

Chapter 14 Environmental Chemistry

NCERT Exercise

Question 1:

Define environmental chemistry?

Solution 1:

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?

Solution 2:

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?

Solution 3:

Carbon monoxide combines with haemoglobin to form a very stable compound known as carboxyhaemoglobin when its 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_2 does not combine with haemoglobin and hence is less harmful than CO.

Question 4:

List gases which are responsible for greenhouse effect.

Solution 4:

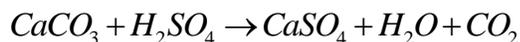
CO₂ is mainly responsible for greenhouse effect. Other greenhouse gases are methane, nitrous oxide, water vapours, CFCs and Ozone.

Question 5:

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

Solution 5:

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?

Solution 6:

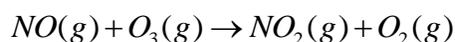
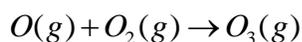
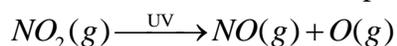
The word smog is a combination of smoke and fog. It is a type of air pollution that occurs in many cities throughout world. Classical smog occurs in cool humid climate. It is also called as reducing smog form by combination of smoke, dust and fog containing sulphur oxides. Whereas photochemical smog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

Question 7:

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

Solution 7:

Mechanism of formation of photochemical smog:



Solution 8:**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 or rubber and extensive damage to plant life.
- It causes corrosion of metals, stones, building materials, and painted surface etc.

Control:

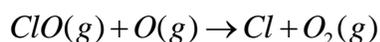
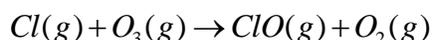
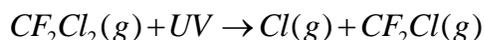
- Use of catalytic converter in automobiles prevents the release of nitrogen dioxide and hydrocarbons to the atmosphere.
- Pinus, Juniparus, Quercus, Pyrus like plants can metabolise nitrogen dioxide thus their plantation could help to some extent.

Question 9:

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

Solution 9:

The reaction can be shown as follows:

**Question 10:**

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

Solution 10:

Depletion of ozone layer creates some sort of holes in the blanket of ozone which surrounds earth; this is known as ozone hole.

- With the depletion of the ozone layer, UV radiation filters into the troposphere which leads to aging of skin, cataract, sunburn, skin cancer etc.
- By killing many of the phytoplanktons, it can damage the fish productivity.
- Evaporation rate increases through the surface and stomata of leaves which can decrease the moisture content of the soil.
- Increase greenhouse effect.

Question 11:

What are the major causes of water pollution? Explain.

Solution 11:**Causes of water pollution:**

- **Pathogens:** Pathogens include bacteria and other microorganisms that enter water from domestic sewage and animal excreta.
Human excreta contain bacteria such as *Escherichia coli* and *Streptococcus faecalis*, which cause gastrointestinal diseases.
- **Organic wastes:** Organic wastes when added to water, as these are biodegradable, bacteria decomposes organic matter and consume dissolved oxygen in water. When the concentration of dissolved oxygen of water is below 6 ppm, the growth of fish gets inhibited. Breakdown of the organic wastes by anaerobic bacteria produces chemicals that have a foul smell and are harmful to human health.
- **Chemical pollutants:** Some inorganic chemicals as an industrial wastes dissolve in water like cadmium, mercury nickel etc. These metals are dangerous to humans and other animals. These metals can damage kidneys and central nervous system lever etc. Petroleum products pollute many sources of water.

Question 12:

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

Solution 12:

Water pollution arises as a result of various human activities. This includes discharges from wastewater treatment plants, run-off from agricultural fields, storm-water drainage, etc.

Pollutants from these sources enter the water bodies, thereby contaminating the water and rendering it impure.

Industries and chemical factories discharge toxic, heavy metals such as Fe, Mn, Al, etc., along with organic wastes into water. Domestic sewage and animal excreta are also responsible for pathogenic contamination of water. These pollutants make water unfit for drinking.

Therefore, all industrial and chemical discharges should be made free from toxic metals before allowing them to enter a water body. The concentration of these pollutants should be checked regularly. Compost should be preferred over chemical fertilizers in gardens and agricultural fields to avoid harmful chemicals from entering ground water.

Question 13:

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

Solution 13:

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?

Solution 14:

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.

Solution 15:

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?

Solution 16:

Green chemistry is a strategy to design chemical processes and products that reduce or eliminates the use and regeneration of hazardous substance. This would bring about minimum pollution or deterioration to the environment.

For example:

- Automobile engines have been fitted with catalytic converters which prevent the release of the vapours of hydrocarbons and oxides of nitrogen into acrolein and peroxyacetyl nitrate.
- CO₂ has replaced CFCs as blowing agents in the manufacture of polystyrene foam sheets.
- Liquid carbon dioxides used for dry cleaning instead of other chemicals.

Question 17:

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

Solution 17:

The solar energy radiated back from the earth surface is absorbed by the green house gases. (CO₂, CH₄, O₃, CFCs) are present near the earth's surface.

They heat up the atmosphere near the earth's surface and keep it warm. As a result of these, there is growth of vegetation which supports the life. In the absence of this effect, there will be no life of both plant and animal on the surface of the earth because temperature will be much lower while CO₂ is very important part of green plants.

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.

Solution 18:

Excessive phytoplankton (organic pollutants such as leaves, grass trash etc.) present in water are biodegradable. Bacteria decomposes these organic matters in water. During this process when large number of bacteria decomposes these organic matters, they-consume the dissolved oxygen in water. When the level of dissolved oxygen falls below 6 ppm and proper amount of oxygen is not available so fish present in lake cannot survive.

Question 19:

How can domestic waste be used as manure?

Solution 19:

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.

Solution 20:

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.

I. Very Short Answer Type Questions**Question 1:**

What do you mean by primary and secondary pollutants of the air?

Solution 1:

Primary pollutants are those which after their formation remains as it was before e.g., No. Secondary pollutants are formed as a reaction with primary pollutants e.g., PAN (peroxyacyl nitrates).

Question 2:

What is the name of the compound formed when CO combines with blood?

Solution 2:

Carboxyhaemoglobin.

Question 3:

How are NO and NO₂ formed in the atmosphere?

Solution 3:

NO is formed due to the reaction between N₂ and O₂ during lightning or by the combustion of fossil fuels. NO is oxidised to form NO₂.

Question 4:

What is chlorosis?

Solution 4:

Slowdown of process of formation of chlorophyll in plants with the presence of SO₂ is called chlorosis. It occurs generally due to deficiency of iron and zinc.

Question 5:

Which zone is known as ozonosphere?

Solution 5:

Stratosphere.

Question 6:

Which main gas is responsible for damage to the ozone layer?

Solution 6:

NO and CFCs

Question 7:

What is the nature of classical smog?

Solution 7:

Reducing.

Question 8:

Name the acids which are responsible for acid rain?

Solution 8:

H₂SO₄, HNO₃ and HCl.

Question 9:

What is BOD?

Solution 9:

The amount of oxygen consumed by micro organism in decomposing organic wastes of sewage water is called BOD (Biochemical Oxygen Demand).

Question 10:

What do you mean by viable and non-viable particulates?

Solution 10:

Viable particulates are microorganisms like bacteria, fungi, moulds, algae etc. Non-viable particulates are formed by the disintegration of bigger size particles or by the condensation of water vapour.

e.g., mist, smoke, fume and dust.

Question 11:

What is siltation?

Solution 11:

Mixing of soil or rock particles in water is called siltation which become suspended after sometime period in form of silt.

Question 12:

What is the composition of London Smog?

Solution 12:

London Smog consists H_2SO_4 deposited on the particulates suspended in the atmosphere.

Question 13:

List out the gases which are considered as major source of air pollution.

Solution 13:

Carbon monoxide (CO), sulphur dioxide (SO_2) and oxides of nitrogen (NO_2).

Question 14:

Why is acid rain considered as threat to Taj Mahal?

Solution 14:

Acids present in acid rain can react with marble (CaCO_3) and damage the monument.

Question 15:

Give one example of organic herbicide.

Solution 15:

Triazines.

Question 16:

What are pesticides?

Solution 16:

Pesticides are the substances used to kill unwanted pests. For example, DDT.

Question 17:

What is PAN stands for?

Solution 17:

It is Peroxyacetyl nitrate.

Question 18:

Give the examples of insecticides.

Solution 18:

DDT, BHC.

Question 19:

Which gas was mainly responsible for Bhopal gas tragedy?

Solution 19:

Methyl isocyanate.

Question 20:

What is meant by polar vortex?

Solution 20:

A tight whirlpool of wind formed in the stratosphere which surrounds Antarctica is called polar vortex.

Question 21:

What should be the tolerable limit of F ions in drinking water?

Solution 21:

1-1.5 ppm or 1-1.5 mg dm³.

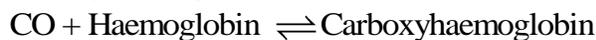
II. Short Answer Questions

Question 1:

How carbon monoxide acts as a poison for human beings?

Solution 1:

Carbon monoxide is poisonous because it combines with haemoglobin of R.B.C. to form carboxyhaemoglobin as.



It inhibits the transport of oxygen to different parts of the body. Thus the body becomes oxygen-starved.

Question 2:

What is 'Acid Rain'? How is it harmful to the environment?

Solution 2:

Acid rain is the rain water mixed with small amount of sulphuric acid, nitric and 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. Taj Mahal has been damaged by acid rain.
- Acid rain corrodes water conducting pipes resulting in the leaching of heavy metals such as iron, lead, etc., to the drinking water.

Question 3:

What is photochemical smog? What are its effects? How can it be controlled?

Solution 3:

This is a type of smog formed in warm, dry and sunny climate. They are formed when sunlight is absorbed by SO_2 , oxides of nitrogen and hydrocarbons.

They act as oxidizing agents.

Effects of photochemical smog

- They produce irritation in the eyes and also in respiratory system.
- They can damage many materials such as metals, stones, building material etc.
- NO_2 present gives a brown colour to the photochemical smog which reduces visibility.
- It is harmful to fabrics, crops and ornamental plants.

Control of photochemical smog

- By using catalytic converters in automobiles.
- By spraying certain compounds into atmosphere which generate free radicals that can

Chapter 14 Environmental Chemistry

easily combine with the free radicals that initiate the reaction forming toxic compounds of photochemical smog.

- Certain plants such as Pinus, Juniparus, Pyrus could be helpful in this matter.

Question 4:

What do you mean by greenhouse effect? What is the role CO_2 in the greenhouse effect?

Solution 4:

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_2 , 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_2 and then radiated back to the earth. Thus making the environment of the earth warm and results in melting of glaciers and increases sea levels.

Question 5:

- (a) Define eutrophication and pneumoconiosis.
 (b) Write difference between photochemical and classical smog.

Solution 5:

(a) Eutrophication: When the growth of algae increases in the surface of water, dissolved oxygen in water is reduced. This phenomenon is known as eutrophication. (Due to this growth of fish gets inhibited because algae growth releases toxins in water).

Pneumoconiosis: It is a disease which irritates lungs. It causes scarring or fibrosis of the lung.

(b)

Photochemical smog	Classical smog
(i) It is formed as a result of photochemical decomposition of nitrogen dioxide and chemical reactions involving hydrocarbons. (ii) It takes place during dry warm season in presence of sunlight by reaction with nitrogen oxides and hydrocarbon released by automobiles. (iii) It is oxidizing in nature.	(i) It is formed due to condensation of SO_2 vapours on particles of carbon in cold climate. (ii) It is generally formed during winter when there is severe cold due to reaction of sulphur oxide and polluted air. (iii) It is reducing in nature.

III. Multiple Choice Questions**Question 1:**

Which of the following acid is most abundant in acid rain?

- (a) HCl (b) HNO₃ (c) H₂SO₄ (d) Organic acid

Solution 1:

- (c) H₂SO₄

Question 2:

Which of the following causes less pollution?

- (a) NO_x (b) SO_x (c) CO₂ (d) C_xH_y

Solution 2:

- (c) CO₂

Question 3:

Besides CO₂, the other greenhouse gas is

- (a) Ar (b) N₂ (c) O₂ (d) CH₄

Solution 3:

- (d) CH₄

Question 4:

BOD is a measure of

- (a) Organic pollutant in water (b) Inorganic pollutant in water
(c) Particulate matter in water (d) All of the above

Solution 4:

- (a) Organic pollutant in water

Question 5:

The gas which reacts with haemoglobin in blood is

- (a) CO (b) SO₂ (c) CO₂ (d) NO₂

Solution 5:

(a) CO

Question 6:

Ozone depletion is mainly due to

- (a) HCFs (b) CFCs (c) CH₃Br (d) all of the above

Solution 6:

(b) CFCs

Question 7:

The pollutant released in Bhopal gas tragedy was

- (a) Ammonia (b) Mustard gas (c) Nitrous oxide (d) Methyl isocyanate

Solution 7:

(d) Methyl isocyanate

Question 8:

Which of the following will increase the BOD of water supply?

- (a) O₃ (b) C₂H₅OH (c) H₂O (d) CO₂

Solution 8:

(c) H₂O

IV. Hots Questions**Question 1:**

What is meant by PCBs?

Solution 1:

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

Question 2:

Which compound is formed when CO combines with blood?

Solution 2:

When CO combines with blood, the following reaction occurs forming carboxyhaemoglobin which is a permanent compound and does not dissociate further:-

**Question 3:**

Give three examples in which green chemistry has been applied.

Solution 3:

- In dry-cleaning, use of liquefied CO₂ in place of tetrachlorethene (Cl₂C = CCl₂).
- In bleaching of paper using H₂O₂ in place of chlorine.
- In the manufacture of chemicals like ethanol using environment-friendly chemicals and conditions.