

## Chapter 14 Environmental Chemistry

### Environmental Chemistry

- Environmental chemistry deals with the study of the origin, transport, reactions, effects, fates of chemical species in the environment.

#### **ENVIRONMENTAL POLLUTION**

Environmental pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings. A substance which causes pollution is called a pollutant. It can be solid, liquid or in the gaseous state.

#### **ATMOSPHERIC POLLUTION**

The atmosphere that surrounds the earth is not of the same thickness at different heights. Atmospheric pollution is generally studied as tropospheric and stratospheric pollution. The ozone layer prevents about 99.5% of the sun's UV rays.

#### **TROPOSPHERIC POLLUTION**

Tropospheric pollution occurs due to the presence of undesirable solid or gaseous particles in the air. The following are the major gaseous and particulate pollutants present in the troposphere;

- Gaseous air pollutants: These are oxides of sulphur, nitrogen and carbon, hydrogen sulphide, hydrocarbons, ozone and other oxidants.
- Particulate pollutants; these are dust, mist, fumes, smoke, smog etc

#### **GLOBAL WARMING AND GREENHOUSE EFFECT**

About 75% of the solar energy reaching the earth is absorbed by the earth's surface, which increases its temperature. The rest of the heat radiates back to the atmosphere. Some of the heat is trapped by the gases such as carbon dioxide, methane, ozone, CFCs and Water vapour. They add to the heating of the atmosphere causing Global warming. In a greenhouse, visible light passes through the transparent glass and heats up the soil and the plants. The warm soil and plants emit infrared rays, it partly reflects and partly absorbs these radiations, this mechanism keeps the energy of the sun trapped in the greenhouse.

#### **ACID RAIN**

When the pH of the rain water drops below 5.6, it is called acid rain. Acid rain is harmful for agriculture, trees and plants as it dissolves and washes away nutrients needed for their growth. It causes respiratory ailments in human beings and animals. When acid rain falls and flows as ground water to reach rivers, lakes etc. it affects plants and animal life in aquatic ecosystem

#### **SMOG**

The word smog is derived from smoke and fog. There are two types of smog: classical and

photochemical smog. Classical smog occurs in cool humid climate. It is a mixture of smoke, fog and sulphur dioxide. It is also called reducing smog. Whereas 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.

### **OZONE HOLE**

Depletion of ozone layer is known as ozone hole.

### **EFFECTS OF DEPLETION OF THE 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

### **WATER POLLUTION**

contamination of water by foreign substances which make it harmful for health of animals or plants or aquatic life and make it unfit for domestic, industrial and agriculture use.

### **SOURCES/ CAUSES OF WATER POLLUTION**

Sewage and domestic wastes Industrial effluents Agriculture effluents Siltation-mixing of soil or rock into water Thermal pollutants Radioactive discharge

### **EUTROPHICATION-**

The process in which nutrient-enriched water bodies support a dense plant population, which kills animal life by depriving it of oxygen and results 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)

### **SOIL POLLUTION**

Insecticides, pesticides and herbicides cause soil pollution.

### **GREEN CHEMISTRY**

Green chemistry is a way of thinking and is about utilizing the existing knowledge and principles of chemistry and other sciences to reduce the adverse impact on environment. Green chemistry is a production process that would bring out minimum pollution or deterioration to the environment. Utilization of existing knowledge base for reducing the chemical hazards along with the development of activities is the foundation of green chemistry.

SUMMARY

ENVIRONMENTAL CHEMISTRY

- Environmental chemistry deals with the study of the origin, transport, reactions, effects, fates of chemical species in the environment.
- ENVIRONMENTAL POLLUTION:-Environmental pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings. A substance which causes pollution is called a pollutant. They can be solid, liquid or in the gaseous state.
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### ONE MARK QUESTION

1. What is the name of the compound formed when CO combines with blood?  
Ans:-Carboxyhaemoglobin.
2. Which zone is known as ozonosphere?  
Ans:-Stratosphere.
3. Which main gas is responsible for damage in ozone layer?  
Ans:-NO and CFCs(freons).
4. What is the nature of classical smog?  
Ans:-Reducing
5. Name the acids which are responsible for acid rain?  
Ans:-H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub> and HCl.
6. List out the gasses which are considered as major source of air pollution?  
Ans:-Carbon monoxide(CO), sulphur dioxide(SO<sub>2</sub>) and oxides of nitrogen(NO<sub>2</sub>).
7. What is PAN stands for?  
Ans:-It is peroxyacetyl nitrate.
8. Give the examples of insecticides?  
Ans:-DDT, BHC.
9. Which gas is mainly responsible for Bhopal gas tragedy?  
Ans:-Methyl isocyanate.
10. What should be the tolerable limit of F<sup>-</sup> ions in drinking water?  
Ans:-1ppm or 1mg dm<sup>-3</sup>.

### TWO MARKS QUESTION

1. What is 'acid rain'? How is it harmful to the environment?  
Ans:-Acid rain is the rain water mixed with small amount of sulphuric acid, nitric acid along with hydrochloric acid which are formed from the oxides of sulphur and nitrogen present in air as pollutants. It has a pH of 4-5.  
Harmful effects of acid rain:-  
It is toxic to vegetation and aquatic life.  
It damages buildings and statues

2. What do you mean by Green house effect? What is the role of CO<sub>2</sub> in the greenhouse effect.

Ans:-It is the phenomenon in which earth's atmosphere traps the heat from the sun and prevents it from escaping in outer space. Gases such as CO<sub>2</sub>, methane, ozone, CFCs are believed to be responsible for this effect.

Heat from the sun after being absorbed by the earth is absorbed by CO<sub>2</sub> and then radiated back to the earth. Thus making the environment of the earth warm.

3. Which gases are responsible for greenhouse effect? List some of them.

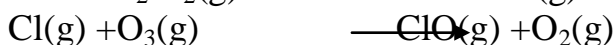
Ans:-CO<sub>2</sub> is mainly responsible for greenhouse effect. Other greenhouse gases are methane, nitrous oxide, water vapours.

4. What is smog? How is classical smog different from photochemical smog?

Ans:-The word smog is a combination of smoke and fog. It is a type of air pollution that occurs in many cities throughout the world. Classical smog occurs in cool humid climate. It is also called reducing smog.

Whereas 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.

5. What are the reactions involved for ozone layer depletion in the stratosphere?



6. What is the full form of BOD and COD?

Ans:-BOD stands for Biochemical Oxygen Demand whereas COD stands for Chemical Oxygen Demand.

7. What are viable and non-viable particulates?

Ans:-Viable particulates:-They are minute living organisms that are dispersed in the atmosphere including bacteria, fungi, moulds, algae etc.

Non-viable particulates:-They are formed by the breakdown of larger materials or by the condensation of minute particles and droplets.

8. What is B.H.C? Give its IUPAC name?

Ans:-B.H.C is BENZENE HEXACHLORIDE Its IUPAC name is 1,2,3,4,5,6-hexachlorocyclohexane.

9. What is meant by PCBs?

Ans:-PCBs are polychlorinated biphenyls. They are contaminants of water. They are used as fluids in transformers and capacitors.

10. What is the compound formed when CO combines with blood?

Ans:-When CO combines with blood, the following reaction occurs forming carboxyhaemoglobin:-



### THREE MARKS QUESTION

1. What do you understand by- (i) Mist (ii) Smoke (iii) Fumes

Ans(i) Mists:-Mists are produced by particles of spray liquids and the condensation of vapours in air.

(ii)Smoke:- They are very small soot particles produced by burning of organic matter.

(iii)Fumes:- These are condensed vapours;fumes of metals are well known particulates of this type.

2. Define the term pesticides? What are three categories of pesticides?

Ans:-Pesticides are substances which are used to kill or block the reproductive process of unwanted organisms.

The three main categories of pesticides are:-

(i)Insecticides:-These are used to control insects and curb diseasesand protect crops.

(ii)Herbicides:-These are used to kill weeds .Example- sodium chlorate ( $\text{NaClO}_3$ ), sodium arsenite( $\text{Na}_3\text{AsO}_3$ )

(iii)Fungicides:- These are used to check the growth of fungi. Example-methyl, mercury.

3. What do you mean by ozone hole? What are its consequences?

Ans:-Depletion of ozone hole creates some sort of holes in the blanket of ozone which surround us. This is known as ozone hole.

(i)With the depletion of the ozone layer UV radiation filters into the troposphere which leads to aging of skin,cataract,sunburn etc.

(ii)By killing many of the phytoplanktons it can damage the fish productivity.

4. What are harmful effects of photochemical smog and how can they becontrolled?

Ans:- (i)Photochemical smog causes eye irritation.

(ii)It damages plants (the leaves develop a metallic sheen)

(iii)Rubber on exposure to photochemical smog loses its elasticity and becomes inflexible and brittle.

Usually catalyticconverters are used in the automobiles, whichprevent the release of nitrogen oxide andhydrocarbons to the atmosphere. Certainplants e.g., Pinus, Juniparus, Quercus, Pyrusand Vitis can metabolise nitrogen oxide andtherefore, their plantation could help in thismatter.

5. Give three examples in which green chemistry has been applied.

Ans:-

(i) In dry cleaning ,use of liquefied  $\text{CO}_2$  in place of tetrachloroethene( $\text{Cl}_2\text{C}=\text{CCl}_2$ )

( ii)In bleaching of paper using  $\text{H}_2\text{O}_2$  in place of chlorine.

(iii)In the manufacture of chemicals like ethanal using environment-friendly chemicals and conditions.