CHAPTER 11

ENVIRONMENTAL CHEMISTRY

UNIT : 1

1. Definition of terms : Air, water and soil pollutions
2. Oxides of carbon, Carbon monoxide, CO
3. Oxides of nitrogen and sulphur and chlorofluro carbons
4. Chemical reactions in atmosphere , smogs major atmospheric pollutants and acid rain

VERY SHORT ANSWER QUESTIONS :

1. Define pollutant and contaminant ?

A. A substance which is already present in nature but grows in Quantity due to human activity and adversely effects the environment is called pollutant

Ex : CO_2, SO_2….etc

A substance which is not present in nature, but produced by human activity and has adverse effect on environment is called contaminant

Ex : MIC (methyl Isocyanate)

2. Define Receptor, sink and speciation?

A. The medium which is affected by the pollutant is called receptor

The medium which reacts with pollutants is called sink.

The chemical form of the pollutants is known as speciation.

3. Why is environment getting polluted?

A. The environment is getting polluted due to increase in population, decrease in natural resources, industrialisation, urbanisation and deforestation.

4. Name the environmental segments ?

A. Atmosphere, hydrosphere, lithosphere, biosphere are the segments of environment.

5. Name any four pollutants ?

A. Sulphur dioxide - SO_2

Carbon dioxide - CO_2

Mercury – Hg

Carbon Monoxide – CO

6. Why is the temperature of the earth increasing ?

A. CO_2 and water vapour absorb I.R. radiations coming from the earth and partly reflected it back to the earths surface. Due to this the temperature of the earth increases.

7. Name any four green house gases?

A. Carbon dioxide –CO_2

Ozone-O_3

Nitric Oxide – NO

Chlorofluoro Carbons – CFC.

8. Acid rains are harmful. Why ?

A. Acid rains are harmful, because

1) The life of old buildings and historical monuments are considerably reduced

2) Qualitiyof drinking water will be decreased.

2) It reduces the fertility of soil

9. What are the causes of acid rains ? Why ?

A. The substances which cause acid rain are oxides of Nitrogen (NO, NO_2, N_2O_5) and oxides of sulphur (SO_2, SO_3)

Because these oxides dissolve in rain water and come down to earth as HNO_3 and H_2SO_4. It is called acid rain.

$$N_2O_5 + H_2O \longrightarrow 2HNO_3$$

$$SO_3 + H_2O \longrightarrow H_2SO_4$$

10. What happens when CO is increased in the air ?

A. When carbon monoxide is increased in the air, it combines with haemoglobin of blood to form carboxyl haemoglobin. This results in loss of vision, headache, fatigue, unconsciousness, some times even death.

11. How is water polluted ?

A. Water is polluted due to the following aspects :

1) Increase of the population leads to more sewage water

2) Increase of industries leads to more waste substances

3) Increase of agricultural product leads to more use of pesticides and fertilizers

12. Name some organic pollutants ?

A. Malathion, DDT, Carboxyl, chloro phenoxy group of compounds, phenyl mercury acetate, PAN, PBN….. etc

13. What harm is caused in plants due to sulphur dioxide.

A. SO_2 bleaches the green colour of leaf apexes in plants to yellow colour, this preventing it from performing photosynthetic properly.

14. What happens due to oil pollution in Sea ?

A. The volatile substances become evaporated, but the non volatile substances remain in the sea water. They are absorbed by the sea weeds and taken by fish. They are carcinogenic and they also prevent photosynthetic of algae in the sea.

15. Name the important sinks of CO_2 ?

A. Sea and Trees

16. How is carbon monoxide released into the atmosphere ?

A. It is released from the smoke emitted from automobiles like lorries, motor cars, buses, trains, etc, due to incomplete combustion of petrol and diesel.

It is also released in the oxidation of methane

17. What is Bio amplification?

A. The process of increases in concentration of pollutants from lower animals to higher animals through food chains is called Bio-amplification.

18. What are COD and BOD ?

A. The amount of oxygen required to oxidize organic substances present in polluted water is called COD.

The amount of oxygen used by the suitable micro – organisms present in water during five days at $20°C$ is called B.O.D.

19. What is TLV ? How can we protect the environment ?

A. The permissible level of a toxic pollutant without any adverse effect on a healthy industrial worker, working for 8 hours per day in a polluted atmosphere is called TLV.

We can protect the environment by planting trees and protecting the forests. By keeping the environment clean and green.

20. What happens when water is polluted ? Name one disease caused by water pollution ?

A. When water is polluted

1) It gives bad odour

2) Uncontrolled growth of weeds in it

3) Not useful for drinking

Polluted water leads to diseases like cholera, jaundice, typhoid and diarrhea

21. What happens when fluorides are present in water ?

A. If concentration of fluorides exceeds more than 3ppm in drinking water, it becomes harmful. The fluorides react with calcium present in the body to form CaF_2

$$Ca + F_2 \longrightarrow CaF_2$$

The colour of the teeth turns yellow. The bones become weak and the disease is called 'Fluorosis'.

22. How do pollutants effect the aquatic life ?

A. 1) Due to the presence of pollutants like cyanides, H_2S, CO_2. pH of water varies and becomes toxic to aquatic animals

2) Over nutrition in ponds causes eutrophication and ultimately the ponds become dry

3) Due to the presence of pollutants the D.O decreases in the water and this effects the aquatic life

23. Explain the Nalgonda defluoridation technique?

A. In this method bleaching powder, lime and alum are added in the same order and the water is kept for some time. The fluoride ions are precipitated as calcium aluminium fluoride and is separated by filtration.

24. How can we protect the environment from pollution ?

A. 1) Use of Biotechnology

2) Research must be developed to avoid the formation of by products in the reaction

3) Use of non – conventional fuels and energy systems like solar energy etc

4) Growth of population must be controlled

5) Growing forests and prevent the forest fires

6) Preventing the extinction of plants and animal species

7) Protecting and keeping the environment clean and green

SHORT ANSWER QUESTIONS :

1. How is soil pollution controlled by the following methods.

1) collection of wastes

2) disposal of wastes

3) recovery of resources

4) bioremediation

A. 1) Wastes containing suspended matter in solid form but little polluting matter in solution

e.g : China clay works, coal washeresis, etc

2) Wastes containing suspended solid matter and polluting matter in solution

e.g : Tanneries, denses, etc

3) Wastes containing polluting substances mainly in solution

e.g : Electroplating industry

2. Explain (a) Pollutants (b) Sink (c) Dissolved oxygen

A. a) Pollutant : A substance released into the environment due to natural or human activity and effects adversely the environment is called as pollutant

e.g : SO_2CO, lead, mercury, etc

b) Sink : The medium which reacts with pollutants is called sink

e.g : 1) Sea water is a big sink for CO_2

2) Microorganisms which eat the dead animals or which convert the dried leaves and garbage into fertilizers

c) Dissolved oxygen : The amount of oxygen present in water is called dissolved oxygen. The amount of oxygen required for the healthy growth of plants and animals in water is $4-6\,mg/litre$. On the basis of the dissolved oxygen value, the extent of pollution is usually estimated.

3. How do acid rains occur ? What are the effects of acid rains ?

A. Acid rain: Oxides of nitrogen i.e. nitric oxide and nitrogen dioxide combine with oxygen and ozone to form higher oxides of nitrogen. These oxides ultimately dissolve in water to form nitric acid

1) $NO + O_3 \rightarrow NO_2 + O_2$

2) $NO + O_3 \rightarrow NO_3 + O_2$

] 3) $NO_2 + NO_3 \rightarrow N_2O_5$

4) $N_2O_5 + H_2O \rightarrow 2HNO_3$

Sulphur dioxide reacts with oxygen and water to form sulphuric acid.

$$SO_2 + \frac{1}{2}O_2 \rightarrow SO_3 \xrightarrow{+H_2O} H_2SO_4$$

The nitric acid and sulphuric acids dissolve in rain water and come down to earth as acid rain. This is more in industrial areas.

Effect of acid rain:

1) Due to acid rain, the lifespan of buildings will be considerably reduced. The glossy nature of Taj Mahal is getting affected due to the action of acid rain on marble stones

2) Due to acid rain, the pH of the soil changes affecting its fertility.

4. What is the effect of carbon monoxide on human beings?

A. Carbon monoxide (CO) effects human beings. In human beings, oxygen which is inhaled during respiration combines with haemoglobin of red blood corpuscles and forms oxyhaemoglobin. One oxyhaemoglobin molecule transfers oxygen to another haemoglobin molecule i.e., oxygen is transported through blood to every part of the body.

$$\underset{\text{Oxyhaemoglobin}}{O_2 - Hb} + CO \longrightarrow \underset{\text{Carboxyhaemoglobin}}{CO - Hb} + O_2$$

Level of CO in ppm present in atmosphere	**%of CO-Hb formed from O_2-Hb**	**Effect on the health of human beings**
10	2%	Loss of vision
100	15%	Headache, fatigue
250	32%	Unconsciousness
750	60%	Death after a few hours
1000	66%	Immediate death

5. Write about the inorganic pollutants.

Inorganic pollutants	Effect
1) Salts, trace elements like copper, zinc, arsenic, etc metals coming out from chromium plating industry	1) Affects the human health and aquatic animals
2) Metals and complex compounds	2) Metals disturb the water system. Algae cannot grow properly. Such surroundings, decrease photosynthesis and increase air pollution directly
3) Cyanides, hydrogen sulphides, Carbondioxide, nitrogen dioxide and sulphites	3) pH of the water varies and becomes toxic to aquatic animals
4) Algae nutrients : Nutrients like Carbondioxide, hydrogen, oxygen, nitrogen, nitrates, phosphates, sulphates and micronutrients like boron, chlorine, copper, iron, manganese, vanadium, zinc, etc compounds	4) Eutrophication of the pond causes excess growth of the algae and subsequently the ponds get dried up
5) Heavy metals like lead and mercury	5) Water becomes toxic
6) Fluorides present in water	6) Water cannot be used for drinking purposes, as bones and teeth of human beings get effected. Water becomes toxic

6. Water pollution depends on the nature of industry. Give examples.

A. 1) Metals coming out from chromium plating industry effects the human health and aquatic animals
Due to heavy metals like lead and mercury, water becomes toxic, which effects the human health and aquatic animals

2) The waste water coming out from paper, pulp, leather, sugarcane and chemical industries degrade the presence of microorganisms. Due to this, dissolved oxygen value of water gets reduced, which affect the aquatic life (both plants and animals)

3) Water becomes over nutritious when organic substances from industry are thrown into the water resources like ponds and lakes. This type of nutritious lake or pond is called as “eutrophic lake” which causes excess growth of the algae and subsequently the ponds get dried up.

4) Wastage of organic pollutants coming from industries mix with water and are consumed by the fish and other aquatic life. It is propagated in the form of ‘food chains’ from lower animals to higher

animals and human beings is called as bio amplification. Thus, it results in high B.P. and increase in irritation levels of human beings.

7. Pollution is increasing by deforestation. Justify.

A. Due to cutting of forests, the concentration of CO_2 in the atmosphere gets increased. A 50% increase in CO_2 level, increases the surface temperature of earth by $3°C$. If there is $1°C$ increase in temperature, the following bad effects are predicted.

1) The ice caps of the polar region melt thereby increasing the level of the sea water by 90cm due to which many countries will get submerged

2) Due to global warming, the rate of evaporation of water from the seas, rivers, ponds will increase. This leads to ultimately rains, cyclones and hurricanes

3) A great effect on agriculture sector

8. What is the tolerable concentration of F^- ions in water ? What is the effect if it increases ?

A. The tolerable concentration of F^- ions in drinking water is 3ppm. When it exceeds 3ppm, it cannot be used for drinking. The water contains excess of fluorides which reach with calcium present in the body (especially teeth and bones) to form calcium fluorides.

$$Ca + F_2 \longrightarrow CaF_2$$

By this reaction, the colour of the teeth turns yellow and the bones becomes weak causing the disease "fluorosis".

9. Explain the different regions of the atmosphere.

A. Different regions of atmosphere are

1) Troposphere (0 – 11 km)

2) Stratosphere (11 – 50 km)

3) Mesosphere (50 – 85 km)

4) Thermosphere)85 – 50 km)

These regions extend upto 500 km above the earth

1) Troposphere : It is the major portion of the atmosphere. It contains chemicals like N_2, O_2, CO_2, H_2O, etc

Use : Maintenance of heat balance

2) Stratosphere : In this region, mainly ozone layer is present. It absorbs the ultraviolet radiation coming from the sun and prevents harmful ultraviolet radiation from falling on the earth.

3) Mesosphere : The chemicals present in this region are O_2^+, NO^+. In this region, temperature rises as we go up and reaches a maximum of 1473K. In this region, atmospheric gases especially oxygen undergoes ionization after the absorption of solar radiations.

10. What is environmental pollution ?

A. Environment is getting polluted by the following reasons

1) Due to increase in pollution, urbanization, deforestation, etc

2) Due to increase in industrialization and the natural resources have diminished

3) Due to increase in agricultural products like pesticides, fungicides, etc

4) Sewage from domestic, commercial, food processing and industrial effluents causes the decrease in dissolved oxygen by which the water is said to be polluted

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LONG ANSWER QUESTIONS :

1. Discuss soil pollution.

A. Soil is polluted mainly from i) Agricultural practices, ii) Industrial wastes, iii) Urban wastes, iv) Chemical and mechanical pollutants, v) Mining vi) Soil sediments, vii) Radioactive pollutants and vii) Biological agents

Soil is rich in several minerals and different kinds of organic matter. These minerals and organic matter undergoes natural decays and causes soil pollution. Soil is also polluted due to industrial wastes, urban wastes, radioactive pollutants, agricultural practices, etc.

In agricultural practices several chemical substances are used as fertilizers, pesticides, herbicides, fungicides and rodenticides. All these substances leads to soil pollution.

2. Explain the environmental segments.

A. Environment can be divided into four segments.

1) Atmosphere 2) Hydrosphere 3) Lithosphere 4) Biosphere

1) Atmosphere : The blanket of gases present around the earth is called the atmosphere. It absorbs a portion of electromagnetic radiation coming from the sun and transmits near U.V., visible and near infrared radiations. It plays an important role in maintaining the heat balance on earth. The major components in the atmosphere are oxygen and nitrogen, minor components are carbondioxide, water vapour etc. During respiration, all the animals take in oxygen and let out carbondioxide. During photosynthesis, plants utilize carbondioxide and release oxygen. Atmosphere can also supply nitrogen for nitrogen fixing bacteria.

2) Hydrosphere : All the natural water resources together constitute the hydrosphere. These include oceans, seas, rivers, lakes, streams, reservoirs, glaciers, polar ice caps, ground waters, etc

Water occupies four fifths of the earth's surface. Out of this, 97% is present in the form of ice in polar ice caps and only a small percentage of water is available for drinking, agriculture and other human purposes. Though sea water is not used for drinking, many of the marine animals and plants survive in sea water. The growth and decline of the ancient civilizations are closely linked to the water supply (e.g : Indus valley civilization)

3) Lithosphere : The outer mantle of the solid earth consists of minerals occurring in earth crest and soil. While the inner surface layers of earth contain natural gas and soil. Mountains and hills also come under lithosphere.

4) Biosphere : All living organisms like plants, animals and human beings constitute the biosphere. Biospheres and other segments of the environments are inter related.

e.g : The levels of O_2 and CO_2 depend on the plants present in the biosphere

Biosphere is dependent on atmosphere and hydrosphere

If water is contaminated with any unwanted substances, it may either cause infectious diseases or may lead to the death of the aquatic animals. Similarly, polluted atmosphere, can arrest the plant growth and can create health hazards among animals and human beings.

3. What are air pollutants ? How are they causing air pollution ?

A. The important air pollutants are :

i) Carbon monoxide ii) Oxides of nitrogen and sulphur

iii) Chlorofluorocarbons (Freons) iv) Hydrocarbons and photochemical smog

v) Dust, particulate matter from automobiles and certain industries

Possible hazards of air pollution :

1) Due to the increase in CO_2 levels in the atmosphere causing green house effect global warming.

Gases which cause global warming are - CH_4, nitrogen oxides (NO_x), O_3, CFC, H_2O, SO_2, etc

Effect of global warming : The temperature of earth increases resulting in :

i) The melting of ice caps

ii) The decrease in ground water

iii) The unseasonal rains

iv) a great effect on agriculture sector

Prevention : By growing trees and forests, stopping the production of CFC etc

2) Due to increase of oxides of nitrogen and sulphur causing acid rains

Acid rains : Higher oxides of nitrogen and sulphur react with water to form nitric acid and sulphuric acid. These acid dissolve in rain water and come down to earth as acid rain.

$$N_2O_5 + H_2O \longrightarrow 2HNO_3$$

$$SO_3 + H_2O \longrightarrow H_2SO_4$$

Acid rains are more in industrial areas

Effect of acid rain :

1) Due to acid rain, the life time of buildings will considerably reduced. The glossy nature of Taj Mahal is getting affected due to the action of acid rain on marble stones

2) Due to acid rain, the pH of the soil changes affecting its fertility

3) Due to the photochemical reactions taking place in stratosphere, ozone layer is depleted

Depletion of the ozone layer : Ozone layer present around the earth in the stratosphere protects the earth from harmful U.V. radiation falling on it. But due to certain chemicals like chlorolfluorocarbons (CFCs), Nitric oxide (NO), Chlorine, etc react with ozone and destroy it.

Effects of depletion of ozone layer :

1) It causes skin diseases, skin cancer, cataract cases etc

2) The efficiency of photosynthesis in plants decreased considerably

Prevention : To decrease the use of CFCs and search for alternative sources of refrigeration, pains spraying, etc, where CFCs were hither to used extensively

Hydrocarbons : Among hydrocarbons, methane is present in large quantities. When organic matter and biomass are degraded, methane gas is produced. The smoke coming out from automobiles contain a mixture of hydrocarbons. Carcinogenic benzopyrene is also released from the emission tubes of diesel engines. All the hydrocarbons are oxidized and converted into free radical which are harmful to the plants and can damage both the cellulose and tissues present in it. Peroxy Acetyl Nitrate (PAN) and Peroxy Benzoyl Nitrate (PBN) are harmful substances, damages the plants and causes irritation to eyes respectively. PBN undergoes photochemical oxidation, mixes with ozone, oxides of nitrogen and forms smog (smoke + fog). It is called “photochemical smog”, which has oxidizing character and formed during summer when the intensity of solar radiation is high.

4. Write a note on water pollution.

A. With an increase in the population, industries and use of pesticides and synthetic fertilizers in agricultural sector, many unwanted substances were released into the water. Due to this, the quality of water decreased sharply. This is called water pollution.

The main water pollutants are :

1) Inorganic pollutants : Salts, Cu, Zn, As metals, Cyanides, Fluorides, etc

2) Organic pollutants : Sewage and industrial effluents

3) Sediments and oils

4) Domestic waste

5) Industrial and agricultural waste

6) Fluorides

The pollutants get into water from industries, by agricultural operations and domestic sewages. Faecal matter polluting water causes water – born diseases like jaundice, cholera, etc.

Organic pollutants :

i) The production of synthetic organic compounds is increasing year by year. They are plastics, pesticides, detergents, dyes, pharmaceuticals. Their presence in water imparts colour and offensive odour.

ii) Industrial wastage coming from sugar, paper and leather industries and domestic wastage, when enter in water undergoes degradation with micro organisms. Thereby, D.O. value of water decreases. It adversely affects the aquatic life.

iii) Indiscriminate usage of pesticides resulted in water pollution. The pesticides cause water pollution are DDT, Malathion, Phenyl mercury acetate, etc. The substances mix with water and are consumed by fish. These are eaten by birds and human beings. In human body, they remain unchanged for sometime. It results in high B.P. and increase in irritation levels of human beings.

Oil pollution of seas : Oil – spilling on seas during oil – transport has increased in recent years. Thus, sea – water getting polluted.

Eutrophication : When organic substances from agriculture and industry thrown into the water resources like ponds and lakes, water become over nutrients. It makes the luxuriant growth of Algae and ultimately lakes become dry.

Natural water pollution : It occurs due to soil erosion, deposition of animal waste and fallen leaves. In certain areas of Nalgonda and Prakasam districts of A.P., Fluorides are present in harmful quantities in the ground water.

Effect of water pollution :

1) Polluted water is not used for drinking

2) Polluted water leads to contaminated diseases like cholera, jaundice, typhoid and diarrhoea

3) Aquatic life gets destroyed

5 How do the following substances pollute atmosphere

(a) CO (b) NO (c) SO_2

A. **a) CO :** 80% of the carbon monoxide released from automobiles. In human beings, oxygen is carried to the different parts of body by haemoglobin. If CO also present in air and is inhaled it decreases the oxygen carrying capacity of haemoglobin, due to the formation of complex compound carboxy haemoglobin.

$$\underset{\text{Haemoglobin}}{O_2 + Hb} \longrightarrow \underset{\text{Oxyhaemoglobin}}{O_2 - Hb}$$

$$\underset{\text{Oxyhaemoglobin}}{O_2 - Hb} + CO \longrightarrow \underset{\text{Carboxyhaemoglobin}}{CO - Hb} + O_2$$

Thus, Haemoglobin looses oxygen – carrying capacity. 100ppm of CO in air cause headache and fatigue. 750ppm of CO in air can also causes death.

b) NO : NO (Nitric oxide) emitted super sonic jet planes and come from the burning of fossil fuels. It reach the stratosphere and react with ozone. Thus, it causes depletion of ozone layer which causes the increase of UV radiation falling on the earth. UV radiation is harmful to human being, plants and animals.

Nitric oxide combine with oxygen and ozone to form higher oxides of Nitrogen

$NO + O_3 \longrightarrow NO_2 + O_2$

$2NO_2 + 2O_2 \longrightarrow 2NO_3 + O_2$

$NO_2 + NO_3 \longrightarrow N_2O_5$

These oxides ultimately dissolve in water to form Nitric acid

$N_2O_5 + H_2O \longrightarrow 2HNO_3$

HNO_3 dissolve in rain – water and cause acid – rain which is harmful

c) SO_2 **:** Sulphur dioxide is released into the atmosphere during :

i) Burning of sulphur

$S + O_2 \longrightarrow SO_2$

ii) Roasting of sulphide ores

$Cu_2S + 2O_2 \longrightarrow 2CuO + SO_2$

Pollution of air with SO_2 causes

i) Respiratory tract diseases in human beings

ii) Bleaches the green colour of the leaf apexes in plants to yellow colour and preventing it from photosynthesis

iii) Acid – rain

SO_2 reacts with O_2 and H_2O to form sulphuric acid

$SO_2 + \frac{1}{2}O_2 \longrightarrow SO_3$

$SO_3 + H_2O \longrightarrow H_2SO_4$

When H_2SO_4 dissolved in rain – water, it leads to acid – rain which is quite harmful

6. What happens if fluorides are present in water and how is it detected ? Explain any one defluoridation technique.

A. **Fluorides :** The concentration of fluorides up to 3ppm in drinking water is harmless. When it exceeds 3ppm it cannot be used for drinking. It reacts with calcium present in the body (especially teeth and bones) to form calcium fluorides

$Ca + F_2 \longrightarrow CaF_2$

By this reaction, the colour of the teeth turns yellow and the bones become weak causing the disease “fluorosis”

Detection of fluorides in water : Fluorides can be detected very easily from the reaction of fluorides with zirconium alizarin – S – dye. (The mixture of zirconium alizarin – S is coloured).

Fluoride reacts with zirconium to form zirconium fluoride which is colourless. The colour of the dye becomes weak with the increase in the amount of fluorides.

Defluoridation technique, Nalgonda technique : In this method, bleaching power, lime and alum are added in the same order and the water is stored and kept for sometime. The fluoride ions of water gets precipitated as complex calcium aluminium fluoride. This is filtered and pure water is used for drinking. The substances used in the method are harmless and are also cheap. This method is used even now.

ENVIRONMENTAL CHEMISTRY

UNIT : 2

1 Ozone and its reactions, effects of depletion of ozone layer
2 Green house effect and Global warming
3 pollution due to industrial wastes
4.Green chemistryas an alternative tool for reducing pollution with examples

VERY SHORT ANSWER QUESTIONS :

1. What happens when 'holes are formed in ozone layer ?

A. Due to holes in ozone layer, the U.V. radiations from the sun directly fall on the earth, causing a number of problems like skin cancer, cataract of eyes.

2. What is the harm caused by CFCs.

A. When CFC's reach to the stratosphere they decompose to give Cl free radicals, which cause depletion of ozone layer.

So the U.V radiations directly fall on earth causing skin cancer and damaging eyes.

3. In which segment of the atmosphere ozone is present ? What is the advantage of ozone layer.

A. Ozone is present in stratosphere

The O_3 layer protects the fall of U.V. radiations on the earth

4. What is Eutrophication?

A. Water from industry and agriculture is over nutritious with organic substances. When it is thrown in to the water resources like ponds and lakes, it supports the over growth of algae. Due to this the lake becomes marshy, filled with sediments and ultimately becomes dry. This is known as Eutrophication.

SHORT ANSWER QUESTIONS :

1. Suggest some methods to minimize pollution due to industrial wastes.

A. Methods to minimize pollution due to industrial wastes

i) Process and raw material changes : In textile industry for sizing starch is replaced with cellulose

ii) Equipment modification : Traps are provided on the discharge lines to present feathers and fat entering by which water pollution is reduced

iii) By product recovery : In pulp and paper industry wood chips are cooked in NaOH and Na_2SO_4 to produce a black liquid called black liquor. The components of this black liquor are recovered as by product, instead of treating it to present pollution

iv) Segregation of wastes : Highly toxic wasted are segregated to treat by solar evaporation or incineration

2. Explain the types of industrial wastes.

A. **i) Process wastes :**

These are from inorganic process wastes and organic process wastes. Inorganic process wastes are present in the effluents from chemical industries, electroplating industries, metallurgical and petroleum industries, etc. These are mainly toxic but do not generally produce biological problems. Organic process wastes are from food processing industries, dairies, distilleries, paper, textile mills, etc. It is very difficult to dispose organic process wastes.

ii) Chemical wastes :

Industries that manufacture acids, bases, detergents, explosives, dyes, insecticides, fungicides, fertilizers, silicones, plastics, resins etc which are generally used as raw materials for further manufacturing processes, contain chemical wastes. These wastes are produced during sedimentation, flocculation, washing, filtering, evaporation, distillation, electrolysis, adsorption, crystallization, burning, centrifuging, etc. Chemical wastes are generally acidic, basic or toxic materials, coloured and inflammable. Chemical wastes require biological oxidation treatment methods like thickening filters, activated sludge or logooning.

3. What are the characteristics of industrial wastes ?

A. 1) Wastes containing suspended matter in solid form but little polluting matter in solution

e.g : China clay works, coal washeresis, etc

2) Wastes containing suspended solid matter and polluting matter in solution

3) Wastes containing polluting substances mainly in solution

e.g : Electroplating industry

4. Explain the principles of industrial waste treatment.

A. the principles of industrial waste treatment are

1) nature of industrial waste

2) BOD and COD of the effluent

3) pH value of the effluent

4) suspended solids present

5) pollutants present

6) toxic chemicals present

5. What is green chemistry ? Explain it with an example.

A. The ways of using the knowledge and the principles of chemistry and other sciences to develop methods to reduce as far as possible the pollution of the environment are known as green chemistry

e.g : To bleach paper and pulp earlier chlorine gas was used. Now it is bleached with suitable catalyst. By this pollution of atmosphere by chlorine is prevented

6. Explain the effect of ozone hole.

A Due to depletion of ozone more UV rays enter into troposphere. Thus UV radiation leads to

1) Ageing of skin 2) Cataracts

3) Skin burns 4) Skin cancer

5) Damage to fish production 6) Killing many phytoplanktons

7) Effect plant proteins leading to the harmful mutation of cells

8) Evaporate surface water through the stomata of the leaves

9) Decrease moisture content of the soil

10) Damage paints, fibers, by fading them faster

11) Effect on photosynthesis etc

7. Ozone is a pollutant and protector to the environment. Discuss.

A. 1) Ozone is a pollutant : If the concentration of O_3 gas is increased in atmosphere, the temperature of earth increases resulting in global warming

2) Ozone is a protector : Ozone layer present around the earth in the stratosphere protects the earth from the harmful ultraviolet radiations falling on it

Hence, ozone is pollutant and also protector to the environment

8. Explain the reaction and effect of chlorolfluoro carbons with ozone.

A. 1) Chlorofluoro carbons are stable in troposphere, if it percolates into the upper atmosphere (stratosphere) they absorb ultraviolet radiation and get photolysed to liberate chlorine atoms

$$\underset{\text{Freon}}{CFCl_3} \xrightarrow[UV]{h\upsilon} \overset{*}{C}FCl_2 + \underset{\text{Free radical}}{Cl^*}$$

2) These chlorine atoms catalyse the decomposition of ozone resulting in the "depletion of ozone layer"

$$Cl^* + O_3 \longrightarrow ClO^* + O_2$$

$$ClO^* + [O] \longrightarrow Cl^* + O_2$$

3) In the above reaction, ozone is converted into oxygen, thereby decreasing the density of ozone in stratosphere, which results in the formation of holes in the ozone layer

4) These holes allow the harmful ultraviolet radiation from the sun to fall on the earth causing skin cancer, cataract of eyes, irritation of the skin, etc

9. How can you prevent green house effect by growing plants ?

A. CO_2 is a green house gas. Due to burning of fossil fuels the percentage of CO_2 increases

CO_2 is absorbed by plants for photosynthesis. By growing plants the intake of CO_2 increases, thus the quantity of CO_2 in the atmosphere decreases. Thus green house effect can be reduced by growing more and more plants.

10. "CFC"s are a boon to industry but a curve to the environment" – Discuss.

A. CFXs are synthetic compounds of chlorine, fluorine and carbon. Their trade name is Freon. They are very cheap and widely used as a refrigerant in air conditioning, as propellants, as solvents and also as foaming agents. Thus CFCs are a "boon" to industry.

CFC's are gaseous. They percolate into stratosphere and cause depletion of ozone layer. As a result, human life gets affected. Thus, CFC's become a curse to the environment.

LONG ANSWER QUESTIONS :

1. Explain the pollution due to industrial wastes. What are processes adopted to minimize the industrial pollution ?

A. Industrial activities produce different types of waste products which are generally discharged into water streams, organic compounds, the large proportion of these wastes are very slowly destroyed by bacteria and unpleasant odoum and tastes are produce.

Types of industrial pollution :

a) Process wastes : These are form inorganic process wastes and organic process wastes. Inorganic wastes are mainly toxic but do not produce generally biological problems. It is very difficult to dispose organic process wastes.

b) Chemical wastes : These are produced during sedimentation flocculation, washing, filtering, evaporation, distillations, electrolysis, etc.

Strength of wastes can be reduced by following methods :

1) Process and raw material changes : e.g : Highly polluted waste because of use of starch as a sizing agent in textile industry is modified by using cellulose as sizing agent to reduce pollution.

2) Equipment modification method : e.g : Providing traps on the discharge lines to prevent feathers and pieces of fat entering by which water pollution is reduced.

3) Equilization of wastes : It is necessary to equalize the discharge by holding the water in retaining basins and releasing it slowly it batches.

4) By – product recovery : If the useful by - products from industrial wastes are recovered, it reduces pollution and it is economically profitable.

5) Segregation of wastes : Highly toxic wastes that are less in volume may be segregated from the main stream to treat by solar evaporation, incineration etc, processes.

2. What is green chemistry ? Explain it with suitable examples.

A. Green chemistry involves not to produce green house gases like CH_4, CO etc are responsible for green house effect.

In many processes by – products become the pollutants. Green chemistry works for not producing wasteful by – products in these processes.

Green chemistry is a cost effective approach that involves minimum chemical usage, minimum energy consumption are minimum waste (pollutant) generation.

e.g – 1 : In the dry cleaning of clothes, earlier $(CCl_2 = CCl_2)$ tetrachloro ethane was used. This compound contaminates the ground water and is a suspected carcinogen. Therefore, using this compound is replaced by a process in which liquefied CO_2 with a suitable detergent is used. This would not pollute ground water much.

e.g – 2 : Earlier pungent odoured chlorine gas was used to bleach the paper. Now it is bleached with H_2O_2 with suitable catalyst that promotes the bleaching property of hydrogen peroxide.

3. How is global warming takes place ? What are its effects ?

A. **Global warming :**

Gases like $CO_2, CFC's, O_3, NO$ and water vapour absorb I.R. radiation coming to the earth and reflect them back to the earth's surface. Due to this, the surface of the earth gets heated. This is called green house effect or global warming. The gases which are responsible for this effect are called green house gases.

Effects of global warming :

1) For a $1°C$ rise in temperature, the ice caps of polar regions melt and level of the sea water increases. Thereby many coastal countries gets submerged

2) Due to global warming, the rate of evaporation of water from the seas, rivers, ponds will increase. This leads to unwarranted rains, cyclones and hurricanes

3) Due to global warming, short of water supply for agriculture occurs

Global warming can be prevented by growing trees, forests, stopping production of CFCs etc