Environmental Chemistry Questions with Solutions

1. Dinitrogen and dioxygen are the main constituents of air but these do not react with each other to form oxides of nitrogen because _____.

a) the reaction is endothermic and requires a very high temperature.
b) the reaction can be initiated only in the presence of a catalyst.
c) oxides of nitrogen are unstable.
d) N_2 and O_2 are unreactive.

Answer.
a) the reaction is endothermic and requires a very high temperature.

Explanation: Dinitrogen and dioxygen are the main constituents of air, but they do not react with each other to form nitrogen oxides because the reaction of dinitrogen and dioxygen is endothermic and requires a very high temperature, which air does not provide.

2. Which of the following is not a consequence of the greenhouse effect?

a) Climatic conditions will be changed
b) Plants in warmer climates with adequate rainfall would grow faster
c) The incidence of infectious diseases is likely to increase
d) Malaria will be controlled as the mosquitoes will not survive.

Answer.
d) Malaria will be controlled as the mosquitoes will not survive.

Explanation: The mosquito population will grow, and malaria will spread.

3. Identify the wrong statement in the following:

a) Chlorofluorocarbons are responsible for ozone layer depletion.
b) Greenhouse effect is responsible for global warming.
c) Acid rain is mostly because of oxides of nitrogen and sulphur.
d) Ozone layer does not permit infrared radiation from the sun to reach the earth.

Answer.
d) Ozone layer does not permit infrared radiation from the sun to reach the earth.

Explanation: The ozone layer acts as a shield, preventing ultraviolet radiation from the sun from reaching the earth. It does not prevent infrared radiation from the sun from reaching Earth.

4. What is DDT among the following?

a) Greenhouse gas
b) Non-biodegradable pollutant
c) Biodegradable pollutant
d) A fertiliser

Answer.
b) Non-biodegradable pollutant

Explanation: DDT is a persistent organic pollutant that is easily absorbed by soils and sediments, which can serve as both sinks and long-term sources of exposure for organisms.

5. Eutrophication causes a reduction in-

a) Dissolved Oxygen
b) Nutrients
c) Dissolved Salts
d) All of these

Answer.
a) Dissolved Oxygen

Explanation: Eutrophication significantly reduces the amount of dissolved oxygen in bodies of water. This occurs primarily when a body of water becomes overly enriched with nutrients as a result of excessive algae or plankton growth. It is a serious concern because eutrophication renders the body of water incapable of supporting life.

6. Why is photochemical smog so named?

Photochemical smog is so named because it is formed as a result of a photochemical reaction between nitrogen oxides and hydrocarbons.

7. What exactly do you mean by 'inversion temperature' in different parts of the atmosphere?

When we move from one region of the atmosphere to the next adjacent region, the temperature trend changes from increase to decrease or vice versa. This is referred to as inversion temperature.

8. What is the most significant CO pollutant sink?

Soil microorganisms are the most significant CO pollutant sink.

9. What is the aetiology of blue baby syndrome?

Excess nitrates in drinking water cause methemoglobinemia, also known as "blue baby syndrome."

10. Give I.U.P.A.C. the name of B.H.C.

The IUPAC name of B.H.C is 1, 2, 3, 4, 5, 6, Hexa-chlorocyclohexane.

11. Why is carbon monoxide regarded as poisonous?

Carbon monoxide binds to haemoglobin to form carboxyl-haemoglobin, which is approximately 300 times more stable than the oxygen-haemoglobin complex. When the concentration of carboxyl haemoglobin in the blood is greatly reduced, This lack of oxygen causes headaches, blurred vision, nervousness, and cardiovascular problems.

12. What are the reactions involved in the depletion of the ozone layer in the atmosphere?

- UV rays react with dioxygen to form ozone.
- The production and decomposition of ozone are in dynamic equilibrium. The disruption of this equilibrium causes ozone depletion.
- Chlorofluorocarbons combine with atmospheric gases and travel to the stratosphere, where UV rays decompose them to produce chlorine-free radicals.
- These chlorine-free radicals react with ozone to produce oxygen and ClO free radicals, which then react with atomic O to generate more chlorine-free radicals.
- As a result, the ozone layer is harmed by the continuous breakdown of ozone in the stratosphere.

$O_2 \rightarrow O + O$
$O_2 + O \rightarrow O_3\ (g)$
$CF_2Cl_2\ (g) \rightarrow Cl\bullet\ (g) + CF_2Cl$
$Cl\bullet + O_3\ (g) \rightarrow ClO\bullet + O_2\ (g) + Cl\ (g)$
$ClO\bullet\ (g) + O\ (g) \rightarrow Cl\bullet + O_2\ (g)$

13. Why is it that rainwater typically has a pH of around 5.6? When does it turn into acid rain?

Rainwater has a pH of 5.6 because of the formation of H^+ ions from the reaction of rainwater with CO_2 in the atmosphere.

$H_2O + CO_2 \rightarrow 2H^+ + CO_3^{2-}$
It becomes acidic when the pH falls below 5.6. Acid rain is also formed as a result of the presence of sulphur and nitrogen oxides in the atmosphere.
$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$
$4NO + O_2 + 2H_2O \rightarrow 4HNO_3$.

14. Explain how does greenhouse effect affect global warming?

The majority of visible light from the sun can pass through the earth's atmosphere and reach the earth's surface. When the earth's surface is heated by sunlight, it radiates some of that energy back into space as longer IR wavelengths. Some of the heat is trapped in the atmosphere by CH_2, CO_2, CFCs, and water vapour. They absorb infrared radiation and block a significant portion of the earth's emitted radiation. The absorbed radiations are partially remitted to the earth's surface. As a result, the earth's surface is heated by a phenomenon known as the greenhouse effect.

Thus, the greenhouse effect is defined as the heating of the earth's surface caused by the CO_2 layer in the atmosphere trapping infrared radiations reflected by the earth's surface. Global warming refers to the warming of the earth caused by the greenhouse effect.

15. Green plants use carbon dioxide for photosynthesis and return oxygen to the atmosphere, even then carbon dioxide is considered to be responsible for the greenhouse effect. Explain why?

Carbon dioxide is a naturally-occurring constituent of the atmosphere that is essential for all forms of plant life. It accounts for approximately 0.033 % of the volume of the atmosphere. It contributes to keeping the earth's temperature stable, which is necessary for living organisms.

CO_2 balance in the atmosphere is maintained because CO_2 is produced by respiration, the combustion of fossil fuels, and the decomposition of limestone, but it is also consumed by plants during photosynthesis.
However, human activities have disrupted this balance, and the level of CO_2 in the atmosphere is rising. This has occurred as a result of deforestation, increased use of fossil fuels, and industrialization.

CO_2 concentrations are estimated to have increased by about 25% over the last century. The average global temperature has risen by 0.4 to 0.8 degrees Celsius over the last nearly 120 years. According to current estimates, doubling the CO_2 concentration will result in a temperature increase of between 1.0 and 3.5 degrees Celsius. CO_2 contributes 50% of the greenhouse effect, and other trace gases contribute about 50% as well.

Practise Questions on Environmental Chemistry

1. **Living in the atmosphere of CO is dangerous because it:**

a) Combines with O_2 present inside to form CO_2
b) Reduces the organic matter of tissues.
c) Combines with Haemoglobin and makes it incapable of absorbing oxygen.
d) Dilute the blood.

Correct Answer. (c)
Solution:
Carbon monoxide combines with blood haemoglobin to form the carboxy-haemoglobin complex. The formation of this complex renders haemoglobin incapable of transporting oxygen. As a result, there will be an oxygen deficiency in the blood.

2. **Most hazardous metal pollutant of automobile exhaust is:**

a) Pb
b) Cd
c) Hg
d) Cu

Correct Answer. (a)
Solution:
The most immobile heavy metal pollutant is lead. Lead poisoning is localised due to its immobility. Tetraethyl and tetramethyl lead are used as antiknock agents in gasoline.

3. **In the absence of greenhouse gases-**

a) Life on Earth would be impossible.
b) Average temperature of the Earth will decrease drastically.
c) There will be no effect on Earth.
d) Both (a) and (b)

Correct Answer. (d)

4. **The aromatic compound that is present as particulates is:**

a) Benzene

b) Toluene
c) Nitrobenzene
d) Polycyclic hydrocarbons

Correct Answer. (d)
Solution:
PAHs are primarily produced by anthropogenic processes, most notably incomplete combustion of organic fuels. PAHs are widely distributed in the atmosphere.
Natural processes such as volcanic eruptions and forest fires also contribute to the presence of PAHs in the environment. PAHs, depending on their volatility, can exist in both particulate and gaseous phases.

5. **If a lake is contaminated with DDT, its highest concentration would be found in:**

a) Primary consumer
b) Secondary consumer
c) Tertiary consumer
d) None of the above

Correct Answer. (c)
Solution:
Zooplanktons are eaten by small fish, which are then eaten by large fish, which are then eaten by a fish-eating bird at the highest trophic level (tertiary or quaternary), resulting in the organism at the highest trophic level (tertiary or quaternary) accumulating the most hazardous chemicals.