ENVIRONMENTAL CHEMISTRY

→ **Speciation: detection of different chemical forms of inorganic , organic and organometallic compounds present in environment causing pollution.**

→ **Chemical Oxygen Demand(COD): amount of oxygen required to oxidise organic matter present in water.**

(50% of H_2SO_4 with $K_2Cr_2O_7$ is used to determine COD)

→ **Biological Oxygen Demand(BOD): amount of oxygen used by microorganisms for 5 days at 20°C in water.**

PURE WATER – 1ppm of oxygen

MUNICIPAL SEWAGE – 100-4000ppm

B.O.D >17ppm

❶ *AIR POLLUTION*

TROPOSPHERIC POLLUTION:

(i) SO_x-- low conc. SO_2 causes resipiratory problems like asthma, emphysema, bronchitis, etc.. irritation to eyes and redness. High conc. stiffness of buds.

(ii)NO_x – high damage to leaves and plants and decrease rate of photosynthesis.

NO_2 is a lung irritant lead to resipiratory diseases in children,NO_2 is harmful to fabrics and metals.

(iii) hydrocarbons causes ageing, breakdown of tissues and shedding of leaves and flowersand twigs.

→ pregnant women having habit of smoking leads to ↑in CO level in blood, may induce premature delivery, spontaneous abortions, deformation of baby so, they are advised not to smoke because CO level ↑ and carboxyhaemoglobin causes weak eyesight, nervousness, headache, cardiovascular disorders.

Greenhouse effect: CO_2 ,CH_4 ,O_3 , CFC's, H_2O (vapour)

→ Atmosphere traps natural sun light keeps the earth warmth (natural).

→Warm soil & plants emit IR radiation.

→ CH_4 production due to burning of vegetation.

→due to global warming ↑ in infectious diseases like dengue, malaria, yellow fever, sleeping sickness, etc..

Acid rains: **ph of rain <5.6 (oxides of S,N)**

→ **Particulate pollutants bigger than 5 microns block the (reside) in the nasal passage, 10 microns easily go into lungs.**

→**Lead cracked petrol causes release of lead which interferes the development & maturation of red blood cells.**

Classical smog – reducing (SO_2)

↗

Smog(smoke+fog)

↘

Photochemical smog- oxidizing (O_3 , NO_2)

[warm, dry and sunny climate]

reacts with unburnt hydrocarbons like HCHO ,acrolein ($CH_2 = CHCHO$) ,peroxyacetyl nitrate ($CH_3 - CO - O - O - NO_2$)

NO_2 , O_3 , **are powerful eye irritants causes throat and nose irritation at high conc. headache, chestpain , dryness of throat , cough, difficulty in breathing .**

→ **This smog causes cracking of rubber and damage to plant life. To control photochemical smog we use plants like *pinus, juniparus, querus, pyrus & vitis* plants they metabolise NO_x.**

STRATOSPHERIC POLLUTION:

Above 10 km -50 km from sea level , contains ozone layer which protects us from UV radiation.

→ **UV radiation causes melonema (skin cancer) in humans.**

$$O_2 \rightarrow O + O$$

$$O_2 + O \rightarrow O_3 \text{ (unstable)}$$

→ **CFC's is the reason**

$$CF_2Cl_2 \xrightarrow{UV\ rays} CF_2\dot{C}l + \dot{C}l$$

$$\dot{C}l + O_3 \rightarrow Cl\dot{O} + O_2$$

$$C\dot{l}O + \dot{O} \rightarrow \dot{C}l + O_2$$

→ **1 CFC molecule can destroy 10^5 molecules of O_3 .**

→ **Ozone hole: atmospheric scientists in 1980's found around Antaratica.**

→ **Summer :** $NO_2 + CH_4 + Cl\dot{O} + Cl_2 \rightarrow$ *chlorine sink prevention of* O_3 *degradation*

→ **Winter : polar stratospheric clouds provides surface on which chlorine nitrate formed gets hydrolysed to HClO.**

After sunlight return $HClO \xrightarrow{h\nu} \dot{O}H + \dot{C}l$

$$2\dot{C}l \rightarrow Cl_2$$

❷ *WATER POLLUTION*

→ **Caused by disease causing agents called pathogens (Bacteria, fungi).**

→ **Human excreta contains E.Coli, streptococau faecalis causes gastrointestinal diseases.**

→ **If conc. of dissolved** O_2 $is\ 6ppm$ **, it is good for survial of fishes**

CHEMICAL POLLUTANTS : heavy metals like Cd,Ni,Hg, etc are pollutants dangerous to humans & cannot be excrete them causes damage to kidneys, CNS, liver ,etc .

→ **Industrial chemicals like polychlorinated biphenyls (PCB's) are used as cleaning agents ,detergents and fertilizers are carcinogenic .**

→ **The process in which nutrient rich water bodies support the growth of plant population which kills animal life by depriving of** O_2 **results in subsequent low of biodiversity known as** *Eutrophication*.

INTERNATIONAL STANDARDS FOR DRINKING WATER

Fluoride : upto 1ppm or 1mg/dm^3 **,** F^-**ions makes teeth enamel harder by converting it into much harder hydroxyfluapatite [**$3Ca_3(PO_4)_2 . Ca(OH)_2$**] the enamel of teeth turned much harder**

→ **Above 2ppm of** F^- **ions causes browning of teeth ss**

→ **>10ppm harmful effect to teeth & bones**

Lead (Pb): prescribed conc. of lead is 50 ppb, can cause damage to kidneys ,liver , reproductive system .

SO_4^{-2} **: causes laxative effect above 500 ppm (moderate is harmless)**

NO_3^- **: max. limit = 50 ppm ,excess** NO_3^- **causes methemoglobinemia (blue baby syndrome)**

❸ *SOIL POLLUTION*

→ **Pesticides – DDT**

→ **Organo-phosphates and carbonates are nerve toxins**

→ **Herbicides –** $NaClO_3$ **,** Na_3AsO_3 **causes birth defects**

$$CH_2 = CH_2 + O_2 \xrightarrow{Pb(II)/Cu(II),H_2O} CH_3\ CHO_{(90\%)}$$