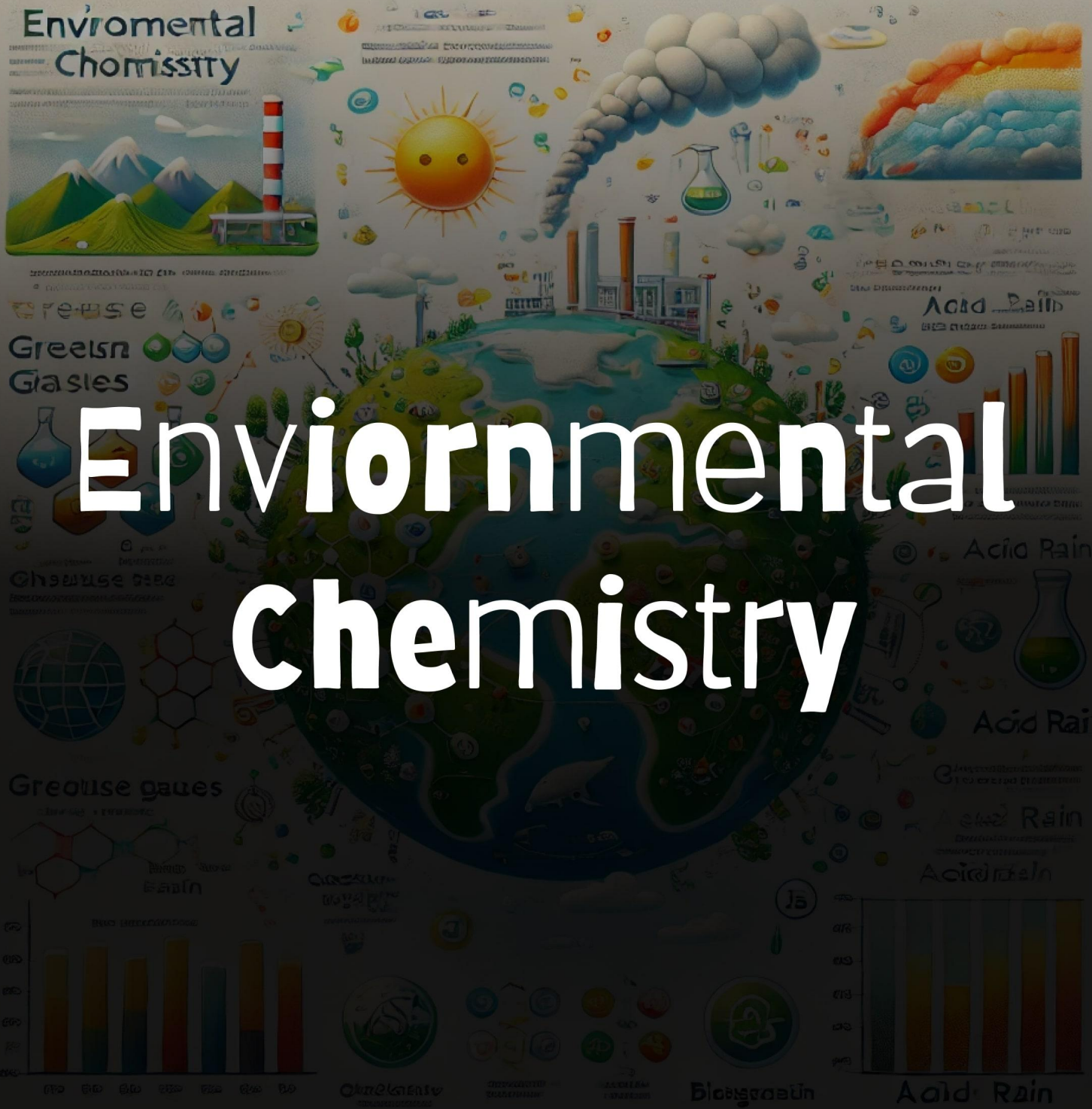


' Environmental Chemistry '



Environmental Chemistry

* Environmental Chemistry *



Environmental pollution - undesirable changes in surroundings which affects plants, animals, human beings.

Pollutant - substance which cause pollution (Solid / liq / Gas)

- Primary pollutant - exist in natural form - NO , SO_2 , NO_2 etc
- Secondary pollutant - PAN (Peroxy acetyl nitrate)
- Biodegradable pollutant - decomposed by microorganisms.
discarded vegetables, plant leaves etc
- Non-biodegradable pollutant - not decomposed by microorganisms.
DDT, (Dichloro diphenyl trichloroethane), plastic waste
Heavy metal, Hg, Ag, Pb.

Environment

- Atmosphere (air containing part)
- Hydrosphere (water contain part) sea, river, ocean.
- Lithosphere (Rock & mountain part)
- Biosphere (part where living org. interact with atmosphere, hydrosphere, lithosphere Biosphere)

Atmospheric pollution

- Troposphere (0-10 km)
- Stratosphere (10-50 km) → Ozonosphere
- Mesosphere
- Thermosphere

Tropospheric pollution -

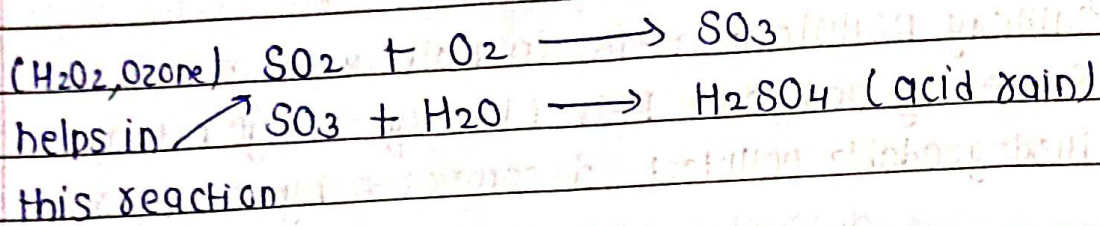
- Tropospheric pollutant - SO_x , NO_x , CO_x , H_2S , C_xH_y (gaseous pollutant)
- Dust, Mist, fume, smoke, smog (particulate pollutant)

SO_x -

- Produced when sulphur containing fossil is burnt in thermal plants

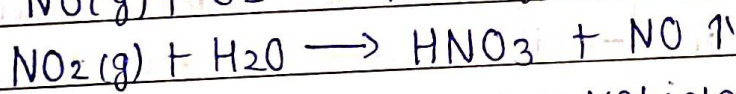
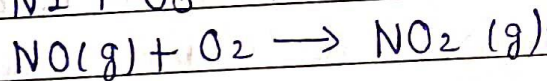
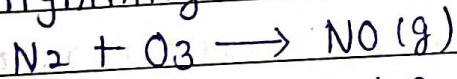


- Produced by volcanic eruption
- Cause asthma, bronchitis, irritation to eyes (low concn)
- High concentration of SO_2 leads to stiffness of flower buds
- Also cause acid rain

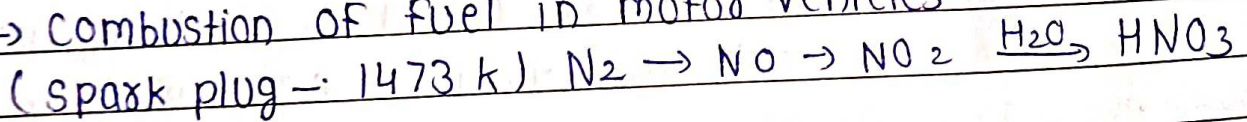


NO_x

- N_2 gas
- $\text{N} \equiv \text{N}$ (requires high Temp. to break)
- when lightning occurs



- Combustion of fuel in motor vehicles.



Effects

- damages plant leaves
- decreases photosynthesis
- respiratory illness in children

C_xH_y

- Incomplete combustion of fuel in automobile
- anaerobic bacterial decomposition of organic matter
- These are carcinogenic (cancer-producing)
- Ageing of plants & Shading of leaves, flower etc

COx

CO :- Automobile exhaust, incomplete combustion of coal, fossil fuel

$O_2 + \text{haemoglobin} \rightarrow \text{oxyhaemoglobin}$

$CO + \text{''} \rightarrow \text{Carboxyhaemoglobin (more stable)}$

'CO' reduces oxygen carrying capacity of blood because ↑

Global warming and Greenhouse effect

→ Global warming - Increase in concn. of green house gases, will lead to rise in global temperature. which again leads to melting of polar ice caps & flooding in low areas

→ Green house gases - CO_2 , CH_4 , O_3 , CFCs, nitrous oxide, water vapour.

→ Green house effect - Trapping of infra red radiation by green house gas. will lead to heating of earth's atmosphere called GH effect

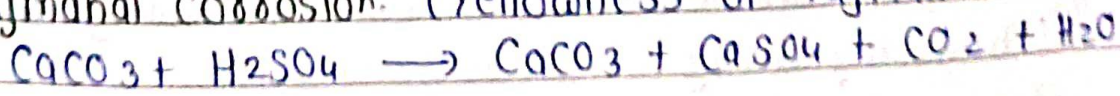
Acid Rain - normal rain has $pH = 5.6$

→ When pH of rain water is less than 5.6 it is acid rain due to presence of HNO_3 , H_2SO_4
 \downarrow \downarrow
 NO_x SO_x

Effect - Harmful for agriculture (washes away useful nutrients)

- Damages aquatic ecosystem (for growth)
- Respiratory illness (↑ pH of aquatic system)
- damage building made up of stone, marble, metal

Tajmahal corrosion. (Yellowness of Tajmahal)



* Particulate pollutant

1) viable

→ Small size living organism

→ Bacteria, fungi, moulds, algae etc.

→ particulate size bigger than 10 microns are likely to lodge in nasal cavity but less than 1 micron enters into lungs easily

2) Non-viable.

Smoke - Cigarette smoke, oil smoke

Dust - crushing of stone, sawdust of wood, cement

Mist - particles of spray liquid & by condensation of vapour in liq. factory

Fumes - condensation of vapours during sublimation, distillation, boiling etc.

Smog - Smoke + Fog → (containing harmful gas)

↳ It is a major air pollutant

Smog

1) Classical smog or London smog

Photochemical smog / Los Angeles smog

→ cool & humid climate

→ contains oxides of sulphur

→ contain primary pollutant

→ Reducing nature / Reducing smog

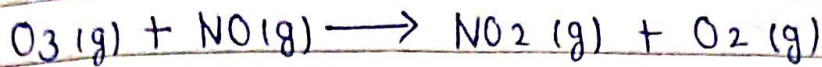
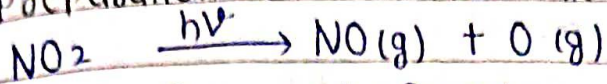
→ warm & dry climate

→ Oxides of nitrogen

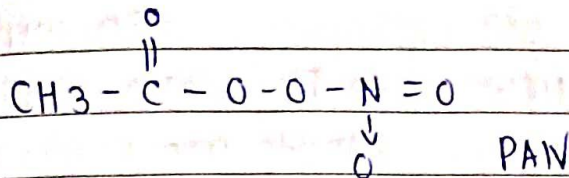
→ Secondary pollutant

→ Oxidising nature / Oxidising smog

Preparation of Photochemical Smog



Both NO_2 and O_3 are strong oxidizing agents & reacts with unburnt hydrocarbon to produce formaldehyde, acrolein, PAN.



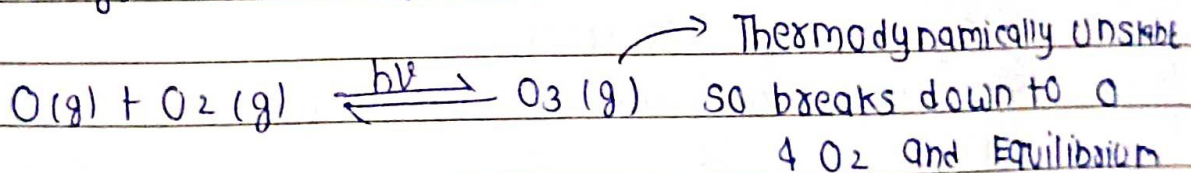
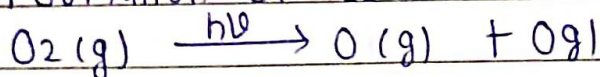
Effects: Irritation in eyes:

- Respiratory illness ; Cracking of rubber & extensive damage to plant life.

Stratospheric pollution (Ozonosphere)

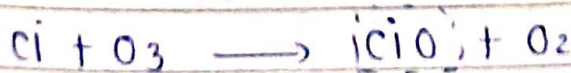
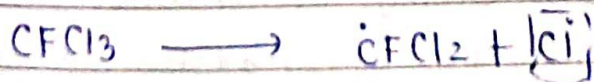
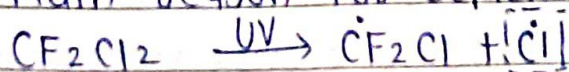
→ Ozone present in Stratosphere, protects us from harmful UV radiation from Sun
↳ Causes cancer

Formation of Ozone.

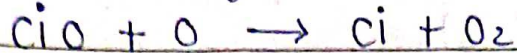


Depletion of Ozone

→ Main reason for depletion is CFCs (Ac. Fridge)



Cl[•] is regenerated



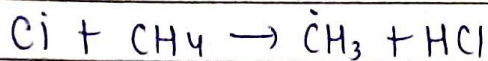
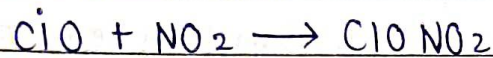
1 molecule of CFCs destroys 1000 ozone molecule

Ozone hole in Antarctica

In Sept & Oct each year ozone hole develops over Antarctica

In summer

→ ClO reacts with NO₂ and CH₄ and forms Chlorine sink.

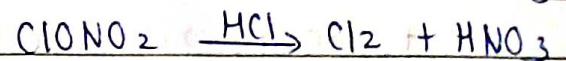
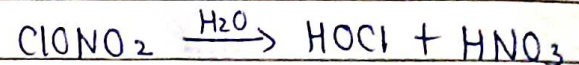
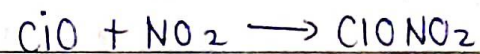


This prevents ozone layer depletion

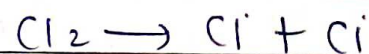
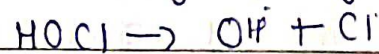
In winter

→ In winter special type of clouds are formed called Polar stratospheric clouds

which contains (HNO₃·3H₂O) or ice



→ During spring season



Effect of ozone layer depletion

- Skin Cancer

- eye damage (cataract)

- increase evaporation of surface water (harmful to agriculture)

* Water pollution

Water pollutant

1) Pathogen - disease causing agents (organism from domestic sewage & animal excreta)

2) Organic waste - (leaves, grass trash, excessive phytoplankton growth)

3) BOD - oxygen req. by bacteria to break organic matter in water

Pure water \rightarrow BOD - less than 5 PPM

Highly polluted water - BOD $\rightarrow \geq 17$ PPM

4) chemical pollutant - major oil spill

Acid from mining

International Standard for pure drinking water

Fluoride 1 PPM \rightarrow above 2 PPM \rightarrow brown mottling of teeth.

Over 10 PPM \rightarrow bones & teeth damage

Lead 50 PPM \rightarrow damages kidney, liver, reproductive system

nitrate 50 PPM \rightarrow blue baby syndrome (methanoglobinemia)

Sulphate 500 PPM \rightarrow Causes laxative effect

Fe - 0.2

Cu - 3

Al - 0.2

Zn - 5

Mn - 0.05

Cd - 0.005

Soil pollution

causes -

Pesticide - chemical used to kill / stop growth of unwanted organism

\rightarrow Insecticide \rightarrow DDT, BHC, Aldrin (stays in soil for long period of time & contaminate root crops potato, carrot, radish)

\rightarrow Herbicide \rightarrow NaClO_3 , Na_2ASO_3 \rightarrow earlier used
Triazines \rightarrow अजै गन्ना

\rightarrow Fungicide - organo mercury compound
- leaves mercury in soil