



Chapter - 14

Environmental Chemistry

- **Environmental chemistry** deals with the study of the origin, transport, reactions, effects, fates of chemical species in the environment.
- **Environmental pollution** is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings.
- **Main regions of atmosphere** are (i) troposphere (ii) Stratosphere (iii) mesosphere and (iv) ionosphere.
- **Pollutants** can be (i) gaseous air pollutants (*e.g.*, SO_2 , NO_2 , CO_2 , H_2S , O_3 hydrocarbons etc. and (ii) particular pollutants (*e.g.*, dust, mist, fumes, smoke, smog etc.)
- **Gaseous air pollutants** : SO_2 can cause acute irritation to the membranes of the eyes resulting in tears and redness. It is also responsible for acid rain. NO_2 is extremely toxic to living tissues, textiles and in the production of photochemical smog.
- **Particulate pollutants** : They are of two types :
 - (i) **Visible particulate or viable particulates** : These are the minute living organisms that are dispersed in atmosphere. Ex. Bacteria, fungi, moulds etc.
 - (ii) **Non-viable particulates** : These are formed either by the breakdown of larger materials or by the condensation of minute particles and droplets. For example mists, smoke, fumes and dust.
- **Green House Effect** is the phenomenon of warming of earth by absorption and re-emission of solar radiations.
- **Green house gases** are CO_2 , CH_4 , O_3 water vapours, chlorofluoro carbons etc.
- **Acid rain** : When the pH of the rain water drops below 5.6, it is called acid rain. It damages monuments and structures made of firm marble, corrode articles made from metals, destroy plants and trees and it is also harmful to the aquatic life in lakes and rivers.
- **Ozone hole** is formed over South Pole due to depletion of ozone layer. CFCs and NO are responsible for ozone layer depletion.

- **Effects of depletion of ozone layer :** With the depletion of ozone layer, more UV radiation filters into troposphere. UV radiations lead to ageing of skin, cataract, sunburn, skin cancer, killing of many phytoplanktons, damage to fish productivity etc.
- **Smog** is derived from smoke and fog.
- **Classical smog** occurs in cool humid climate. It is a mixture of smoke, fog and sulphur dioxide. It is also called reducing smog.
- **Photochemical smog** occurs in warm and dry sunny climate. It has high concentration of oxidizing agents and therefore, it is also called as oxidizing smog.
- There are three main components of photochemical smog : nitrogen oxides, ozone and organic derivatives such as acrolein, formaldehyde, peroxyacetyl nitrate (PAN). PAN has the highest toxicity to plants attacking younger leaves and causing 'bronzing' and 'glazing' of their surface.
- **Water Pollution :** It is mainly caused by industrial waste which include heavy metals like Cd, Pb and Hg.
- **Eutrophication :** The process is which nutrient enriched water bodies support a dense plant population, which kills animal life by depriving it of oxygen and result in subsequent loss of biodiversity is known as Eutrophication.
- **BOD :** The amount of oxygen required by bacteria to break down the organic matter present in a certain volume of a sample of water, is called Biochemical Oxygen Demand (BOD).
- **Land Pollution :** It is caused by pesticides. Most pesticides can be divided into three categories—Insecticides, Herbicides and fungicides.
- The environmental pollution can be controlled :
 - (a) By recycling of household and industrial wastes.
 - (b) By sewage treatment.
 - (c) Incineration converts organic material to CO_2 and H_2O .
- **Green Chemistry** is a way of thinking and is about utilizing the existing knowledge and principles of chemistry and other science to reduce the adverse impact on environment.
- Green Chemistry in Day to Day life :
 - (1) Dry cleaning of clothes by using liquified CO_2 along with detergent instead of tetrachloroethene.
 - (2) Bleaching of paper and clothes by using H_2O_2 a better bleaching agent as compared to Cl_2 .

Environmental chemistry

1-Mark Questions

1. Define environmental pollution.
2. Name three toxic metals that can pollute the environment.
3. Name the four non-viable particulates present in atmosphere.
4. Give one advantage and one disadvantage of ozone in atmosphere.
5. What is the name of the compound formed when CO combines with blood?
6. Which gas caused Bhopal Gas Tragedy? Give its formula.
7. What is the meaning of the term eutrophication with regard to water pollution?
8. Every year some people die by being in a room containing a faulty heater that uses coal, gas or oil. How might the death occur?
9. Mention two ways to reduce air pollution caused by automobiles.
10. How fluoride in tooth paste protects teeth against decay?
[Hint : By converting hydroxyapatite (enamel on the surface of the teeth) into much harder fluorapatite]
11. What do you mean by Biochemical oxygen demand (BOD)?
12. Greenhouse effect leads to global warming. Which substances are responsible for greenhouse effect? What does CFC stand for?
13. What does CFC stand for?
14. Which out of CO_2 and CO is more toxic and why?
15. Name the various components into which atmosphere can be divided.

2-Mark Questions

1. Write the adverse effect of excessive use of (i) fertilizers, and (ii) pesticides in the soil.
2. Write down the reactions involved during the formation of photochemical smog.
3. Why does rain water normally have a pH of about 5.6? When does it become acid rain? Why is acid rain considered as a threat to Taj Mahal?
4. What are biodegradable and non-biodegradable pollutants?
5. Explain giving reasons "The presence of CO reduces the amount of haemoglobin available in the blood for carrying oxygen to body cells."
6. What should be the tolerable limit of fluoride ions in drinking water? What happens if it is higher than 10 ppm?
7. Name four methods for waste management.
8. "Oxygen plays a key role in the troposphere while ozone in the stratosphere." Explain.

9. Write the effect of the following gases on human being : SO_2 , NO_2 , CO , CO_2 .
10. What are viable and non-viable particulates ?
11. How does SO_2 cause pollution ? Give steps to control it.
12. A person started using underground water after facing acute shortage in municipality water supply. He felt taxative effect. What could be the cause ?

3-Mark Questions

1. What do you understand by Ozone hole ? What are its consequences ?
2. What do you mean by green chemistry ? How will it help decrease environmental pollution ?
3. How can domestic waste be used as manure ?
4. What is the composition of photochemical smog and classical smog ? How do the two differ in their behaviour ?
5. A large no. of fish are suddenly found floating dead on a lake. There is no evidence of toxic dumping but you find an abundance of phytoplankton. Suggest a reason for the fish kill.
6. Do as directed :
 - (i) Name two important sinks of CO_2 .
 - (ii) What is marine pollution ?
 - (iii) What is humification ?

[Hint : Production of humus by micro-organism in soil]
7. In view of green chemistry name the following :
 - (i) A chemical which can be used in place of CFC as blowing agent.
 - (ii) A chemical which can replace chlorine containing bleaching in paper industry.
8. Write the causes of depletion of ozone in the stratosphere. Write reactions also.
9. What are the harmful effects of small size particulate matters ?
10. How oxides of nitrogen are generated ? What are the harmful effects of oxides of nitrogen ?

5-Mark Questions

1. What do you understand by greenhouse effect ? What are the major greenhouse gases ? Why does green house effect leads to global warming ? What could be the consequences of global warming ?
2. Discuss the importance of dissolved oxygen in water. What processes are generally responsible for the deoxygenation of the water ?

3. How is photochemical smog formed ? What are harmful effects of photochemical smog ? Give some control measures to reduce photochemical smog ?
4. What is soil pollution ? Mention four ways of controlling soil pollution.
5. Explain the following terms :
 - (a) Green house effect
 - (b) Green chemistry
 - (c) Ozone layer depletion
 - (d) Global warming
 - (e) Eutrophication
6. (a) Discuss the effects if green house gases were totally missing in earth's atmosphere.
(b) Chlorine radicals play an important role in ozone layer depletion. Write chemical reactions in support of the statement.