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## Chapter – 14 (Environmental Chemistry)

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### Exercise Questions:

#### Question :1 Define environmental chemistry?

Answer:

Environmental chemistry is the branch of science which deals with the chemical phenomenon occurring in the environment. It includes our surroundings such as air, water soil, forest etc.

#### Question :2 Explain the tropospheric pollution in 100 words?

Answer :

Tropospheric pollution occurs due to the presence of undesirable substance in air. These may be the solid or gaseous pollutants.

- 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 and smog etc.

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

Answer :

Carbon monoxide combines with haemoglobin to form a very stable compound known as carboxyhaemoglobin when it's concentration in blood reaches 3-4% ,the oxygen carrying capacity of the blood is greatly reduced because level of haemoglobin reduced and not available for combination with oxygen. This results into headache, nervousness and sometimes death of the person. On the other hand CO does not combine with haemoglobin and hence is less harmful than CO.

#### Question :4 List gases which are responsible for greenhouse effect.

Answer:

CO is mainly responsible for greenhouse effect. Other greenhouse gases are methane, nitrous oxide, water vapours, CFCs and ozone.

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

Answer:

This is mainly due to the large number of industries and power plants in the nearby areas. Acid rain has vapours of sulphuric acid dissolved in it. When it comes in contact with various statues or monuments, the acid reacts chemically with calcium carbonate.



**Question :6 What is smog? How is classical smog different from photochemical smog?**

Answer :

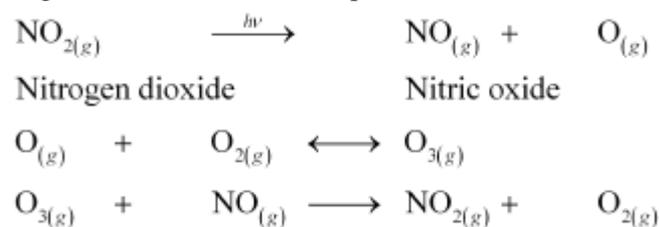
The word smog is a combination of smoke and fog. It is a type of air pollution that occurs in many cities throughout world. Classical smog occurs in cool humid climate. It is also called as reducing smog form by combination of smoke, dust and fog containing sulphur oxides. Whereas photochemical smog occurs in warm and dry sunny climate. It has high concentration of oxidizing agents and therefore, it is also called as oxidising smog.

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

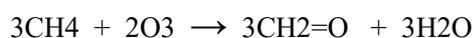
Answer:

Photochemical smog is formed as a result of the reaction of sunlight with hydrocarbons and nitrogen oxides. Ozone, nitric oxide, acrolein, formaldehyde, and peroxyacetyl nitrate (PAN) are common components of photochemical smog. The formation of photochemical smog can be summarized as follows:

Burning of fossil fuels leads to the emission of hydrocarbons and nitrogen dioxide in the atmosphere. High concentrations of these pollutants in air results in their interaction with sunlight as follows:



While ozone is toxic in nature, both  $\text{NO}_2$  and  $\text{O}_3$  are oxidizing agents. They react with the unburnt hydrocarbons in air to produce formaldehyde, PAN, and acrolein.



formaldehyde

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

Answer :

Harmful effects of photochemical smog:

- Their high concentration causes headache, chest pain and dryness of the throat.
- Ozone and PAN act as powerful eye irritants.
- Photochemical smog leads to cracking of rubber and extensive damage to plant life.
- It causes corrosion of metals, stones, building materials and painted surface etc.

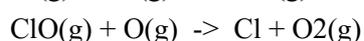
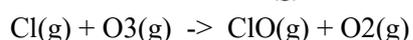
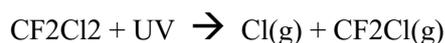
Control:

- Use of catalytic converter in automobiles prevent the release of nitrogen dioxide and hydrocarbons to the atmosphere.
- Pinus, Juniparus, Quercus, Pyrus like plants can metabolise nitrogen dioxide thus their plantation could help to some extent.

**Question :9 What are the reactions involved for ozone layer depletion in the stratosphere?**

Answer:

The reaction can be shown as follows :



**Question :10 What do you mean by ozone hole? What are it's consequences?**

Answer:

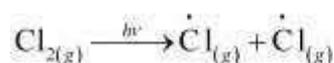
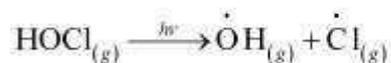
In polar regions, stratospheric clouds provide the surface for chlorine nitrate and hypochlorous acid. They react to form chlorine molecules. Photolysis of chlorine molecules and HOCl gives chlorine free radicals.

The chlorine free radicals lead to the decomposition of ozone

This initiates a chain reaction. The chlorine free radical is continuously regenerated which depletes the ozone layer. It is called ozone hole.

Consequences of ozone depletion:

The ozone layer protects the earth from the harmful UV radiations of the sun. Due to its depletion, more radiation enters the earth's atmosphere. UV radiations cause aging of skin, cataract, skin cancer and sunburns. Hence, they are harmful. They cause the death of phytoplanktons which leads to a decrease of fish productivity. Excess exposure may even cause mutation in plants, increase UV radiation, decrease moisture content of soil and damage both plants and fibers.



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

Answer:

The major cause of water pollutions are -

- 1.) Radioactive waste- These waste substances are direct throw into the oceans.
- 2.) Pathogens- include bacteria and other organisms, which enters into the water from animal excreta and domestic sewage. Also, human excreta contain bacterias like Escherichia coli and Streptococcus faecalis which cause gastrointestinal diseases
- 3.) Organic Wastes- These are biodegradable waste that pollutes water as a consequence of runoff. The excess of organic matter in water causes a decrease in the amount of oxygen held by the water.
- 4.) Chemical pollutants- water-soluble inorganic chemicals such as heavy metals like cadmium, mercury, nickel etc. The presence of these metals in the human body, damages the kidneys, central nervous system, liver etc. These are dangerous for human beings because our body cannot excrete them.

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**Question :12 Have you ever observed any water pollution in your area? What measures would you suggest to control it?**

Answer:

Yes , I observed water pollution in my area. As i Know, the contamination of water by foreign substance , which make of harmful for health of animals or plants or aquatic life and make it unfit for the domestic , industrial and agricultural use . It can be controlled by the following methods :

- i) Excessive amount of chemical fertilizers should be prevented .
- ii) Regularly , we should check pH of water. if pH value is mantained at 7 then, water is pure. otherwise polluted .
- iii) Industrial waste discharge from fertilizers , paper , pesticides , detergents , drugs , industries and refineries should not be allowed to get mixed in water bodies like river, lakes etc.
- iv) Avoid the use of DDT, malathion at home.
- v) Domestic waste should be properly discharged and treated .

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

Answer:

The amount of oxygen required by bacteria to breakdown the organic matter present in a certain volume of a sample of water is called Biochemical Oxygen Demand (BOD).

**Question :14 Do you observe any soil pollution in your neighborhood? What efforts will you make for controlling the soil pollution?**

Answer:

Major sources of soil pollution are industrial wastes and agricultural pollutants such as pesticides, fertilizers, etc.

It is very important to maintain the quality and fertility of soil to ensure and sustain the growth of plants and food crops.

Insecticides like DDT are not soluble in water. For this reason, they remain in soil for a long time, contaminating the root crops. Pesticides like Aldrin and Dieldrin are non-biodegradable and highly toxic in nature. They can enter the higher trophic levels through food chains, causing metabolic and physiological disorders. The same is true for industrial wastes that comprises of several toxic metals like Pb, As, Hg, Cd, etc.Hence, the best way to check soil pollution is to avoid direct addition of

pollutants to the soil. Also, wastes should undergo proper treatment. They should be recycled and only then, allowed to be dumped.

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

Answer :

Pesticides are the chemical compounds used in agriculture to control the damages caused by insects, rodents, weeds and various crop diseases.

Example : Aldrin, Dieldrin, B. H. C etc.

Herbicides : These are the chemicals used to control weeds.

Example: Triazines.

**Question : 16 What do you mean by green chemistry? How will it help in decreasing environmental pollution?**

Answer:

Green chemistry is a production process that aims at using the existing knowledge and principles of chemistry for developing and implementing chemical products and processes to reduce the use and generation of substances hazardous to the environment.

The release of different harmful chemicals (particulates, gases, organic and inorganic wastes) causes environmental pollution. In green chemistry, the reactants to be used in chemical reactions are chosen in such a way that the yield of the end products is up to 100%. This prevents or limits chemical pollutants from being introduced into the environment. Through the efforts of green chemists, H<sub>2</sub>O<sub>2</sub> has replaced tetrachlorethane and chlorine gas in drying and bleaching of paper.

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

Answer:

Following gases are responsible for green house effect.

Carbon dioxide CO<sub>2</sub>

Methane CH<sub>4</sub>

Water H<sub>2</sub>O

Nitrous oxide NO

Ozone O<sub>3</sub>

Chlorofluorocarbons CFCs

They are present near earth's surface. They absorb solar energy radiated back from the earth surface.

Due to this, the atmosphere is heated. Thus, these gases are essential for maintaining the temperature of earth for the sustenance of life.

In the absence of green house gases, there will be significant decrease in the average temperature of earth. Due to this, life will not be possible on earth.

**Question :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.**

Answer:

Excessive phytoplankton {The organic pollutants such as leaves grass , trash etc is known as phytoplankton } present in water is biodegradable. A large pollution of bacteria decomposes this organic matter in water . during this process, they consume the oxygen dissolved in water . water has already limited dissolved oxygen (10ppm) . thus it is further depleted, when the level of dissolved oxygen falls below 6ppm , the fish can't survive . Hence, they die and float dead on the lake.

**Question :19 How can domestic waste be used as manure?**

Answer:

Domestic waste consists of biodegradable waste which can be converted into manure by suitable method.

**Question :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.**

Answer :

The compost producing pit should be kept covered so that flies cannot make entry into it and bad odour is minimized. The waste materials which are non-biodegradable like glasses, plastic bags, polybags, must be handed over to the vendors who can send them to the recycling plants.