatment**, of sewage and wastewater involves the removal in settling tanks of particulate matter such as plant waste. The solids that sediment are strained off, and the sludge is collected to be burned or buried in landfills. Alternatively, it can be treated in an anaerobic sludge digesting tank, as follows.

During the **secondary treatment** of wastewater and sewage, the microbial population of liquid and sludge waste is reduced. In the **anaerobic** sludge digester, microorganisms break down the organic matter of proteins, lipids, and cellulose into smaller substances for metabolism by other organisms. Results of these breakdowns include organic acids, alcohols, and simple compounds.

In **aerobic** secondary sewage treatment, the fluid waste is aerated and then passed through a **trickling filter**. In this process, the liquid waste is sprayed over a bed of crushed rocks, tree bark, or other filtering material. Colonies of bacteria, fungi, and protozoa grow in the bed and act as secondary filters to remove organic materials. The microorganisms metabolize organic compounds and convert them to carbon dioxide, sulfate, phosphates, nitrates, and other ions. The material that comes through the filter has been 99 percent cleansed of microorganisms.

In the **tertiary treatment** of sewage, the fluid from the secondary treatment process is cleansed of phosphate and nitrate ions that might cause pollution. The ions are precipitated as solids, often by combining them with calcium or iron, and the ammonia is released by oxidizing it to nitrate in the nitrification process. Adsorption to activated charcoal removes many organic compounds such as polychlorinated biphenyls (PCBs), a chemical pollutant.

Q.7. Write short notes on the following.

(a) Photochemical smog

Ans. Photochemical smog is a unique type of air pollution which is caused by reactions between sunlight and pollutants like hydrocarbons and nitrogen dioxide. Although photochemical smog is often invisible, it can be extremely harmful, leading to irritations of the respiratory tract and eyes.

Chemistry of Photochemical Smog

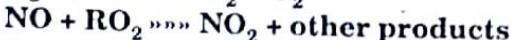
The previous section suggested that the development of photochemical smog is primarily determined by an abundance of nitrogen oxides and volatile organic compounds in the atmosphere and the presence of particular environmental conditions. To begin the chemical process of photochemical smog development the following conditions must occur:

- Sunlight.
- The production of oxides of nitrogen (NO_x).

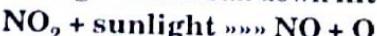
- The production of volatile organic compounds (VOCs).
- Temperatures greater than 18 degrees Celsius.

If the above criteria are met, several reactions will occur producing the toxic chemical constituents of photochemical smog. The following discussion outlines the processes required for the formation of two most dominant toxic components: ozone (O₃) and peroxyacetyl nitrate (PAN). Note the symbol R represents a hydrocarbon (a molecule composed of carbon, hydrogen and other atoms) which is primarily created from volatile organic compounds.

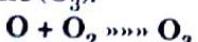
Nitrogen dioxide can be formed by one of the following reactions. Notice that the nitrogen oxide (NO) acts to remove ozone (O₃) from the atmosphere and this mechanism occurs naturally in an unpolluted atmosphere.



Sunlight can break down nitrogen dioxide (NO₂) back into nitrogen oxide (NO).



The atomic oxygen (O) formed in the above reaction then reacts with one of the abundant oxygen molecules (which makes up 20.94 % of the atmosphere) producing ozone (O₃):



Nitrogen dioxide (NO₂) can also react with radicals produced from volatile organic compounds in a series of reactions to form toxic products such as peroxyacetyl nitrates (PAN).



It should be noted that ozone can be produced naturally in an unpolluted atmosphere. However, it is consumed by nitrogen oxide as illustrated in the first reaction. The introduction of volatile organic compounds results in an alternative pathway for the nitrogen oxide, still forming nitrogen dioxide but not consuming the ozone, and therefore ozone concentrations can be elevated to toxic levels.

Q.8. Write short notes on the following

(4+4+4.5)

(a) Flood Disaster Management Map

Ans. Flood Hazard Map(FHM) is defined as a map

- (1) with anticipated inundation area
- (2) with information for safe evacuation
- (3) made by municipality.

However, a map of past inundation with/without information for safe evacuation can also be called "FHM". It can be considered that the essence of FHM is "hazard" of floods. Then, so-called "flood risk map" can also be included in FHM.

Flood hazard maps shall cover the geographical areas which could be flooded according to the following scenarios:

- (a) floods with a low probability, or extreme event scenarios;
- (b) floods with a medium probability (likely return period ≥ 100 years);
- (c) floods with a high probability, where appropriate.

For each scenario the following elements shall be shown:

- (a) the flood extent;
- (b) water depths or water level, as appropriate;
- (c) where appropriate, the flow velocity or the relevant water flow.

Q.8.(b) Problems of urbanization

Ans. Problem of urbanization

(1)Housing problems

Urbanization attracts people to cities and towns which lead to high population increase. With the increase in the number of people living in urban centers, there is continued scarcity of houses..

(2) Overcrowding

- This form of congestion in urban areas is consistent because of overpopulation and it is an aspect that increases day by day as more people and immigrants move into cities and towns in search of better life.

(3)Unemployment

The problem of joblessness is highest in urban areas and it is even higher among the educated people. The increasing relocation of people from rural or developing areas to urban areas is the leading cause of urban unemployment.

(4)Development of slums

The cost of living in urban areas is very high. When this is combined with random and unexpected growth as well as unemployment, there is the spread of unlawful resident settlements represented by slums and squatters.

(5) Water and sanitation problems

Because of overpopulation and rapid population increase in most urban centers, it is common to find there are inadequate sewage facilities.

Overcrowding also highly contributes to water scarcity as supply falls short of demand.

(6) Poor health and spread of diseases

The social, economic and living conditions in congested urban areas affects access and utilization of public health care services. Slum areas in particular experience poor sanitation and insufficient water supply which generally make slum populations susceptible to communicable disease

(7) Traffic congestion

More people means increased number of vehicles which leads to traffic congestion and vehicular pollution.

(8) Urban crime

Issues of lack of resources, overcrowding, unemployment, poverty, and lack of social services and education habitually leads to many social problems including violence, drug abuse, and crime. Most of the crimes such as murder, rape, kidnapping, riots, assault, theft, robbery, and hijacking are reported to be more prominent in the urban vicinities.

Q.9. Explain the following terms:

(4+4+4.5)

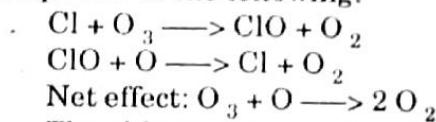
(a) Ozone layer depletion

Ans. The decrease in ozone concentration in the middle layers of the atmosphere – mainly in the stratosphere – is extremely damaging to life on earth, and is largely caused by emissions of halogenated hydrocarbons produced by man, CFCs, HCFCs, halons, carbon tetrachloride and methyl bromide. For this reason, such substances are commonly referred to as Substances that Deplete the Ozone Layer (ODS).

Ozone Destruction Mechanism

Substances such as CFCs, and others that are cited, that lower the ozone layer do not directly destroy ozone. First they undergo photolysis, forming hydrogen chloride (HCl) or chlorine nitrate (ClONO_2), molecules that do not react with ozone directly, but slowly decompose, giving, among other things, a small number of chlorine atoms (Cl) and of chlorine monoxide (ClO) molecules that catalyze the destruction of ozone.

The reactions involved in the processes of destruction are more than 100, but can be simplified in the following:



The chlorine atom acts as a catalyst, ie it is not consumed in the reaction, so it destroys thousands of ozone molecules before disappearing.

Cause of Ozone Layers Depletion

Chlorofluorocarbons (CFCs)

They are compounds formed by chlorine, fluorine and carbon. They are often used as refrigerants, solvents, and for the manufacture of spongy plastics.

Hydrochlorofluorocarbons (HCFCs)

They are being used as substitutes for CFCs because many of their properties are similar and are less harmful to ozone by having a shorter half-life and releasing fewer Cl atoms.

Halons

They are compounds formed by Br, F and C. Because of their ability to put out fires are used in fire extinguishers, although their manufacture and use is prohibited in many countries because of their ozone-depleting action

Effects of the depletion of the ozone layer on human health

1. Skin Cancer: Today, it is estimated that skin cancer rates increased due to the decrease in stratospheric ozone (ozone layer).

2. The Immune System: It is known that exposure to ultraviolet light reduces the effectiveness of the immune system, not only relating to infections to the skin but also to those that can be verified in other parts of the body.

3. Effects on aquatic ecosystems: The loss of phytoplankton, the basis of the marine food chain, has been observed as the cause of the increase in ultraviolet radiation.

4. Plants: Plants In many plants UV-B radiation can have the following adverse effects: alter its shape and damage plant growth; Reduce tree growth; Change flowering times; Make plants more vulnerable to disease and produce toxic substances. There could even be losses of biodiversity and species.

Q.9. (c) Sustainable Development

Ans. Sustainable development is defined as development that satisfies the needs of the present without compromising the ability of future generations to satisfy theirs.

Sustainable development implies the fulfilment of several conditions: preserving the overall balance, respect for the environment, and preventing the exhaustion of natural resources. Sustainable development is based on two fundamental concepts. The first concept considers earth's carrying capacity and stresses on natural resources like forest, soil fertility, healthy wetlands, ozone layer etc. which provide basic requirements of human being. The second concept focuses on balancing of economical, social and ecological goals which include the basic needs like health, literacy, democratic values etc.

There are three pillars of sustainable development namely community development (which includes providing basic needs like food, shelter, clothes, health, education etc.), economic development (which include industrialization creating job opportunity) and environmental protection (which includes providing clean air, safe water, quality environment).

The sustainability in environmental restoration programme considers the following key issues:

- (i) Stabilisation of population growth.
- (ii) Conservation and rational exploitation of forest resources.
- (iii) Afforestation in waste lands and deforested areas.
- (iv) Control of pollution (Air, water, land etc.)
- (v) Maintenance of sustainability in agriculture
- (vi) Recycling of waste and residue
- (vii) Conservation of biodiversity
- (viii) Development of non-polluting renewable energy stems.
- (ix) Updating environmental laws and its strict imposition.
- (x) Assessment of ecological security.

For the sustainable development, the following points should be considered.

- (i) The input of matter and energy should be reduced up to their limiting values.
- (ii) The exhaustible and polluting fossil fuels should be replaced by less harmful renewable energy.
- (iii) Technology should be developed which provides essential goods with minimum waste in a non-polluted manner.
- (iv) The population growth should be slow down which will reduce stress on global life support.
- (v) There should be strict implementation of environmental laws.
- (vi) Steps should be taken for the conservation of forest, conservation of biodiversity, recycling of wastes, control of pollution etc.
- (vii) There should be integrated land use planning.
- (viii) Environmental education should be made compulsory to create awareness about the basic environmental issues.

Q.5(b) What is Environmental Impact Assessment? Why is it necessary to have EIA before the development of any project. 6

Ans. Environmental impact assessments refers to the effect and some action on the environment particularly action by human EIA is defined as a formal process used to predict the environmental consequences of any developmental project EIA is meant for intercomparison of the developmental options and screening of alternating sites for locating the projects. For analysis of the impacts, experts from various discipline should be involved. The objective of EIA are

1. Predict environmental impacts of projects after its completion.
2. Find ways and means to reduce the negative impacts.
3. Shape the projects to make it conducive to the local environment.
4. Present the predictions and viable options to policy maker.

Positive impacts

1. Increase in the small scale industries
2. Increase in employment to the local people
3. Improved standards of living because of improved infrastructure.

Negative Impacts :

1. Deterioration in the quality of local environment
2. Deforestation which may lead to soil erosion.
3. Natural flora and fauna is disturbed which disturbs the ecosystem.
4. May lead to increased level of noise pollutions.

Q.6. Write short notes on any five of the following:

$2.5 \times 5 = 12$

(a) Objectives of Environmental Studies

Ans. Awareness: To acquire the awareness and sensitivity to total environment and its allied problems.

Knowledge: To gain experience and acquire basic understanding of the environment and its associated problems.

Attitude: To acquire set of values and develop feeling for the environment and build the motivation for active participation in environment improvement and its protection

Skills: To develop skills in identifying and solving problems.

Participation: To provide an opportunity to be actively involved at all levels in working towards resolving environmental problems