MODULE - V
NATURAL RESOURCES AND ENVIRONMENTAL POLLUTION

Part - A

| 1 | What are renewable and non-renewable resources? Give examples. |

Renewable Energy:

Those sources of energy which are inexhaustible and can be regenerated again and again are called renewable sources of energy.
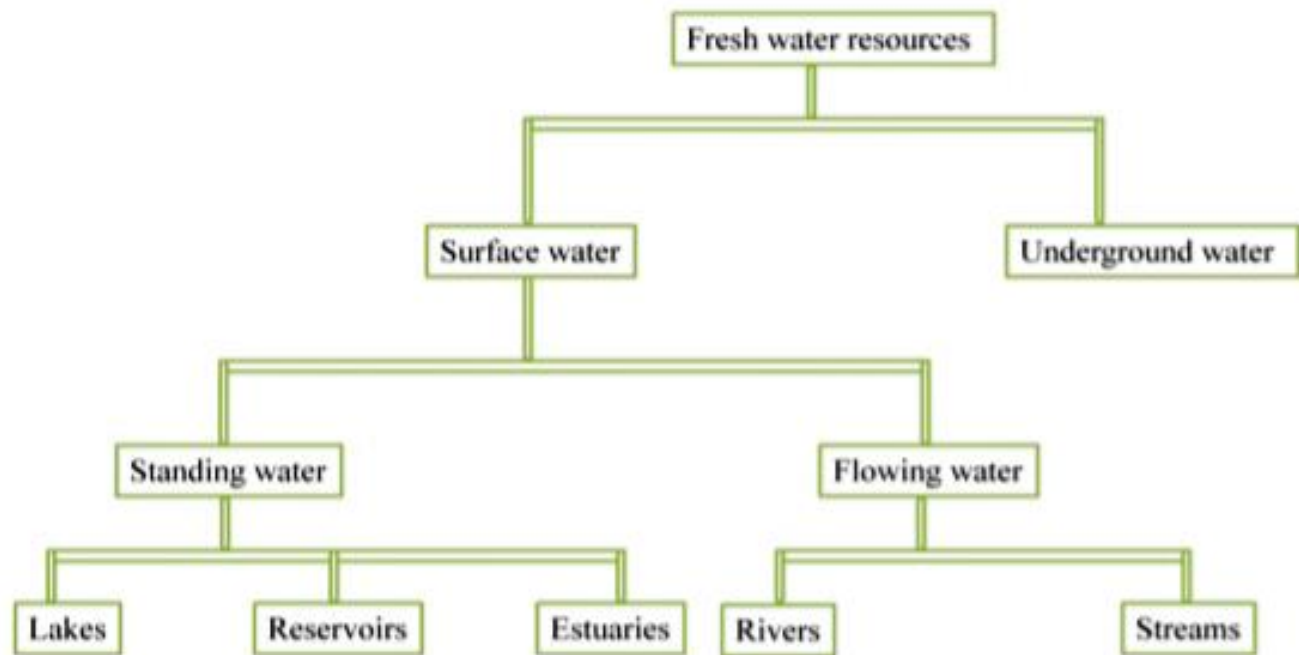
Eg: Solar energy, wind energy, Ocean energy (Tidal and Ocean thermal energy-OTE), Geothermal energy, Biomass energy, Hydropower energy, etc.,

Non-renewable Energy:

Those sources of energy which are exhaustible and can't be regenerated again and again are called non-renewable sources of energy.

Eg: Coal energy, Natural Gas energy (CH_4), Liquefied Petroleum Gas – LPG (Ethane, n-butane, iso-butane, butylenes and propane), Nuclear fuels ($_{92}U^{235}$), etc.,

| 2 | Enlist different surface and ground water resources. |

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                              ┌─────────────────────┐
                              │ Fresh water resources│
                              └─────────────────────┘
                ┌───────────────────────┴───────────────────────┐
          ┌───────────────┐                              ┌──────────────────┐
          │ Surface water │                              │ Underground water│
          └───────────────┘                              └──────────────────┘
      ┌───────────┴─────────────┐
┌───────────────┐        ┌───────────────┐
│ Standing water│        │ Flowing water │
└───────────────┘        └───────────────┘
  ┌──────┬──────┬────────┐        ┌─────┴──────┐
┌──────┐┌──────────┐┌─────────┐┌────────┐  ┌─────────┐
│Lakes ││Reservoirs││Estuaries││ Rivers │  │ Streams │
└──────┘└──────────┘└─────────┘└────────┘  └─────────┘
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Fresh water resources

Surface water

The water stored on the surface of the water is called as surface water.

The surface water is a very small portion of fresh water readily available for human use.

The surface water is largely used for irrigation, industrial use, public water supply, navigation etc,. A county's economy is largely dependent upon its rivers.

Underground water

The water source available deep in the ground due to percolation (Filtration of a liquid through a porous substance) of surface water is called as underground water.

Underground water is the major source of fresh water. It is pure and used for various domestic and industrial purposes.

Eg: Aquifers

Aquifers: A layer of sediment or rock that is highly permeable and contains water is called aquifer. Layers of sand and gravel are good aquifers while clay and crystalline rocks (like granite) are not since they have low permeability. Aquifers are of two types:

Unconfined aquifers: Unconfined aquifers are overlaid by permeable earth materials and they are recharged by water seeping down from above in the form of rainfall and snow melt.

| 3 | What is an aquifer? write its types. |

Aquifers: A layer of sediment or rock that is highly permeable and contains water is called aquifer. Layers of sand and gravel are good aquifers while clay and crystalline rocks (like granite) are not since they have low permeability. Aquifers are of two types:

Unconfined aquifers: Unconfined aquifers are overlaid by permeable earth materials and they are recharged by water seeping down from above in the form of rainfall and snow melt.

Confined aquifers: Confined aquifers which are sandwiched between two impermeable layers of rock or sediments and are recharged only in those areas where the aquifer intersects the land surface. Sometimes the recharged area is hundreds of kilometers away from the location of the well.

| 4 | What are the benefits and problems provided by large dams? |

Dams benefits & problems

The construction of dams has their own benefits & drawbacks. Dams are built for storing water. The stored water is used for irrigation, hydroelectric power generation and flood control.

Advantages of Dams

1. Dams are built for generating electricity.
2. Dams are used for irrigation of agriculture land efficiency.
3. Dams can provide drinking water for the community.
4. Dams can store flood water thereby control of flood threat.
5. Dams have saved countless millions of lives from floods
6. Dams can divert flow of water from river into a channel.
7. Drought control

Problems in constructing dams

1. Constructing dams would leads to an environmental degradation
2. Deforestation can cause loss of habitat and loss of biodiversity
3. Constructing dam results in displacement of several villages, communities, loss of agriculture land
4. Dams harm the environment
5. Water is lost through evaporation and seepage
6. Dams fill with sediment and change the geomorphology of the river
7. Dams can be unsafe; have killed thousands

| 5 | Define solar cells. Write its applications. |

1.Solar Energy

Solar energy is the technology used to harness the sun's energy and make it useable. Many people are familiar with so-called photovoltaic (PV) cells, or solar panels, found on things like spacecraft, rooftops, handheld calculators, etc.,. The cells are made of semiconductor materials like those found in computer chips. When sunlight hits the cells, it knocks electrons loose from their atoms (Einstein's photoelectric effect). As the electrons flow through the cell, they generate electricity.

On a much larger scale, solar thermal power plants employ various techniques to concentrate the sun's energy as a heat source (Solar heat collectors). The heat is then used to boil water (any liquid with low boiling point) to drive a steam turbine that generates electricity in much the same fashion as coal and nuclear power plants, supplying electricity for thousands of people.

application:

| 6 | What is the importance of land as a natural resource? |

Land is a physical entity which includes ==natural resources== like forest, water, minerals, food, energy and etc. Land is the biggest resources for biotic community to reproduce, live, sustain, grow, exploit and many life supporting activities.

The land is used for building homes, cultivating food, maintain pastures for domestic animals, industrial use etc. It is equally important to protect forests, grasslands, wetlands, mountains, coasts etc. in order to presence biodiversity. Soils are formed due to disintegration of rocks by various physical processes like change in temperature, pressure, blowing wind and flow of water. The top layer of soil consists of mixtures of Humus (dead leaves & plants), some of the living organisms and Inorganic components which supply nutrients to the soil.

| 7 | List the different types of natural resources |

Soil composition: Soil fertility depends four major components of soil are mineral materials, organic matter, water and air.

Mineral materials:

Mineral materials elements (Si, Fe, O, Mg, Al, Ca, Na, K and etc..), quartz (SiO_2), iron-silicates and aluminum silicates.

Organic matter: Came from the residues of plants and animals.Organic matter can be crop residues, grasses, bacteria, fungi, other microorganisms and animal wastes.

Water: It is a good solvent for many nutrients which move into plant roots.

Air: Air encourages optimum rate of the essential metabolic process of various organisms.

Land degradation: Any change in land that reduces its quality and productivity is referred land degradation. The land degradation results in deterioration of soil or loss of fertility of the soil.

| 8 | Describe the problems of over exploitation of ground water. |

The demand of water resources is increasing due to rapid growth in population and industry. After using all available surface water resources to the maximum, human beings began using groundwater to meet their needs.

Huge amount of water is utilized in industry and irrigation. Much of the water used in irrigation is lost through evaporation in the atmosphere and therefore it is referred to as consumed.

Effects of overutilization of water

1. Overutilization of groundwater disturbs the state of equilibrium of reservoir. This results in lowering the water level, decreased pressure in aquifers.
2. When the groundwater withdrawal is more than its recharge rate, the sediments in aquifer get compacted. This results in sinking of overlaying land surface and called as ground subsidence.
3. Ground subsidence causes change in speed and direction of water flow, it could disturb the hydrological cycle in the region, triggering several negative environmental impacts.
4. Over utilization of groundwater in coastal areas leads to rapid intrusion of salt water from the sea thereby rendering it unusable for drinking and agriculture.
5. Overutilization of groundwater lads to decrease in water level thereby causing earthquake, landslides and famine.
6. Overutilization of groundwater leads to drying-up of dug wells as well as bore wells.
7. Overutilization near agriculture land decreases the water level. The surface water containing fertilizers, pesticides and animal wastes containing nitrate percolates rapidly into ground and pollute the groundwater. When nitrate concentration exceeding 45 mg/L, water becomes unsuitable for drinking.

| 9 | What exactly are fossil fuels and why are they non-renewable? |

(2) Non-renewable resources: Non-renewable resources are not capable of regenerating. These resources have fixed quantity of stock in the earth's crust.

Eg: i) **Energy resources** – coal, oil, natural gas etc..

ii) **Metal resources** – iron copper, aluminum etc..

iii) **Non-Metal resources** – salt, clay, sand etc..

A few mineral resources, which occur in the earth's, crust namely copper, aluminum, mercury, gold etc.., minerals of asbestos, clay and mica are considered as non-renewable resources. Fossil fuels are derived from organic matter that accumulated during hundreds of millions of years of early bio-geological history. There is no way of recycling the energy in fossil fuels.

| 10 | Describe the measures to be taken for the control of floods. |

Flood Management

1. Construction of dams and reservoirs is an effective method of controlling floods.
2. Advance metrological information can give enough time to active disaster management systems.
3. Hydroengineering operations in flood affected areas for proper diversion of flood water.
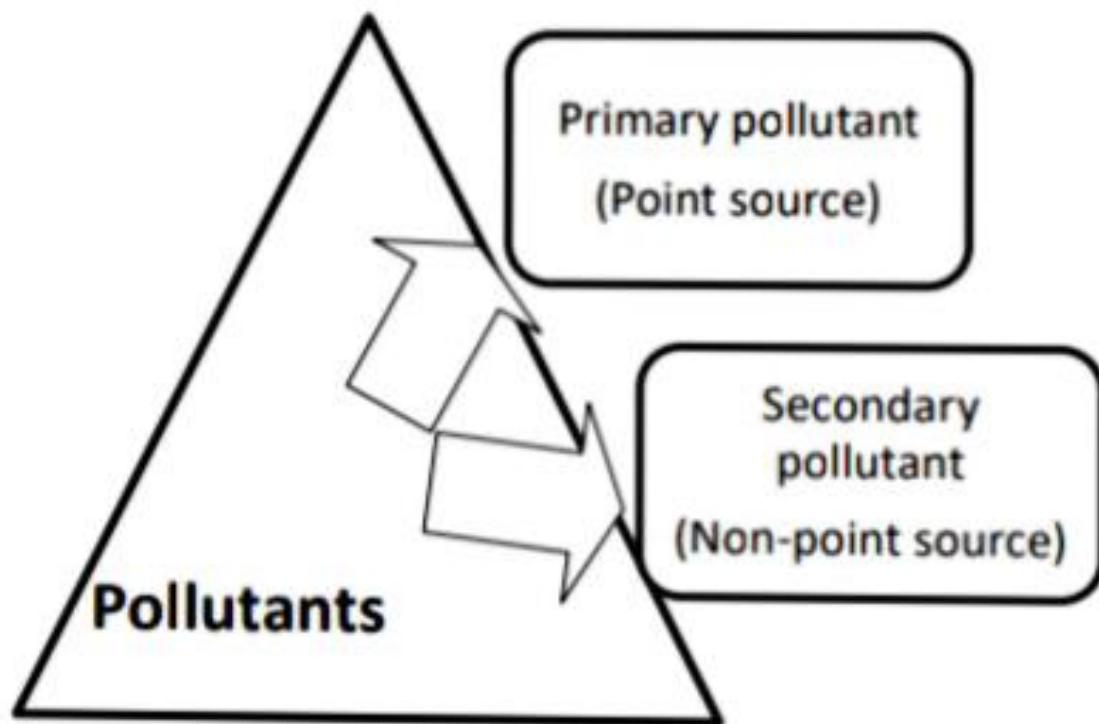4. Construction of floodways and reserving green zone on the river banks.

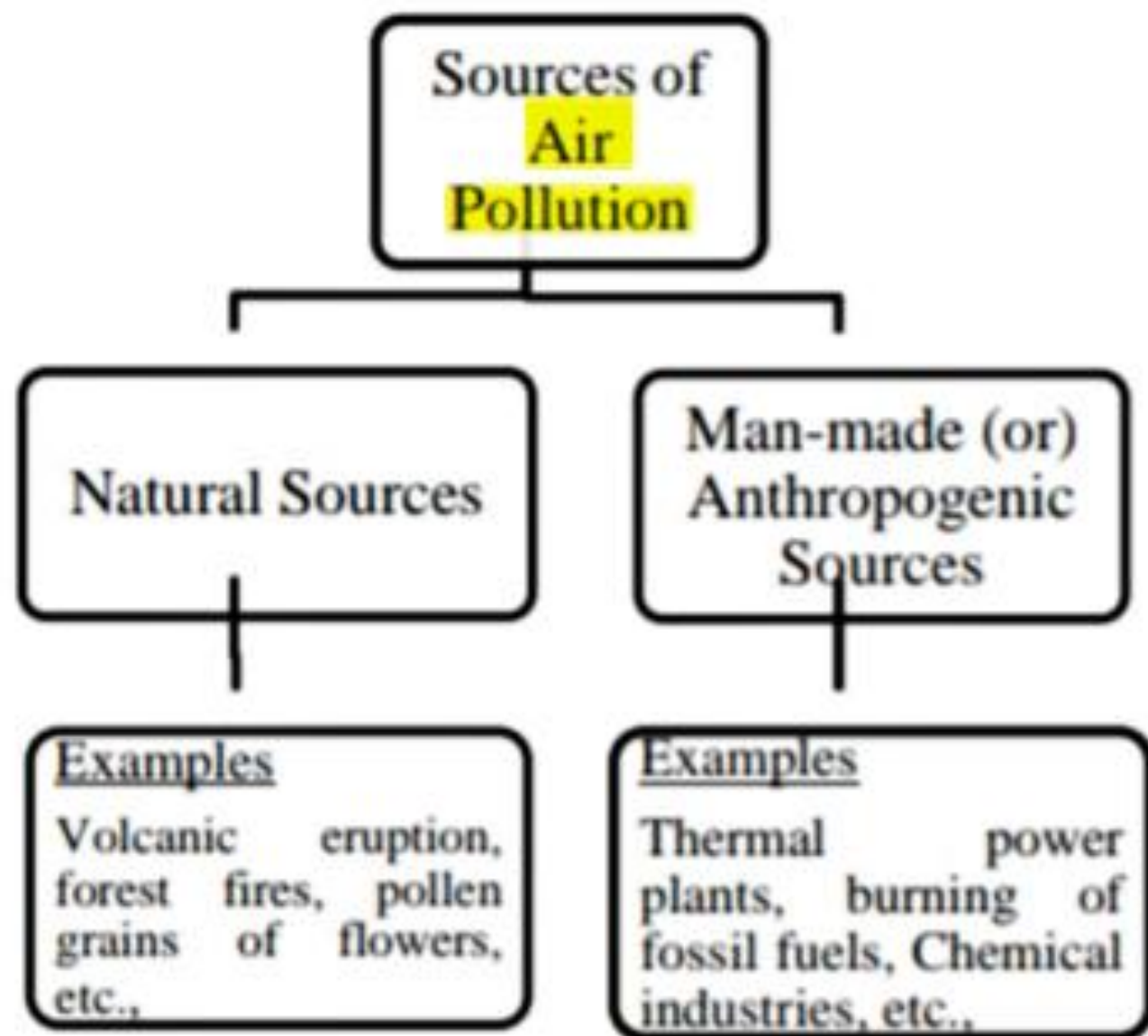| 11 | Define air pollution. What are the sources of air pollution? |

1. Air Pollution:

Any contaminant, which causes adverse change in the air quality, is called as **air pollution** and the contaminant is known as pollutant.

Pollutants classified into two categories

Sources of Air Pollutants:

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                    ┌─────────────┐
                    │  Sources of │
                    │     Air     │
                    │  Pollution  │
                    └──────┬──────┘
               ┌───────────┴───────────┐
       ┌───────┴────────┐      ┌────────┴────────┐
       │    Natural     │      │  Man-made (or)  │
       │    Sources     │      │  Anthropogenic  │
       │                │      │    Sources      │
       └───────┬────────┘      └────────┬────────┘
               │                        │
    ┌──────────┴─────────┐   ┌──────────┴──────────┐
    │ Examples           │   │ Examples            │
    │ Volcanic eruption, │   │ Thermal     power   │
    │ forest fires,      │   │ plants, burning of  │
    │ pollen grains of   │   │ fossil fuels,       │
    │ flowers, etc.,     │   │ Chemical            │
    │                    │   │ industries, etc.,   │
    └────────────────────┘   └─────────────────────┘
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| 12 | What is environmental pollution? |

1. Pollution: Any contaminant, which causes adverse change in the environment, is called as **pollution** and the contaminant is known as pollutant.

2. Classification of pollution:

Classification of Pollution

- **Air pollution**
- **Water pollution**
- **Soil or Land pollution**
- **Noise or Sound pollution**

| 13 | What are the various methods to control water pollution in industries? |

Preventions or control measures of water pollution:

1. Drinking water should be boiled, cooled and then used.
2. Disinfection of drinking water should be done by using chemicals like bleaching powder.
3. Pesticides and insecticides should be prevented from nearby use of water lakes, ponds and pools.
4. Drainage water should not be allowed to mix with drinking water.
5. Drainage system should be maintained properly.
6. Chlorination process is to be adopted for drinking water. For 1 litre of water 30-40 mg of chlorine is to be added to get perfect disinfection. It kills bacteria, fungi, fungal spores and other microbes also.
7. Reverse osmosis, UV-treated and ozonized water is one of the established drinking water technology which helps in providing the safe drinking water. All the municipalities should equip the technology to provide safe drinking water.

| 14 | Explain how ground water get pollutes? |

Sewage: sewage is wastewater from municipal and industrial area where there is human habitation. Waste material (such as human urine and feces) that is carried away from homes and other buildings in a system of pipes is known as sewage.

In nature water, Kimball (1975) classifies pollution into three types. They are:

(a) Domestic water pollution:

Sewage is a part of domestic water pollution. Domestic sewage not only contains unwanted waste materials, but it is also infested with harmful bacteria, virus etc. These are responsible for causing diseases in animals and human beings.

(b) Agricultural Water Pollution:

Water require for plants for its growth. Major irrigation, minor irrigation, sprinkler irrigation, drip irrigation, lift irrigation carry waste substances and causing water pollution in addition to the utilization of fertilizer and pesticides. Agricultural water pollution leads to Eutrophication & Water Bloom.

(c) Eutrophication:

Eutrophication is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates, through fertilizers or sewage, to an aquatic system. Eutrophication also occurs when fresh water bodies like ponds, lakes, pools which contain organic waste material. Because of that, the fresh water ponds and lakes get polluted. Eutrophication is a type of water pollution. Eutrophication was recognized as a pollution problem in European and North American lakes and reservoirs in the mid-20th century. Since then, it has become more widespread. Surveys showed that 54% of lakes in Asia are eutrophic; in Europe, 53%; in North America, 48%; in South America, 41%; and in Africa, 28%.

| 15 | Name various atmospheric pollutants. |

Criteria pollutants

- *Carbon monoxide.*

- *Lead.*

- *Nitrogen dioxide.*

- *Ozone.*

- *Particles.*

- *Sulfur dioxide.*

| 16 | What is noise pollution? Mention its sources. |

4. Noise Pollution

Everyone knows that sound is a form of energy that is capable of causing disturbances in human beings and structure (buildings, bridges, etc.,). Ears are the hearing organs in human beings. A thin membrane is called Tympanum (or) ear drum receives the vibrations produced by sound to a limited extent. Human ear is capable of perceiving about 85 decibels of sound. Beyond the limit, the ear drum cannot bear sound. In nature, we hear different types of sounds. Sound is a kind of vibration which travel through air, water, and are sensed by the ear. This is from music, speech, etc from radio / television / computers etc., one thing in this matter is that we can increase the volume of sound or decrease as per our taste whereas, a noise is a sound which cannot be heard clearly and only mixed sounds will be heard.

Ex: In general, a sound is a vibration from a particular machine, place or material which can be heard clearly whereas a noise a mixed vibrations that will come to us from all directions. A sound can be clear and can be able to hear, whereas a noise will not be clear and cannot be heard.

1. Sources of Noise pollution

An unwanted sound is called noise. When it cross optimum limit then that is called noise pollution. This noise pollution occurs through different sources:

i.   Vehicles produce noise that leads to noise pollution.

ii.   Automobile industry is another source of noise pollution.

iii. Noise pollution is very common in industrial areas where machines are working for factories making more noise.

iv.   The sources of noise are more in urban and industrial areas, than in rural areas.

v.   The sources of noise may be stationary or mobile.

vi.   The stationary sources include industries, loud speakers, mining operations and use of machineries, TV, Radio and Grinders etc.

vii. The mobile sources include Road Traffic, Highway Noise, Railway Traffic and Air Traffic.

| 17 | What are the natural and man-made pollutants that cause air pollution? |

Term	Meaning	Examples
Aerosol	General term for particles suspended in air	Sprays from pressurized cans
Mist	Aerosol consisting of liquid droplets	Sulfuric acid mist
Dust	Aerosol consisting of solid particles that are blown into the air or are produced from larger particles by grinding them down.	Dust storm
Smoke	Aerosol consisting of solid particles or a mixture of solid and liquid particles produced by chemical reaction such as fires.	Cigarette smoke, smoke from burning garbage
Fume	Generally means the same as smoke but often applies specifically to aerosols produced by condensation of hot vapors of metals.	Zinc/lead fumes
Plume	Geometrical shape or form of the smoke coming out of a chimney.	

| 18 | What are the various methods to control air pollution in industries? |

6. Prevention and control of Air Pollution

i) Adopting eco-friendly technologies for the prevention of air pollutants.

ii) Afforestation helps in controlling the air pollution.

iii) Thermal power station and other coal energy based industries should use low sulphur coal.

iv) De-sulphurization techniques should be used to remove the coal such as washing or with help of bacteria.

v) Gaseous pollutants should be controlled at source itself by using physical adsorption on porous solid materials such as charcoal, silica gel, Fuller's earth, etc.,

vi) Incomplete combustion of fossil fuels produce more carbon monoxide, carbon dioxide, hydrocarbons, particulate matter, hence, fossil fuels should burn at optimal conditions of oxygen and temperature.

vii) Particulate matter should be bring into control at source itself by using any one of the methods like cyclone separators, bag house filters, wet scrubber and Electrostatic precipitator methods.

| 19 | Describe the soil pollution caused by fertilizers. |

| 20 | Describe the adverse health effects due to industrial noise. |
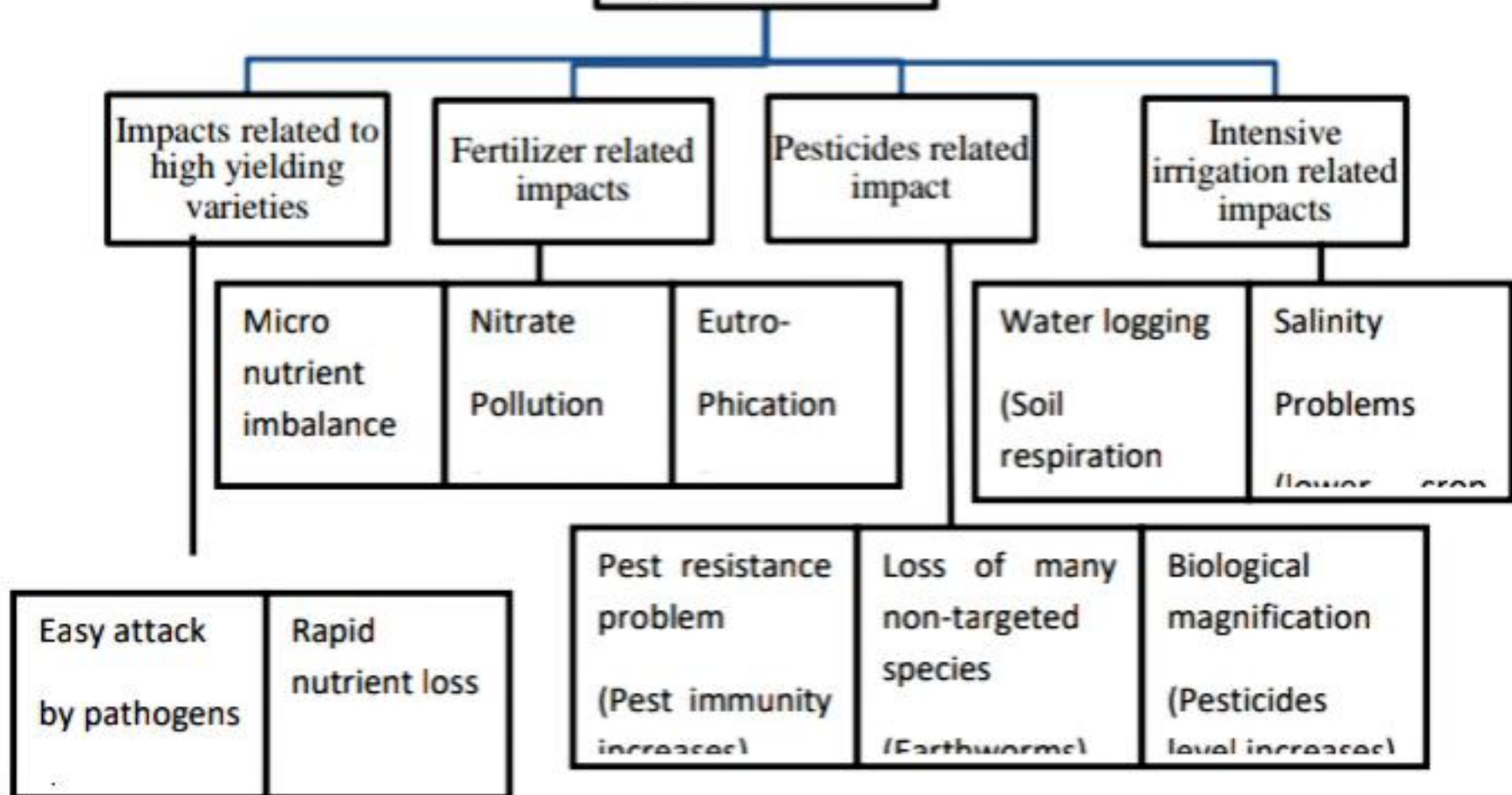
Stationary sources:

(a) **Industrial noise:** The main categories of industrial activity that are particularly relevant to the study of noise are the following: Product fabrication Product assembly Power generation by means of generators. Combusting process in furnaces. (Burning of gases)

(b) **Noise from construction works:** Construction noise, a major source of noise pollution is emitted by construction equipment. The sources of noise are dozers, excavators, front end loaders, soil compactors, cranes, air compressors, concrete vibrators, riveting steel structure during the casting, dismantling of construction materials etc...

(c) **Noise from other sources:** These include sources such as sirens, barking dogs, ambulances, Police vehicles, Fire engines etc.

Part - B (Long Answer Questions)

| 1 | Classify natural resources. What are the different methods of conserving water resource? |

Classification of Resource:

The natural resources can be classified into two major categories.

(1) **Renewable resources**: The renewable resources are the resources which regenerate through natural process within a reasonable time period. **Eg:** Forests, wild life, water air, grass lands.

(2) **Non-renewable resources**: Non-renewable resources are not capable of regenerating. These resources have fixed quantity of stock in the earth's crust.

Eg: i) **Energy resources** – coal, oil, natural gas etc..

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| 2 | Explain how water becomes a renewable resource. What are the effects of over exploitation of water resources. |

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Inexhaustible Resources: These resources are present in unlimited quantity in the nature and they are not likely to be exhausted by human activities.

Eg: solar energy, wind power, tidal power, rainfall, atomic energy etc…

It is very important to protect and conserve the natural resources. Natural resources are to be used in a judicious manner so that they cannot be exhausted. It does not mean that we should stop using them. Natural resources are to be used in such a way that we can make use for future generations. Among the natural resources, Water resources; Mineral resources; Energy resources; Land resources are the major ones to discuss.

| 3 | Describe briefly droughts and floods with respect to their occurrence and impacts. |

Floods:

An overflow of water, whenever the magnitude of water flow exceeds the carrying capacity of channel within its banks is called as flood.

Causes of Floods

Various causes of floods are..

1. Heavy rainfall and sudden melting of ice.
2. Insufficient water channel capacity of rivers.
3. Construction of buildings, roads which prevents infiltration of water into soil.
4. Deforestation, overgrazing and mining increases the runoff from rains and hence increases the flood level.
5. Soil erosion and loss of vegetation would lead to flooding due to heavy rain.

Effects of Floods

1. Flood water brings various diseases, flood kills human lives.
2. Aquatic and wildlife habitats are destroyed by floods. This leads to loss of bio-diversity due to migration of wildlife species to the adjoining areas.
3. Flood causes economic loss, loss of crops, loss of livestock and property damage.
4. Drainage system and public transport systems gets disrupted causing inconvenience and discomfort to common public.
5. Flood can cause slitting of dams, damage of bridges and damage of hydropower plants.
6. Agriculture produce can be submerged under flood water causing financial loss to community.

Flood Management

1. Construction of dams and reservoirs is an effective method of controlling floods.
2. Advance metrological information can give enough time to active disaster management systems.
3. Hydroengineering operations in flood affected areas for proper diversion of flood water.
4. Construction of floodways and reserving green zone on the river banks.

Drought

Drought is scarcity of water. Drought occurs due to inadequate rainfall, late arrival of rains overutilization of ground water.

The condition of dryness for prolonged period is called drought due to drop of average rainfall. Drought cause famine and starvation of human & animal population of region concerned. Drought is the most serious physical hazard to agriculture. Shortage of water for even the basic needs is the main problem in the drought areas. Shallow rooted plants don't grow. Infiltration wells, construction of dams, water sheds are being taken up in drought prone areas. Clouds seeding techniques, artificial rains etc., are to be implemented.

| 4 | What are the advantages and disadvantages of dams to the society and environment? |

Dams benefits & problems

The construction of dams has their own benefits & drawbacks. Dams are built for storing water. The stored water is used for irrigation, hydroelectric power generation and flood control.

Advantages of Dams

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| 5 | List out alternate energy sources. Explain their present status, merits and demerits. |

The Best Examples of Alternative Energy Sources

- *Wave Energy.*
- *Biofuels. ...*
- *Natural Gas. ...*
- *Geothermal Power. ...*
- *Wind Energy. ...*
- *Biomass Energy. ...*
- *Tidal Energy. ...*
- *Hydrogen Gas. Unlike other forms of natural gas, hydrogen is a completely clean burning fuel. ...*

present status,merits, demerits

| 6 | Compare the advantages and disadvantages of oil, coal and natural gas as energy sources. |

| 7 | What are the advantages of hydropower? How energy is generated in hydroelectric power plant. |

Hydroelectric Energy

Hydroelectric power, or hydroelectricity, is basically electrical energy that has been generated using natural forces such as gravity or flowing water. It's usually produced by dams, because dams can store and direct large volumes of water. Hydroelectric power is becoming increasingly popular.

Dams can generate electricity because they contain special mechanisms designed to take the energy in flowing water and turn it into electrical power. A power source is used to spin a turbine basically a propeller which in turn spins a metal shaft, forming the equivalent of an electrical generator that produces and stores electricity. The power source, in the case of hydropower, is water itself. When water moves a turbine, the turbine spins, and electromagnets in the turbine generate an electric current in the stationary coils of wire inside them.
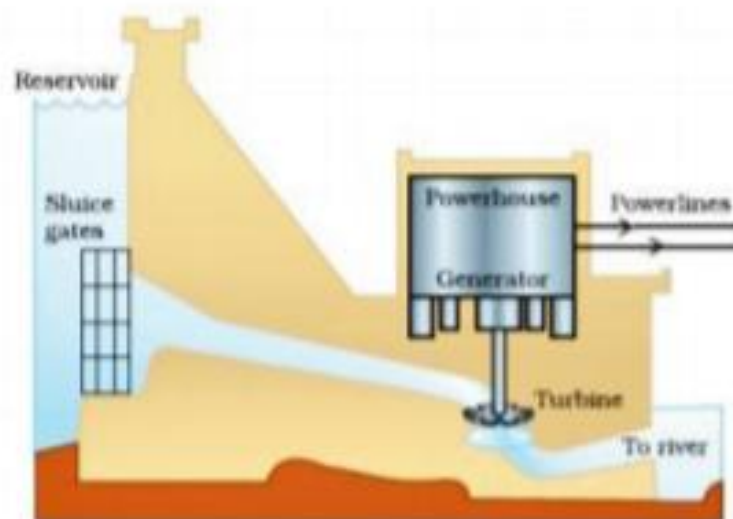
Schematic representation of hydroelectric power plant

Advantages:
1) Hydropower is a fueled by water, so it's a clean fuel source.
2) Hydropower doesn't pollute the air like power plants that burn
    a. fossil fuels, such as coal or natural gas.
3) Hydropower is a domestic source of energy, produced in the United States.
   Hydropower is generally available asneeded,engineers can control the flow of water through the t urbines to produce electricity on demand.
4) Hydropower plants provide benefits in addition to clean electricity.
5) Other benefits may include water supply and flood control.

| 8 | What is the impact of urbanization and industrialization on land? |

11. Industrial Pollution

Due to **industrialization**, we are facing many types of pollution. Based on nature of industry variety of industrial pollutant released into atmosphere. Pollutants released from thermal power plants, nuclear power plants, pulp and paper, chemical, cement, fertilizers, mining, etc., are of major concern.

Reasons of land degradation:

Population: With rapid growth in population more land is needed for producing food, wood, fiber and fuel. Thus land resources are over utilized causing land degradation.

Urbanization: Because of population urbanization also increases. The urbanization leads to deforestation which effects millions of plants and animal species.

9 | Describe the non-renewable energy resources. Explain how almost every source of energy has its limits.

Non-renewable Energy:

Those sources of energy which are exhaustible and can't be regenerated again and again are called non-renewable sources of energy.

Eg: Coal energy, Natural Gas energy (CH_4), Liquefied Petroleum Gas – LPG (Ethane, n-butane, iso-butane, butylenes and propane), Nuclear fuels ($_{92}U^{235}$), etc.,

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2.Wind Energy

Wind energy is a source of renewable power which comes from air current flowing across the earth's surface. Wind turbines harvest this kinetic energy and convert it into usable power which can provide electricity for domestic, industrial and agriculture sectors (**Ref. Figure 3**)

3.Ocean energy

The ocean is an enormous source of energy. It is estimated that 0.1% of the energy in ocean waves could be capable of supplying the entire world's energy requirements. Currently, a number of technologies aimed at harnessing this potential have been investigated and are at different stages of development including *tidal energy* (**Ref. Figure 4**), *difference of temperature (Ocean thermal*

| 10 | Describe about crude oil, coal and natural gas as energy sources. |

| 11 | Describe about alternate energy sources with example. |

| 12 | Explain about land resources with example. |

Land Resources

Land is the major part of the lithosphere. Land is made up of soils / rocks and are considered as very important resources of earth. Land plays a major role for growth of crops, vegetation, forests etc., Land represents an important resource for the economic life of a majority of people in the world. The way people handle and use land resource is decisive for their social and economic well-being as well as for the sustained quality of land resources. Land use however is not only an area of those directly using it; it is

exposed to a part of the wider reality of social and economic development and change. Land use therefore is a highly dynamic process.

Land is a physical entity which includes natural resources like forest, water, minerals, food, energy and etc. Land is the biggest resources for biotic community to reproduce, live, sustain, grow, exploit and many life supporting activities.

The land is used for building homes, cultivating food, maintain pastures for domestic animals, industrial use etc. It is equally important to protect forests, grasslands, wetlands, mountains, coasts etc. in order to presence biodiversity. Soils are formed due to disintegration of rocks by various physical processes like change in temperature, pressure, blowing wind and flow of water. The top layer of soil consists of mixtures of Humus (dead leaves & plants), some of the living organisms and Inorganic components which supply nutrients to the soil.

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Mineral materials:

Mineral materials elements (Si, Fe, O, Mg, Al, Ca, Na, K and etc..), quartz (SiO_2), iron-silicates and aluminum silicates.

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Water: It is a good solvent for many nutrients which move into plant roots.

Air: Air encourages optimum rate of the essential metabolic process of various organisms.

Land degradation: Any change in land that reduces its quality and productivity is referred land degradation. The land degradation results in deterioration of soil or loss of fertility of the soil.

| 13 | Explain about renewable energy resources with example. |

Those sources of energy which are inexhaustible and can be regenerated again and again are called renewable sources of energy.

Eg: Solar energy, wind energy, Ocean energy (Tidal and Ocean thermal energy-OTE), Geothermal energy, Biomass energy, Hydropower energy, etc.,

1.Solar Energy

Solar energy is the technology used to harness the sun's energy and make it useable. Many people are familiar with so-called photovoltaic (PV) cells, or solar panels, found on things like spacecraft, rooftops, handheld calculators, etc.,. The cells are made of semiconductor materials like those found in computer chips. When sunlight hits the cells, it knocks electrons loose from their atoms (Einstein's photoelectric effect). As the electrons flow through the cell, they generate electricity.

2. Wind Energy

Wind energy is a source of renewable power which comes from air current flowing across the earth's surface. Wind turbines harvest this kinetic energy and convert it into usable power which can provide electricity for domestic, industrial and agriculture sectors (**Ref. Figure 3**)

3.Ocean energy

The ocean is an enormous source of energy. It is estimated that 0.1% of the energy in ocean waves could be capable of supplying the entire world's energy requirements. Currently, a number of technologies aimed at harnessing this potential have been investigated and are at different stages of development including *tidal energy* (**Ref. Figure 4**), *difference of temperature (Ocean thermal energy-OTE)* and *salinity energy*.

If you ever went swimming in the ocean and dove deep below the surface, you would have

| 14 | What is environmental pollution? Explain the causes and effects of noise pollution. |

Environmental Pollution and Control Technologies

1. Pollution: Any contaminant, which causes adverse change in the environment, is called as **pollution** and the contaminant is known as pollutant.

1. Sources of Noise pollution

An unwanted sound is called noise. When it cross optimum limit then that is called noise pollution. This noise pollution occurs through different sources:

i. Vehicles produce noise that leads to noise pollution.
ii. Automobile industry is another source of noise pollution.
iii. Noise pollution is very common in industrial areas where machines are working for factories making more noise.
iv. The sources of noise are more in urban and industrial areas, than in rural areas.
v. The sources of noise may be stationary or mobile.
vi. The stationary sources include industries, loud speakers, mining operations and use of machineries, TV, Radio and Grinders etc.
vii. The mobile sources include Road Traffic, Highway Noise, Railway Traffic and Air Traffic.

2. Effects of Noise Pollution:

At 120 decibels, the ear registers pain but hearing damage begins about 85 decibels. Apart from hearing loss, noise can cause lack of sleep, irritation, indigestion, ulcers, High blood pressure, Heart diseases , Stress, speech problems, anxiety, depression, etc.,.

Annoyance (Feeling slightly angry): One of the most important effects of noise on human is annoyance. Due to this breathing rate affects.

Noise- induced hearing loss: Exposure to noise for long enough duration results in damage to the inner ear and thus decreases one's ability to hear. The louder the noise the less time it takes to cause hearing loss.

Effects on sleep: Noise disturbs sleep. It has been found that the cases related to various levels of noise are associated with sleep disturbances. Sleep disturbance by noise depends on the characteristics of the noise such as frequency, loudness and whether the noise is continuous or intermittent.

Other effects: There are many other effects of noises, which involve aggression (ready to attack). People may neurological disorder, hence, nonfunctioning of hands, legs etc due to the continuous exposure to the noise pollution.

On structures: Sometimes noise causes cracks to the buildings, bridges and even collapse at high pitch sounds.

3. Controlling of Noise pollution:

Noise pollution could be controlled by either reducing the noise at the source or by preventing its transmission. The first step in the prevention of noise pollution is to control the noise at source itself.

i.   Lubrication of machines reduces the noise produced
ii. Tightening the loose nuts
iii. Reducing the vibrations produced by machines etc.
iv. Developing of new technologies to get free from noise pollution
v.   Electric vehicles (e-vehicles) reduce the noise pollution great extent
vi. Bringing awareness among the people about noise pollution and consequence of noise pollution
vii. Through laws noise from various social functions, meetings, etc., can be controlled.
viii. Festivals (Diwali, Dhasara, moharam, etc.,) should celebrate with low noise pollution.
ix. Avoiding horns except in emergency situations.
x.   Sound proof or eco-generators and turning down the volume of stereos.

| 15 | Explain about sources, effects and control of soil pollution. |

3. Soil Pollution

Soil is a thin covering over the land consisting of a mixture of minerals, organic material, living organisms, air and water that together support the growth of plant life. Several factors contribute to the formation of soil from the parent material. This includes mechanical weathering of rocks due to temperature changes and abrasion, wind, moving water, glaciers, chemical weathering activities and lichens. Climate and time are also important in the development of soils. Extremely dry or cold climates develop soils very slowly while humid and warm climates develop them more rapidly. Under ideal climatic conditions soft parent material may develop into a centimeter of soil within 15 years. Under poor climatic conditions a hard parent material may require hundreds of years to develop into soil.

Any contaminant, which causes adverse change in the soil quality, is called as soil pollution.

1. Causes of Soil Pollution

   i.   Population growth
   ii.   Urbanization
   iii. Industrialization
   iv.   Excessive use of insecticides
   v.   Excessive use of chemical fertilizers
   vi.   Dumping of waste materials such as plastic, expired chemicals, etc.,
   vii. More than necessary use of irrigation projects

3. Effects of Soil Pollution

i) These pollutants affect and alter the chemical and biological properties of soil.

ii) As a result, hazardous chemicals can enter into human food chain from the soil or water, disturb the biochemical process and finally lead to serious effects on living organisms.
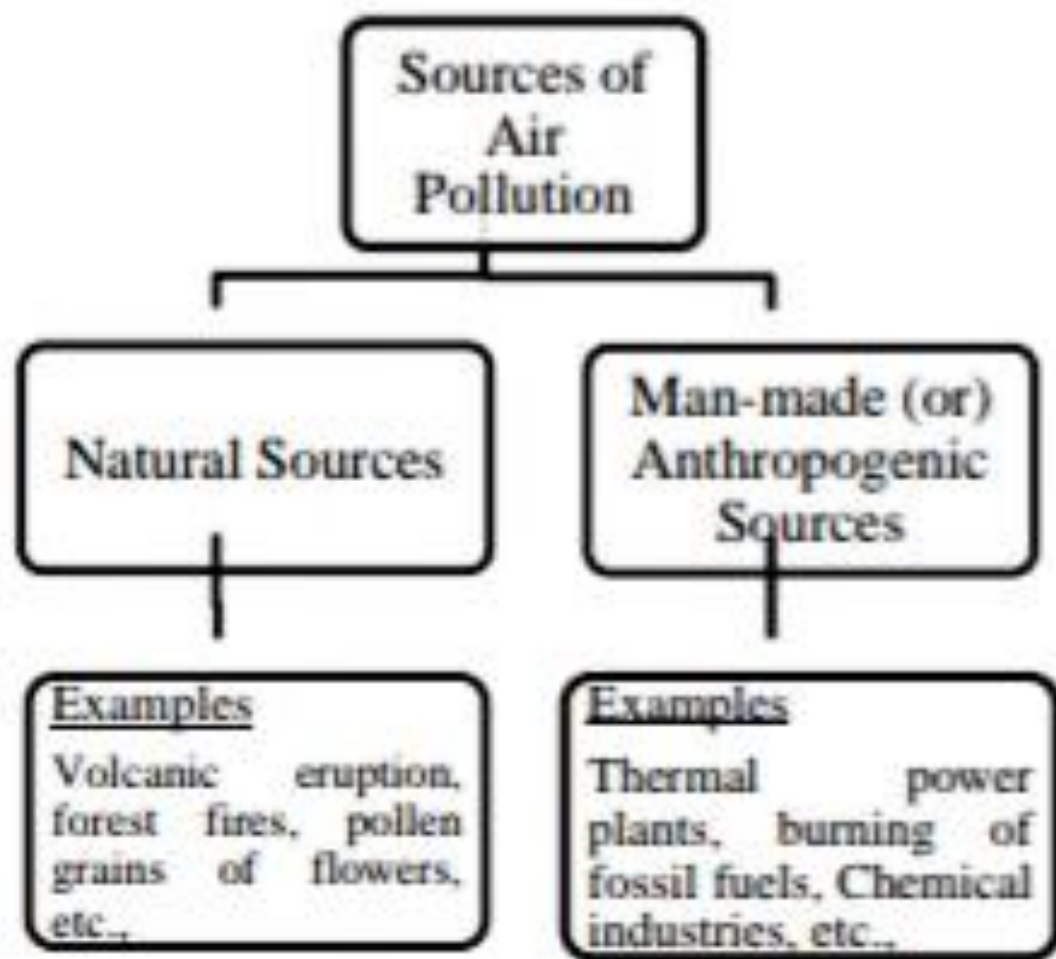
4. Control measures of soil pollution

i) Soil erosion can be controlled by a variety of forestry and farm practices. 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 helps arrest soil erosion in the long term.

ii) Proper dumping of unwanted materials: Excess wastes by man and animals pose a disposal problem. Open dumping is the most commonly practiced technique. Nowadays, controlled tipping is followed for solid waste disposal. The surface so obtained is used for housing or sports field.

iii) 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. Ex: Organic wastes in animal dung may be used to prepare compost manure instead of throwing them wastefully and polluting the soil.

| 16 | Explain about sources, effects and control of air pollution? |

1. Air Pollution:

Any contaminant, which causes adverse change in the air quality, is called as **air pollution** and the contaminant is known as pollutant.

1. Causes/ Sources of Air Pollutants:

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              ┌─────────────────┐
              │   Sources of    │
              │      Air        │
              │   Pollution     │
              └────────┬────────┘
          ┌────────────┴────────────┐
┌─────────────────┐        ┌─────────────────┐
│                 │        │  Man-made (or)  │
│ Natural Sources │        │  Anthropogenic  │
│                 │        │     Sources     │
└────────┬────────┘        └────────┬────────┘
         │                          │
┌─────────────────┐        ┌─────────────────┐
│ Examples        │        │ Examples        │
│ Volcanic        │        │ Thermal    power│
│ eruption,       │        │ plants, burning │
│ forest fires,   │        │ of fossil fuels,│
│ pollen grains   │        │ Chemical        │
│ of flowers,     │        │ industries, etc.│
│ etc.,           │        │                 │
└─────────────────┘        └─────────────────┘
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2. Effects of air pollution on living organisms

(a) On human beings:

Our respiratory system has a number of mechanisms that help in protecting us from air pollution. The hair in our nose filters out large particles. The sticky mucus in the lining of the upper respiratory tract captures smaller particles and dissolves some gaseous pollutants. When pollutants irritate the upper respiratory system, sneezing and coughing expel contaminated air and mucus. Prolonged smoking or exposure to air pollutants can overload or breakdown these natural defenses causing or contributing to diseases such as lung cancer, asthma, chronic bronchitis and emphysema. Elderly people, infants, pregnant women and people with heart disease, asthma or other respiratory diseases are especially vulnerable to air pollution.

Cigarette smoking is responsible for the greatest exposure to carbon monoxide. Exposure to air containing even 0.001 percent of carbon monoxide for several hours can cause collapse, coma and even death. As carbon monoxide remains attached to hemoglobin in blood for a long time, it accumulates and reduces the oxygen carrying capacity of blood. This impairs perception and thinking, slows reflexes and causes headaches, drowsiness, dizziness and nausea. Carbon monoxide in heavy traffic causes headaches, drowsiness and blurred vision.

Sulfur dioxide irritates respiratory tissues. Chronic exposure causes a condition similar to bronchitis. It also reacts with water, oxygen and other material in the air to form sulfur-containing acids. The acids can become attached to particles which when inhaled are very corrosive to the lung. Nitrogen oxides especially NO_2 can irritate the lungs, aggravate asthma or chronic bronchitis and increase susceptibility to respiratory infections such as influenza or common colds. Suspended particles aggravate bronchitis and asthma. Exposure to these particles over a long period damages lung tissue and contributes to the development of chronic respiratory disease and cancer. Many volatile organic compounds such as (benzene and formaldehyde) and toxic particulates (such as lead, cadmium) can cause mutations, reproductive problems or cancer. Inhaling ozone, a component of photochemical smog causes coughing, chest pain, breathlessness and irritation of the eye, nose and the throat.

(b) On plants

When some gaseous pollutants enter leaf pores they damage the leaves of crop plants. Chronic exposure of the leaves to air pollutants can break down the waxy coating that helps prevent excessive water loss and leads to damage from diseases, pests, drought and frost. Such exposure interferes with photosynthesis and plant growth, reduces nutrient uptake and causes leaves to turn yellow, brown or drop off altogether. At a higher concentration of sulphur dioxide majority of the flower buds become stiff and hard. They eventually fall from the plants, as they are unable to flower. Prolonged exposure to high levels of several air pollutants from smelters, coal burning power plants and industrial units as well as from cars and trucks can damage trees and other plants.

(c) Effects on aquatic life

Burning of fossil fuels creates carbon oxides (CO_x), nitrogen oxides (NO_x), sulphur oxides (SO_x) and solid particulate matter. Air pollutants like carbon dioxide mixing up with rainwater and absorbing in ocean water cause high acidity (low pH). This acidic nature of aquatic system causes damage to the phytoplankton, zooplankton, fish that are present and in the entire marine ecosystem.

| 17 | What are primary and secondary air pollutants? Enumerate various methods to control air pollution. |

1. Air Pollution:

Any contaminant, which causes adverse change in the air quality, is called as **air pollution** and the contaminant is known as pollutant.

Pollutants classified into two categories
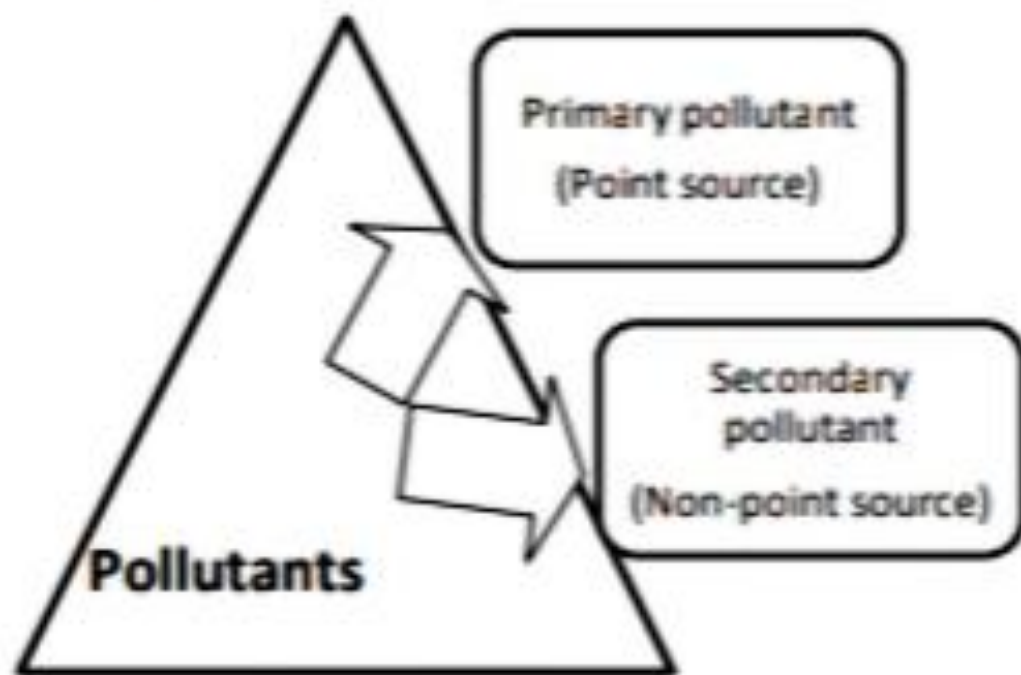
(1) Primary pollutant (Point source)   (2) Secondary pollutant (Non-point source)

Comparison of primary and secondary pollutants

Primary Pollutant	Secondary pollutant
Pollutants that are emitted directly from identifiable sources are produced by both natural events and human activities. These are called primary pollutants.	Pollutants that are produced in the atmosphere when certain chemical reactions take place among the primary pollutants are called secondary pollutants.
It is point source (one can see the pollution source with naked eye)	It is non-point source (one cannot see the pollution source with naked eye). It is formed after a single or series of reactions happened in atmosphere
Eg: dust storms and volcanic eruptions, emission from vehicles and industries, etc., All these sources emit pollutants such as CO_x (CO & CO_2), SO_x (SO_2 & SO_3), NO_x (N_2O, NO, N_2O_3, NO_2, N_2O_5), particulates mater, hydrocarbons, etc.,	Eg: sulfuric acid, nitric acid, carbonic acid, peroxyacetyl nitrate (PAN), etc.,

| 18 | Describe the major sources of soil pollution. How does soil pollution affect soil productivity and what measures can be taken to prevent soil pollution. |

3. Soil Pollution

Soil is a thin covering over the land consisting of a mixture of minerals, organic material, living organisms, air and water that together support the growth of plant life. Several factors contribute to the formation of soil from the parent material. This includes mechanical weathering of rocks due to temperature changes and abrasion, wind, moving water, glaciers, chemical weathering activities and lichens. Climate and time are also important in the development of soils. Extremely dry or cold climates develop soils very slowly while humid and warm climates develop them more rapidly. Under ideal climatic conditions soft parent material may develop into a centimeter of soil within 15 years. Under poor climatic conditions a hard parent material may require hundreds of years to develop into soil.

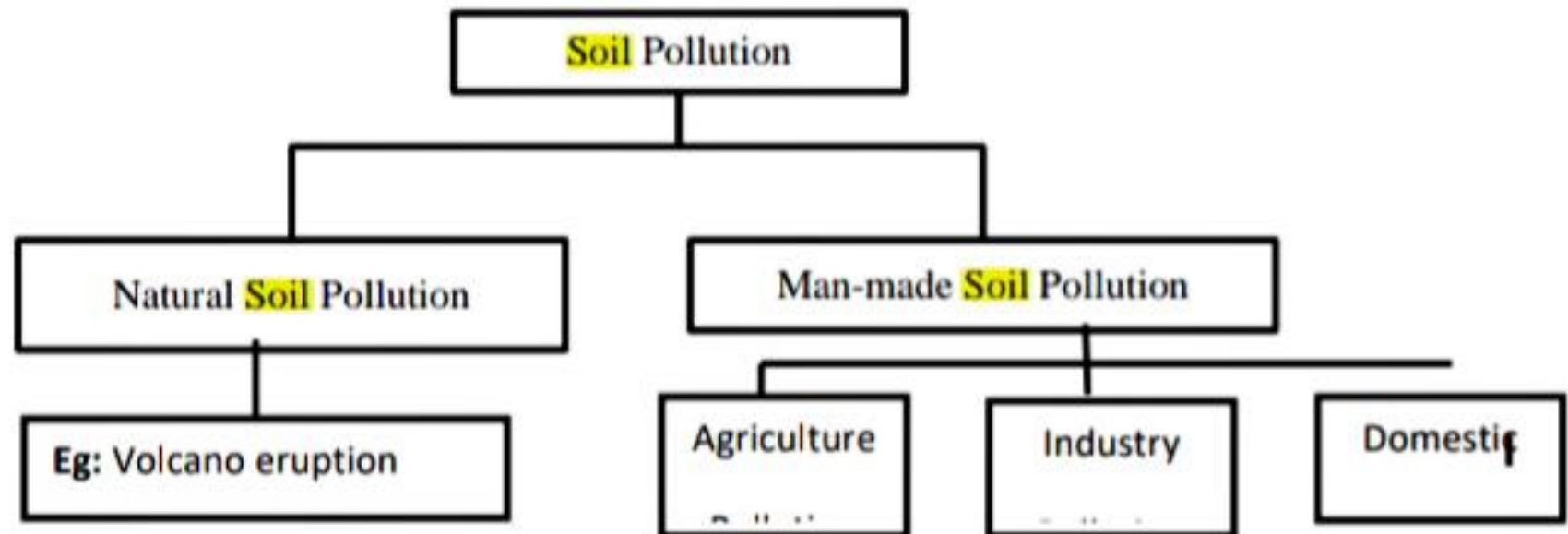Any contaminant, which causes adverse change in the soil quality, is called as soil pollution.

1. Causes of Soil Pollution

i.   Population growth
ii.   Urbanization
iii. Industrialization
iv.   Excessive use of insecticides
v.   Excessive use of chemical fertilizers
vi.   Dumping of waste materials such as plastic, expired chemicals, etc.,
vii. More than necessary use of irrigation projects

2. Types of Soil Pollution

Soil pollution is two types.

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                    ┌──────────────────┐
                    │  Soil Pollution  │
                    └──────────────────┘
                ┌────────────┴─────────────┐
   ┌────────────────────────┐    ┌──────────────────────────┐
   │ Natural Soil Pollution │    │ Man-made Soil Pollution  │
   └────────────────────────┘    └──────────────────────────┘
               │              ┌───────────┼───────────────┐
   ┌───────────────────┐  ┌──────────┐ ┌──────────┐ ┌──────────┐
   │ Eg: Volcano eruption│ │Agriculture│ │ Industry │ │ Domestic │
   └───────────────────┘  └──────────┘ └──────────┘ └──────────┘
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3. Impact of Modern Agriculture on Soil Degradation

Industrial agriculture is a form of modern farming that refers to the industrialized production of livestock, poultry, fish and crops. The methods of industrial agriculture are techno-scientific, economic and political. They include innovation in agricultural machinery, hybrid seeds and farming. Modern methods of agriculture have resulted in use of fertilizers and pesticides to increase the yield of the crops. Most of them are synthetic and chemicals-based. They are collectively called agro-chemicals. These intensive practices have several environmental impacts as given in the following Figure.

4. Control measures of soil pollution

i) Soil erosion can be controlled by a variety of forestry and farm practices. 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 helps arrest soil erosion in the long term.

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| 19 | Describe briefly the sources, effects and control of noise pollution. |

4. Noise Pollution

Everyone knows that sound is a form of energy that is capable of causing disturbances in human beings and structure (buildings, bridges, etc.,). Ears are the hearing organs in human beings. A thin membrane is called Tympanum (or) ear drum receives the vibrations produced by sound to a limited extent. Human ear is capable of perceiving about 85 decibels of sound. Beyond the limit, the ear drum cannot bear sound. In nature, we hear different types of sounds. Sound is a kind of vibration which travel through air, water, and are sensed by the ear. This is from music, speech, etc from radio / television / computers etc., one thing in this matter is that we can increase the volume of sound or decrease as per our taste whereas, a noise is a sound which cannot be heard clearly and only mixed sounds will be heard.

Ex: In general, a sound is a vibration from a particular machine, place or material which can be heard clearly whereas a noise a mixed vibrations that will come to us from all directions. A sound can be clear and can be able to hear, whereas a noise will not be clear and cannot be heard.

1. Sources of Noise pollution

An unwanted sound is called noise. When it cross optimum limit then that is called noise pollution. This noise pollution occurs through different sources:

i. Vehicles produce noise that leads to noise pollution.
ii. Automobile industry is another source of noise pollution.
iii. Noise pollution is very common in industrial areas where machines are working for factories making more noise.
iv. The sources of noise are more in urban and industrial areas, than in rural areas.
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vi. The stationary sources include industries, loud speakers, mining operations and use of machineries, TV, Radio and Grinders etc.
vii. The mobile sources include Road Traffic, Highway Noise, Railway Traffic and Air Traffic.

2. Effects of Noise Pollution:

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Annoyance (Feeling slightly angry): One of the most important effects of noise on human is annoyance. Due to this breathing rate affects.

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v.   Electric vehicles (e-vehicles) reduce the noise pollution great extent
vi.   Bringing awareness among the people about noise pollution and consequence of noise pollution
vii. Through laws noise from various social functions, meetings, etc., can be controlled.
viii. Festivals (Diwali, Dhasara, moharam, etc.,) should celebrate with low noise pollution.
ix.   Avoiding horns except in emergency situations.
x.   Sound proof or eco-generators and turning down the volume of stereos.

| 20 | Describe briefly the sources, effects and control of water pollution. |

2. Water Pollution

Hydrosphere in the universe contains water in the form of oceans, rivers, lakes, tanks and many other water sources. Water sources in the world are of two types. They are (1) Marine water bodies and (2) Fresh Water bodies. Water is a good solvent for many substances. Because of this property water cannot exist in its pure form at many parts of the world. Water pollution is mainly because of sewage, industrial disposals effluents. Any contaminant, which causes adverse change in the water quality, is called as **water pollution**.

2. Sources or Causes of water pollutants:

Disease causing agents: Bacteria, viruses, protozoan's that enter water from domestic sewage and animal wastes.

Water soluble inorganic chemicals: Acids, salts and compounds of toxic metals such as Pb, Hg can make water unfit to drink, harm fishes and other aquatic life. Also Nitrate, Phosphate compounds dissolve in water that can cause excessive growth of algae, which then die and decay, depleting dissolved O_2 in water and killing fish.

Water Soluble Organic chemicals: Oil, gasoline (a type of oil is obtained from petroleum), pesticides, detergents and many other water-soluble chemicals that threaten human health and harm fish.

Heat: Large quantity of water is heated when it is used in the cooling towers of thermal power plants. When this hot water is discharged into the nearby water bodies, it causes an increase in its temperature.

Sewage: sewage is wastewater from municipal and industrial area where there is human habitation. Waste material (such as human urine and feces) that is carried away from homes and other buildings in a system of pipes is known as sewage.

In nature water, Kimball (1975) classifies pollution into three types. They are:

(a) Domestic water pollution:

Sewage is a part of domestic water pollution. Domestic sewage not only contains unwanted waste materials, but it is also infested with harmful bacteria, virus etc. These are responsible for causing diseases in animals and human beings.

(b) Agricultural Water Pollution:

Water require for plants for its growth. Major irrigation, minor irrigation, sprinkler irrigation, drip irrigation, lift irrigation carry waste substances and causing water pollution in addition to the utilization of fertilizer and pesticides. Agricultural water pollution leads to Eutrophication & Water Bloom.

(c) Eutrophication:

Eutrophication is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates, through fertilizers or sewage, to an aquatic system. Eutrophication also occurs when fresh water bodies like ponds, lakes, pools which contain organic waste material. Because of that, the fresh water ponds and lakes get polluted. Eutrophication is a type of water pollution. Eutrophication was recognized as a pollution problem in European and North American lakes and reservoirs in the mid-20th century. Since then, it has become more widespread. Surveys showed that 54% of lakes in Asia are eutrophic; in Europe, 53%; in North America, 48%; in South America, 41%; and in Africa, 28%.

3. Effects of water pollution

(a) Ecological effects of Eutrophication:

i)   Excessive nutrients in water bodies promote plant growth which leads to a drop in water quality;

ii) Lack of oxygen for shellfish and marine life get in trouble (causing a drop in their population).

iii) Decrease in the recreational and aesthetic value of water bodies.

iv) Health problems when it occurs in drinking water reserves.

v)   Coral reef will decline.

vi) Decreased biodiversity.

vii) Changes in species composition and dominance and toxicity effects.

viii)   Increase of toxic phytoplankton species.

ix) Decreases in water transparency (increased turbidity).

x)   Color, smell, and water treatment problems.

xi) Dissolved oxygen depletion.

4. Preventions or control measures of <mark>water</mark> pollution:

1. Drinking water should be boiled, cooled and then used.
2. Disinfection of drinking water should be done by using chemicals like bleaching powder.
3. Pesticides and insecticides should be prevented from nearby use of water lakes, ponds and pools.
4. Drainage water should not be allowed to mix with drinking water.
5. Drainage system should be maintained properly.
6. Chlorination process is to be adopted for drinking water. For 1 litre of water 30-40 mg of chlorine is to be added to get perfect disinfection. It kills bacteria, fungi, fungal spores and other microbes also.
7. Reverse osmosis, UV-treated and ozonized water is one of the established drinking water technology which helps in providing the safe drinking water. All the municipalities should equip the technology to provide safe drinking water.

Some of drinking water quality standards

S. No.	Parameter	Allowed limit	Remarks
1	Colour	5 hazen units	Max 25 hazen units
2	Odour	Unobjectionable	-
3	Taste	Agreeable	-
4	Turbidity	5 NTU	Max 10 NTU

| 1 | What is the importance of land as a natural resource? Explain how world's land surface is getting degraded. |

Land Resources

Land is the major part of the lithosphere. Land is made up of soils / rocks and are considered as very important resources of earth. Land plays a major role for growth of crops, vegetation, forests etc., Land represents an important resource for the economic life of a majority of people in the world. The way people handle and use land resource is decisive for their social and economic well-being as well as for the sustained quality of land resources. Land use however is not only an area of those directly using it; it is

Reasons of land degradation:

Population: With rapid growth in population more land is needed for producing food, wood, fiber and fuel. Thus land resources are over utilized causing land degradation.

Urbanization: Because of population urbanization also increases. The urbanization leads to deforestation which effects millions of plants and animal species.

Fertilizers and pesticides: To improve the agricultural productivity, fertilizers and pesticides are used on large scale. The excess use of fertilizers and pesticides leads to pollution of land and water. Thus land (soil) gets degraded further.

Damage to top soil: Increased food production causing damage of top soil through nutrient depletion.

| 2 | What kind of energy do we get from the sun? Explain how we convert solar energy in to electricity. |

Those sources of energy which are inexhaustible and can be regenerated again and again are called renewable sources of energy.

Eg: Solar energy, wind energy, Ocean energy (Tidal and Ocean thermal energy-OTE), Geothermal energy, Biomass energy, Hydropower energy, etc.,
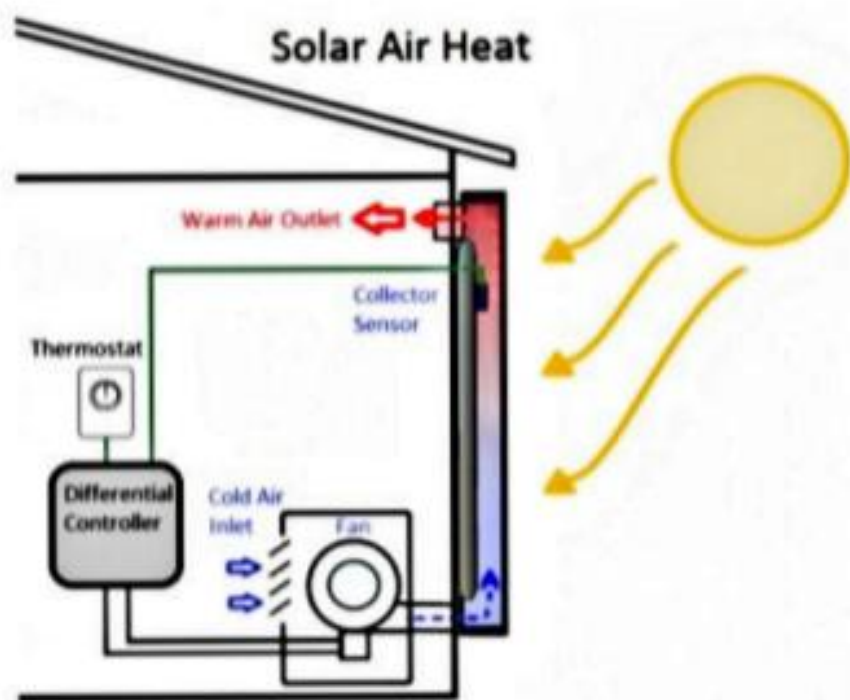
1.Solar Energy

Solar energy is the technology used to harness the sun's energy and make it useable. Many people are familiar with so-called photovoltaic (PV) cells, or solar panels, found on things like spacecraft, rooftops, handheld calculators, etc.,. The cells are made of semiconductor materials like those found in computer chips. When sunlight hits the cells, it knocks electrons loose from their atoms (Einstein's photoelectric effect). As the electrons flow through the cell, they generate electricity.

On a much larger scale, solar thermal power plants employ various techniques to concentrate the sun's energy as a heat source (Solar heat collectors). The heat is then used to boil water (any liquid with low boiling point) to drive a steam turbine that generates electricity in much the same fashion as coal and nuclear power plants, supplying electricity for thousands of people.

Powering the Home

Solar Panels

Energy grid

Inverter

Meter Box

Household circuits

Lights

Appliances

Schematic representation of solar energy (PV cells) power plant

Solar Air Heat

Warm Air Outlet

Collector Sensor

Thermostat

Differential Controller

Cold Air Inlet

Fan

Schematic representation of thermal solar energy power plant

| 3 | Describe some of the water resources problems in India. |

3. Effects of water pollution

(a) Ecological effects of Eutrophication:

i) Excessive nutrients in water bodies promote plant growth which leads to a drop in water quality;

ii) Lack of oxygen for shellfish and marine life get in trouble (causing a drop in their population).

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viii) Increase of toxic phytoplankton species.

ix) Decreases in water transparency (increased turbidity).

x) Color, smell, and water treatment problems.

xi) Dissolved oxygen depletion.

(b) Water Bloom:

It is defined as "A growth of algae at or near the surface of a body of water, such as a pond". This is another kind of water pollution because of the presence of Blue Green Algae (BGA). Blue-green algae are microscopic organisms that can be considered as simple aquatic plants that occur naturally in habitats such as marine waters, rivers, lakes, damp soil, tree trunks, hot springs and snow. They can vary considerably in shape, colour and size. They usually are present in low numbers. Blue-green algae can become very abundant in warm, shallow, undisturbed surface water that receives a lot of sunlight. When this occurs, they can form blooms that discolor the water or produce floating rafts or scums on the surface of the water. Blue in color or blue green water, this is unsuitable for drinking. This type of pollution of fresh water bodies by blue Green Algae is generally called "Water Bloom".

(c) Industrial water pollution:

Many industries discharge waste materials containing harmful chemicals. Such Industrial wastes are called effluents. Rivers get polluted when the river water is polluted by mixing of chemical substances released by the petrochemical industries, paper industries, chemical industries etc. The river Godavari is polluted because of effluents released by the paper industry. It affects the entire water ecosystem causing enormous damage to fishes, prawns and fresh water animals.

Eg: Minimita disease & Fluorosis.

| 4 | What are the major anthropogenic causes of droughts and floods? Give its remedial measures. |

Floods:

An overflow of water, whenever the magnitude of water flow exceeds the carrying capacity of channel within its banks is called as flood.

Causes of Floods

Various causes of floods are..

1. Heavy rainfall and sudden melting of ice.
2. Insufficient water channel capacity of rivers.
3. Construction of buildings, roads which prevents infiltration of water into soil.
4. Deforestation, overgrazing and mining increases the runoff from rains and hence increases the flood level.
5. Soil erosion and loss of vegetation would lead to flooding due to heavy rain.

Effects of Floods

1. Flood water brings various diseases, flood kills human lives.
2. Aquatic and wildlife habitats are destroyed by floods. This leads to loss of bio-diversity due to migration of wildlife species to the adjoining areas.
3. Flood causes economic loss, loss of crops, loss of livestock and property damage.
4. Drainage system and public transport systems gets disrupted causing inconvenience and discomfort to common public.
5. Flood can cause slitting of dams, damage of bridges and damage of hydropower plants.
6. Agriculture produce can be submerged under flood water causing financial loss to community.

Flood Management

1. Construction of dams and reservoirs is an effective method of controlling floods.
2. Advance metrological information can give enough time to active disaster management systems.
3. Hydroengineering operations in flood affected areas for proper diversion of flood water.
4. Construction of floodways and reserving green zone on the river banks.

Drought

Drought is scarcity of water. Drought occurs due to inadequate rainfall, late arrival of rains overutilization of ground water.

The condition of dryness for prolonged period is called drought due to drop of average rainfall. Drought cause famine and starvation of human & animal population of region concerned. Drought is the most serious physical hazard to agriculture. Shortage of water for even the basic needs is the main problem in the drought areas. Shallow rooted plants don't grow. Infiltration wells, construction of dams, water sheds are being taken up in drought prone areas. Clouds seeding techniques, artificial rains etc., are to be implemented.

| 5 | What is wind energy? Enumerate advantages and disadvantages associated with wind power. |

2. Wind Energy

Wind energy is a source of renewable power which comes from air current flowing across the earth's surface. Wind turbines harvest this kinetic energy and convert it into usable power which can provide electricity for domestic, industrial and agriculture sectors (**Ref. Figure 3**)

Wind energy is one of the fastest growing sources of new electricity generation in the world today. These growth trends can be linked to the multi-dimensional benefits associated with wind energy.
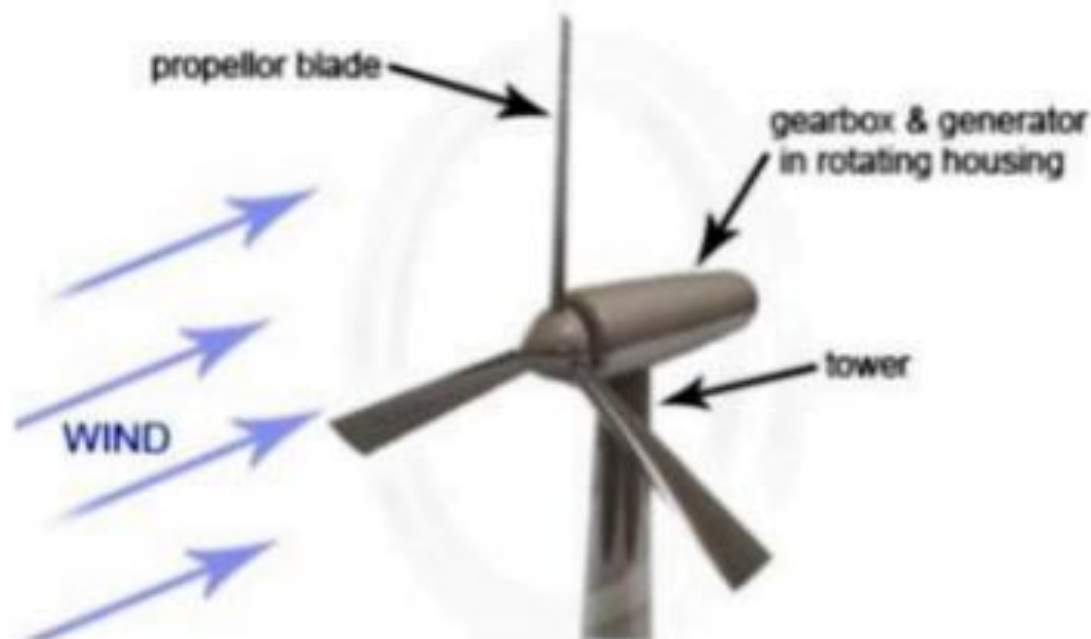

Figure 3: Schematic representation of wind turbine energy power plant

Advantages:

1) The electricity produced from wind power is said to be eco-friendly because its generation produces no pollution or greenhouse gases.
2) It is good for health and environmental safe.
3) Available for free of cost.
4) Wind is a renewable energy resource, it is inexhaustible.
5) From wind energy one can locally produce electricity.

Disadvantages:

1) Generates noise pollution.
2) The amount of electricity generated depends on the strength of the wind - if there is no wind, there is no electricity
3) Wind energy is that winds can never be predicted.
4) Wind mill kills birds.
5) Tornadoes, hurricanes and cyclones cause heavy damage.
6) Skilled manpower is required for installation

| 6 | Explain how groundwater in many places in India become contaminates with fluoride and arsenic. |

(c) Industrial water pollution:

Many industries discharge waste materials containing harmful chemicals. Such Industrial wastes are called effluents. Rivers get polluted when the river water is polluted by mixing of chemical substances released by the petrochemical industries, paper industries, chemical industries etc. The river Godavari is polluted because of effluents released by the paper industry. It affects the entire water ecosystem causing enormous damage to fishes, prawns and fresh water animals.

Eg: Minimita disease & Fluorosis.

(d) Fluorosis:

People suffer from a disease called fluorosis after consuming water containing fluorine for sufficiently a long time. Quantity of fluoride in water is only 1 ppm (WHO standards) (1-1.5 ppm, India standards).

2. Water Pollution

Hydrosphere in the universe contains water in the form of oceans, rivers, lakes, tanks and many other water sources. Water sources in the world are of two types. They are (1) Marine water bodies and (2) Fresh Water bodies. Water is a good solvent for many substances. Because of this property water cannot exist in its pure form at many parts of the world. Water pollution is mainly because of sewage, industrial disposals effluents. Any contaminant, which causes adverse change in the water quality, is called as **water pollution**.

1. Chemical examination of water (tests): pH; Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) Dissolved Oxygen, Conductivity, etc., are some of the chemical tests to find the stage of pollution of water.

pH: The value of pH gives the degree of acidity or alkalinity of polluted water. Determination of pH is important in calculating the coagulant (thick or thin) dose.
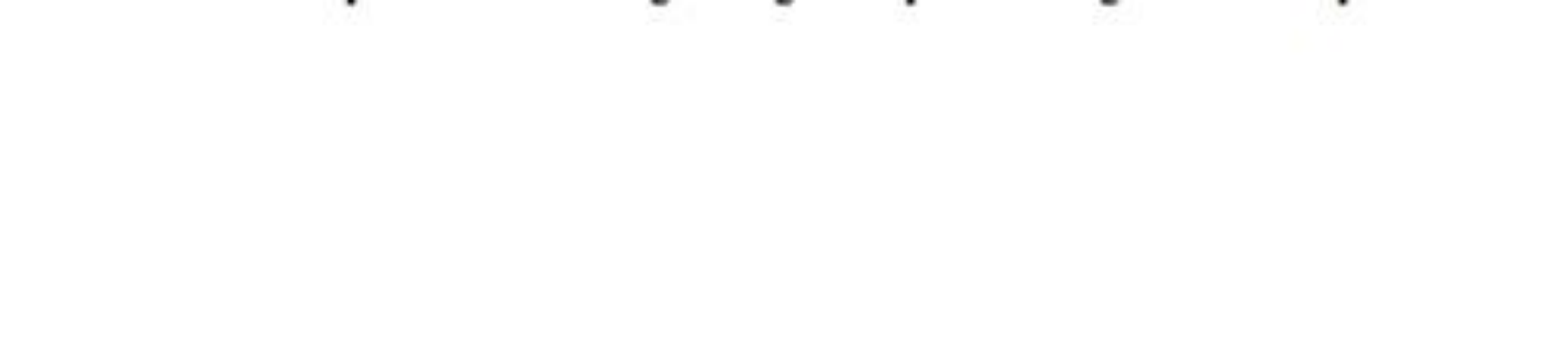
Biological Oxygen Demand (BOD): It is defined as the quantity of oxygen utilized by microorganisms at a temperature of 20°C, generally measured for 5 days. When unwanted materials pollute water, naturally the O_2 content gets reduced and that water become not fit for consumption either by human beings or animals or plants. Living organisms require water with some quantity of sustainable oxygen in it. That oxygen is necessary for living organisms is generally called BOD. If there is reduction in oxygen content of water, it becomes unfit for biological consumption because there is change in BOD.

Dissolved O_2: The amount of oxygen dissolved form in water at a particular temperature and atmospheric pressure is known as dissolved Oxygen. In polluted waters, dissolved oxygen is the factor, which determines whether the biological changes are carried by aerobic (needing oxygen) or by anaerobic (oxygen not required) microorganisms.

Ex: 5 to 8 mg/L of dissolved oxygen is required for most of the species and fishes.

Chemical Oxygen Demand (COD): This test is conducted to determine the pollution strength of the sewage. Potassium dichromate and potassium permanganate are used as oxidizing agents.

| 7 | Water is a unique resource. Comment on this statement. | U |

| 8 | List the physical, physiological and psychological effects of noise. Describe the adverse health effects due to industrial noise. |

4. Noise Pollution

Everyone knows that sound is a form of energy that is capable of causing disturbances in human beings and structure (buildings, bridges, etc.,). Ears are the hearing organs in human beings. A thin membrane is called Tympanum (or) ear drum receives the vibrations produced by sound to a limited extent. Human ear is capable of perceiving about 85 decibels of sound. Beyond the limit, the ear drum cannot bear sound. In nature, we hear different types of sounds. Sound is a kind of vibration which travel through air, water, and are sensed by the ear. This is from music, speech, etc from radio / television / computers etc., one thing in this matter is that we can increase the volume of sound or decrease as per our taste whereas, a noise is a sound which cannot be heard clearly and only mixed sounds will be heard.

Ex: In general, a sound is a vibration from a particular machine, place or material which can be heard clearly whereas a noise a mixed vibrations that will come to us from all directions. A sound can be clear and can be able to hear, whereas a noise will not be clear and cannot be heard.

2. Effects of Noise Pollution:

At 120 decibels, the ear registers pain but hearing damage begins about 85 decibels. Apart from hearing loss, noise can cause lack of sleep, irritation, indigestion, ulcers, High blood pressure, Heart diseases , Stress, speech problems, anxiety, depression, etc.,.

Annoyance (Feeling slightly angry): One of the most important effects of noise on human is annoyance. Due to this breathing rate affects.

Noise- induced hearing loss: Exposure to noise for long enough duration results in damage to the inner ear and thus decreases one's ability to hear. The louder the noise the less time it takes to cause hearing loss.

Effects on sleep: Noise disturbs sleep. It has been found that the cases related to various levels of noise are associated with sleep disturbances. Sleep disturbance by noise depends on the characteristics of the noise such as frequency, loudness and whether the noise is continuous or intermittent.

Other effects: There are many other effects of noises, which involve aggression (ready to attack). People may neurological disorder, hence, nonfunctioning of hands, legs etc due to the continuous exposure to the noise pollution.

On structures: Sometimes noise causes cracks to the buildings, bridges and even collapse at high pitch sounds.

| 9 | Explain the role of automobiles in creating air pollution and other environmental problems. |

7. Automobile Pollution

The day-to-day increase of fossil fuel based personal vehicles cause air pollution besides noise pollution. Pollutants from automobiles are emitted to the atmosphere through exhaust pipe. These pollutants are CO_x (CO & CO_2), NO_x (N_2O, NO, N_2O_3, etc..), SO_x (SO_2 & SO_3), unburnt hydrocarbons, particulate matter, Pb from leaded petrol, etc.. NO_x primary pollutants react with unburnt hydrocarbons in the presence of sunlight and produces secondary pollutant Peroxy Acetyl Nitrates (PANs).

8. Effects of automobile pollution

i) Automobile pollution causes breathing problems to the humanity.

ii) Spark plug in engine produces ozone and ozone is one of the well-known respiratory irritants. A respiratory irritant causing damage to the lungs, reducing lung capacity and aggravation respiratory problems, especially in the elderly, the very young, and the asthmatic.

iii) A strong oxidant gas that damages animal respiratory systems, plant leaf cells, reducing photosynthesis.

iv) Visibility reduction due to the heavy smoke from the vehicles causes eyes and skin damage in long run.

9. Remedial actions to control automobile pollution

i) Use mass transit, bicycle or walk whenever possible. The fewer vehicles on the highway, the fewer pollutants emitted to the air.

ii) Another way to reduce vehicle pollution is by practicing good vehicle maintenance.

iii) Automobile emissions testing programs are designed to ensure that vehicles are polluting as little as possible.

iv) Use of catalytic converter helps in reduction of automobile pollution.

v) Modification of internal combustion engine causes improvements of its efficiency.

vi) Unleaded petrol should be used to control Pb-emission into the environment.

| 10 | Explain any five major categories of water pollutants, their sources and effects. |

2. Water Pollution

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Chemical Oxygen Demand (COD): This test is conducted to determine the pollution strength of the sewage. Potassium dichromate and potassium permanganate are used as oxidizing agents.

2. Sources or Causes of water pollutants:

Disease causing agents: Bacteria, viruses, protozoan's that enter water from domestic sewage and animal wastes.

Water soluble inorganic chemicals: Acids, salts and compounds of toxic metals such as Pb, Hg can make water unfit to drink, harm fishes and other aquatic life. Also Nitrate, Phosphate compounds dissolve in water that can cause excessive growth of algae, which then die and decay, depleting dissolved O_2 in water and killing fish.

Water Soluble Organic chemicals: Oil, gasoline (a type of oil is obtained from petroleum), pesticides, detergents and many other water-soluble chemicals that threaten human health and harm fish.

Heat: Large quantity of water is heated when it is used in the cooling towers of thermal power plants. When this hot water is discharged into the nearby water bodies, it causes an increase in its temperature.

Sewage: sewage is wastewater from municipal and industrial area where there is human habitation. Waste material (such as human urine and feces) that is carried away from homes and other buildings in a system of pipes is known as sewage.

In nature water, Kimball (1975) classifies pollution into three types. They are:

3. Effects of water pollution

(a) Ecological effects of Eutrophication:

i) Excessive nutrients in water bodies promote plant growth which leads to a drop in water quality;

ii) Lack of oxygen for shellfish and marine life get in trouble (causing a drop in their population).

iii) Decrease in the recreational and aesthetic value of water bodies.

iv) Health problems when it occurs in drinking water reserves.

v) Coral reef will decline.

vi) Decreased biodiversity.

vii) Changes in species composition and dominance and toxicity effects.

viii) Increase of toxic phytoplankton species.

ix) Decreases in water transparency (increased turbidity).

x) Color, smell, and water treatment problems.

xi) Dissolved oxygen depletion.