Unit 15: Environmental Chemistry

18. Dissolved oxygen in water is responsible for aquatic life. What processes are responsible for the reduction in dissolved oxygen in water?

- The oxygen is dissolved in water either from atmosphere or by photosynthesis, however at night, there is no photosynthesis, so amount of oxygen dissolved in water reduces.
- Thus, water contains only a limited amount of dissolved oxygen.
- Thus, the decomposition of a moderate amount of organic matter by aerobic bacteria can make water deficient in dissolved oxygen.

19. What would happen, if the greenhouse gases were totally missing in the earth's atmosphere?

In the absence of greenhouse gases, the average temperature of earth will decrease drastically earth average temperature would be bear of on earth would be impossible .

20. Define smog.

Smog is a combination of smoke and fog which forms droplets that remain suspended in the air.

21. Which is considered to be earth's protective umbrella? Why?

- **Ozone layer** in the upper atmosphere is considered to be earth's protective umbrella.
- It protects us from harmful effect such as skin cancer.
- UV radiation can convert molecular oxygen into ozone as shown in the following reaction.

$$O_{2(g)} \xrightarrow{UV} O_{(g)} + O_{(g)}$$

$$O_{(g)} + O_{2(g)} \xrightarrow{UV} O_{3(g)}$$

The ozone layer acts as a fitter for the shorten wavelength and highly hazardous ultraviolet radiation from the sun, protecting life on earth.

22. What are degradable and non-degradable pollutants?

Bio-degradable pollutants: The pollutants which can be easily decomposed by the natural biological processes are called bio-degradable pollutants. ***Examples:*** plant wastes, animal wastes….

Non- degradable pollutants:

The pollutants which cannot be decomposed by the natural biological processes are called Non bio-degradable pollutants.

Examples: metal wastes (mainly Hg and Pb), D.D.T, plastic, nuclear wastes etc.

23. From where does ozone come in the photo chemical smog?

In the **earth's lower atmosphere** ozone is formed when pollutants emitted by cars, power plants, industrial boilers, refineries etc chemically react in the presence of sunlight. It is formed by reaction between oxides of nitrogen and volatile organic compounds. (Or)

$$NO_2 \xrightarrow{Sun\ light} NO + (O)$$

O_3 are strong oxidizing agent and can react with unburnt hydrocarbons in polluted air to form formaldehyde, acrolein and peroxy acetyl nitrate(PAN).

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

Excessive concentration (> 500ppm) of sulphates in drinking water causes laxative effect.

25. What is green chemistry?

Green chemistry means science of environmentally favorable chemical synthesis. Green chemistry is a chemical philosophy encouraging the design of products and processes that reduce or eliminate the use and generation of hazardous substances.

26. Explain how does green house effect cause global warming

Greenhouse effect may be defined as "the heating up of the earth surface due to trapping of infrared radiations reflected by earth's surface by CO_2 layer in the in the atmosphere". The heating up of earth through the greenhouse effect is called global warming.

27. Mention the standards prescribed by BIS for quality of drinking water

Standard characteristics prescribed for deciding the quality of drinking water by BIS

S.No	Characteristics	Desirable limit
I	**Physico-chemical Characteristics**	
i)	P^H	6.5 to 8.5
ii)	Total Dissolved Solids(TDS)	500 ppm
iii)	Total Hardness (as $CaCO_3$)	300 ppm
iv)	Nitrate	45ppm
v)	Chloride	250 ppm
vi)	Sulphate	200 ppm
vii)	Fluoride	1 ppm
II	**Biological Characteristics**	
i)	Escherichia Coli (E.Coli)	Not at all
ii)	Coliforms	Not to exceed 10 (In 100 ml water sample)

28. How does classical smog differ from photochemical smog?

No	Classical smog (London smog)	Photochemical smog (Los Angel smog)
1.	It occurs in cool humid climate.	It occurs in warm and dry climate.
2.	It consists of **coal smoke and fog.** The Chemical composition in the mixture of SO_2, SO_3 and humidity.	It is formed by the combination of **smoke, fog, dust and air pollutants** like oxides of nitrogen and hydrocarbons in the presence of sunlight.
3.	It is reducing in nature due to high concentration SO_2 and called **reducing smog.**	It is oxidizing in nature due to high concentration of oxidizing agents like NO_2 and O_3 and is called **oxidizing smog** .
4.	Classical smog is responsible for acid rain and causes bronchial irritation.	Photo chemical smog causes irritation of eyes skin and lungs, increase in chances of asthma.

29. What are particulate pollutants? Explain any three.

Particulate pollutants are small solid particles and liquid droplets suspended in air.

(i) Smoke:

Smoke particulate consists of solid particles (or) mixture of solid and liquid particles formed by combustion of organic matter. **For example**, cigarette smoke, oil smoke, smokes from burning of fossil fuel, garbage and dry leaves.

(ii) Dust :

Dustcomposed of fine solid particles produced during crushing and grinding of solid materials. **For example**, sand from sand blasting, saw dust from wood works, cement dust from cement factories and fly ash from power generating units.

(iii) Mists:

They are formed by particles of spray liquids and condensation of vapours in air. **For example**, sulphuric acid mist, herbicides and insecticides sprays can form mists.

30. Even though the use of pesticides increases the crop production, they adversely affect the living organisms. Explain the function and the adverse effects of the pesticides.

Pesticides are the chemicals that are used to kill or stop the growth of unwanted organisms. But these pesticides can affect the health of human beings.

These are further classified as

- **Insecticides:**

It like DDT, BHC, aldrin etc., can stay in soil for long period of time and are absorbed by soil. They contaminate root crops like carrot, raddish etc.,

- **Fungicide:** Organo mercury compounds are used as most common fungicide. They dissociate in soil to produce mercury which is highly toxic.
- **Herbicides:** Herbicides are the chemical compounds used to control unwanted plants. They are otherwise known as weed killers.

31. Ethane burns completely in air to give CO_2, while in a limited supply of air gives CO. The same gases are found in automobile exhaust. Both CO and CO_2 are atmospheric pollutants i) What is the danger associated with these gases

ii) How do the pollutants affect the human body?

(i)What is the danger associated with these gases

(a) Carbon monoxide:

Carbon monoxide is a poisonous gas produced as a result of incomplete combustion of coal are firewood. It is released into the air mainly by automobile exhaust. It binds with haemoglobin and form carboxy haemoglobin which impairs normal oxygen transport by blood and hence the oxygen carrying capacity of blood is reduced. This oxygen deficiency results in headache, dizziness, tension, Loss of consciousness, blurring of eye sight and cardiac arrest.

(b) Carbon dioxide:

Carbon dioxide is released into the atmosphere mainly by the process of respiration, burning of fossil fuels, forest fire, decomposition of limestone in cement industry etc.

Green plants can convert CO_2 gas in the atmosphere into carbohydrate and oxygen through a process called photosynthesis. The increased CO_2 level in the atmosphere is responsible for global warming. It causes headache and nausea.

i) a) How do the pollutants affect the human body?

i) Particulate pollutants bigger than 5 microns are likely to settle in the nasal passage whereas particles of about 10 micron enters the lungs easily and causes scaring or fibrosis of lung lining. They irritate the lungs and causes cancer and asthma

ii) Lead particulates affect children's brain, interferes maturation of RBCs and even cause cancer

iii) Acid rain causes respiratory ailment in humans and animals.

iv) Hydrocarbons are potential cancer causing (carcinogenic) agents

v) The increased CO_2 level in the atmosphere causes headache and nausea

vi) Carbon monoxide reduces the oxygen carrying capacity of blood. This oxygen deficiency results in headache, dizziness, tension, Loss of consciousness, blurring of eye sight and cardiac arrest.

b) Harmful effects of water pollutants:

i) Cadmium and mercury can cause kidney damage .

i) Lead poisoning can leads to the severe damage of kidneys, liver, brain etc.It also effects central nervous system

iii) Polychlorinated biphenyls (PCBs) causes skin diseases and are carcinogenic in nature.

Harmful effects of soil pollutants:

Pesticides used in soil for food cultivation can affect the health of human beings.

32. On the basis of chemical reactions involved, explain how do CFC's cause depletion of ozone layer in stratosphere?

In the presence of uv radiation, CFC's break up into chlorine free radical

$$CF_2Cl_2 \xrightarrow{h\upsilon} CF_2Cl + Cl$$

$$CFCl_3 \xrightarrow{h\upsilon} CFCl_2 + Cl$$

$$Cl^\circ + O_3 \rightarrow ClO + O_2$$

$$ClO^\circ + O \rightarrow Cl + O_2$$

Chlorine radical is regenerated in the course of reaction. Due to this continuous attack of Cl° thinning of ozone layer takes place which leads to formation of ozone hole.

33. How is acid rain formed? Explain its effect.

Burning of fossil fuels (coal and oil) in power stations, furnaces and petrol, diesel in motor engines produce sulphur dioxide and nitrogen oxides. The main contributors of acid rain are SO_2 and NO_2. They are converted into sulphuric acid and nitric acid respectively by the reaction with oxygen and water.

$$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$$

$$4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$$

The pH of rain water drops to 5:6 and hence its is called acid rain

Harmful effects of acid rain:

i. Acid rain causes extensive damage to buildings and structural materials of marbles. This attack on marble is termed as Stone leprosy. $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2\uparrow$

ii. Acid rain affects plants and animal life in aquatic ecosystem.

ii. It is harmful for agriculture, trees and plants as it dissolves and removes the nutrients needed for their growth.

iv. It corrodes water pipes resulting in the leaching of heavy metals such as iron, lead and copper into the drinking water which have toxic effects.

v. It causes respiratory ailment in humans and animals.

34. Differentiate the following (i) BOD and COD (ii) Viable and non-viable particulate pollutants

(i) BOD and COD: BOD: The total amount of oxygen in milligrams consumed by microorganisms in decomposing the waste in one litre of water at 20° C for a period of 5 days is called biochemical oxygen demand (BOD) and its value is expressed in ppm.

Chemical oxygen demand (COD) is defined as the amount of oxygen required by the organic matter in a sample of water for its oxidation by a strong oxidizing agent like $K_2Cr_2O_7$ in acid medium for a period of 2 hrs.

(ii) Viable and non-viable particulate pollutants

The viable particulates are the small size living organisms such as bacteria, fungi, moulds, algae, etc. Which are dispersed in air. The non-viable particulates are small solid particles and liquid droplets suspended in air. **Example:** Smoke, dust, mists, fumes etc

35. Explain how oxygen deficiency is caused by carbon monoxide in our blood? Give its effect

Carbon monoxide is a poisonous gas produced as a result of incomplete combustion of coal are firewood. It is released into the air mainly by automobile exhaust. It binds with hemoglobin and form carboxy hemoglobin which impairs normal oxygen transport by blood and hence the oxygen carrying capacity of blood is reduced. This oxygen deficiency results in headache, dizziness, tension, loss of consciousness, blurring of eye sight and cardiac arrest.

36. What are the various methods you suggest to protect our environment from pollution?

Strategies to control environment pollution.

1. Waste Management : Environmental pollution can be controlled by proper disposal of wastes.
2. Recycling reused by recycling the waste material can be reused by recycling the waste, thus it reduces the land fill and converts waste into useful forms.
3. Substitution of less toxic solvents for highly toxic ones used in certain industrial processes.
4. Use of fuels with lower sulphur content (e.g., washed coal)
5. Growing more trees.
6. Control measures in vehicle emissions are adequate.

ALL THE BEST

E.MUTHUSAMY
NAGERCOIL
9940847892