

1. Define environmental chemistry.

**Ans.** Environmental chemistry is defined as that branch of science which deals with the chemical phenomenon occurring in the environment, i.e., study of origin, transport, reactions, effects and the fates of chemical species in the environment.

2. Explain tropospheric pollution in 100 words.

**Ans.** Tropospheric pollution occurs due to the presence of undesirable gases and the solid particles in the air.

The major gaseous and the particulate pollutants present in the stratosphere are as follows:

(i) Gaseous air pollutants. These include mainly oxides of sulphur ( $\text{SO}_2$ ,  $\text{SO}_3$ ), oxides of nitrogen ( $\text{NO}$ ,  $\text{NO}_2$ ) and oxides of carbon ( $\text{CO}$ ,  $\text{CO}_2$ ) in addition to hydrogen sulphide ( $\text{H}_2\text{S}$ ), hydrocarbons, ozone and other oxidants.

(ii) Particulate pollutants. These include dust, mist, fumes, smoke, smog, etc.

3. Carbon monoxide gas is more dangerous than carbon dioxide gas. Why?

**Ans.** CO binds to haemoglobin for which it has 300 times more affinity than oxygen and forms carboxyhaemoglobin. In blood, when the concentration of carboxyhaemoglobin reaches 3.4%, the oxygen carrying capacity of the blood is greatly reduced. In other words, the body becomes oxygen-starved. This results into headache, nervousness, cardiovascular disorder, weak eye-sight etc. On the other hand,  $\text{CO}_2$  does not combine with haemoglobin and hence is less harmful as pollutant.  $\text{CO}_2$  is the main contributor towards green-house effect and global warming.

4. Which gases are responsible for green-house effect? List some of them.

**Ans.**  $\text{CO}_2$  is the main gas responsible for green-house effect. Other green-house gases are methane, nitrous oxide, water vapors, chlorofluorocarbons (CFC's) and ozone.

5. Statues and monuments in India are affected by acid rain. How?

**Ans.** The air around the statues and monuments in India contains fairly high levels of the oxides of sulphur and nitrogen. This is mainly due to a large number of industries and power plants in the nearby areas. The problem has been further aggravated due to use of poor quality of coal, kerosene and firewood as fuel for domestic purposes. The resulting acid rain attacks the marble of these statues and monuments:  $\text{CaCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O} + \text{CO}_2$

As a result, these monuments are being slowly eaten away and marble is getting discolored and lustreless.

6. What is smog? How the classical and photochemical smog are different?

**Ans.** Smog is a combination of smoke and fog. Difference between Classical and photochemical smog is given below:

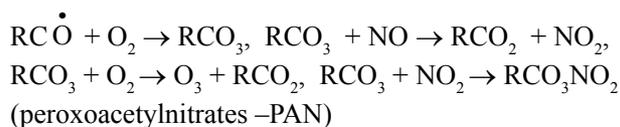
	<i>Classical Smog</i>	<i>Photochemical Smog</i>
1.	This was first time observed in London in 1952.	This was observed in Los Angeles in 1950.
2.	It is formed due to presence of SO <sub>2</sub> and humidity in the air which combines to form H <sub>2</sub> SO <sub>4</sub> fog which deposits on the particulates.	It is formed due to photochemical reaction taking when air contains NO <sub>2</sub> and hydrocarbons.
3.	It involves smoke and fog.	It does not involve any smoke or fog.
4.	It is formed in the months of winter particularly in the morning hours when the temperature is low.	It is formed in the months of summer during afternoon when there is a bright sunlight so that photochemical reactions can take place.
5.	It causes bronchitis, i.e., irritation in lungs.	It causes irritation in the eyes
6.	It is reducing in character.	It is oxidising in character.

7. Write down the reactions involved during the formation of photochemical smog.

**Ans.** In the presence of sunlight, NO<sub>2</sub> undergoes photolysis to form NO and atomic oxygen. Atomic oxygen then combines with the molecular oxygen in the presence of some molecule which acts as a source of transfer of energy to form ozone, O<sub>3</sub>. The ozone formed reacts with NO to form NO<sub>2</sub> and O<sub>2</sub>. Thus NO<sub>2</sub> cycle is completed.



When hydrocarbons are present, they combine with oxygen atom, produced in the first step during photolysis of NO<sub>2</sub>, to form highly reactive free radicals as intermediates. These free radicals initiate a variety of reactions:



As a result concentration of ozone, PAN and aldehydes and ketones is a build up in the atmosphere.

8. What are the harmful effects of photochemical smog and how can they be controlled?

**Ans.** The harmful effects of smog are:

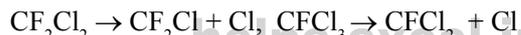
- (i) All these compounds like ozone, PAN etc. cause irritation in our eyes.
- (ii) They damage many materials such as metals, stones, building materials.
- (iii) Ozone destroys rubber.
- (iv) It is also harmful to fabrics, crops and ornamental plants.
- (v)  $\text{NO}_2$  present in photochemical smog, reduces visibility. Hence pilots experience problems due to this smog.

9. What are the reactions involved for ozone layer depletion in the atmosphere?

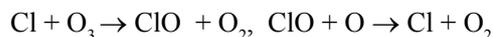
**Ans.** NO which may be produced at the ground level due to human activity react with ozone and some different oxides of nitrogen and oxygen



Chlorofluorocarbons (CFC) are commonly known as freons which introduced in the atmosphere from aerosol sprays, refrigerating equipments and others. These compounds decompose to form Cl free radical.



The reactive chlorine atoms then destroy the ozone layer through the following sequence of reactions.



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

**Ans.** Due to depletion of ozone in the atmosphere, large ozone holes are created in the ozone layer.

#### Effects of Ozone depletion

- (i) The U.V. rays coming from the sun passes through the stratosphere and reach the surface of earth. This radiation causes cancer in skin.
- (ii) Exposure of eyes to the U.V. radiation can cause cataract or even blindness.
- (iii) Exposure of plants to the U.V. radiations can adversely affect the plant proteins and results in destruction of chlorophyll and harmful mutation.
- (iv) It has a very strong effect on our climate. It upsets the heat balance of the earth.

(v) If it is not controlled, it would cause ecological disturbances.

**11.** What are major causes of water pollution? Explain.

**Ans.** The main causes for pollution in water are:

- (i) Sewage and domestic wastes release pathogens which are disease causing bacteria and also result in gastro-intestinal diseases.
- (ii) The industrial effluents contain toxic and hazardous chemicals cause lead poisoning, kidney damage, etc.
- (iii) The agricultural discharge includes fertilisers, pesticides, etc. causing harmful effects on human being and animals.
- (iv) Siltation produces turbidity in water thereby hindering the free movement of aquatic organisms and their growth and productivity.
- (v) The thermal pollutants increase the temperature of water adversely affecting the aquatic lives present in them.
- (vi) The radioactive discharge from nuclear reactors are highly hazardous.

**12.** Have you ever observed any water pollution in your area ? How can you control it ?

**Ans.** We have water pollution due to sewage disposal in our area. It is controlled by spraying insecticides in the drains. Some places have been earmarked for water harvesting.

**13.** What do you mean by Biochemical Oxygen Demand (BOD) ?

**Ans.** The total amount of oxygen consumed by micro-organisms in decomposing the waste present in a certain volume of a sample of water is called Biochemical Oxygen Demand (BOD) of water.

**14.** Do you observe any soil pollution in your neighbourhood? What efforts will you make for controlling the soil pollution?

**Ans.** Yes, we do observe soil pollution in our neighbourhood due to dumping of non-biodegradable waste like plastic bags and cans along with biodegradable wastes.

The best way to manage waste from house-holds is to keep two garbage bins, one for the biodegradable waste and the other for the non-biodegradable waste. Many combustible wastes can be burned and the ashes can be used for land-fill. However, care must be taken for the toxic gases which can emit during combustion.

**15.** What are pesticides and herbicides? Explain giving examples.

**Ans. Pesticides:** These are synthetic toxic chemicals which are used in agriculture to control the damages caused by insects, rodents, weeds and various crop diseases. Their repeated use gives rise to pests that are resistant to that group

of pesticides. As a result, these pesticides become ineffective for those pests. Earlier DDT was used. As insect resistance towards DDT increased, other organic toxins such as Aldrin and Dieldrin were introduced for use as pesticides. But these were non-biodegradable and slowly transferred to human being through food chain causing metabolic and physiological disorders. Consequently, a new series of pesticides, organophosphates and carbamates have been introduced. These are biodegradable but are severe nerve toxins and hence more harmful to humans and have caused even deaths. Thus, the insecticide industry is engaged in developing new insecticides.

**Herbicides:** These are the chemicals used to control weeds. Earlier, inorganic compounds such as sodium chlorate ( $\text{NaClO}_3$ ) and sodium arsenite ( $\text{Na}_3\text{AsO}_3$ ) were used but arsenic compounds, being toxic to mammals, are no longer preferred. Instead, organic compounds such as triazines, are now considered as better herbicides, especially for the corn-fields.

**16.** What do you mean by green chemistry? How will it help to decrease environmental pollution?

**Ans.** Producing chemicals of our daily needs using such reactions and chemical processes which neither use toxic chemicals nor emit them into the atmosphere. It is evident that if concerted efforts are made to develop green chemical products, it will certainly help us to keep our environment pollution free.

**17.** What would have happened if the greenhouse gases were totally missing in the earth's atmosphere? Discuss.

**Ans.** The solar energy radiated back from the earth surface is absorbed by the greenhouse gases (i.e.,  $\text{CO}_2$ ,  $\text{CH}_4$ ,  $\text{O}_3$ , CFC's and water vapour) present near the earth's surface. Thus, they heat up the atmosphere near the earth's surface and keep it warm. As a result, they keep the temperature of the earth constant and help in the growth of plants and existence of life on the earth. If there were no greenhouse gases, there would have no vegetation and life on the earth.

**18.** A large number 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.

**Ans.** Excessive phytoplankton (organic pollutants such as leaves, grass, trash, etc.) present in water is biodegradable. A large population of bacteria decomposes this organic matter in water. During this process, they consume the oxygen dissolved in water. Water has already limited dissolved oxygen (10 ppm). Thus, it is further depleted. When the level of dissolved oxygen falls below 6 ppm, the fish cannot survive. Hence, they die and float dead on the lake.

19. How can domestic waste be used as manure?

**Ans.** Domestic waste comprises two types of materials, biodegradable such as leaves, rotten food etc. and non-biodegradable such as plastics, glass, metal scrap etc. The non-biodegradable waste is sent to industry for recycling. The biodegradable waste should be deposited in the land fills. With the passage of time, it is converted into manure (compost).

20. For your agricultural field or garden, you have developed a compost producing pit. Discuss the process in the light of bad odour, flies and recycling of wastes for a good produce.

**Ans.** The compost producing pit should be set up at a suitable place or in a tin to protect ourselves from bad odour and flies. It should be kept covered so that flies cannot make entry into it and the bad odour is minimised. The recyclable material like plastics, glass, newspapers, etc. should be sold to the vendor who further sells it to the dealer. The dealer further supplies it to the industry involved in recycling process.

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