

# Environmental Chemistry

## Multiple Choice Questions (MCQs)

**Q. 1** Which of the following gases is not a green house gas?

- (a) CO (b) O<sub>3</sub>  
(c) CH<sub>4</sub> (d) H<sub>2</sub>O vapour

**Ans. (a)** The gases which absorb sunlight near the earth's surface and then its radiated back to the earth are called green house gases.

Carbon dioxide, water vapour, methane, ozone, oxides of nitrogen, chlorofluoro carbons etc; are green house gases. CO is not a green house gas.

**Q. 2** Photochemical smog occurs in warm, dry and sunny climate. One of the following is not amongst the components of photochemical smog, identify it.

- (a) NO<sub>2</sub> (b) O<sub>3</sub>  
(c) SO<sub>2</sub> (d) Unsaturated hydrocarbon

**Ans. (c)** The smog which is formed in presence of sunlight is called photochemical smog. This occurs in the months of summer when NO<sub>2</sub> and hydrocarbons are present in large amounts in atmosphere.

Concentration of O<sub>3</sub>, PAN, aldehydes and ketones builds up in the atmosphere. SO<sub>2</sub> is not responsible for photochemical smog.

**Q. 3** Which of the following statements is not true about classical smog?

- (a) Its main components are produced by the action of sunlight on emissions of automobiles and factories  
(b) Produced in cold and humid climate  
(c) It contains compounds of reducing nature  
(d) It contains smoke, fog and sulphur dioxide

**Ans. (a)** Smog are of two types-classical smog and photochemical smog.

Classical smog occurs in cold humid climate. It is a mixture of smoke, fog and sulphur dioxide. Chemically it is a reducing mixture that's why, it is also called as reducing smog.

**Note** Gases released by automobiles and factories are not responsible for classical smog.

**Q. 4** Biochemical Oxygen Demand, (BOD) is a measure of organic material present in water. BOD value less than 5 ppm indicates a water sample to be

- (a) rich in dissolved oxygen
- (b) poor in dissolved oxygen
- (c) highly polluted
- (d) not suitable for aquatic life

**Ans. (a)** The total amount of oxygen consumed by microorganisms (bacteria) in decomposing organic matter present in certain volume of a sample of water is called Biochemical Oxygen Demand (BOD) of the water.

Water considered to be pure if it has BOD less than 5 ppm whereas highly polluted water has BOD more than 17ppm.

Thus, water having BOD less than 5 ppm is rich in dissolved oxygen.

**Q. 5** Which of the following statement(s) is/are wrong?

- (a) Ozone is not responsible for green house effect
- (b) Ozone can oxidise sulphur dioxide present in the atmosphere to sulphur trioxide
- (c) Ozone hole is thinning of ozone layer present in stratosphere
- (d) Ozone is produced in upper stratosphere by the action of UV rays on oxygen

**Ans. (a)**  $O_3$  is responsible for greenhouse effect. Its contribution is about 8%.

**Note** The warming of earth due to re-emission of sun's energy absorbed by the earth followed by its absorption by  $CO_2$  and  $H_2O$  vapour present near the earth surface and then its radiation back to earth is called green house effect.

**Q. 6** Sewage containing organic waste should not be disposed in water bodies because it causes major water pollution. Fishes in such a polluted water die because of

- (a) large number of mosquitoes
- (b) increase in the amount of dissolved oxygen
- (c) decrease in the amount of dissolved oxygen in water
- (d) clogging of gills by mud

**Ans. (c)** Dissolved oxygen is essential for aquatic life. Organic waste is oxidised by microorganisms using dissolved oxygen. Hence, oxygen from water decreases. It is harmful for aquatic life.

**Q. 7** Which of the following statements about photochemical smog is wrong?

- (a) It has high concentration of oxidising agents
- (b) It has low concentration of oxidising agent
- (c) It can be controlled by controlling the release of  $NO_2$ , hydrocarbons, ozone etc
- (d) Plantation of some plants like pinus helps in controlling photochemical smog

**Ans. (b)** Photochemical smog or Los Angeles smog was first observed in Los Angeles in 1950. It is formed due to photochemical reactions taking place when air contain  $NO_2$  and hydrocarbons.

The concentrations of  $O_3$ , PAN,  $RCHO$  and  $R_2CO$  builds up in the atmosphere. These compounds produce irritation in the eyes. Photochemical smog has high concentration of oxidants such as  $O_3$ , organic oxidant etc.



**Q. 8** The gaseous envelope around the earth is known as atmosphere. The lowest layer of this is extended upto 10 km from sea level, this layer is

- (a) stratosphere      (b) troposphere      (c) mesosphere      (d) hydrosphere

**Ans. (b)** Troposphere is the lowest region of the atmosphere. It extends upto the height of ~10 km from sea level. Troposphere is a turbulent, dusty zone containing air, much water vapour and clouds.

**Note** The atmosphere is divided into four major regions

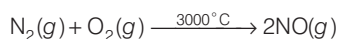
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| (i) Troposphere  | (ii) Stratosphere |
| (iii) Mesosphere | (iv) Thermosphere |

**Q. 9** Dinitrogen and dioxygen are 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 very high temperature  
(b) the reaction can be initiated only in presence of a catalyst  
(c) oxides of nitrogen are unstable  
(d)  $N_2$  and  $O_2$  are unreactive

**Ans. (a)** Major components of atmosphere are dinitrogen, dioxygen and water vapour  
 $N_2 = 78.08\%$ ,  $O_2 = 20.95\%$ .

Both do not react with each other as nitrogen is an inactive gas. The triple bond in  $N_2$  is very stable and its dissociation energy is very high. Both react with each other at very high temperature.

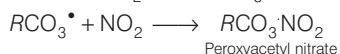
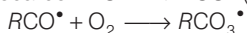
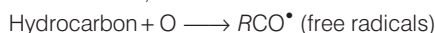


**Q. 10** The pollutants which come directly in the air from sources are called primary pollutants. Primary pollutants are sometimes converted into secondary pollutants. Which of the following belongs to secondary air pollutants?

- (a) CO      (b) Hydrocarbon  
(c) Peroxyacetyl nitrate      (d) NO

**Ans. (c)** Hydrocarbons present in atmosphere combine with oxygen atom produced by the photolysis of  $NO_2$  to form highly reactive intermediate called free radical. Free radical initiates a series of reaction.

Peroxyacetyl nitrates are formed, which can be said as secondary pollutants.



**Q. 11** Which of the following statements is correct?

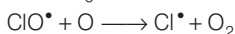
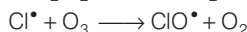
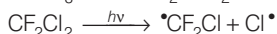
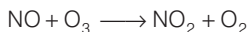
- (a) Ozone hole is a hole formed in stratosphere from which ozone oozes out  
(b) Ozone hole is a hole formed in troposphere from which ozone oozes out  
(c) Ozone hole is thinning of ozone layer of stratosphere at some places  
(d) Ozone hole means vanishing of ozone layer around the earth completely

**Ans. (c)** Ozone hole is thinning of ozone layer of stratosphere at some place.

Two types of compounds have been found to be the most responsible for depleting the ozone layer.



These are (i) NO (ii) chlorofluoro carbon



These reactions occur in stratosphere.

**Q. 12** Which of the following practices will not come under green chemistry?

- (a) If possible, making use of soap made of vegetable oils instead of using synthetic detergents
- (b) Using  $\text{H}_2\text{O}_2$  for bleaching purpose instead of using chlorine based bleaching agents
- (c) Using bicycle for travelling small distances instead of using petrol/ diesel based vehicles
- (d) Using plastic cans for neatly storing substances

**Ans. (d)** Using plastic cans for neatly storing substances will not come under green chemistry. Water in lakes and rivers have been polluted by the use of plastic materials. The plastic materials are non-biodegradable.

## Multiple Choice Questions (More Than One Options)

**Q. 13** Which of the following conditions shows the polluted environment ?

- (a) pH of rain water is 5.6
- (b) Amount of carbon dioxide in the atmosphere is 0.03%
- (c) Biochemical oxygen demand 10 ppm
- (d) Eutrophication

**Ans. (c, d)**

Polluted water may contain nutrients for the growth of algae, which covers the water surface and reduces the oxygen concentration in water. This leads to anaerobic condition, accumulation of abnoxious decay and animal death. This is process of eutrophication.

The amount of oxygen required by bacteria to break down the organic matter present in a certain volume of sample of water, is called Biochemical Oxygen Demand. Clean water would have BOD value of 5 ppm whereas highly polluted could have BOD value of 17ppm or more.

Normally rain water has pH of 6 due to  $\text{H}^+$  ion formed by reaction of rain water with carbon dioxide in the atmosphere. When the pH of the rain water drops below 5.6, it is called acid rain.

**Q. 14** Phosphate containing fertilisers cause water pollution. Addition of such compounds in water bodies causes .....

- (a) enhanced growth of algae
- (b) decrease in amount of dissolved oxygen in water
- (c) deposition of calcium phosphate
- (d) increase in fish population



**Ans. (a, b)**

Fertilisers contain phosphates as additives. The addition of phosphates in water enhances, algae growth. Such profuse growth of algae covers the water surface and reduces the oxygen concentration in water.

This leads to anaerobic condition, commonly with accumulation of abnoxious decay and animal death. Thus, bloom infested water inhibits the growth of other living organisms in the water body.

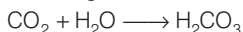
This process in which nutrient enriched water bodies support a dense plant population which kills animal life by depriving it of oxygen and results in subsequent loss of biodiversity is known as eutrophication.

**Q. 15** The acids present in acid rain are .....

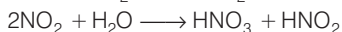
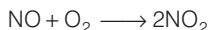
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| (a) Peroxyacetyl nitrate | (b) $\text{H}_2\text{CO}_3$ |
| (c) $\text{NHO}_3$       | (d) $\text{H}_2\text{SO}_4$ |

**Ans. (b, c, d)**

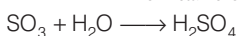
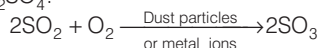
$\text{CO}_2$  is slightly soluble in water forming carbonic acid.



The oxides of nitrogen undergo oxidation reaction followed by reaction with water vapours to form nitric acid.



The oxidation of  $\text{SO}_2$  into  $\text{SO}_3$  in presence of dust particles or metal ions.  $\text{SO}_3$ , then react with water vapours to form  $\text{H}_2\text{SO}_4$ .



**Q. 16** The consequences of global warming may be .....

- (a) increase in average temperature of the earth
- (b) melting of Himalayan Glaciers
- (c) increased biochemical oxygen demand
- (d) eutrophication

**Ans. (a, b)**

If the rate at which solar radiation are arriving the earth remain constant but the amount of  $\text{CO}_2$  in the air increases. The heat radiated back to the earth will increase consequently, the temperature of the earth surface will increase.

This increase in temperature will disturb the thermal balance on the earth and could cause glaciers and ice caps to melt.



## Short Answer Type Questions

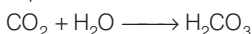
**Q. 17** Green house effect leads to global warming. Which substances are responsible for green house effect?

**Ans.** The various gases which bring green house effect responsible for global warming are the following with relative contributions

Various gases	Relative contribution
Carbon dioxide	50%
Water vapour	2%
Nitrous oxide	4%
Ozone	8%
Chlorofluorocarbons	17%
Methane	19%

**Q. 18** Acid rain is known to contain some acids. Name these acids and where from they come in rain?

**Ans.** Acid rain contains  $\text{H}_2\text{CO}_3$ ,  $\text{HNO}_3$  and  $\text{H}_2\text{SO}_4$ .  $\text{H}_2\text{CO}_3$  is formed by the dissolution of  $\text{CO}_2$  of the air in which the water vapour present.

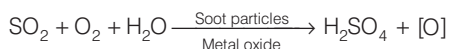


Forest fire and lightning are the natural source of nitric oxide (NO). Nitrogen oxides are also produced by combustion engines, aircraft, furnaces, incinerators, industrial plants.

Nitric oxide slowly reacts with atmospheric air and produce  $\text{NO}_2$ .  $\text{NO}_2$  dissolves in water to form  $\text{HNO}_3$ .



Sulphur oxides are produced by the burning of fossil fuels and in extraction of metals from their sulphide ores etc. Sulphur dioxide also produces sulphuric acid in the similar way.



**Q. 19** Ozone is a toxic gas and is a strong oxidising agent even then its presence in the stratosphere is very important. Explain what would happen if ozone from this region is completely removed?

**Ans.** The ozone layer in the stratosphere is a natural feature of the earth's environment. The ozone layer exists between 20 to 35 km above the earth surface layer. This layer protects the earth from the harmful effects of the ultraviolet radiation of the sun.

A depletion of ozone layer is considered as a serious threat to all forms of life on the earth. A 5% decrease in ozone concentration could increase the incidence of skin cancer by 20%. Ultraviolet radiation is also the factor for disease of eye, including cataract formation.

It can cause genetic mutations and destroy crops and other forms of vegetation. Aquatic animals and aquatic plants are generally affected by UV-radiation.

**Q. 20** Dissolved oxygen in water is very important for aquatic life. What processes are responsible for the reduction of dissolved oxygen in water?

**Ans.** The process which are responsible for the reduction of dissolved oxygen in water are use of phosphatic and nitrate fertilisers, detergents, the discharge of human sewage and organic waste from food, paper and pulp industries.

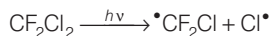
The microorganisms which oxidise organic matter also utilise oxygen dissolved in water. Moreover during night, photosynthesis stops but the aquatic plants continue to respire, resulting in reduction of dissolved oxygen.



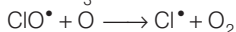
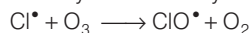
**Q. 21** On the basis of chemical reactions involved, explain how do chlorofluorocarbons cause thinning of ozone layer in stratosphere?

**Ans.** Chlorofluorocarbons are introduced into the atmosphere from aerosol sprays in which they function as propellants and from refrigerating equipments in which they act as coolants. It is also used as solvents.

It has very long life and stay in atmosphere for years and ultimately reach the upper layer of atmosphere (stratosphere) where it decompose in presence of UV-radiation of the sun. On account of decomposition, it forms chlorine atom or free radicals.



The active chlorine atoms then destroy the ozone layer.



It has been found that one molecule of chlorofluorocarbon can destroy one thousand ozone molecules in the stratosphere.

**Q. 22** What could be the harmful effects of improper management of industrial and domestic solid waste in a city?

**Ans.** All the solid wastes either domestic or industrial are of two types

(i) biodegradable and

(ii) non-biodegradable

If the disposal of these wastes is not properly done, these wastes may find their way into sewers and some may be eaten up by the cattle. The non-biodegradable waste like polythene bags, if swallowed by cattle, can result into their death.

**Q. 23** During an educational trip, a student of botany saw a beautiful lake in a village. She collected many plants from that area. She noticed that villagers were washing clothes around the lake and at some places waste material from houses was destroying its beauty.

After few years, she visited the same lake again. She was surprised to find that the lake was covered with algae, stinking smell was coming out and its water had become unusable. Can you explain the reason for this condition of the lake?

#### 🔍 Thinking Process

*This phenomenon shows the process of eutrophication. Eutrophication is the process in which the waste materials enter into water. As a result, formation of algae is accelerated and concentration of dissolved oxygen decreases.*

**Ans.** The process of eutrophication is responsible for this condition of lake. The domestic waste and organic compounds such as detergents can provide plant nutrients which can enhance the growth of algae and aquatic plants.

These are decomposed by the bacterial population giving disagreeable odour and spoiling the beauty of the lake.

**Q. 24** What are biodegradable and non-biodegradable pollutants?

**Ans.** Biodegradable pollutants are those which are decomposed by bacteria e.g., sewage, cow dung, fruit, vegetable etc.

Non-biodegradable pollutants are those which cannot be decomposed by bacteria e.g., mercury, aluminium, lead, copper, DDT etc.



**Q. 25** What are the sources of dissolved oxygen in water?

**Ans.** The following are the sources of dissolved oxygen in water

- (i) Photosynthesis by aquatic plants
- (ii) Due to direct contact of the water surface with air i.e., natural aeration
- (iii) Mechanical aeration

**Q. 26** What is the importance of measuring BOD of a water body?

**Ans.** Biological Oxygen Demand (BOD) is the measure of level of pollution caused by organic biodegradable material. These biodegradable materials are decomposed by microorganism (bacteria) consuming dissolved oxygen.

Low value of BOD indicates that water contains less biodegradable material.

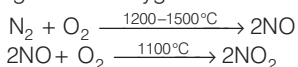
**Q. 27** Why does water covered with excessive algae growth become polluted?

**Ans.** Presence of excessive algae growth shows that water contains a lot of phosphate due to inflow of fertilizers, etc., from the surroundings.

The decomposition of algae growth produces bad smell and unattractive appearance making it unfit for recreational use like swimming, boating etc. Further, decrease in dissolved oxygen may be harmful for aquatic species like fishes etc.

**Q. 28** A factory was started near a village. Suddenly villagers started feeling the presence of irritating vapours in the village and cases of headache, chest pain, cough, dryness of throat and breathing problems increased. Villagers blamed the emissions from the chimney of the factory for such problems. Explain what could have happened. Give chemical reactions for the support of your explanation.

**Ans.** The symptoms observed in a village indicate that nitrogen oxide and sulphur oxide are released from the chimney of the factory. These are produced by the burning of fossil fuels such as gasoline, coal, natural gas etc. In an automobile engine, at high temperature when fossil fuel is burnt, dinitrogen and dioxygen combine to yield NO is i.e., nitric oxide.

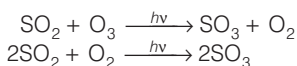


SO<sub>2</sub> is produced by burning of sulphur containing fossil fuel or by roasting of sulphide ores such as iron pyrites, copper pyrites etc.



**Q. 29** Oxidation of sulphur dioxide into sulphur trioxide in the absence of a catalyst is a slow process but this oxidation occurs easily in the atmosphere. Explain how does this happen? Give chemical reactions for the conversion of SO<sub>2</sub> into SO<sub>3</sub>.

**Ans.** The oxidation of sulphur dioxide into sulphur trioxide can occur both photochemically or non-photochemically. In the near ultraviolet region, the SO<sub>2</sub> molecules react with ozone photochemically.

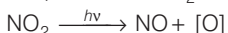


Non-photochemically, SO<sub>2</sub> may be oxidised by molecular oxygen in presence of dust and soot particles.

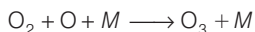


**Q. 30** From where does ozone come in the photochemical smog?

**Ans.** Sunlight cause photochemical decomposition of  $\text{NO}_2$  into NO and O.



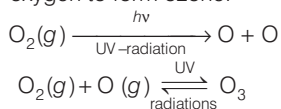
Atomic oxygen is a highly reactive species. It combines with diatomic oxygen and forms ozone.



where,  $M$  is inert gas such as nitrogen. This,  $\text{O}_3$  is formed during the formation of smog.

**Q. 31** How is ozone produced in stratosphere?

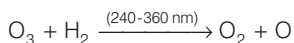
**Ans.** Ozone in stratosphere is a product of action of UV-radiations on dioxygen ( $\text{O}_2$ ) molecules. The UV radiation split apart molecular oxygen into free oxygen atoms. These oxygen atoms combine with the molecular oxygen to form ozone.



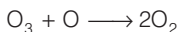
**Note** In stratosphere, a photon with a wavelength between 180 nm and 240 nm breaks the  $\text{O}_2$  molecule into atomic oxygen.

**Q. 32** Ozone is a gas heavier than air. Why does ozone layer not settle down near the earth?

**Ans.** In stratosphere, the formation of  $\text{O}_3$  goes on continuously but  $\text{O}_3$  is also decomposed by UV- radiation between 240 nm to 360 nm.



The O-atom reacts with  $\text{O}_3$  molecule



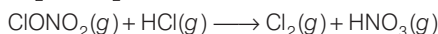
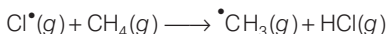
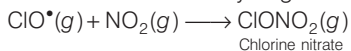
Net reaction



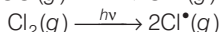
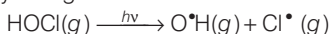
Thus, the reaction form a delicate balance in which the rate of  $\text{O}_3$  decomposition match the rate of  $\text{O}_3$  formation is a dynamic equilibrium exists and maintains a constant concentration of  $\text{O}_3$ .

**Q. 33** Some time ago formation of polar stratospheric clouds was reported over Antarctica. Why were these formed? What happens when such clouds break up by warmth of sunlight?

**Ans.** In summer season, nitrogen dioxide and methane react with chlorine monoxide and chlorine atoms forming chlorine sinks, preventing much ozone depletion, whereas in winter, special type of clouds called polar stratospheric clouds are formed over Antarctica. These polar stratospheric clouds provide surface on which chlorine nitrate gets hydrolysed to form hypochlorous acid. It also reacts with hydrogen chloride to give molecular chlorine.



When sunlight returns to the Antarctica in the spring, the sun's warmth breaks up the clouds and HOCl,  $\text{Cl}_2$  are photolysed by sunlight.



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



**Q. 34** A person was using water supplied by Municipality. Due to shortage of water he started using underground water. He felt laxative effect. What could be the cause?

**Ans.** The laxative effect is observed only when the sulphates present in water have concentration greater than 500 ppm. Otherwise at moderate levels it is harmless.

## Matching The Columns

**Q. 35** Match the terms given in Column I with the compounds given in Column II.

Column I	Column II
A. Acid rain	1. $\text{CHCl}_2\text{-CHF}_2$
B. Photochemical smog	2. CO
C. Combination with haemoglobin	3. $\text{CO}_2$
D. Depletion of ozone layer	4. $\text{SO}_2$
	5. Unsaturated hydrocarbons

**Ans.** A.  $\rightarrow$  (3, 4)    B.  $\rightarrow$  (4, 5)    C.  $\rightarrow$  (2)    D.  $\rightarrow$  (1)

A. Acid rain is due to oxides of carbon, sulphur (unsaturated hydrocarbon) and nitrogen.

B. Photochemical smog is formed by unburnt fuel (unsaturated hydrocarbon and  $\text{SO}_2$ ).

C. Carbon monoxide with haemoglobin is poisonous.

D. Chlorofluorocarbon ( $\text{CHCl}_2\text{-CHF}_2$ ) cause ozone depletion.

**Q. 36** Match the pollutant(s) in Column I with the effect(s) in Column II.

Column I	Column II
A. Oxides of sulphur	1. Global warming
B. Nitrogen dioxide	2. Damage to kidney
C. Carbon dioxide	3. 'Blue baby' syndrome
D. Nitrate in drinking water	4. Respiratory diseases
E. Lead	5. Red haze in traffic and congested areas

**Ans.** A.  $\rightarrow$  (4)    B.  $\rightarrow$  (5)    C.  $\rightarrow$  (1)    D.  $\rightarrow$  (3)    E.  $\rightarrow$  (2)

A. Low concentration of sulphur dioxide causes respiratory disease e.g., asthma, bronchitis etc.

B. The irritant red haze in the traffic and congested place is due to oxides of nitrogen.

C. The increased amount of  $\text{CO}_2$  in air is mainly responsible for global warming.

D. Excess nitrate in drinking water cause methemoglobinemia (blue baby syndrome).

E. Lead can damage kidney, liver, reproductive system etc.

**Q. 37** Match the activity given in Column I with the type of pollution created by it given in Column II.

Column I (Activity)	Column II (Effect)
A. Releasing gases to the atmosphere after burning waste material containing sulphur	1. Water pollution
B. Using carbamates as pesticides	2. Photochemical smog, damage to plant life, corrosion to building material, induce breathing problems, water pollution
C. Using synthetic detergents for washing clothes	3. Damaging ozone layer
D. Releasing gases produced by automobiles and factories in the atmosphere	4. May cause nerve diseases in human
E. Using chlorofluorocarbon compounds for cleaning computer parts	5. Classical smog, acid rain, water pollution, induce breathing problems, damage to buildings, corrosion of metals

**Ans.** A. → (5)    B. → (4)    C. → (1)    D. → (2)    E. → (3)

- A. Classical smog, acid rain, water pollution, induce breathing problems, damage to buildings, corrosion of metals.  
 B. May cause nerve disease in human.  
 C. Water pollution.  
 D. Photochemical smog, damage to plant life, corrosion to building material, induce breathing problems, water pollution.  
 E. Damaging ozone layer.

**Q. 38** Match the pollutants given in Column I with their effects given in Column II.

Column I	Column II
A. Phosphate fertilisers in water	1. BOD level of water increases
B. Methane in air	2. Acid rain
C. Synthetic detergents in water	3. Global warming
D. Nitrogen oxides in air	4. Eutrophication

A. → (1, 4)    B. → (3)    C. → (1)    D. → (2)

- A. Phosphate fertilisers increase growth of algae increasing BOD level, causing eutrophication.  
 B. Methane oxidises to  $\text{CO}_2$  which causes, global warming.  
 C. Synthetic detergents increases BOD level.  
 D. Nitrogen oxide mix with water forming nitric acid.

## Assertion and Reason

*In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below in each question.*

**Q. 39 Assertion (A)** Green house effect was observed in houses used to grow plants and these are made of green glass.

**Reason (R)** Green house name has been given because glass houses are made of green glass.

- (a) Both A and R are correct and R is the correct explanation of A
- (b) Both A and R are correct but R is not the correct explanation of A
- (c) Both A and R are not correct
- (d) A is not correct but R is correct

**Ans. (c)** Both assertion and reason are not correct.

In cold countries, sunlight required to grow plants is less. Hence, plants are kept in a house made of glass, placed in such a manner, so that sunlight enters the green house, heat up the soil and plants.

The warm soil and plants emit infrared radiations. Since, glass is opaque to infrared radiations, it partly reflects and partly absorbs these radiations.

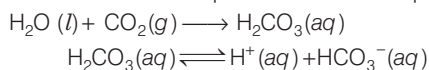
**Q. 40 Assertion (A)** The pH of acid rain is less than 5.6.

**Reason (R)** Carbon dioxide present in the atmosphere dissolves in rain water and forms carbonic acid.

- (a) Both A and R are correct and R is the correct explanation of A
- (b) Both A and R are correct but R is not the correct explanation of A
- (c) Both A and R are not correct
- (d) A is not correct but R is correct

**Ans. (b)** Both assertion and reason are correct but reason is not the correct explanation of assertion.

Normally rain water has a pH of 5.6 due to the presence of  $H^+$  ions formed by the reaction of rain water with carbon dioxide present in the atmosphere.



When the pH of rain water drops below 5.6 it is called acid rain.

**Q. 41 Assertion (A)** Photochemical smog is oxidising in nature.

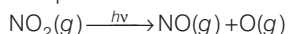
**Reason (R)** Photochemical smog contains  $NO_2$  and  $O_3$ , which are formed during the sequence of reactions.

- (a) Both A and R are correct and R is the correct explanation of A
- (b) Both A and R are correct but R is not the correct explanation of A
- (c) Both A and R are not correct
- (d) A is not correct but R is correct

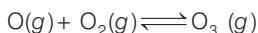
**Ans. (a)** Both assertion and reason are correct and reason is the correct explanation of assertion.

When fossil fuel are burnt, a variety of pollutants are emitted into the earth's troposphere. Two of the pollutants that are emitted hydrocarbons (unburnt fuels) and nitric oxide (NO).

When these pollutants build up to sufficiently high levels, a chain reaction occurs from their interaction with sun light in which NO oxidises to NO<sub>2</sub>. This NO<sub>2</sub> in turns absorbs energy from sunlight and breaks up into nitric oxide and free oxygen atom.



Oxygen atoms are very reactive and combine with O<sub>2</sub> in air to produce ozone.



**Q. 42 Assertion (A)** Carbon dioxide is one of the important green house gases.

**Reason (R)** It is largely produced by respiratory function of animals and plants.

- (a) Both A and R are correct and R is the correct explanation of A
- (b) Both A and R are correct but R is not the correct explanation of A
- (c) Both A and R are not correct
- (d) A is not correct but R is correct

**Ans. (b)** Both assertion and reason are correct but reason is not the correct explanation of assertion.

Carbon dioxide is one of the important green house gases. It is largely produced by the combustion of fossil fuels like coal, natural gas, petroleum, etc. It is also produced by respiratory function of animals and plants.

**Q. 43 Assertion (A)** Ozone is destroyed by solar radiation in upper stratosphere.

**Reason (R)** Thinning of the ozone layer allows excessive UV radiations to reach the surface of earth.

- (a) Both A and R are correct and R is the correct explanation of A
- (b) Both A and R are correct but R is not the correct explanation of A
- (c) Both A and R are not correct
- (d) A is not correct but R is correct

**Ans. (d)** Assertion is not correct but reason is correct.

**Ozone** layer is found in the stratosphere. The depletion of ozone layer (creation of ozone hole) is taking place due to reaction with NO (produced from natural sources or human activity or in the exhaust gases of engines of supersonic planes) or by reaction with **chlorofluorocarbons** (CFC's) called **freons** (produced from aerosol sprays used in propellents or from refrigerators where they are used as coolants).

The ozone hole allows the UV radiations to pass through and reach us, increasing chances of skin cancer.

**Q. 44 Assertion (A)** Excessive use of chlorinated synthetic pesticides causes soil and water pollution.

**Reason (R)** Such pesticides are non-biodegradable.

- (a) Both A and R are correct and R is the correct explanation of A
- (b) Both A and R are correct but R is not the correct explanation of A
- (c) Both A and R are not correct
- (d) A is not correct but R is correct



**Ans. (a)** Both assertion and reason are correct but reason is the correct explanation of assertion. Insecticides, pesticides and herbicides cause soil and water pollution. They are non-biodegradable.

**Q. 45 Assertion (A)** If BOD level of water in a reservoir is less than 5 ppm it is highly polluted.

**Reason (R)** High biological oxygen demand means low activity of bacteria in water.

- (a) Both A and R are correct and R is the correct explanation of A
- (b) Both A and R are correct but R is not the correct explanation of A
- (c) Both A and R are not correct
- (d) A is not correct but R is correct

**Ans. (c)** Both assertion and reason are not correct.

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).

If BOD level is less than 5 ppm, water is almost pure. High biological oxygen demand means high activity of bacteria in water.

## Long Answer Type Questions

**Q. 46** How can you apply green chemistry for the following?

- (a) To control photochemical smog.
- (b) To avoid use of halogenated solvents in drycleaning and that of chlorine in bleaching.
- (c) To reduce use of synthetic detergents.
- (d) To reduce the consumption of petrol and diesel.

**Ans. (a)** The most straight forward way to reduce or prevent the formation of photochemical smog is to minimise the release of oxides of nitrogen and hydrocarbons to the atmosphere.

*The following methods can be applied to minimise the oxides of nitrogen and hydrocarbons.*

- (i) By fitting efficient catalytic converters in automobiles, the harmful gases are converted catalytically into harmless gases.
- (ii) By spraying certain compound into the atmosphere which generate free radicals that readily combine with the free radicals that initiate the reactions forming toxic compounds of the photochemical smog.  
The compound diethyl hydroxylamine has been found to possess smog inhibiting property.
- (iii) Certain plants such as pinus, juniparus, pyrus, irtis etc., can metabolise oxides of nitrogen.



- (b) Solvents used to dryclean clothes are usually chlorinated compounds which are carcinogen. Suitable detergents which work in liquid carbon dioxide have been discovered to replace the chlorinated compounds.

For bleaching of clothes in laundry,  $\text{H}_2\text{O}_2$  and not  $\text{Cl}_2$  is used which gives better results and is not harmful. Earlier,  $\text{Cl}_2$  gas was used for bleaching paper. Chlorine is highly toxic in nature. Its use has been replaced by  $\text{H}_2\text{O}_2$  in presence of a suitable catalyst.

- (c) To reduce the use of synthetic detergents as cleaning agent, emphasis should be made on the use of soaps prepared of vegetable oils. The vegetable oils are biodegradable while detergents do not undergo biodegradation.

- (d) Instead of petrol and diesel, the use of **CNG** (Condensed Natural Gas) and **LNG** (Liquified Natural Gas) has been preferred as they are pollution free fuels.

The other sources such as hydrogen, ethyl alcohol, etc., can be tried in place of petrol and diesel.

**Q. 47** Green plants use carbon dioxide for photosynthesis and return oxygen to the atmosphere, even then carbon dioxide is considered to be responsible for green house effect. Explain why?

**Ans.** Carbon dioxide is a natural constituent of atmosphere and is vital for all forms of plant life. It forms about **0.033%** by volume of atmosphere. It helps to maintain the temperature of the earth required for living organisms.

A balance of  $\text{CO}_2$  is maintained in air because  $\text{CO}_2$  is produced from respiration, burning of fossil fuels and decomposition of lime stone but at the same time, it is consumed in photosynthesis by plants.

However, human activities have disturbed this balance and  $\text{CO}_2$  level in atmosphere is in increasing order. This has happened due to deforestation, burning of more fossil fuel and industrialisation. It has been estimated that  $\text{CO}_2$  concentration has risen about 25% in the past century.

During the past nearly 120 years, the average temperature of the planet has increased by somewhere between  $0.4^\circ\text{C}$  to  $0.8^\circ\text{C}$ . Current estimated are that doubling the  $\text{CO}_2$  concentration will result in a temperature increase of between  $1.0^\circ\text{C}$  and  $3.5^\circ\text{C}$ . In green house effect, contribution of  $\text{CO}_2$  is 50% and of other trace gases is also about 50%.

**Q. 48** Explain how does green house effect cause global warming?

**Ans.** Visible light from the sun reaches the earth and heats it up. However, when the earth cools, the energy is re-emitted from the earth's surface in the form of infrared radiation which have **longer wavelength** and **heating effect**.

These infrared radiation can be absorbed by  $\text{CO}_2$  and  $\text{H}_2\text{O}$  vapours. The heat thus absorbed is radiated back to the surface of the earth. In this way, warming of the earth occurs.

If the rate at which solar energy is arriving the earth remains constant but the amount of  $\text{CO}_2$  in the air increases, the heat radiated back to the earth will increase. Consequently, the temperature of the earth's surface will increase.

Hence, **global warming** depends on the concentration of those gases which are responsible for green house effect.



**Q. 49** A farmer was using pesticides on his farm. He used the produce of his farm as food for rearing fishes. He was told that fishes were not fit for human consumption because large amount of pesticides had accumulated in the tissues of fishes. Explain how did this happen?

**Ans.** **Pesticides** from soil are transferred into the crops and from the crops these are transferred into rearing fish food. Pesticides entered into water through rearing fish food and finally entered into the bodies of the fishes.

Therefore, pesticides are transferred from lower trophic level to higher trophic level through food chain. Over the time, the concentration of pesticides in fishes reach a level which causes serious metabolic and physiological disorders.

**Q. 50** For dry cleaning, in the place of tetrachloroethane, liquified carbon dioxide with suitable detergent is an alternative solvent. What type of harm to the environment will be prevented by stopping use of tetrachloroethane? Will use of liquified carbon dioxide with detergent be completely safe from the point of view of pollution? Explain.

**Ans.** Tetrachloroethane,  $\text{Cl}_2\text{CH} - \text{CHI}_2$  is suspected to be carcinogenic and also contaminates the ground water. The harmful effect will be prevented by using liquified  $\text{CO}_2$  along with suitable detergent.

Use of liquified  $\text{CO}_2$  along with detergent will not be completely safe because most of the detergents are non-biodegradable and they cause water pollution. Moreover, liquified  $\text{CO}_2$  will ultimately enter into the atmosphere and contributed to the green house effect.