CHAPTER 14

Environmental Chemistry

Atmospheric Pollution

1. The pollution due to oxides of sulphur gets enhanced due to the presence of: *(2022)*

A. particulate matter B. ozone
C. hydrocarbons D. hydrogen peroxide

Choose the most appropriate answer from the options given below:

a. A, C, D only b. A, D only
c. A, B, D only d. B, C, D only

2. Match List-I with List-II. *(2021)*

	List-I		List-II
(A)	$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$	(i)	Acid rain
(B)	$HOCl(g) \xrightarrow{h\nu} \dot{O}H + \dot{C}l$	(ii)	Smog
(C)	$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$	(iii)	Ozone depletion
(D)	$NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$	(iv)	Tropospheric pollution

Choose the correct answer from the options given below.

a. A-ii B-iii C-iv D-i
b. A-iv B-iii C-i D-ii
c. A-iii B-ii C-iv D-i
d. A-i B-ii C-iii D-iv

3. Which of the following statement is NOT true about acid rain? *(2020-Covid)*

a. Causes no damage to monuments like Taj Mahal.
b. It is harmful for plants.
c. Its pH is less than 5.6
d. It is due to reaction of SO_2, NO_2 and CO_2 with rain water

4. Among the following, the one that is not a green house gas is *(2019)*

a. Nitrous oxide b. Methane
c. Ozone d. Sulphur dioxide

5. Which oxide of nitrogen is not a common pollutant introduced into the atmosphere both due to natural and human activity? *(2018)*

a. N_2O_5 b. NO_2
c. NO d. N_2O

6. Which of the following is a sink for CO? *(2017-Delhi)*

a. Plants
b. Haemoglobin
c. Micro-organisms present in the soil
d. Oceans

7. Which one of the following is not a common component of Photochemical Smog? *(2014)*

a. Acrolein b. Peroxyacetyl nitrate
c. Chlorofluorocarbons d. Ozone

8. Which one of the following statements regarding photochemical smog is not correct? *(2012 Pre)*

a. Photochemical smog does not cause irritation in eyes and throat
b. Carbon monoxide does not play any role in photochemical smog formation
c. Photochemical smog is an oxidizing agent in character
d. Photochemical smog is formed through photochemical reaction involving solar energy

9. Which of the following is responsible for depletion of the ozone layer in the upper strata of the atmosphere? *(2004)*

a. Ferrocene b. Fullerenes
c. Freons d. Polyhalogens

Water & Soil Pollution

10. Which one of the following statement is not true? *(2011 Pre)*

a. Oxides of sulphur, nitrogen and carbon are the most widespread air pollutant
b. pH of drinking water should be between 5.5 – 9.5
c. Concentration of D.O below 6 ppm is good for the growth of fish
d. Clean water would have a B.O.D value of less than 5 ppm

11. The decomposition of organic compounds, in the presence of oxygen and without the development of odoriferous substances, is called: *(1999)*

a. Nitrification b. N_2-fixation
c. Decay d. Denitrification

Green Chemistry

12. Green chemistry means such reactions which: *(2008)*

a. Study the reactions in plants
b. Produce colour during reactions
c. Reduce the use and production of hazardous chemicals
d. Are related to the depletion of ozone layer

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12
c	b	a	d	a	c	c	a	c	c	c	c

Explanations

1. (c) The presence of particulate matter in polluted air catalyses the oxidation of sulphur dioxide to sulphur trioxide.

$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

Sulphur dioxide in the presence of ozone gets oxidised to sulphur trioxide and oxygen.

$SO_2(g) + O_3(g) \rightarrow SO_3(g) + O_2(g)$

Sulphur dioxide in the presence of H_2O_2 gets oxidized to H_2SO_4.

$SO_2(g) + H_2O_2(I) \rightarrow H_2SO_4(aq)$

2. (b) Tropospheric pollution: Tropospheric pollution is mainly due to the presence of gaseous air pollutants and particulate pollutants. Oxides of sulphur is one of the gaseous air pollutants of the troposphere. The presence of particulate matter in polluted air catalyses the oxidation of sulphur dioxide to sulphur trioxide.

$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

Ozone depletion : In spring season, sunlight breaks HOCl and Cl_2 to give chlorine radicals.

$$HOCl(g) \xrightarrow{h\nu} \dot{O}H + \dot{C}l$$

The chlorine radicals thus formed, initiate the chain reaction for ozone depletion.

Acid rain : When the pH of the rain water drops below 5.6, it is known as acid rain. SO_2 and NO_2 after oxidation and reaction with water are major contributors to acid rain. Acid rain reacts with the marbles of monuments and causes discoloring and disfiguring of the monuments.

$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

Smog : A chain reaction occurs from interaction of NO with the sunlight in which NO is converted into nitrogen dioxide (NO_2). This NO_2 in turn absorbs energy from sunlight and breaks up into nitric oxide and free oxygen atom, which causes photochemical smog.

$$NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$$

3. (a) Acid rain is any form of precipitation that contains acidic components, such as sulfuric or nitric acid. Acid rain affects nearly everything: plants, soil, trees, buildings and even statues. The pH of acid rain is below 5.6.

SO_2, NO_2 and CO_2 present in the atmosphere react with water, oxygen and other chemicals present in the atmosphere to form sulphuric acid, nitric acid and carbonic acid respectively and thus, contributing to acid rain.

$$2SO_2(g) + O_2(g) + 2H_2O(l) \longrightarrow 2H_2SO_4\,(aq)$$
(Sulphuric acid)

$$4NO_2(g) + O_2(g) + 2H_2O(l) \longrightarrow 4HNO_3\,(aq)$$
(Nitric acid)

$$CO_2(g) + H_2O(l) \longrightarrow H_2CO_3\,(aq)$$
(Carbonic acid)

Acid rain reacts with marble, $CaCO_3$ of Taj Mahal causing damage to it. As a result, the monument is being slowly disfigured and the marble is getting discoloured and lustreless.

4. (d) The greenhouse effect is the way in which heat is trapped close to Earth's surface by greenhouse gases. Greenhouse gases are the gases which absorb the infrared radiations and cause greenhouse effect.

Carbon dioxide, methane, water vapour, nitrous oxide, CFCs and ozone are the examples of green house gases.

SO_2 (g) is not a greenhouse gas.

5. (a) Oxides of nitrogen are formed due to the reaction of nitrogen and oxygen at high temperature.

- N_2O is dinitrogen oxide also known as laughing gas. N_2O is released from agricultural waste, and is more potent in destroying the ozone layer.
- NO and NO_2 are produced from the burning of fossils. NO_2 causes acid rain and is also a lung irritant. Nitrogen dioxide is also harmful to various textile fibres and metals.

- Among the given, the only pollutant nitrogen oxide which is not generated due to human or natural activity is N_2O_5 (nitrogen pentoxide). It is a strong oxidiser and is used in nitration of organic compounds.

6. (c) Sink is a medium present in the environment which consumes pollutants, from the environment. CO is a pollutant and among the given, only micro-organisms present in the soil consumes CO and converts it into CO_2 and hence, acts as a sink for CO. Plants, oceans and hemoglobin cannot act as CO sink. Plants act as a sink of CO_2 and CO is not soluble in water, therefore ocean cannot act as sink.

7. (c) The main components of the photochemical smog are nitrogen dioxide (NO_2), ozone (O_3), acrolein, peroxyacetyl nitrate (PAN) etc. Hence, among the given compounds, CFCs is not the common components of photochemical smog.

8. (a) Photochemical smog is harmful because it causes irritation in eyes & throat. The main components of photochemical smog are nitrogen oxides, volatile organic compounds (VOCs), tropospheric ozone, and PAN (peroxyacytyl nitrate).

9. (c) In addition to fluorine and carbon, freons often contain hydrogen, chlorine or bromine thus, freons are types of CFC's. Its chlorine molecule that deplete the ozone layer.

10. (c) When concentration of dissolved oxygen (D.O) decreases or fall below a certain level (6 ppm) because of high B.O.D (Biochemical Dissolved Oxygen), due to more organic matter present in water body, this is not considered good for growth of fishes & leads to starvation of aquatic life.

11. (c) The other 3 types of reactions takes place only in the presence of bacteria, in which the nitrogen compound is decomposed either of nitrogen or nitrates or nitrites. While in decay reaction, an organic compound is decomposed in presence of oxygen.

12. (c) Green chemistry or organic chemistry uses natural manure, organic fertilizers & biological pests. This is a conventional practice to maintain the ecological diversity of that area. It avoids the use of hazardous chemicals & pesticides to reduce environment pollution.