Environmental pollution

Pollution – derived from Latin word "pollutinionem" (make dirty)

Definition: Pollution is an undesirable change in the physical, chemical or biological characteristics of water, air and land (Soil) which may cause potential health hazards of any living being or species or loss of cultural and natural assets.

Factors causing pollution:

- Rapid industrialization
- Development in science and technology
- Increase in human population
- Deforestation
- Unplanned urbanization
- Over exploitation of natural resources, etc

Pollution is mostly man made called anthropogenic, but it can also be natural.

Natural pollution is caused by:

- Volcanic eruptions
- Emission of natural gases
- Soil erosion
- Ultraviolet rays
- Cosmic rays, etc

Pollutants: Pollutants are the materials or factors, which cause adverse effect on the natural quality of any component of the environment. Pollutants are the waste products or by-products of the materials we make use or throw away. Example – Smoke from industries and automobiles, Chemical from factories, radioactive substances from nuclear plants, sewage of houses, etc.

Types of Environmental pollution:

1. Water
2. Air
3. Land/soil

WATER POLLUTION – Change in physical, chemical and biological characteristics of water which may cause harmful effects on human, animal and aquatic biota.
Water pollution happens in

- Surface water of rivers, oceans, lakes, ponds, etc. through industries.
- Groundwater through percolation of septic tanks, seepage tanks, spillage of chemicals, refuse dumps etc.
- Marine water through transporting crude oil and other goods.

Sources (Causes) of Water pollution:

- Non-point or natural sources – Decomposed vegetables and animals (Organic wastes), Agricultural runoff (Detergents/Fertilizers/Pesticides/Fungicides), Weathering products (Sediments), etc.
- Point or artificial sources – Sewage (Domestic waste), Industries (Industrial waste), Radioactive (Radioactive waste), Mining (Tailings, Mineral oils), etc.

Effects of Water pollution:

- It causes psychological disorder
- It kills aquatic animals
- Pollutes drinking water
- It causes biological imbalance

Control of Water pollution:
Different methods adopted are

1. Physical units
2. Chemical units
3. Biological units

Physico-Chemical	Biological	Advanced
Physical	**Aerobic**	Electrolysis
Screening	Aerated lagoon	Reverse – osmosis
Grit chamber	Extended aeration	Ion exchange
Floatation	Oxidation pond	Adsorption etc
Oil & grease trap	Activated sludge process	
Plane sedimentation etc	Stabilisation pond	
	Trickling filter etc	
Chemical	**Anaerobic**	
Coagulation-sedimentation	Anaerobic digestion	
Clarifier	Anaerobic lagoon	
	Anaerobic filter etc	

Other classifications based on treatment are:

1. **Primary treatment stage:** Removal of floating and suspended solids, oils, grease and grit.
2. **Secondary treatment stage:** Using chemicals (coagulants) - chemical used are Alum, Lime, Ferous sulphate etc. Biological processes – Use of micro-organisms which decompose organic material and after several hours, bacteria are settled as Sludge in secondary settling tank.
3. **Tertiary treatment stage:** Complex chemical and biological process that removes metals, organic compounds, minerals, viruses etc. The sewage used as fertilizer since the bacteria contains nitrates and phosphates etc.

AIR POLLUTION – Substances introduced into the air by the activity of mankind in such concentration, sufficient to cause serious effect to his health, plants and property.

Types of Air pollutants

1. Gaseous pollutants – These pollutants are in gaseous state at normal temperature
2. Particulate pollutants – These pollutants occur as solid and liquid particles. They are of two types – setteable and suspended.
    a. Seetable – The particles larger than 10 μm in diameter such as water drops, sand etc, which settle down rapidly in still air are called setteable pollutants.
    b. Suspended – The smaller particles such as dust, smoke etc. which remain suspended for long period in the air are called suspended pollutants. Ex: Asbestos fibres, pesticides, metals etc.

Sources (Causes) of Air pollution:

- Particulate matter – Smoke emitted emitted from industries
- Carbon-mon-oxide – Non-irritating gas by stoves, furnaces, forest fires, factories, power plants.
- Carbon-di-oxide – Burning of fossil fuel of coal and oil for domestic cooking, transportation, industries, heating.
- Sulphur compounds – Thermal power plants, Automobile, smelting
- Sulphur-di-oxide – Burning of fossil fuel
- Nitrogen oxides (NO_X) – Major are Nitric Oxide (NO) and Nitrogen-di-oxide (NO_2) produced by combustion of coal, natural gas, oil and petrol
- Ozone – O_3 formed in the atmosphere through chemical reaction involving NO_2, SO_2 etc on absorption of UV radiations
- Photo-chemical SMOG – It is a mixture of pollutants such as Nitrogen oxides, ozone etc.
  NO_x, O2 + Hydrocarbons ---------- photochemical reaction⟶ SMOG
  SMOKE + FOG ⟶SMOG
- Chlorofluorocarbons (CFC) – Compounds containing Cl_2, Fl, Carbon from solvents, refrigerators, aerosol propellers etc

Effects of Air pollution:

- Reduction of visibility, climate change, changes in chemical characteristic of precipitation
- Dust, soot fume, mists etc dangerous to human health
- Cause cardio-vascular illness
- Asbestos fibers cause asbestosis
- Breathing difficulty, headache, irritation to eyes, skin, lung inflammation, etc
- Plants growth suppresses, visible injury to leaf
- Reduces crop yields and damages tomato, beans and other plants
- NO_X reacts with moisture to form HNO_3 and this falls on the ground as Acid Rain
- Leads to ozone depletion in the atmosphere

Control of Air pollution:

- Selection of suitable fuel (low sulphur content)
- Use of efficient engines
- Catalytic converter filters in the vehicles can convert NO to nitrogen and reduce the potential hazards of NO_x
- Use of automobile engines operated with compressed natural gas (CNG)
- Modifications in industrial processes / equipment to reduce emission

- Selection of suitable manufacturing site from far distance of residential areas, installation of tall chimneys
- Destroying the pollutants by thermal or catalytic combustion
- Changing the pollutants to a less toxic form
- Collecting the pollutant by using equipment to prevent its escape into the atmosphere
- Arresters – Used to separate particulate matters from contaminated air
- Scrubbers – Used to clean air for both dusts and gases by passing it through a dry or wet packing material
- Gaseous pollutants can be controlled through the techniques of combustion, absorption and adsorption

LAND/SOIL POLLUTION – The addition of substances to the soil, which adversely affect physical, chemical and biological properties of soil and reduces its productivity.

Sources (Causes) of Soil pollution:

- Industrial wastes – Both solid and liquid wastes of industries such as mercury, lead, copper, zinc, cynides, acids are dumped over the soil
- Pesticides and insecticides – They are sprayed on plants to kill insects and damage number of species including micro-organisms which are present in soils, thus effect the fertility of soil by contaminates
- Fertilizers – Excessive use of chemical fertilizers decreases population of useful bacteria and changes the fertility of soil
- Manures – The excretory products of people and livestock used as manure pollute the soil
- Discarded materials – Refused materials such as concrete, asphalt, rugs, leather, cans, plastics, glass etc are dumped on the soil by man
- Radioactive wastes – Radioactive elements from mining and nuclear power plants, find their ways into water and then into the soil
- Other pollutants – Many air pollutants (acid rain) and water pollutants ultimately become part of the soil

Effects of Soil pollution:

- The toxicants are transferred to organisms present in soil and enter the food chain, which leads to undesirable effects
- Pesticides and fertilizers affect the beneficial micro-organisms, worms and bacteria in the soil
- It decreases agriculture production
- Loose/infertility soil leads to soil erosion
- Floods occur due to accumulation of loose soil in the rivers
- Dams/reservoir fails due to silting which reduces storage capacities

Control of Soil pollution:

- Discharge sites are constructed for transfer of refuse wastes rather than spreading on lands
- Pneumatic pipes used for collecting and disposing wastes
- Special pit or low lying areas be selected for dumping industrial wastes
- Materials such as paper, glass and kinds of plastic can be recycled
- Animal refuse and agricultural wastes can be utilized for production of biogas
- Use of biofertilizers to reduce chemical fertilizers
- Biological pest control methods can reduce the use of pesticides

SOLID WASTE MANAGEMENT – Any substance that is discarded is designated as waste.

- Urban wastes – comprise a complex mixture of materials discarded by urban society which include garbage, kitchen wastes, concrete, asphalt, rugs, leather, can, plastic, glass, hospital wastes etc.
- Industrial wastes – includes slag, fly ash, mica wastes, metal scraps, used batteries, acids, petrochemicals, dyes etc.

Classification of Wastes

1. Biodegradable wastes – Degraded by micro-organisms which includes vegetable peelings, food, tea leaves, egg shells, crop and farm residue etc.
2. Non-biodegradable wastes – Cannot degraded by micro-organisms which includes polythene bags, scrap metal, glass bottles, plastic, aluminum cans, ceramics etc.
3. Toxic wastes – Poisonous wastes such as pesticides, acids, radioactive substances etc.
4. Biomedical wastes – Hospitals and clinics wastes such as cotton, syringe, glass, plastic bottles, anatomical and pathological wastes etc.

Impact of Waste accumulation:

- Spoilage of Landscape
- Pollution
- Health hazards
- Effect on soil
- Effect on terrestrial and aquatic life

Solid Waste Management:

1. Collection of solid wastes –
    - Door to door collection
    - Community storage system
    - Kerb side collection
    - Block collection
2. Transportation of solid waste – Several collection vehicles transport waste to a large vehicle, which than carries it to the disposal site
3. Disposal of solid waste – Sanitary landfill is adopted in developed countries by spreading the solid waste to the smallest practical cell, compacting and applying cover material daily a the end of each day
4. Waste utilization – Used as manure, casseroles and silos, bricks, tables, chairs, cardboards, glass, new products etc

Treatment methods of Municipal Solid Waste:

1. Composting – Degradation of organic wastes by micro-organisms produce manure and methane through anaerobic digestion process
2. Vermicomposting – Technique used from earthworm farming to convert wastes into compost
3. Recycling – Waste is converted into another useful product
4. Landfilling – Disposal of urban waste in sanitary landfill which is away from human habitation and aesthetic reasons
5. Incineration – Process of controlled burning of waste at high temperature and it is an alternative to landfilling and provide an efficient energy. It reduces the volume of waste significantly much less than landfilling but releases toxic chemicals in the atmosphere

Multiple choice questions:

1. The atmosphere of big cities is polluted most by
a. Household waste
b. Radioactive fall out
c. Automobile exhausts
d. Pesticides

2. Acid rain is caused by increase in the atmospheric concentration of
a. Ozone and dust
b. SO_2 and NO_2
c. SO_3 and CO
d. CO_2 and CO

3. Gas leaked in Bhopal tragedy was
a. Potassium isothiocynate
b. Sodium isothiocynate
c. Ethyl isocynnate
d. Methyl isocyannate

4. Ozone layer of upper atmosphere is being destroyed by
a. Sulphur dioxide
b. Photochemical oxidants
c. Chlorofluorocarbon
d. Smog

5. Ozone depletion in the stratosphere will cause
a. Skin cancer
b. Forest fires
c. Global warming
d. None of these

6. The ultraviolet radiations in the stratosphere are absorbed by
a. Ozone
b. Oxygen
c. Sulphur dioxide
d. Argon

7. Biochemical oxygen demand measures
a. Industrial pollution
b. Air pollution
c. Polluting capacity of effluents
d. Dissolved O_2 needed by microbes to decompose organic waste

8. Taj Mahal at Agra may be damaged by
a. Sulphur dioxide
b. Chlorine
c. Hydrogen
d. Oxygen

9. Increasing skin cancer and high mutation rate are the result of
a. Ozone depletion
b. Acid rain
c. CO_2 pollution
d. CO pollution

10. Fluoride pollution mainly affects
a. Kidney
b. Brain
c. Heart
d. Teeth

11. Which of the following are biodegradable pollutants
a. Plastics
b. Detergent
c. Domestic sewage
d. All of the above

12. SMOG is
a. A natural phenomenon
b. Combination of smoke and fog
c. Colorless
d. All of the above

13. Out of the following nutrients in fertilizer, which one causes minimum water pollution?
a. Nitrogen
b. Phosphorus
c. Potassium
d. Organic matter

14. When the solid waste consists of large amount of organic matter and if the moisture content is high, which of the methods of treatment will be ideal?
a. Incineration
b. Palletizing
c. Recycle
d. Composting

15. Which of the following is as secondary air pollutant?
a. Carbon monoxide
b. Sulphur dioxide
c. Ozone
d. Carbon dioxide

16. Which of the following is a non point source of water pollution?
a. Factories
b. Sewage treatment plants
c. Urban and suburban lands
d. All of the above

17. Which of the following strategies should be given first preference as far as the management of plastic waste is concerned?
a. Recycle
b. Reuse
c. Reduce the usage
d. None of the above

18. Thermal power plants pollute the water by adding
a. Heavy metals
b. Heat
c. Dissolved solids
d. All of these

19. Recycled waste water can be used for
a. Crop irrigation
b. Landscape gardening
c. Replenishing fast depleting aquifers
d. All of these

20. The urban solid waste is known as
a. Municipal Solid waste
b. Environmental Impact Assessment
c. Sanitary fill
d. Biogas

21. Air pollution from automobiles can be controlled by fitting
a. Electrostatic precipitator
b. Wet scrubber
c. Catalytic converter
d. All of the above

22. Main components of smog are
a. Unsaturated hydrocarbons
b. NO_X
c. Sulphur compound
d. All of the above

23. The green house gas is
a. N_2O
b. CH_4
c. CO_2
d. All of these

24. Environmental pollution is due to
a. Rapid Urbanization
b. Deforestation
c. Afforestation
d. a & b

25. Which of the following is air pollutant
a. CO
b. O_2
c. N_2
d. All

26. Which of the following industry generates colored waste
a. Software industry
b. Textile industry
c. Biomedical industry
d. None

27. Physical pollution of water is due to
a. Dissolved oxygen
b. Turbidity
c. pH
d. None of these

28. Introducing harmful micro-organisms in water is called
a. Land pollution
b. Air contamination
c. Soil contamination
d. Water pollution

29. Burning the waste @ very high temperature is called
a. Incineration
b. Palletizing
c. Recycle
d. Composting

30. The land area where the large amounts of waste generated is dumped is called
a. Incineration
b. Land fill
c. Recycle
d. Composting

31. The organic portion of municipal solid waste is allowed to decompose under carefully controlled condition is called
a. Incineration
b. Palletizing
c. Recycle
d. Composting

32. Disposal of solid waste in thin layer alternatively with soil over the earth is known as
a. Incineration
b. Land fill
c. Recycle
d. Composting

33. Wastewater coming out from residential area or commercial area is called
a. Sewage
b. Colored water
c. Industrial wastewater
d. None of the above

34. The wastewater generated by industrial sector is called as
a. Sewage
b. Colored water
c. Industrial wastewater
d. None of the above

35. The process of conversion of organic waste into manure is called
a. Incineration
b. Land fill
c. Recycle
d. Composting

Answer the following questions:

1. Define environmental pollution. List the different kinds of pollution. Give brief account of effects of these pollution.
2. Define air pollution and list air pollutants and their effects on human beings.
3. Suggest measures to control air pollution.
4. Explain the causes, effects and control measure of air pollution.
5. Explain how air is getting polluted? Briefly explain the methods of control of air pollution.
6. Enumerate the causes, effects and control measures of water pollution.
7. What are the harmful effects of water pollution?
8. Define water pollution. Mention the sources of water pollution and its control methods.
9. Explain the control measures of water pollution.
10. Explain the effects and control of soil pollution.
11. Define the land pollution. List down the major causes and effects of land pollution.
12. Explain the sources and types of solid wastes.
13. Write short note on: Management of Municipal Solid waste and methods of their disposal.
14. What is municipal solid waste management? Explain the steps involved in municipal solid waste management.
15. Discuss briefly the solid waste management.