passenger plane move in Troposphere

Ozone:

Formation:

$\Rightarrow O_2 \xrightarrow{135-170nm} [O] + [O]$

$[O] + O_2 \longrightarrow O_3$

$\Rightarrow O_2 \xrightarrow{h\nu} O_2^*$

$O_2^* + NO_2 \longrightarrow O_3 + NO$

Depletion:

$O_3 \xrightarrow{240-260nm} O_2 + [O]$

$HO^\cdot + O_3 \longrightarrow HOO^\cdot + O_2$

$HOO^\cdot + O \longrightarrow HO^\cdot + O_2$

$N_2O + O \longrightarrow 2NO$

$2NO + O_2 \longrightarrow 2NO_2$

Nitric oxide formation:

Below 30km:-

$N_2O + O \longrightarrow 2NO$

$\Rightarrow$ Conc. of N_2O is high

Above 30 km:-

$N_2 \xrightarrow{h\nu} N + N$

$2N + O_2 \longrightarrow 2NO$.

Facts due to which ozone layer depletion.

① Chlorofluorocarbon $\Rightarrow$ one chlorine can destroy

gs/mol

1 billion of O_3 molecule, one CFC's acts as catalyst

Oxides of Nitrogen:

N_2O, NO, NO_2, N_2O_5 ⟶ NO_x troposphere.

- N_2O (Laughing gas): naturally exist 0.25 ppm → due to microbial action (decomposition) of bacteria
- NO, NO_2, N_2O_5 (very low conc.): other are due to human activities → they act as pollutants (burning of fossil fuels in vechels, industries etc)

Sources:

$N_2O \xrightarrow{[O]} NO \xrightarrow{[O]} NO_2 \xrightarrow{[O]} N_2O_5$

These N_2O in stratosphere

⇒ N_2O, NO_2 decreases the thickness of ozone in stratosphere and fighter Jets fly in Strat. N_2O acts as fuel of modern jets. So jets directly emit the oxides of Nitrogen which destroy the ozone.

Strat: N_2O

Generally ↑ most in troposphere

⇒ But in stratosphere N_2O is not most

Residence time:

NO ⟶ 4-days in troposphere

NO_2 ⟶ 3-days ——

But their residence time is in

1 billion of O_3 molecule, and CFC's acts as Catalyst

Oxides of Nitrogen:

N_2O, NO, NO_2, N_2O_5 ⟶ NO_x (troposphere)

- N_2O — Laughing gas
  - naturally exist
  - 0.25 ppm
  - due to microbial action (decomposition) of bacteria
- NO, NO_2, N_2O_5 — very low conc.
  - others are due to human activities
  - They act as pollutants (burning of fossil fuels in vechels, industries etc)

Sources:

$N_2O \xrightarrow{[O]} NO \xrightarrow{[O]} NO_2 \xrightarrow{[O]} N_2O_5$

These are in stratosphere

⇒ N_2O, NO_2 decreases the thickness of ozone in stratosphere and fighter Jets fly in strat^{re}. N_2O acts as fuel of modern jets. So jets directly emits the oxides of Nitrogen which destroy the ozone.

Jets fly Strat:

N_2O — Generally ↑ mest in troposphere

⇒ But in stratosphere N_2O is not mest

Residence time:

NO ⟶ 4-days in troposphere

NO_2 ⟶ 3-days ——

But their residence time is in

years in Stratosphere because conc. of gases is low so collision is low due to which residance time is much greater.

Chemical Reactions:-

$$2NO_2 + H_2O \longrightarrow HNO_3 + HNO_2$$

$$N_2O_5 + H_2O \longrightarrow 2HNO_3$$

$$HNO_3 + NH_3 \longrightarrow NH_4NO_3$$

$$2HNO_3 + CaO \longrightarrow Ca(NO_3)_2 + H_2O$$

Direct Emissions in Stratosphere.

1) Ultrasonic fly jets:
Fighter jets

2) Nuclear Explosions.

It also increases oxides of nitrogen in stratosphere. In 1960's American & Russ perform Nuclear Explosions as result ozone conc decreases about 4% and drastic change 50% ozone depletion chances of these nuclear Experiments

Oxides of Sulphur:

Most stable oxide is SO_2 → 300 - 400nm

↓

S_8

Sources:

(1) Biodeisels → 5th generation oil, pollution free b/c they are sulphur free

Sources:

(2) ⇒ Burning of fossil fuels

2nd Rxn:

$$SO_2 + O_2 + H_2O \longrightarrow H_2SO_4 \text{ (acid rain)}$$

$$H_2SO_4 + CaCO_3 \rightarrow CaSO_4$$

$$H_2SO_4 + NH_3 \rightarrow NH_4SO_4$$

SO_2 + Hydrocarbons + NH_3 + $\dot{O}H$

↓

Photochemical Smog

⇒ play role in troposphere only.

17-2-2020

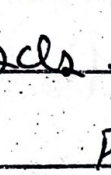
Chlorofluorocarbons:

CFC's name are :-

→ Freon-12

→ Freon-13

→ Freon-14

CF_2Cl_2 →  → All bonds have high E

Propellants: A material which can be dispersed easily under pressure called propellent.

⇒ They are inert in Troposphere b/c high bond E, of C-Cl and C-F bonds.

⇒ Due to high bond E in troposphere they are inert.

⇒ Radiations $\boxed{<200nm}$ fall on CFC's

$CF_2Cl_2 \xrightarrow{220nm} \dot{C}F_2Cl + \dot{C}l$

$\dot{C}l + O_2 \longrightarrow ClO\dot{} + O_2$; act as a catalyst in next reaction

$ClO\dot{} + O \longrightarrow$

$O_3 \rightleftharpoons O_2 + [O]$

⇒ $Cl^{\cdot}$ not destroy all O_3 molecules b/c it is a chain reaction and if Hydrocarbons present, it starts reacting with them

$\dot{Cl} + CH_4 \longrightarrow \dot{C}H_3 + H{:}\ddot{Cl}{:}$ (acid rain)

$Cl\dot{O} + NO_2 \longrightarrow Cl-O-N(=O)=O$

⇒ Every $\dot{Cl}$ can destroy one million O_3 molecules.

⇒ CFC's move in stratosphere b/c of light weight.

Sources of CFC,s:

i) Propellents used in AC, refrigrator, aerosols spray etc.

ii) Used as inert Specie in Troposphere.

Sink:

⇒ Stratosphere OR (ozone layer) which retain it for long time. All reactions of chlorine & here radicals.

⇒

Last part of organic Radicals.

⇒ Smog not formed in Summer because absence of fog and air Currents flow is low and environment Conditions are not Static i.e Temp. changes after few hours

⇒ Incomplete Combustion of coal or other material increases conc. of radicals of hydrocarbons and h/c of these radicals' high concent of fog become the reason of Smog.