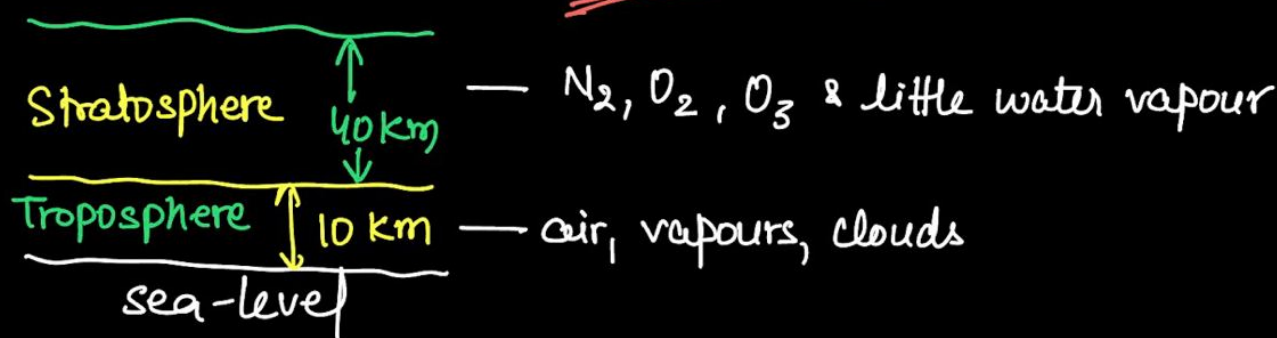


Environmental Chemistry



* Tropospheric Pollution

Gaseous Pollutants

SO_x, NO_x, CO_x, H₂S
HC, O₃ etc.

Particulate pollutants

• Dust, mist, fumes, smoke, smog

• SO₂ (low conc) causes respiratory diseases like asthma, bronchitis, emphysema

• SO₂ causes irritation to eyes, tears & redness

• SO₂ $\xrightarrow{[O]}$ SO₃ is catalyzed by PM in air

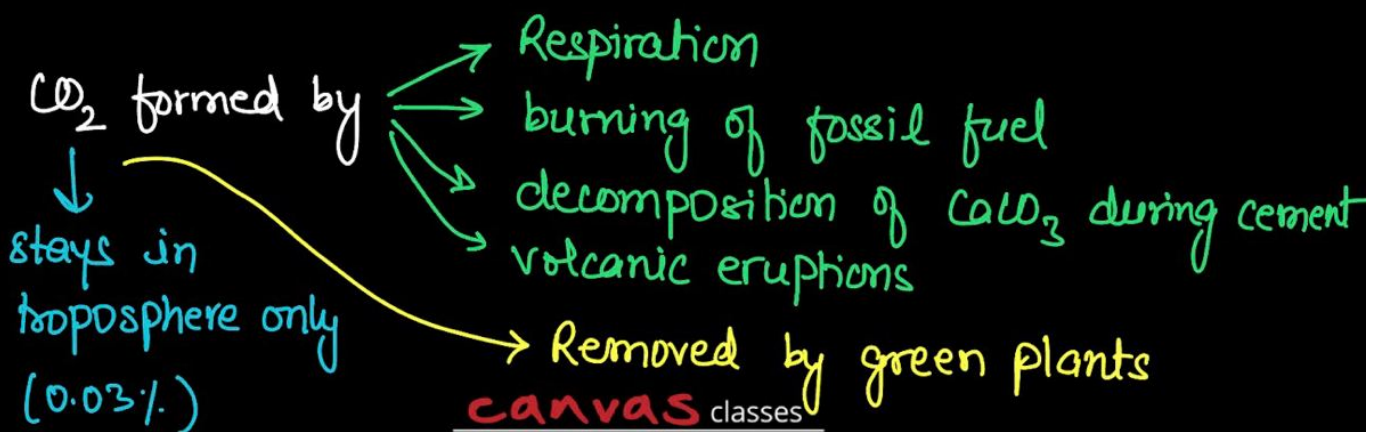
• N₂ + O₂ $\xrightarrow{1483K}$ 2NO(g) $\xrightarrow{[O]}$ NO₂ $\xrightarrow{[O]}$ NO₃⁻ \rightarrow washed into soil

- Irritant red haze in the traffic is caused by NO_x
- High conc. of NO_2 retard photosynthesis & damage leaves
- NO_2 is a lung irritant
- HC are carcinogenic & harm plants by causing ageing, breakdown to tissues & shedding of leaves.
- CO is deadly coz carboxyhaemoglobin is 300 times more stable than oxy-haemoglobin.

- CO % in blood \Rightarrow 3-4% \Rightarrow headache
 \Rightarrow weak eyesight
 \Rightarrow Cardiovascular disorder

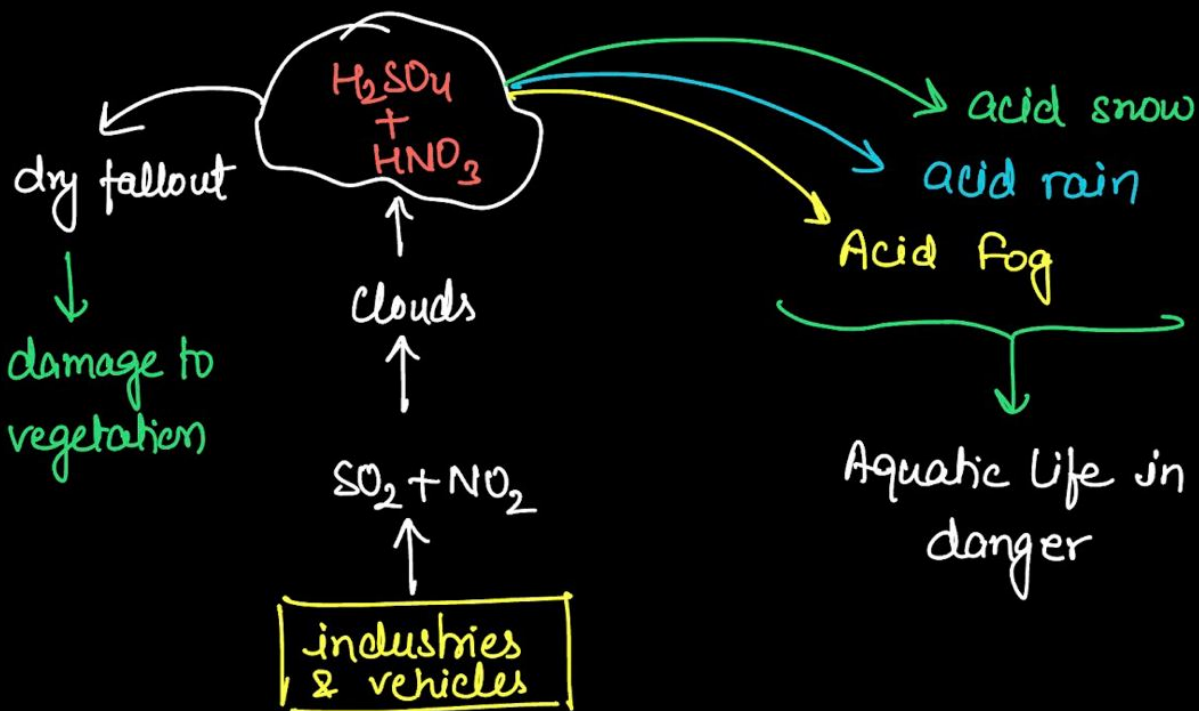
\downarrow
 in pregnant ladies causes

- \rightarrow Premature birth
- \rightarrow spontaneous abortions
- \rightarrow deformed babies



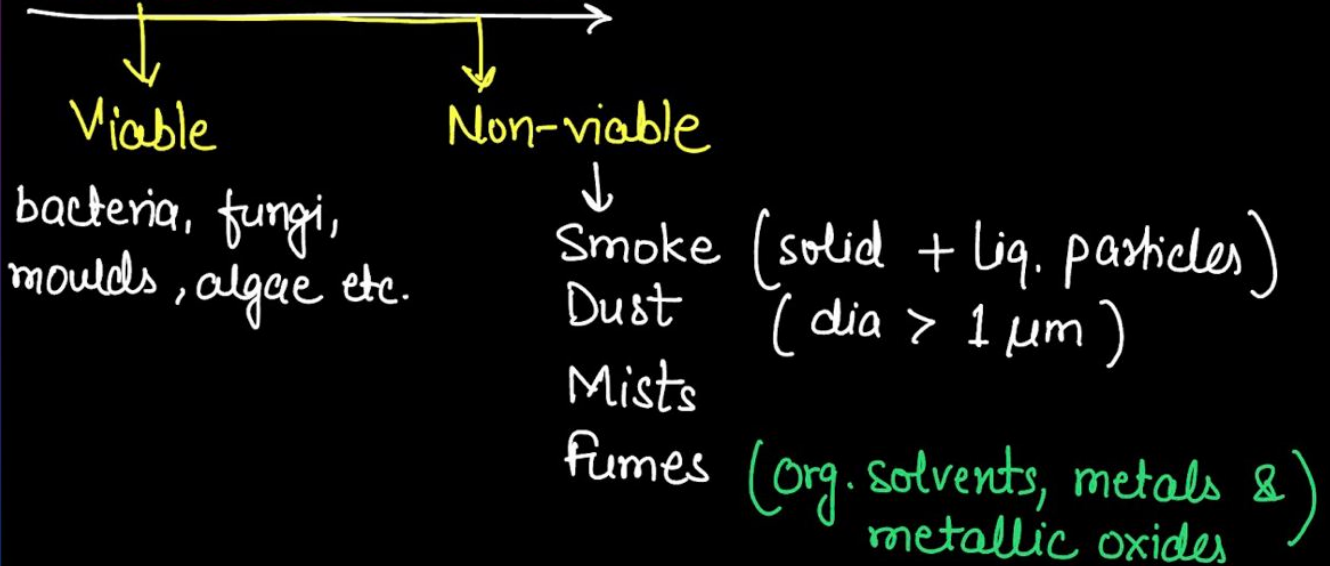
- Global Warming → CO_2 — major contributor
- CH_4 } trap heat
- Ozone }
- CFC's }
- Water vap }
- N_2O (Nitrous oxide)

Atmosphere traps the sun's heat near the earth's surface & keeps it warm — natural greenhouse effect



- Normal rain $\text{pH} = 5.6$ Acid rain $\text{pH} < 5.6$
- Aerosol particles of oxides or amm. salts in rain drops result in wet deposition.
 SO_2 is absorbed directly on both solid & liq. ground surfaces \rightarrow dry deposition
- Acid rain in water \rightarrow corrodes water pipes \rightarrow leaching of heavy metals (Fe, Cu, Pb)
 \downarrow
 reacts with marble as
 $\text{CaCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{CO}_2 + \text{H}_2\text{O}$

Particulate Pollutants

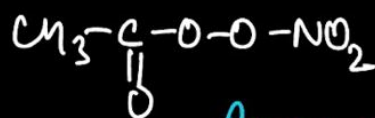
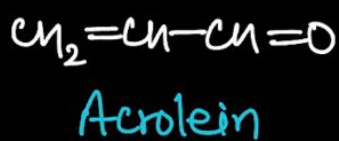
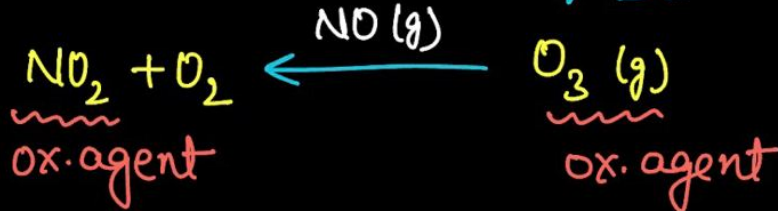
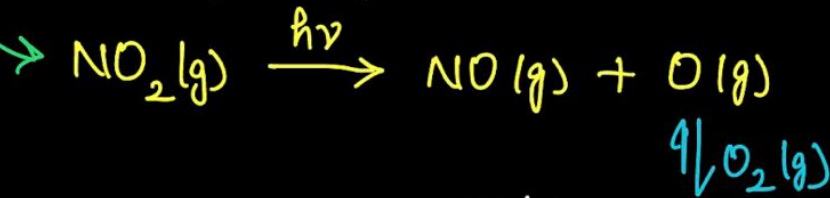


- $PM > 5$ microns \Rightarrow lodge in nasal passage
 ≈ 1 micron \Rightarrow enter into lungs
- Pb interferes with the development and maturation of red blood cells.

- Smog \rightarrow Classical \rightarrow
 - in cool humid climate
 - smoke + fog + SO_2
 - reducing smog

↓
Photochemical (O_3 , NO , acrolein, $HCHO$, PAN)

- In warm, dry & sunny climate
- Results from action of sunlight on Unsaturated HC & NO_x
- Oxidising smog

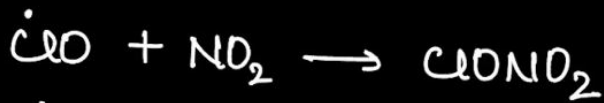


Peroxyacetyl nitrate (PAN)

* Stratospheric Pollution

- $O_2(g) \xrightarrow{UV} O(g) + O(g)$
 $O(g) + O_2(g) \rightleftharpoons O_3(g)$ → thermodynamically unstable
- $CF_2Cl_2(g) \xrightarrow{UV} \dot{C}l \xrightarrow{O_3} Cl\dot{O} \xrightarrow{O(g)} \dot{C}l + O_2(g)$
Ozone depletion

* Ozone hole



} Ozone depletion starts

• Causes of Water Pollution

- Pathogens
- Organic waste : DO in cold water = 10 ppm (max)
DO < 6 ppm — Fish can't survive
- Plant nutrients (fertilizers)
- Toxic heavy metals (Industries)
- Sediments (erosion of soil by agriculture, mining)
- Pesticides
- Radioactive substances
- Heat

BOD = amt. of O_2 req. by bacteria to breakdown organic matter present in a certain vol. of water sample.

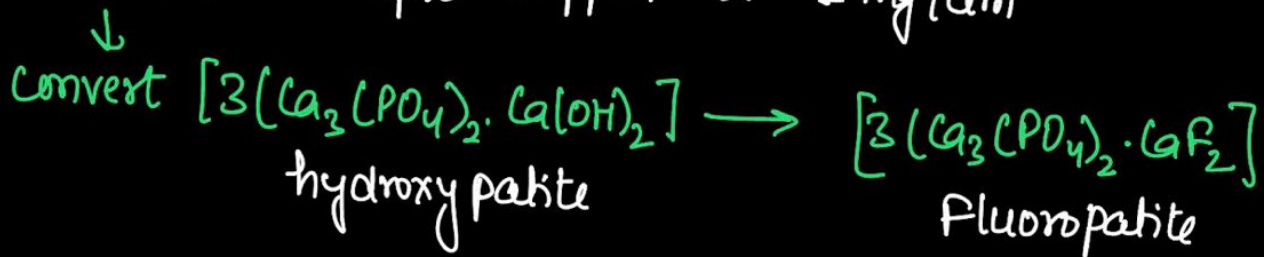
Clean water \Rightarrow BOD < 5 ppm

Highly Polluted water \Rightarrow BOD \geq 17 ppm

- **Eutrophication** \Rightarrow Process where nutrient enriched water bodies support a dense plant population which kills animal life by depriving it of O_2 & results in loss of Biodiversity.

- **Standards for Drinking Water**

\rightarrow Fluoride = upto 1 ppm or 1 mg/dm³



$F^- > 2 \text{ ppm} \Rightarrow$ brown mottling of teeth

\rightarrow Lead = 50 ppb

\rightarrow $SO_4^{2-} \rightarrow > 500 \text{ ppm}$ causes laxative effect

\rightarrow $NO_3^- \rightarrow 50 \text{ ppm}$

\rightarrow Fe - 0.2 ppm

Mn - 0.05 ppm

AP - 0.2

Cu - 3 ppm

Zn - 5 ppm

Cd - 0.005 ppm