Chapter 13. Environmental Chemistry

Question-1

What are the differences between Tropospheric pollution and stratospheric pollution?

Solution:

Tropospheric Pollution	Stratospheric Pollution
1. Pollution in atmosphere up to 10 km from sea level.	Pollution in atmosphere from between 10 - 50 km from sea level.
2. Pollution affects air (80% or total air) and moisture of atmosphere.	Pollution depletes ozone layer.
3. Pollution widespread	Pollution is narrow

Question-2

What are biodegradable and non-biodegradable pollutants?

Solution:

(i) Biodegradable pollutants are materials such as domestic sewage, cow dung etc. which are easily decomposed by the micro-organisms either by nature itself or by suitable treatment and thus not harmful but if these are present in excess in the environmental they do not go degradation completely and thus become pollutants.

(ii) Non-biodegradable pollutants: These are materials such as mercury, aluminium, D.D.T. etc. which do not undergo degradation or degrade very slowly, but their presence even in very small quantity in the environment is very harmful for the humans as well as plants. They may react with other compounds present in the environment and produce even more toxic compounds.

Question-3

How does carbon monoxide acts as a poison for human beings?

Solution:

Carbon monoxide is poisonous because it combines with haemoglobin of the red blood corpuscles (R.B.C) about 300 times more easily than does oxygen to form carboxy haemoglobin reversibly as follows:

$$\text{Hemoglobin} + CO \rightleftharpoons HbCO$$

The maximum permissible concentration of CO in the ambient air(Surrounding air) is 40 ppm for an exposure 6-8 hours. At concentration of greater than 100 ppm difficulty in breathing starts and there is headache and dizziness. Concentration of 750 ppm or more lead to acute oxygen starvation(called anoxia or asphyxiation) and lead to coma or death.

Question-4

How do lead halides enter into atmosphere as pollutants?

Solution:

Tetraethyl Lead $Pb(C_2H_5)_4$ is added to gasoline to act as an anti-knocking agent. During combustion in the engine, it is oxidised to PbO which deposits in different parts of the engine and may cause damage. To avoid this damage $Pb(C_2H_5)_4$ is mixed with dichloroethane and dibromoethane which converts PbO into $PbCl_2$ and $PbBr_2$ which are volatile and thus come along with the exhaust gases and introduced into the atmosphere.

$$Pb(C_2H_5)_4 + O_2 + C_2H_4Cl_2 + C_2H_4Br_2 \rightarrow CO_2 + H_2O + PbCl_2 + PbBr_2$$

This engine is protected but air gets polluted.

Question-5

Comment upon the state "Green chemistry is an alternative tools for reducing pollution".

Solution:

Green chemistry focuses on processes and products that reduce or eliminate the use and generation of hazardous substances. This may be achieved by following the aspects.

1) The use of starting materials – reagents and solvents that pose less hazards to man and his environment.

2) Using raw materials more efficiently generating less waste. This may be achieved by adopting only the reactions are simple additions, which completely converts reactants into products directly, without intermediate.

3) Date bases of information on the hazardous and toxic properties of chemicals, should be utilized by scientific commonly.

Development of a new method of synthesizing ibu profen which involves less use of solvents and waste; production of a herbicide by catalytic dehydrogenation of diethalamine without using cyanide and HCHO, using CO_2 instead of chlorofluoro carbon as a boiling agent in the manufacture of polystyrene focus, and use of a easily degradable, 'sea-nine' as a anti bonding compound are the few examples for the achievement in Green Chemistry.

Question-6

How plant nutrients and pesticides act as water pollutants?

Solution:

Plant nutrients (containing N and P) flow into lakes where they support the growth of aquatic plants. These plants on decay produce unpleasant odour. Further the microorganisms in decomposing these plants consume oxygen as a result the amount of dissolved oxygen in the water decreases which proves fatal for the aquatic lifes i.e. fish.

Pesticides. These are organic compounds which are sued to protect plants from pests. These are also used to stop the growth of weeds. These are mild poisons. These pesticides include insecticides (to kill insects) fungicides (to kill rodents such as fungi or mold), rodenticides (to kill rodents such as rats and mice).

They flow into lakes along with rain water causing problems to aquatic as well as human life.

Question-7

What is the international standards for drinking water.

Solution:

F^- = 1ppm = To avoid teeth decay. If excess 10 ppm it is harmful to bones & teeth.

Pb^{2+} = 50 ppb (ug dm^{-3})

pH = pH should be between 5.5 and 9.5

If the pH is lower than 5.5, water may dissolve matels.

Other metals

Zn – 5 ppm;

Cd - 0.005 ppm

Mm – 0.05 ppm

Fe - 0.2 ppm

Cu - 3 ppm

Se - 0.2 ppm

SO_4^{2-} 500 ppm - produces a laxative effect

NO_3^- 50 ppm; excess nitrate leads to 'blue – baby' syndrome.

Question-8

Explain the processes involved in the safe disposal wastes?

Solution:

Recycling

When materials are recycled, cost of raw materials as well as well as waste disposal are also reduced. (ex: a) use of break bottles in glass industry, b) use of scrap metal in steel manufacturing, c) burning of combustible water to get energy. Recycling converter work into wealth.

Sewage treatment

1) The removal of large solids by filtering the waste water through screens and disposal of in land fill sites.
2) Settlement in tanks to allow the removal of solids that settlement (sludge)
3) The degradation of the organic content of waste water by microbial oxidation
4) Removal of phosphates, coagulating filtration and disinfection using chlorine and used to improve quality of waste water. Sludge is dried and the may be incinerated, digested or dumped.

Question-9

Briefly explain 'electrostatic precipitation' method for controlling particulate pollution.

Solution:

The air containing the particulates is allowed to enter a tall chamber in which the electrode in the centre is subjected to a negative potential of 30,000 – 40,000 volts, whereas peripheral electrode is earthed. The air inside get ionized into positive ions and electrons. The electrons are absorbed on the particulates thereby giving them a negative charge. They are then attracted towards the positive peripheral electrode on which they accumulated and are removed by vibrating the electrode.

Question-10

What are the effects of oil pollution in sea water?

Solution:

Effects of oil pollution in sea water

(i) Oil spills causes heavy damage to flashes. Oil coating makes them unable to respire and close their gill slits. Aromatic compounds present in them are a poison for the fishes.

(ii) Emulsified oil gas deep down into the sea damaging aquatic animals and plants.

(iii) Oil slits results in reduction of dissolved oxygen (P. O.)

(iv) The most affected by oil pollution are the sea-birds. Natural insulating oil and waxes which shield the birds from water are broken down by the spilled oil. As a result due to loss of insulation, they start shivering and are frozen to death, especially in winter.