

ENVIRONMENTAL EFFECTS :-

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* **Pollution** :- Pollution is the introduction of harmful substances or energy into the environment, causing adverse effects on living organisms and ecosystems. It can occur in various forms, such as air pollution, water pollution, soil pollution, and noise pollution.

* **Pollutant** :- A pollutant is any substance or energy that causes pollution. Pollutants can be natural or human-made. They can exist in solid, liquid, or gaseous forms and negatively impact the environment and human health.

* **Causes of pollution** :-

- i) The uncontrolled growth in number i.e., increase in population all over the world.
- ii) The rapid industrialization.
- iii) The rapid urbanisation.
- iv) The exploitation of nature by cutting trees etc.
- v) Excessive use of insecticides, pesticides and other chemicals.
- vi) Burning of fossil fuels.
- vii) Extracting minerals from the earth releases dust and chemicals.

* **Types of pollution** :-

- i) Air pollution
- ii) Water pollution.

1) **Air pollution** :- Air pollution is the presence of harmful substances in the atmosphere, including gases, particulates, and biological molecules, which can harm human health, animals, plants and the environment.

* **Types of air pollutants** :-

- i) Gases.
- ii) Particulates
- iii) Deforestation
- iv) Radioactive gases.

1. **Gases** :- Gases are freely miscible with air, without settling down. The concentrations of gaseous pollutants are often expressed as 'parts per million (ppm)' by volume.

Sources and effects of gaseous pollutants :-

* **Carbon monoxide (CO)**

Sources :- Released by partial combustion of fuel in automobiles, industries and oil refineries, cigarette, bidi, smoke and domestic appliances.

Effects :- It causes headache, visual difficulty, paralysis and even death.

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* Sulphur dioxide (SO_2)
Sources:- Thermal power plants, petroleum industry, sulphuric acid plants, oil refinery, etc.

Effects:- It causes heart, respiratory diseases, throat troubles, eye irritation, plant damage.

* Sulphur trioxide (SO_3):-
Sources:- Formed by oxidation of SO_2 in presence of sunlight. Droplets of these acids remain suspended in air.

Effect:- Acidic atmosphere has harmful effects on materials like clothes, paper, leather, etc. It corrodes iron and steel.

* Carbon dioxide (CO_2):-
Sources:- Combustion processes, respiration of plants and animals, by deforestation.

Effect:- CO_2 is non-poisonous, non-corrosive but too much in the atmosphere causes pollution, respiratory disorders and suffocation.

* Nitrogen oxides (NO , NO_2)
Sources:- Combustion of fuels, manufacturing acid, explosives and acid-picking plants.

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Effects:- High concentration of NO_2 , causes respiratory illness among children; irritation of eyes, lung congestion. Causes eye-irritation, difficulty in breathing.

ii) Particulates:- These include dust, smog, smoke, lead-dust etc.

* Dust:- Main sources of dust are house cleaning dust, power houses, mines and quarries, vehicles traffic, furnace ashes, natural wind, forest fires, pottery and ceramic factory stacks, combustion operations and several other activities of man raise dust in the atmosphere.

Effects:- Atmospheric dust causes allergic and respiratory diseases in man, "silicosis" if dust contains silica. Moreover, dust causes corrosion and soiling.

* Smoke:- It is composed of tiny particles of carbon, ash, oil etc. Smoke is formed by incomplete combustion of fuel. The major sources of smoke formation are rail roads, locomotives, diesel engines, automobile petrol engines, etc.

Effects:- Loss of calorific value through ~~in~~ incomplete combustion. The possibility of

cancer due to smoke spoiling of clothing, bags, etc.

* **Smog**:- It is the combination of smoke and fog

Effect:- Smog has some effects similar to smoke, but somewhat prolonged one.

* **Asbestos dust**:- Its main sources are mining, processing and manufacture of asbestos gaskets and ropes used in automobiles, buildings, flooring and insulating materials.

Effect:- In addition to the effects of dust, it causes 'asbestosis' disease.

* **Lead dust**:- The main sources are lead mining and smelting works, lead batteries, lead paints and manufacture of lead-base alloys, automobiles exhausts.

Effects:- It causes lead poisoning as lead-dust settles down on plants and food-stuffs meant for human and animal consumption.

(ii) **Deforestation**:- Green leaves of plant absorb CO_2 for the manufacture of their food by photosynthesis and give out CO_2 in the process, thereby purifying the atmospheric air. Plant also control H_2S ,

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HNO_3 and Cl_2 . Thus, plants help in controlling the air pollution. Excessive deforestation causes indirectly air pollution.

(v) **Radioactive gases**:- The radioactive elements, which occur in rocks and soils are derivatives of uranium, thorium and actinium series. They evolve radioactive gases, which mainly consist of radon and thoron. These gases are harmful to human health.

* **Control of Air pollution**:-

- i) Implementation and enforcement of air quality standards.
- ii) Setting emission limits for industries and vehicles.
- iii) Promoting renewable energy sources like solar, wind and hydro.
- iiii) Reducing reliance on fossil fuels such as coal and petroleum.
- v) Using electrostatic precipitators to trap particulate matter.
- vi) Encouraging public transport, carpooling, and cycling.
- vii) Planting trees to absorb pollutants and increase oxygen levels.
- viii) Proper disposal of industrial and household waste to prevent open burning.

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- viii) Educating people on the effects of air pollution and ways to reduce it.
- ix) Government policies promoting eco-friendly practices and pollution taxes.
- x) Using cleaner cooking fuels like LPG, biogas, and electricity.

* Air pollution due to Internal Combustion Engine & its control methods:-

One of the major man-made air pollutant is the internal combustion engine used for running motor cars, buses, planes, trucks, scooters, auto-rickshaws etc. When fuels like kerosene, diesel, petrol is burnt, it releases lot of smoke into the atmosphere. These fuels are the mixtures of various hydrocarbons!

Control methods of I.C. engine are:-

- a) By using engine with better design.
- b) By using suitable catalyst.
- c) By supplying more air for combustion.
- d) By improving the quality of gasoline.

* Deforestation, their effects & control measures.

Deforestation is the large-scale clearing of forests, often for agriculture, urbanization, or industrial purposes. It leads to severe environmental and ecological consequences.

Effects of deforestation:-

- * Loss of biodiversity
- * climate change
- * Soil erosion and desertification
- * disruption of the water cycle
- * Increased natural disasters
- * Impact on indigenous communities
- * Air quality decline.

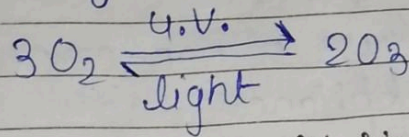
Control measures for deforestation:-

- i) Planting trees to replace lost forests.
- ii) Using selective logging and agroforestry to reduce tree loss.
- iii) Implementing policies to protect forests and limit deforestation.
- iv) Teaching people the importance of forests and their conservation.
- v) Reducing dependence on wood by using bamboo, recycled materials, and other alternatives.
- vi) Establishing protected areas and national parks.
- vii) Promoting agroforestry and sustainable agriculture to reduce land clearance.

* Causes, effects & control measures of Ozone depletion

Ozone is produced in the upper layer of the atmosphere, about 20km above the earth's surface, from oxygen gas by the

absorption of ultraviolet light.



Causes of Ozone Depletion

The depletion of the ozone layer is primarily caused by human-made chemicals known as ozone-depleting substances.

- Chlorofluorocarbons (CFCs) :- found in refrigerators, air conditioners, aerosol sprays and solvents.
- Halons :- Used in fire extinguishers.
- Carbon tetrachloride & methyl chloroform :- Industrial cleaning solvents.
- Nitrous Oxide (N₂O) :- Released from agricultural fertilizers and burning fossil fuels.

Effects of Ozone depletion :-

- i) Increased UV radiation
- ii) Health impacts like skin cancer, cataracts and weakening of immune system.
- iii) Environmental damage.
- iv) Climate change impact.

Control measures :-

- i) Reducing ODS production.
- ii) Enforcing strict industrial regulations on ODS use.
- iii) Promoting international agreements to reduce ozone-depleting emissions.

- iv) Using ozone-friendly refrigerants and fire suppression systems.
- v) Promoting the use of non-aerosol sprays and eco-friendly appliances.
- vi) Encouraging tree planting to absorb harmful gases.

* Greenhouse effects:- The greenhouse effect is the process by which certain gases in Earth's atmosphere trap heat, preventing it from escaping into space and keeping the planet warm. It is essential for maintaining a habitable temperature on Earth, but human activities have intensified this effect, leading to global warming and climate change.

Causes of greenhouse effect

- i) Release large amounts of CO_2 and other gases.
- ii) Changes in the sun's energy output can affect earth's temperature.
- iii) Cutting down trees reduces CO_2 absorption, increasing atmospheric levels.
- iv) Factories emit gases like CO_2 , methane, and nitrous oxide (N_2O).
- v) Increased vehicle use releases CO_2 and other pollutants.

Effects of the greenhouse effect

- i) Global temperatures have increased due to trapped heat.
- ii) Leads to rising sea levels, causing coastal flooding.
- iii) Increased CO_2 absorption in oceans harms marine life.
- iv) Changes in temperature affect animal migration and plant growth.
- v) Damage to infrastructure, agriculture and coastal cities.
- vi) Changes in climate reduce crop yields and water availability.
- vii) Air pollution and heat waves increase respiratory and cardiovascular diseases.

Control Measures to reduce the greenhouse effect.

- i) Industries must limit emissions.
- ii) Planting more trees to absorb CO_2 .
- iii) Using energy-efficient appliances and buildings.
- iv) Minimizing waste helps cut emissions.
- v) Walking, cycling or using public transport.
- vi) Using less plastic, conserving water, and supporting green products.

20. WATER POLLUTION:-

* Water pollution is the contamination of water bodies by harmful substances. These pollutants can come from various sources, including industrial waste, chemicals, sewage, agricultural runoff and plastic debris.

* Causes of water pollution:-

- i) Factories release toxic chemicals and heavy metals into water sources.
- ii) Untreated or poorly treated sewage contaminates water with harmful bacteria and chemicals.
- iii) Pesticides, fertilizers, and animal waste wash into rivers and lakes.
- iv) Non-biodegradable plastics accumulate in water bodies, harming aquatic life.
- v) Mining operations release harmful minerals and chemicals into water supplies.

* Ways to prevent water pollution:-

- i) Treat sewage before releasing it into water bodies.
- ii) Reduce plastic waste and properly dispose of trash.
- iii) Use eco-friendly fertilizers and pesticides.
- iv) Implement stricter industrial waste management.
- v) Participate in water conservation and clean-up efforts.

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* Type of waste

- 1) Domestic waste
- 2) Industrial waste.

1) Domestic waste:- Domestic waste, also known as municipal solid waste, comes from households and residential areas. It includes organic and inorganic waste generated from daily activities.

Physical characteristics of domestic waste:-

- Solid waste:- food scraps, paper, plastic, glass, metal and textiles.
- Liquid waste:- wastewater from kitchens, bathrooms, and laundry.

Biological characteristics of Domestic waste:-

- Biodegradable waste:- food scraps, garden waste, and paper can decompose naturally.
- Non-biodegradable waste:- plastics, metals, and glass do not decompose easily.
- Pathogenic microorganisms:- Household waste, especially sewage, can contain bacteria, viruses, and parasites that cause diseases.

2. Industrial waste:- Industrial waste is generated by factories, manufacturing plants, and production facilities. It includes hazardous and non-hazardous materials.

Physical characteristics of Industrial waste:-

- Solid waste:- ~~may~~ metals scraps, plastics, chemical, packaging materials.
- Liquid waste:- chemical residues, wastewater from production processes.
- Gaseous waste:- Smoke, fumes and emission from factories.

Biological characteristics of Industrial waste:-

- Toxic chemicals:- may contain heavy metals, acids, and synthetic chemicals.
- Non-biodegradable materials:- Plastics, synthetic fibres, and metals that persist in the environment.
- Organic industrial waste:- Some industries produce biodegradable organic waste that can decompose.

* Concept & significance of BOD, COD, biochemical waste & E-waste waste, their origin, Effects & Control Measure.

1) BOD (Bio-Chemical Oxygen Demand) :- BOD of a sewage is defined as "the amount of free oxygen required in water for bacteria which consume organic matter under aerobic conditions at 20°C and for a

period of 5 days".

Concept & Significance

- BOD measures the amount of oxygen required by microorganisms to break down organic matter in water.
- It is an indicator of water pollution and wastewater quality.

Origin :-

- Organic waste from sewage, agricultural runoff, industrial effluents and decaying plants/animals.

Effects :-

- High BOD reduces oxygen in water, leading to the death of aquatic life (hypoxia).
- Causes foul odor and deteriorates water quality.

Control Measures :-

- Treat wastewater before discharge
- Reduce industrial and agricultural waste discharge
- Promote eco-friendly practices to reduce organic pollution.

* **COD (Chemical Oxygen Demand)** :- It is an amount of oxygen required for the chemical oxidation of organic matter in sewage. In other words, it is a measure of oxidisable impurities present in the sewage.

Concept & Significance :-

- COD measures the amount of oxygen needed to chemically oxidize both organic and inorganic matter in water.
- It is a broader indicator of water pollution than BOD.

Origin

- Industrial waste, domestic sewage, agricultural runoff, chemical spills.

Effects :-

- High COD levels indicate toxic pollution, affecting aquatic ecosystem.
- Reduce oxygen availability in water bodies.

Control Measures :-

- Advanced wastewater treatment.
- Reduce industrial chemical discharge.
- Promote green chemistry and sustainable industrial practices.

* Biomedical Waste (BMW)

Biomedical waste is hazardous and infectious waste from hospitals and pathological laboratories. It contains discarded human blood, blood products, plasma, serum and body fluids. Body fluids are the fluids which are generated or removed during surgery, autopsy, emergency care or embalming and includes cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, etc. These may include items such as sponges, surgical gloves and masks, aprons, etc.

Concept & Significance :-

- Biomedical waste includes infectious, pathological, and hazardous medical waste from healthcare facilities.
- Improper disposal poses serious health and environmental risks.

Origin :- Hospitals, clinics, labs, research centers, and pharmaceutical industries.

Effects :-

- Spreads infections (HIV, hepatitis, etc.) if handled improperly.
- Toxic chemicals and radioactive elements can pollute soil and water.

Control measures:-

- Segregation of waste at the source into color-coded bins.
- Safe disposal through incineration, autoclaving, and deep burial.
- Strict adherence to Biomedical Waste Management Rules, 2016.

* **Electronic Waste (E-Waste)** :- E-Waste is a waste part of computer, electronic devices, mobile phones, electrical appliances and other ~~other~~ items that have been discarded by their original users. There is no generally accepted definition of electronic waste.

Concept & Significance

- E-waste consists of discarded electronic devices containing hazardous and valuable materials.
- Rapid technological advancements have increased e-waste generation.

Origin :- Discarded computers, mobile phones, televisions, batteries, circuit boards, and electrical appliances.

Effects:-

- Toxic substances like lead, mercury, and cadmium cause soil and water pollution.
- Health risks include neurological damage, respiratory problems and cancer.

Control measures:-

- Recycling and recovery of precious metals.
- Extended producer Responsibility (EPR) for manufactures.
- Public awareness and e-waste collection drives.

* Preventive Environmental Management (PEM) activities:-

1. Regulating the exploitation of natural resources.
2. Monitor the quality of public water supplies.
3. Controlling over population
4. Monitor emissions from industrial sources.
5. Ensure safe transport of hazardous waste.
6. Balancing ecosystem.
7. Introducing education and training at schools, colleges and universities.
8. Inspect waste management and treatment facilities and give positive suggestions.
9. Advice industries on way to minimize soil and hazardous waste.
10. Underground the all drainage systems and storage sewage tanks.