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Environmental Chemistry

I. MULTIPLE CHOICE QUESTIONS (TYPE-I)

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

- (i) CO (ii) O₃
(iii) CH₄ (iv) H₂O vapour

Ans. (i)

Explanation: CO does not absorb sunlight near the earth's surface and then it is not radiated back to the earth. Green house gases have this property.

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

- (i) NO₂ (ii) O₃
(iii) SO₂ (iv) Unsaturated hydrocarbon

Ans. (iii)

Explanation: Photochemical fog is formed in the presence of sunlight in summer when NO and hydrocarbons are present in large amounts in atmosphere. SO₂ is not responsible for photochemical fog.

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

- (i) Its main components are produced by the action of sunlight on emissions of automobiles and factories.
(ii) Produced in cold and humid climate.
(iii) It contains compounds of reducing nature.
(iv) It contains smoke, fog and sulphur dioxide.

Ans. (i)

Explanation: Classical smog is a mixture of smoke, fog and sulphur dioxide. It occurs in cold humid climate. Gases released by automobiles and factories are not responsible for classical fog.

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 _____.

- (i) rich in dissolved oxygen.
(ii) poor in dissolved oxygen.
(iii) highly polluted.
(iv) not suitable for aquatic life.

Ans. (i)

Explanation: The total amount of oxygen consumed by microorganism in decomposing organic matter present in certain volume of water is

called Biochemical Oxygen Demand (BOD) of water. If BOD value is less than 5 ppm, then sample of water is considered to be pure. It is rich in dissolved oxygen.

5. Which of the following statements is wrong?

- (i) Ozone is not responsible for green house effect.
- (ii) Ozone can oxidise sulphur dioxide present in the atmosphere to sulphur trioxide.
- (iii) Ozone hole is thinning of ozone layer present in stratosphere.
- (iv) Ozone is produced in upper stratosphere by the action of UV rays on oxygen.

Ans. (i)

Explanation: O_3 is responsible for green house effect, its contribution is about 8 to 10%. About 75% of the solar energy reaching the earth is absorbed by the earth's surface, which increases its temperature. The rest of the heat radiates back to the atmosphere. Some of the heat is trapped by gases such as carbon dioxide, methane, ozone, chlorofluorocarbon compounds (CFCs) and water vapour in the atmosphere. Thus, they add to the heating of the atmosphere. This causes global warming.

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

- (i) Large number of mosquitoes.
- (ii) Increase in the amount of dissolved oxygen.
- (iii) Decrease in the amount of dissolved oxygen in water.
- (iv) Clogging of gills by mud.

Ans. (iii)

Explanation: Organic waste is oxidized by microorganisms in presence of dissolved oxygen. Hence, oxygen decreases in water as a result it is harmful for aquatic life.

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

- (i) It has high concentration of oxidising agents.
- (ii) It has low concentration of oxidising agents.
- (iii) It can be controlled by controlling the release of NO_2 , hydrocarbons, ozone etc.
- (iv) Plantation of some plants like pinus helps in controlling photochemical smog.

Ans. (ii)

Explanation: The common components of photochemical smog are ozone, nitric oxide, acrolein, formaldehyde and peroxyacetyl nitrate (PAN). Photochemical smog causes serious health problems. Both ozone and PAN act as powerful eye irritants. Photochemical smog has high concentration of oxidants.

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 _____.

- (i) Stratosphere (ii) Troposphere
(iii) Mesosphere (iv) Hydrosphere

Ans. (ii)

Explanation: The lowest region of atmosphere in which the human beings along with other organisms live is called troposphere. It extends up to the height of ~ 10 km from sea level.

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

- (i) the reaction is endothermic and requires very high temperature.
(ii) the reaction can be initiated only in presence of a catalyst.
(iii) oxides of nitrogen are unstable.
(iv) N_2 and O_2 are unreactive.

Ans. (i)

Explanation: Dinitrogen and dioxygen are the main constituents of air. These gases do not react with each other at a normal temperature. The dissociation energy of N_2 is very high due to the presence of triple bond and it is very stable.

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?

- (i) CO (ii) Hydrocarbon
(iii) Peroxyacetyl nitrate (iv) NO

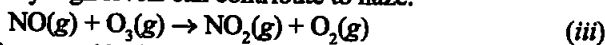
Ans. (iii)

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

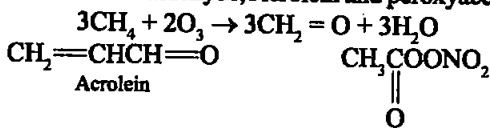
Oxygen atoms are very reactive and combine with the O_2 in air to produce ozone.



The ozone formed in the above reaction (ii) reacts rapidly with the $NO(g)$ formed in the reaction (i) to regenerate NO_2 . NO_2 is a brown gas and at sufficiently high levels can contribute to haze.



Ozone is a toxic gas and both NO_2 and O_3 are strong oxidising agents and can react with the unburnt hydrocarbons in the polluted air to produce chemicals such as formaldehyde, Acrolein and peroxyacetyl nitrate (PAN).



Peroxyacetyl nitrate (PAN)

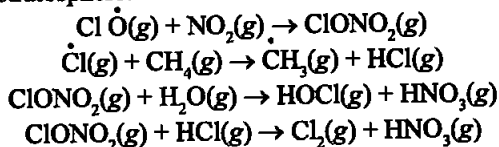
11. Which of the following statements is correct?

- (i) Ozone hole is a hole formed in stratosphere from which ozone oozes out.
- (ii) Ozone hole is a hole formed in the troposphere from which ozone oozes out.
- (iii) Ozone hole is thinning of ozone layer of stratosphere at some places.
- (iv) Ozone hole means vanishing of ozone layer around the earth completely.

Ans. (iii)

Explanation: It was found that a unique set of conditions was responsible for the ozone hole.

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. Following reactions occur in stratosphere.



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

- (i) If possible, making use of soap made of vegetable oils instead of using synthetic detergents.
- (ii) Using H_2O_2 for bleaching purpose instead of using chlorine based bleaching agents.
- (iii) Using bicycle for travelling small distances instead of using petrol/diesel based vehicles.
- (iv) Using plastic cans for neatly storing substances.

Ans. (iv)

Explanation: Use of plastic cans for neatly storing substances will not come under green chemistry because plastic is non-biodegradable and causing pollution.

II. MULTIPLE CHOICE QUESTIONS (TYPE-II)

In the following questions two or more options may be correct.

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

- (i) pH of rain water is 5.6.
- (ii) amount of carbon dioxide in the atmosphere is 0.03%.
- (iii) biochemical oxygen demand 10 ppm.
- (iv) eutrophication.

Ans. (iii) and (iv)

Explanation: Clean water would have BOD less than 5 ppm and polluted water has BOD value higher than 5 ppm. 10 BOD means highly polluted water. 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.

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

- (i) enhanced growth of algae.
- (ii) decrease in amount of dissolved oxygen in water.
- (iii) deposition of calcium phosphate.
- (iv) increase in fish population.

Ans. (i) and (ii)

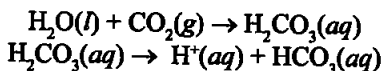
Explanation: Fertilizers contain phosphates as additives. The addition of phosphates in water enhances algae growth. Such profuse growth of algae, covers the water surface and reduces the oxygen concentration in water.

15. The acids present in acid rain are _____.

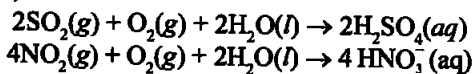
- (i) Peroxyacetylnitrate
- (ii) H_2CO_3
- (iii) HNO_3
- (iv) H_2SO_4

Ans. (ii), (iii) and (iv)

Explanation: 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 the rain water drops below 5.6, it is called acid rain. SO_2 and NO_2 after oxidation and reaction with water are major contributors to acid rain,



16. The consequences of global warming may be _____.

- (i) increase in average temperature of the earth
- (ii) melting of Himalayan Glaciers.
- (iii) increased biochemical oxygen demand.
- (iv) eutrophication.

Ans. (i) and (ii)

Explanation: About 75% of the solar energy reaching the earth is absorbed by the earth's surface, which increases its temperature. The rest of the heat radiates back to the atmosphere. The average global temperature will increase to a level which may lead to melting of polar ice caps and flooding of low lying areas all over the earth. Increase in

the global temperature increases the incidence of infectious diseases like dengue, malaria, yellow fever, sleeping sickness etc.

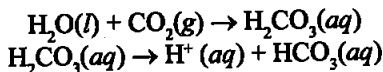
III. SHORT ANSWER TYPE

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

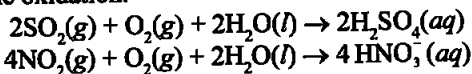
Ans. Besides carbon dioxide, other greenhouse gases are methane, water vapour, nitrous oxide, CFCs and ozone. Methane is produced naturally when vegetation is burnt, digested or rotted in the absence of oxygen. Large amounts of methane are released in paddy fields, coal mines, from rotting garbage dumps and by fossil fuels. Chlorofluorocarbons (CFCs) are man-made industrial chemicals used in air conditioning etc. CFCs are also damaging the ozone layer. Nitrous oxide occurs naturally in the environment.

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

Ans. 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 the rain water drops below 5.6, it is called acid rain. SO_2 and NO_2 after oxidation and reaction with water, are major contributors to acid rain, because polluted air usually contains particulate matter that catalyse the oxidation.



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 upper stratosphere consists of considerable amount of ozone (O_3), which protects us from the harmful ultraviolet (UV) radiations (λ 255 nm) coming from the sun. These radiations cause skin cancer (melanoma) in humans. Therefore, it is important to maintain the ozone shield. The main reason of ozone layer depletion is believed to be the release of chlorofluorocarbon compounds (CFCs), also known as Freon. UV radiation is also one of the cause of cataract formation in eyes. It can cause genetic mutation and destroy crops, aquatic plants and animals are also affected by UV radiations.

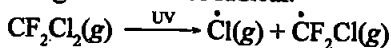
20. Dissolved oxygen in water is very important for aquatic life. What processes are responsible for the reduction of dissolved oxygen in water?

Ans. The bacteria responsible for degrading biodegradable detergent feed on it and grow rapidly. While growing, they may use up all the oxygen

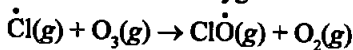
dissolved in water. The lack of oxygen kills all other forms of aquatic life such as fish and plants. Fertilizers contain phosphates as additives. The addition of phosphates in water enhances algae growth. Such profuse growth of algae, covers the water surface and reduces the oxygen concentration in water.

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

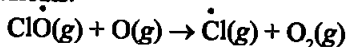
Ans. In stratosphere, chlorofluorocarbons get broken down by powerful UV radiations, releasing chlorine free radical.



The chlorine radical then react with stratospheric ozone to form chlorine monoxide radicals and molecular oxygen.



Reaction of chlorine monoxide radical with atomic oxygen produces more chlorine radicals.



The chlorine radicals are continuously regenerated and cause the breakdown of ozone. Thus, CFCs are transporting agents for continuously generating chlorine radicals into the stratosphere and damaging the ozone layer.

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

Ans. The improper disposal of wastes is one of the major causes of environment pollution. If domestic waste is not properly managed, it may go to sewers or may be eaten by cattle. Non-biodegradable wastes like, metals, glass, polythene etc, may choke the sewers. Polythene bags if swallowed by cattle may result in their death. Similarly, if industrial waste is not properly managed it will lead to air, water and soil pollution.

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?

Ans. The domestic waste and organic compounds like detergents can provide nutrients to enhance the growth of algae and aquatic plants. These are decomposed by bacteria and give unpleasant odour. This process is called eutrophication.

24. What are biodegradable and non-biodegradable pollutants?

Ans. Those pollutants which are decomposed by bacteria like, waste of vegetable and fruits, sewage, cow dung etc. are called biodegradable pollutants. Non-biodegradable pollutants are those which cannot be decomposed by bacteria e.g., mercury, polythene, aluminium, DDT etc.

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

Ans. Oxygen reaches water either through atmosphere or from the process of photosynthesis carried out by many aquatic green plants during day light. However, during night, photosynthesis stops but the plants continue to respire, resulting in reduction of dissolved oxygen. The dissolved oxygen is also used by microorganisms to oxidize organic matter.

In brief, sources of dissolved oxygen in water are:

(i) Photosynthesis by aquatic plants.

(ii) Due to the direct contact of water surface with air.

(iii) Mechanical aeration.

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

Ans. The amount of BOD in water is a measure of the amount of organic material present in water, in terms of how much oxygen will be required to break it down biologically. Clean water would have BOD value less than 5 ppm. Whereas, highly polluted water has BOD value 17 ppm or more.

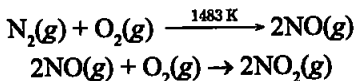
27. Why does water covered with excessive algal growth become polluted?

Ans. Presence of excessive growth of algae shows that water contains lot of phosphate due to the inflow of fertilizers from the surroundings. The decomposition of algae produces bad smell and unattractive appearance making it unfit for swimming, boating etc. and concentration of dissolved oxygen also decreases which may be harmful for aquatic life.

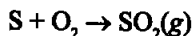
28. A factory was started near a village. Suddenly villagers started feeling the presence of irritating vapours in the village and cases of headache, chest pain, cough, dryness of throat and breathing problems increased. Villagers blamed the emissions from the chimney of the factory for such problems.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

Ans. The symptoms observed in village indicate that oxides of nitrogen and sulphur are released from the chimney of the factory. These gases are the product of combustion of fossil fuel such as gasoline, coal etc.

In an automobile engine, at high temperature, when fossil fuel is burnt, dinitrogen and dioxygen combine to yield significant quantities of nitric oxide (NO) and nitrogen dioxide (NO₂) as given below:

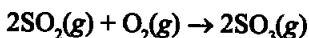


SO_2 is produced by the combustion of sulphur containing fossil fuel.

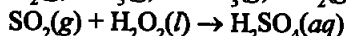
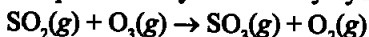


29. Oxidation of sulphur dioxide into sulphur trioxide in the absence of a catalyst is a slow process but this oxidation occurs easily in the atmosphere. Explain how does this happen. Give chemical reactions for the conversion of SO_2 into SO_3 .

Ans. Uncatalysed oxidation of sulphur dioxide is slow. However, the presence of particulate matter in polluted air catalyses the oxidation of sulphur dioxide to sulphur trioxide.

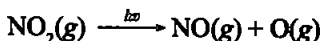


The reaction can be promoted by ozone or by hydrogen peroxide.



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

Ans. NO_2 absorbs energy from sunlight and breaks up into nitric oxide and free oxygen atom.



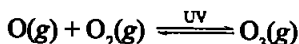
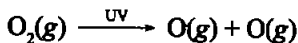
Oxygen atoms are very reactive and combine with O_2 in air to produce ozone.



'M' is an inert gas like N_2 . O_3 is formed during the formation of smog.

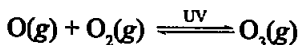
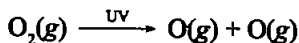
31. How is ozone produced in stratosphere?

Ans. Ozone in the stratosphere is a product of UV radiations acting on dioxygen (O_2) molecules. The UV radiations split apart molecular oxygen into free oxygen (O) atoms. These oxygen atoms combine with molecular oxygen to form ozone,



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

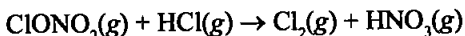
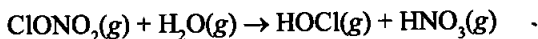
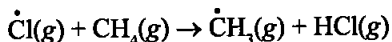
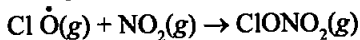
Ans. Ozone is thermodynamically unstable and decomposed into molecular oxygen. Thus, a dynamic equilibrium exists between the production and decomposition of ozone.



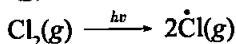
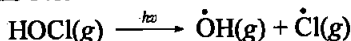
33. Some time ago formation of polar stratospheric clouds was reported over Antarctica. Why were these formed? What happens when such clouds break up by warmth of sunlight?

Ans. Scientists working in Antarctica reported about depletion of ozone layer commonly known as ozone hole over the South Pole. It was found

that a unique set of conditions was responsible for the ozone hole. 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 formed gets hydrolysed to form hypochlorous acid. It also reacts with hydrogen chloride produced to give molecular chlorine.



When sunlight returns to the Antarctica in the spring, the sun's warmth breaks up the clouds and HOCl and Cl₂ are photolysed by sunlight, as given in reactions below:



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

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. Excessive sulphate (>500 ppm) in drinking water causes laxative effect, otherwise at moderate levels it is harmless.

IV. MATCHING TYPE

In the following questions more than one option of Column I and Column II may match.

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

Column I	Column II
(i) Acid rain	(a) CHCl ₂ —CHF ₂
(ii) Photochemical smog	(b) CO
(iii) Combination with haemoglobin	(c) CO ₂
(iv) Depletion of ozone layer	(d) SO ₂
	(e) Unsaturated hydrocarbons

Ans. (i) → (c, d); (ii) → (d, e); (iii) → (b); (iv) → (a)

Explanation:

Column I	Column II
(i) Acid rain	Acid rain is due to the presence of CO_2 and SO_2 in air. With rain water they give carbonic acid and sulphurous acid.
(ii) Photochemical smog	Photochemical smog is formed by unburnt fuel (hydrocarbons) and SO_2 .
(iii) Combination with haemoglobin	Combination of CO with haemoglobin gives poisonous carboxyhaemoglobin.
(iv) Depletion of ozone layer	Chlorofluorocarbon cause depletion of ozone layer.

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

Column I	Column II
(i) Oxides of sulphur	(a) Global warming
(ii) Nitrogen dioxide	(b) Damage to kidney
(iii) Carbon dioxide	(c) 'Blue baby' syndrome
(iv) Nitrate in drinking water	(d) Respiratory diseases
(v) Lead	(e) Red haze in traffic and congested areas

Ans. (i) \rightarrow (d); (ii) \rightarrow (e); (iii) \rightarrow (a); (iv) \rightarrow (c); (v) \rightarrow (b)

Explanation:

Column I	Column II
(i) Oxides of sulphur	Sulphur dioxide is a poisonous gas. It has been reported that even a low concentration of sulphur dioxide causes respiratory diseases e.g., asthma, bronchitis etc.
(ii) Nitrogen dioxide	The irritant red haze in the traffic and congested places is due to oxides of nitrogen.
(iii) Carbon dioxide	The increased amount of CO_2 in the air is mainly responsible for global warming.
(iv) Nitrate in drinking water	The maximum limit of nitrate in drinking water is 50 ppm. Excess nitrate in drinking water can cause disease such as methemoglobinemia ('blue baby' syndrome)
(v) Lead	Drinking water gets contaminated with lead when lead pipes are used for transportation of water. The prescribed upper limit concentration of lead in drinking water is about 50 ppb. Lead can damage kidney.

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)
(i) Releasing gases to the atmosphere after burning waste material containing sulphur.	(a) Water pollution
(ii) Using carbamates as pesticides	(b) Photochemical smog, damage to plant life, corrosion to building material, induce breathing problems, water pollution.
(iii) Using synthetic detergents for washing clothes	(c) Damaging ozone layer
(iv) Releasing gases produced by automobiles and factories in the atmosphere.	(d) May cause nerve diseases in human.
(v) Using chlorofluorocarbon compounds for cleaning computer parts	(e) Classical smog, acid rain, water pollution, induce breathing problems, damage to buildings, corrosion of metals.

Ans. (i) → (e); (ii) → (d); (iii) → (a); (iv) → (b); (v) → (c)

Explanation:

Column I (Activity)	Column II (Effect)
(i) Releasing gases to the atmosphere after burning waste material containing sulphur.	SO ₂ causes acid rain, water pollution, formation of smog, breathing problems, damage to buildings, corrosion of metals.
(ii) Using carbamates as pesticides	Carbamates are pesticides which are more biodegradable but severe nerve toxins hence more harmful to humans.
(iii) Using synthetic detergents for washing clothes	Synthetic detergents are non-biodegradable and cause water pollution.
(iv) Releasing gases produced by automobiles and factories in the atmosphere.	Gases released from automobiles and factories in atmosphere cause photochemical smog, damage to plant life, inducing breathing problems and water pollution.

(v) Using chlorofluorocarbon compounds for cleaning computer parts	Presence of chlorofluorocarbons in atmosphere are responsible for damaging ozone layer.
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38. Match the pollutants given in Column I with their effects given in Column II.

Column I	Column II
(i) Phosphate fertilisers in water	(a) BOD level of water increases
(ii) Methane in air	(b) Acid rain
(iii) Synthetic detergents in water	(c) Global warming
(iv) Nitrogen oxides in air	(d) Eutrophication

Ans. (i) → (a, d); (ii) → (c); (iii) → (a); (iv) → (b)

Explanation: Phosphates in water enhances algae growth. Such profuse growth of algae, covers the water surface and reduces the oxygen concentration in water. BOD level of water increases. This process in which nutrients 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.

V. ASSERTION AND REASON TYPE

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 each question.

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.

- (i) Both A and R are correct and R is the correct explanation of A.
 (ii) Both A and R are correct but R is not the correct explanation of A.
 (iii) Both A and R are not correct.
 (iv) A is not correct but R is correct.

Ans. (iii)

Explanation: A and R both are not correct. In cold places, sunlight required to grow plants which is less. Hence, plants are kept in a glass house so that sunlight enters in the green house to heat up the soil and plants. The warm soil and plants emit infrared radiations which are partially absorbed and partially reflected by the glass.

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

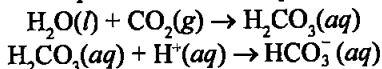
Reason (R) : Carbon dioxide present in the atmosphere dissolves in rain water and forms carbonic acid.

- (i) Both A and R are correct and R is the correct explanation of A.
 (ii) Both A and R are correct but R is not the correct explanation of A.

- (iii) Both A and R are not correct.
 (iv) A is not correct but R is correct.

Ans. (ii)

Explanation: Both A and R correct but R is not the correct explanation of A. Normally, the pH of rain water is 5.6 because of the presence of H^+ ions produced due to the dissolution of CO_2 in rain water from atmosphere. When the pH of rain water drops from 5.6, it is called acid rain.



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

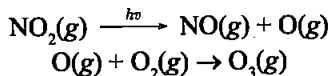
Reason (R) : Photochemical smog contains NO_2 and O_3 , which are formed during the sequence of reactions.

- (i) Both A and R are correct and R is the correct explanation of A.
 (ii) Both A and R are correct but R is not the correct explanation of A.
 (iii) Both A and R are not correct.
 (iv) A is not correct but R is correct.

Ans. (i)

Explanation: Both A and R are correct and R is the correct explanation of A. Photochemical smog has high concentration of oxidizing agents and is, therefore, called as oxidizing smog.

Two of the pollutants that are emitted are hydrocarbons (unburnt fuels) and nitric oxide (NO). When these pollutants build up to sufficiently high levels, a chain reaction occurs from their interaction with 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.



42. Assertion (A) : Carbon dioxide is one of the important greenhouse gases.

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

- (i) Both A and R are correct and R is the correct explanation of A.
 (ii) Both A and R are correct but R is not the correct explanation of A.
 (iii) Both A and R are not correct.
 (iv) A is not correct but R is correct.

Ans. (ii)

Explanation: The increased amount of CO_2 in the air is mainly responsible for global warming. A large amount of carbon dioxide gets released into the atmosphere. Excess of CO_2 in the air is removed by green plants and this maintains an appropriate level of CO_2 in the atmosphere.

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.

- (i) Both A and R are correct and R is the correct explanation of A.
- (ii) Both A and R are correct but R is not the correct explanation of A.
- (iii) Both A and R are not correct.
- (iv) A is not correct but R is correct.

Ans. (iv)

Explanation: A is not correct but R is correct. Ozone in the stratosphere is a product of UV radiations acting on dioxygen (O_2) molecules. The main reason of ozone layer depletion is believed to be the release of chlorofluorocarbon compounds (CFCs), also known as freons. With the depletion of ozone layer, more UV radiations filters into troposphere. UV radiations lead to ageing of skin, cataract, sunburn, skin cancer, killing of many phytoplanktons, damage to fish productivity etc.

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

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

- (i) Both A and R are correct and R is the correct explanation of A.
- (ii) Both A and R are correct but R is not the correct explanation of A.
- (iii) Both A and R are not correct.
- (iv) A is not correct but R is correct.

Ans. (i)

Explanation: Both A and R are correct and R is the correct explanation of A. Pesticides are basically synthetic toxic chemicals with ecological repercussions. The repeated use of the same or similar pesticides give rise to pests that are resistant to that group of pesticides thus making the pesticides ineffective. Therefore, as insect resistance of DDT increased, other organic toxins such as Aldrin and Dieldrin were introduced in the market by pesticide industry. Most of the organic toxins are water insoluble and non-biodegradable.

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.

- (i) Both A and R are correct and R is the correct explanation of A.
- (ii) Both A and R are correct but R is not the correct explanation of A.
- (iii) Both A and R are not correct.
- (iv) A is not correct but R is correct.

Ans. (iii)

Explanation: 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). If BOD of water is less than 5 ppm, it is clean. If BOD increases, water pollution increases.

VI. LONG ANSWER TYPE

46. How can you apply green chemistry for the following:

- (i) to control photochemical smog.
- (ii) to avoid use of halogenated solvents in drycleaning and that of chlorine in bleaching.
- (iii) to reduce use of synthetic detergents.
- (iv) to reduce the consumption of petrol and diesel.

Ans. (i) (a) Many techniques are used to control or reduce the formation of photochemical smog. If we control the primary precursors of photochemical smog, such as NO_2 and hydrocarbons, the secondary precursors such as ozone and PAN of the photochemical smog will automatically be reduced.

(b) Usually, catalytic converters are used in the automobiles, which prevent the release of nitrogen oxide and hydrocarbons to the atmosphere.

(c) Certain plants e.g., *Pinus*, *Juniparus*, *Quercus*, *Pyrus* and *Vitis* can metabolise nitrogen oxide and therefore, their plantation could help in this.

(ii) Organic solvents such as benzene, toluene, carbon tetrachloride etc., are highly toxic. One should be careful while using them. For bleaching the cloth H_2O_2 is used which is not harmful. Earlier Cl_2 was used for bleaching the cloth.

(iii) Synthetic detergents are non-biodegradable therefore their use in daily life is to be reduced. Good quality soaps to be prepared from vegetable oil. Soaps are biodegradable.

(iv) In place of petrol and diesel oil the use of CNG and LNG has been preferred because they are pollution free fuels. The other sources such as H_2 , $\text{C}_2\text{H}_5\text{OH}$ etc. can also be used in place of petrol and diesel.

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 gas is confined to troposphere only. Normally it forms about 0.03 per cent by volume of the atmosphere. With the increased use of fossil fuels, a large amount of carbon dioxide gets released into the atmosphere. Excess of CO_2 in the air is removed by green plants and this maintains an appropriate level of CO_2 in the atmosphere. Green plants require CO_2 for photosynthesis and they, in turn, emit oxygen, thus maintaining the delicate balance. As you know, deforestation and burning of fossil fuel increases the CO_2 level and disturb the balance

in the atmosphere. The increased amount of CO_2 in the air is mainly responsible for global warming.

48. Explain how does green house effect cause global warming.

Ans. Green chemistry is a way of thinking and is about utilizing the existing knowledge and principles of chemistry and other sciences to reduce the adverse impact on environment. Green chemistry is a production process that would bring about minimum pollution or deterioration to the environment. The byproducts generated during a process, if not used gainfully, add to the environmental pollution. Such processes are not only environmental unfriendly but also cost-ineffective. The waste generation and its disposal both are economically unsound. Utilization of existing knowledge base for reducing the chemical hazards along with the developmental activities is the foundation of green chemistry.

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 are basically synthetic toxic chemicals with ecological repercussions. Most of the organic toxins are water insoluble and non-biodegradable. These high persistent toxins are, therefore, transferred from lower trophic level to higher trophic level through food chain. Over the time, the concentration of toxins in higher animals reach a level which causes serious metabolic and physiological disorders.

50. For dry cleaning, in the place of tetrachloroethene, liquefied 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 liquefied carbon dioxide with detergent be completely safe from the point of view of pollution? Explain.

Ans. Tetrachloroethene ($\text{Cl}_2\text{C}=\text{CCl}_2$) was earlier used as solvent for dry cleaning. The compound contaminates the groundwater and is also a suspected carcinogen. The process using this compound is now being replaced by a process, where liquefied carbon dioxide, with a suitable detergent is used. Replacement of halogenated solvent by liquid CO_2 will result in less harm to groundwater. These days, hydrogen peroxide (H_2O_2) is used for the purpose of bleaching clothes in the process of laundry, which gives better results and makes use of lesser amount of water.

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