CHAPTER-14

ENVIRONMENTAL CHEMISTRY

I) One mark questions and answers:

1. Name one insecticide?

A. DDT

2. Which acid is not present in acid rain?

HNO_3, H_2SO4, CH_3COOH, H_2CO_3?

A. CH_3COOH

3. Define the term pollution?

A. It is a substance present in the environment in great proportion than its natural abundance and resulting in harmful damage effect.

4. Name two gases which are responsible for green house effect?

A. CO_2 and CH_4 gases.

5. Which part of the atmosphere contains ozone layers?

A. Stratosphere contains ozone layers.

6. What is full form BOD and DDT?

A. BOD-Biochemical oxygen Demand and DDT- Dichchloro Diphenyl Trichloro ethane.

7. What are PCBs?

A. Poly chlorinated biphenyls (PCBs) are used as cleansing solvent, detergents and fertilizers cause water pollution and it is carcinogenic compound.

8. What is PAN?

A. Peroxyacetyl nitrate (PAN) is one of the components of photo chemical smog and it is powerful eye irritant.

9. What is desirable concentration of F^- ions and PH of drinking water?

A. Desirable concentration of ***F^- ions*** is 1ppm or 1mgdm^{-3} and PH is 5.5 to 9.5

10. Name the oxides of nitrogen?

A. Nitric oxide (NO) and Nitrogen dioxide (NO_2).

11. Which gas caused Bhopal gas tragedy? Give its formula.

A. Methyl isocyanate (MIC) and its molecular formula $CH_3N=C=0$

12. Write any two common chemicals of photochemical smog?

A. Acrolein and formaldehyde

13. Which can damage the great historical monument Tajmahal?

A. Acid rain

($CaCO_3$ (marble) +H_2SO_4 → $CaSO_4$+H_2O+CO_2)

14. What is effect of excess of SO_4^{2-} ion in drinking water?

A. Excess of SO_4^{2-} ion in drinking water causes laxative effect (>500ppm)

15. What is the cause of methemeglobinemia?

A. Excess of nitrate ion (>50ppm) in drinking water cause methemeglobinemia (blue baby syndrome).

16. What is troposphere?

A. The lower regions of atmosphere in which the human beings along with other organisms live are called troposphere. It extends up to the high of ~10KM from sea level

17. What is stratosphere?

A. Above the troposphere, between 10 and 50km above sea level lies is called stratosphere.

18. Name the harmful radiation emitted from sun?

A. UV radiation

19. Which type of harmful radiations absorbed in ozone layers?

A. UV radiation

20. Name the types of pollutants cause troposphere pollution?

A. 1. Gaseous air pollutants

2. Particulate pollutants

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

A. In water, the source of oxygen is either atmospheric oxygen or photosynthesis carried in plants during day light.

22. Which of the following gases is not a green house gas?
CO, CO_3, CH_4, H_2O vapours

A. CO is not a green house gas.

23. What type of radiation are absorbed by CO_2 in the atmosphere

A. IR radiations

24. Name the oxide of carbon?

A. CO & CO_2

25. What is green house effect?

A. The increase in temperature of atmosphere due to presence of gases like CH_4 , CO_2 and water vapours, which absorb infrared radiation is called green house effect.

II) Two marks questions and answers:

1. Name two herbicides?

A. $NaClO_3$ (sodium chlorate) and

Na_3AsO_3 (Sodium Arsenite)

2. List any two harmful effects of smog?

A. 1. Ozone PAN Act as powerful eye irritants

2. Ozone and nitric irritate the nose and throat and their high concentration causes headache, chest pain, and dryness of the throat, cough and difficulty in breathing.

3. Write any two achievement of green chemistry?

A. 1.Development of polystyrene foam sheet packaging material this Technology allows eliminations CFCS which contribute to ozone depletion, global warming and ground level smog.

2. Catalytic hydrogenation of diethanolamine in which environmental friendly herbicide is produced in less dangerous ways.

4. Define environmental chemistry?

A. It is the study of chemical and biochemical process occurring in nature

(OR)

It deals with the study of origin, transport relation, effects and fates of various chemical species in the environment

5. What do you mean by ozone hole? What are its Consequences

A. Ozone hole implies distribution of the ozone layer by the Harmful UV radiations the depletion will virtually result

In creating some sort of holes in the blanket of ozone which surround us. As a result, the harmful radiations cause skin cancer, loss of sight and also affect our immune system

6. What do you mean by Biochemical oxygen demand?

A. Biochemical oxygen demand is the amount of oxygen required by bacteria to decompose organic matter in a certain volume of sample of water. Clean water would have BOD value of less than 5ppm, where as highly polluted water has a BOD of 17ppm or more

7. How does detergent cause water pollution?

A. Tetrachlorothene ($Cl_2C=CCl_2$) was used as solvents for dry cleaning of clothes. This compound is suspected to carcinogenic and contaminated the suspected to carcinogens for bleaching cloths in the laundry, hydrogen peroxide (H_2O_2)is being used which gives better result and is not harmful detergents produce pathogens which are diseases causing bacteria and result in gastrointestinal diseases.

8. Write the methods for management of waste material?

1. Recycling:-materials are recycled which saves the cast of raw material and waste disposal.

2. Sewage treatment

3. Burning and Incineration

4. Digesting

5. Dumping

9. Write the chemical reaction take place during acid rain in the atmosphere?

A. 1. $H_2O + CO_2 \text{ -------> } H_2CO_3$

2. $H_2CO_3 \text{ ------> } H^+ + HCO_3^-$

3. $2SO_2 + O_2 + 2H_2O \text{ ------> } 2H_2SO_4$

10. For your agriculture field or garden you have developed a compost producing pit. Discuss the process in the light of bad odour ,files and recycling as wastes for a good produce.

A. It is essential to take proper care of the compost producing pit in order to protect ourselves from bad odour and files. It should be kept covered to minimize bad odour and prevent files from entering it.

The recyclable waste should not be dumped in the compost producing pit. It should be sent to the industries through vendors for recycling.

11. A large number of fish are suddenly found floating dead on a lake. There is no evidence of toxic dumping by you find an abundance of phytoplankton, suggest a reason for the fish kill.

A. The amount of dissolved oxygen present in water is limited. The abundance of phytoplankton causes depletion of this

dissolved oxygen. This is because phytoplanktons are degraded by bacteria present in water. For their decomposition, they require a large amount of oxygen. hence, they consume the oxygen dissolved in water. As a result, the BOD level of water drops below 6ppm, inhibiting the growth of fish and causing excessive fish kill.

12. What are harmful effects as depletion of ozone layer?

A. 1) The ozone layer protects the earth from the harmful UV radiation of the sun, with the depletion of the layer, more radiation will enter the earth's atmosphere. UV radiations are harmful because they lead to the skin cancer and sun burns.

2) They cause death of many phytoplanktons which lead to a decrease of fish productivity.

3) Increase in UV radiation, decreases the moisture content of the soil and damages both plants and fibres.

13. What are pathogens? Mention its harmful effect?

A. Pathogens are water pollutants include bacteria and other organism. They enter water from animal excreta and domestic sewage.

14. What are harmful effects of acid rain?

A. 1. It is harmful for crops

2. It damages buildings made up of marble.

14. Write by two harmful effects of oxides of nitrogen?

1. Damage the leaves of plants and retard the rate of photosynthesis.

2. Nitrogen dioxide is a lung irritant that can lead to an acute respiratory disease in children.

15. Write any two harmful effects of oxide of sulphur?

1. It causes respiratory diseases e.g. Asthama bronchitis in human beings

2. It causes irritation to the eyes, resulting in tears and redness.

16. Write the harmful effects of hydrocarbons pollutants? Mention its sources?

Harmful effects:

1. Hydrocarbons are carcinogenic i.e. they cause cancer

2. They harm plants and shedding of leaves flowers & twinges

Sources: Incomplete combustion of fuel used in automobiles.

17. What are the harmful effects of CO? Mention its sources?

Harmful effects:

1. It is high poisonous to living beings
2. It causes, headache, weak eyesight, nervousness and cardiovascular disorder

Sources: 1. incomplete combustion of coal, firewood, petrol etc….

2. by automobile exhaust

18. Write the harmful effect of CO_2 ?mention its sources.

A. Harmful effect:

It causes global warming

Sources: 1. Respiration

2. Burning of fossil fuels for energy

3. By volcanic eruptions
4. Deforestation
5. By decomposition of limestone during the manufacture of cements.

19. Giving example differentiate b\w viable and non viable particulate pollutants.

A. *1.viable particulate*:- They are minute living organisms that are dispersed in atmosphere.

Ex:- Bacteria, fungi, moulds, algae etc….

It may be noted that human being are allergic to some of the fungi found in air. Fungi can also cause plant diseases

2. Non viable particulate:- They are formed by the breakdown of larger materials or by condensation of minute particles and droplets.

Ex. mists, smoke, fumes and dust.

20. During ward war II DDT, was found to be of great use for which purpose was is used? Why has its use been banned in India now?

A. It is used to control of malaria and other insect borne diseases.

After the war, DDT is used in Agriculture to control the damages caused by insects, weeds and various crop diseases

However, due to adverse effects, its use has been banned India and it is nonbiodegradable and carcinogenic.

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

A. The acids commonly present in acid rain are nitric acid, sulphuric acid and carbonic acid. Nitric acid is formed by oxidation of nitric oxide present in air to NO_2 & NO_3, which dissolve in water also present in air.

Sulphuric acid is formed by the oxidation of SO_2 result in air to SO_3 followed by dissolution in water.

CO_2 present in the acid dissolves in water to give carbonic acid.

III) Three marks questions and answers

1. Explain tropospheric pollution?

A. Troposphere pollution occurs due to the presence of undesirable gases and the solid particles in the air the major gaseous and the Particulate pollutants presents in the troposphere as follows.

1. Gaseous air pollutants: These include mainly oxides of sulphur (SO_2&SO_3), oxide of nitrogen (NO&NO_2) and oxides of carbon (CO&CO_2) in addition to hydrogen sulphide (H_2S), hydrocarbons and other oxidants.

2. Particulate pollutions: These include dust, mist, fumes, smoke, smog etc…..

2. What is smog? How is classical smog different from photo chemical smog?

A. Smog is a mixture of smoke, dust partials and small drops of fog.

Classical smog	photochemical smog
➢ It occurs in cool humid Climate	It occurs in warm dry and sunny climate
➢ It is called reducing smog	It is called oxidizing smog

- It is a mixture of smoke, Fog and sulphurdioxide

It is a mixture of unsaturated hydrocarbons and Oxides of nitrogen

3. Statues and monuments in India are affected by acid rain, how?

A. The air around the statues and monuments in India contains fairly high levels of the oxides of sulphur and nitrogen.

This is due to a large number of industries and power plants in the near by areas.

The problem has been further aggravated due to use of poor quality of coal, kerosene and fire wood as fuel for domestic purposes.

The states acid rain affects for marble of these statues and monuments.

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

As a result, this away and marble is getting discolored and lusterless.

4. Carbon monoxide gas is more dangerous than carbon dioxide gas. Why? Explain

A. It is highly poisonous to living beings because of its ability to block the delivery of oxygen to the organs and tissues. It binds to haemoglobin complex to form carboxyl haemoglobin (COHb) which is about 300 times more stable than oxy-hemoglobin complex. In the blood when the concentration of carbon haemoglobin reaches about 3-4 percent, the oxygen carrying capacity blood is greatly reduced. This oxygen deficiency, results in to headache, weak eyesight, nervousness and cardiovascular disorder CO_2 does not combine with haemoglobin and hence is less harmful as pollutant but it is the main contributor forwards green house effect & global warming.

5. What are pesticides and herbicides? Give examples

A. ***Pesticides:*** These are a mixture of two or more substances. They are used for killing pests. Pests include insects, plants pathogens, weeds, mollusks etc…., that destroys the plant crop and spread diseases

ex: - Aldrin and Dieldrin

Herbicides: These are chemicals specially meant for killing weeds. Ex:-Sodium chlorate ($NaClO_3$)

Sodium Arsenite ($Na_3\ AsO_3$)

6. Define environmental pollution? Name its types?

A. The addition of any undesirable material to air, water and soil by a nature source

or

Due to human activity to such a level of concentration warm adversely affects the quality of environment is called environmental pollution.

Types

1. Water pollution

2. Soil pollution

3. Air pollution

8. How can domestic waste be used as manure?

A. Depending upon the nature of the waste domestic waste can be segregated in to two categories. i.e. biodegradable and non biodegradables. Biodegradables waste such as leaves, rotten food etc…. should be deposited in land hills, where they get decomposed aerobically and anaerobically in to manure. Non biodegradable waste (Which cannot be degraded) such as plastic, glass, metal scrapes etc…. should be sent for recycling.

9. Write short note on a).BOD b). Photo chemical smog c). Ozone hole.

A. BOD: Biochemical oxygen demand is defined as the amount of oxygen required to oxidise the pollutants presents in water.

Water having BOD less than 5ppm is clean water and greater than 17ppm is polluted water

Photo chemical smog: It consists of oxides of nitrogen which absorb light and form free radicals.

It is extremely harmful and is oxidizing in nature.

Ozone hole: ozone layer is depleted near Antarctica and it is called ozone hole.

10. Define green chemistry? Explain with one example.

Chemistry and chemical process involving the minimum use and generation of harmful substances is called green chemistry

Ex:- Earlier tetrachloroethene themes was used as solvents for dry cleaning. This compound is carcinogenic; therefore it has been replaced by liquefied CO_2 along with a suitable detergent which is less harmful.

11. What are the reactions involves for ozone layer depletion in the stratosphere?

A. CFC'S (chlorofluorocarbons) that are released in the atmosphere mix with the other atmospheric gases and when eventually reach the stratosphere, gets broken down by UV radiations as fallows

CF_2Cl_2 ------> $Cl^{\bullet}$ + $CF_2Cl^{\bullet}$

The chlorine radical reacts with ozone and breaks down ozone molecule as follows

$Cl^{\bullet}$ + O_3 -----> $ClO^{\bullet}$ + O_2

$ClO^{\bullet}$ radical further reacts with atomic oxygen and produces more chlorine radicals as follows

$ClO^{\bullet}$ + O ------> $Cl^{\bullet}$ + O_2

12. Write the chemical reactions formation of oxides of nitrogen? Mention its sources?

ANS.

1. $N_{2(g)}+O_{2(g)}$ ------>$2NO_{(g)}$
2. $2NO_{(g}$ + $O_{2(g}$ ------> $2NO_{2(g)}$

3. $NO_{(g)}+O_{3(g)}$ ------> $NO_{2(g)}+O_{2(g)}$

Sources: 1. At high attitude when lightning strokes, dinitrogen and dioxygen combine to form oxides of nitrogen.

2. Burning of fossil fuels in an automobile engine at high temperature, dinitrogen and dioxygen combine to yield significant quantities of nitric oxide and nitrogen dioxide.

13. Write the chemical reactions for the formation of oxides of sulphur? Mention its sources?

A. 1. $2SO_2 + O_2$ ------> $2SO_3$

2. $SO_2 + O_3$ -------> $SO_3 + O_2$

3. $SO_2 + H_2O_2$ ------> $2H_2SO_4$

Sources: Burning of fossil fuels containing sulphur

14. Write down the chemical equation of reactions involved during the formation of photochemical smog. How can it be controlled?

A. Photochemical smog is formed by absorption of sunlight by oxides of nitrogen to form free radicals which are highly reactive

a) NO_2 -------> $NO^{\cdot} + O^{\cdot}$

b) $O^{\cdot} + O_2$ ------> O_3

c) $N O^{\cdot} + O_3$ ------>$NO_2 + O_2$

d) $3CH_4 + 2O_3$ ------>$3HCHO + 3H_2O$

It can be prevented by spraying chemicals which will destroy free radicals in the atmosphere.

IV) Four marks questions and answers

1. Explain the reactions involved during the formation of photochemical smog?

A. Photochemical smog is formed as a result of the reaction of sunlight with hydrocarbons and nitrogen oxides.
Ozone, nitricoxide, Acrolein, formaldehyde and peroxyacetyl nitrate are common compounds as photochemical smog.

The formation of photochemical smog can be burning as fossil fuels leads to the emission of hydrocarbon and nitrogen dioxide in atmosphere .High concentration of these pollutants in air results in their interaction with sunlight as fallows.

1. $NO_{2(g)}$ ->$N O^{\cdot}_{(g)} + O^{\cdot}_{(g)}$

2. $O^{\cdot}_{(g)}+O_{2(g)} \rightarrow O_{3(g)}$

3. $O_{3(g)+}N\,O^{\cdot}_{(g)} \rightarrow NO_{2(g)+}\,O^{\cdot}_{(g)}$

While ozone is toxic in nature, both NO_2& O_3 are oxidizing agents. They react with the unburnt hydrocarbons in air to produce formaldehyde, PAN and Acrolein.

4. $3CH_4+2O_3 \rightarrow 3\,HCHO+3H_2O$

PAN (CH_2=CH-CH=O) and

Acrolein ($CH_3\,COOONO_2$)

2. What are harmful effects of photochemical smog and how can they be controlled.

A. 1. Ozone and PAN acts as powerful eye irritants

2. Ozone and nitric oxide irritate the nose and throat, and then high concentration cause headache, chest pain, and dryness of the throat, cough and difficulty in breathing

a. It also cause and corrosion and painted surfaces

B.It leads to cracking of rubber and extensive damage to plants life.

Control of photochemical smog

1. Use of catalysts converters in automobiles Which prevents the release of oxides of nitrogen and hydrocarbons to the atmosphere

2. Certain plants e.g.…pines, Juniparus, quercus pyrus and vitis can metabolize oxides of nitrogen and therefore, their plantation could help in this matter.

3. What are the major causes of water pollution? Explain

A. 1. Pathogens: These are water pollutants include bacteria and other organisms.They enter water from animal excreta and domestic Sewage. Bacteria presents in human excreta causes gastrointestinal diseases (Excreta contains, escherichia Coil and streptococcus faecalis)

2. Organic wastes: These are biodegradable water that pollutes water as a result run off. The presence of excess of organic wastes in water decreases the amount of oxygen held by water. This decrease in the amount of dissolved oxygen inhibits aquatic life.

3. Chemical pollutants: These are the water soluble chemicals like heavy metals such as cadmium, mercury, nickel etc…

The presence of these chemicals (above the tolerance limit) can damage the kidneys, central nervous system and liver.

4. What do you mean by green chemistry? How will it help in decreasing environmental pollution?

A. It is a production process that aims at using the existing knowledge and principles of chemistry for developing and implenting chemical products and processes to reduce the use and generation if substances hazardous to the environment.

The release of different harmful chemicals (particulates, gases, organic and inorganic wastes) causes environmental pollution. In green chemistry, the reactants to be used in chemical reactions are chosen in such way that the yield of the end products is up to 100%. This prevents or limits chemical pollutants from being introduced in to the environment

For example, through the efforts of green chemists, H_2O_2 has replaced tetrachloromethene and chlorine gas in drying and bleaching of paper.

CO_2 has replaced CFCs as blowing agents in manufacture of polystyrene foam sheet.

5. Name the pollutants which cause soil pollution?

A.1. Pesticides

2. Insecticides

3. Herbicides

4. Fungicides

5. Industrial wastes

6. Urban wastes

7. Agriculture pollutants

8. Fertilizers

6. What is green house effect? How does it affect the global climate?

A. It is the phenomenon in which earth's atmosphere trap the heat from the sun and prevent it form escaping in to the outer space.

Green house gases such as CO_2, CH_4, ozone, chlorofluorocarbon compounds and water vapour in the atmosphere result in climate changes sunlight intense a green house through. The transparent glass or plastic panes and heats the plants by the heat emitted by the plants in the form of infrared radiation cannot puss through the glass or plastic panes. As a result of inside temperature increases. Increased CO_2 levels in the atmosphere can also cause plants, undergoing photosynthesis, to take use the gas at a greater rate so that plants in warmer climate with adequate rainfall would grow faster. An increase in average global temperature to increase the incidence of infectious diseases like malaria, sleeping sickness, dengue and yellow fever CFCs are also damaging ozone layer. The average

global temperature increase to a level which may lead melting polar ice caps and flooding of lying areas all over the earth. There may be less rain fall in temperature zones and more rain fall in the drier areas of the world. (CO_2 in the major contribute to global warming)

7. What is acid rain? How is it harmful to the environment?

A. When the PH of the rain water below 5.6 due to the presence of oxides of sulphur & nitrogen and carbon dioxide in the atmosphere is called acid rain.

Harmful effects of acid rain

1. It is toxic to vegetation and aquatic life
2. It damages building and states and dissolves heavy metals from soils, rocks and sedimentals. Tajmahal has been damaged by acid rain.
3. The heavy metal ions such as copper, lead and aluminum, leached from the soil, enter well water and produced variety of toxic effects.
4. Acid rain also corrodes water pipes resulting in the leaching as heavy metals such as iron, lead and copper in to drinking water.

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