1 AIR POLLUTION

ATMOSPHERE :

1) TROPOSPHERE :

> 0 - 11 km
> 15 to -56°C
> Contains N_2, O_2, CO_2, H_2O
> Air pressure and temperature drops with altitude
> 99% of water vapour (including clouds).

2) STRATOSPHERE

> 11 - 50 km
> -56 to -2°C
> Contains O_3 (Ozone layer of 15 km)
> Temperature increases with altitude.
> Lacks turbulence, thus jets fly in lower parts

3) MESOSPHERE

> 50 - 90 km
> -2 to -92°C (coldest temp. in atmosphere around top part)
> Contains O_2, O^+, NO^+, e^- (ionosphere)
> Too thin air with pressure 1% of sea level.
> Temperature decreases with altitude

4) THERMOSPHERE

> 90 - 650 km
> -92 to 1200°C
> Contains O_2 and NO^+
> Extremely such
> Thin air that burning temp. feel freezing.
> Contains satellites and phenomenons like aurora, northern southern lights.

EXOSPHERE

- 650 - 100,000 km
- Extreme temp.
- contain H_2, He
- Considered as a leakage of atmosphere in space.

IONOSPHERE

- Between thermosphere & mesosphere
- Contains charged atoms and ions with knocked e^-.

ATMOSPHERIC HAZARDS:

1) ACID RAIN

- SO_2 & NO produced by burning coal (SO_2), oil, CNG, petrol (NO_2), oil (in power station) (in vehicles)

$NO_2 + O_2 \rightarrow 2NO$

$2NO + O_2 \rightarrow 2NO_2$

$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$

H_2SO_4 from SO_2 (sulphuric acid)

HNO_3 from NO (nitric acid)

make acid rain

- $CO_2 + H_2O \rightarrow H_2CO_3$ (carbonic acid) (until saturation where pH = 5.6)
  (atmospheric)
- Thus, all rain is acidic.
- Harms: (i) vegetation destruction (ii) marine life damage
  (iii) Corrosion of metals (iv) Etching of building
  (iv) damage to nervous/respiratory system (v) contaminated lakes/ponds

2) OZONE DEPLETION

$O_2 + h\nu \rightarrow O^\cdot + O^\cdot$ (UV)

$O^\cdot + O_2 \rightarrow O_3$

} formation

$Cl + O_3 \rightarrow ClO + O_2$

$ClO + O^\cdot \rightarrow Cl + O_2$ (again reacts)

} depletion

* Sources of depletion (ODS- Ozone depleting substances
> CFC, HCFC, Halogens, CCl_4, CH_3Br etc.
> CFC sources - refridgerator coolant, cleansing agent etc.
* Effects :

~~GLOBAL WARMING / GREENHOUSE GAS~~ :

(i) Human health - skin cancer, blindness (actinic keratitis), low immunity.
(ii) Aquatic system - damage of fish / larval crabs, phytoplankton (absorber of CO_2) destroyed.
(iii) Materials - paint / plastic degradation
(iv) Climate - global warming

3) GLOBAL WARMING / GREENHOUSE GAS

"Progressive warming up of earth's surface due to blanketing effect of man made CO_2 in atmosphere".

* Greenhouse gases | Time in atmosp. | Warming potential

i) CO_2 — 50 - 120 yrs — 1
ii) CH_4 — 12 - 18 yrs — 23
iii) N_2O — 114 - 120 yrs — 296
iv) CFC_s — 1 - 20 yrs — 900 - 5300
v) $HCFC_s$ — 9 - 390 yrs — 470 - 2000
vi) CCl_4 — 42 yrs — 1400

Ozone and SO_2 are also kinda pollutants.
H_2O vapours ~~are also~~ and hydrocarbons are also major.

* Effects :

i) Sea level - rise due to glacier melts.
ii) Agriculture / forestry - Less productive crop making due to changed rainfall pattern.
iii) Water resources - Drought / floods are frequent.
iv) Terrestrial ecosystem - Inadaptability for plants & animals

4) SMOG:

"Hazy mixture of heavily polluted air due to emission of SO_2 and aerosols (smoke) from the burning fossil fuels, under cold, stable, moist conditions."

* Types:

> Classical / Industrial Smog / London Smog / Sulphurous smog

→ When sulphur particles dissolve in water vapor, while coal soot darkens the sky. (greyish in color)

$SO_2 + OH \longrightarrow HOSO_2$

$HOSO_2 + O_2 \longrightarrow HO_2 + SO_3$

$SO_3 + H_2O \longrightarrow H_2SO_4$

$C + O_2 \longrightarrow CO_2$

$2C + O_2 \longrightarrow CO$

$S + O_2 \longrightarrow SO_2$

$2SO_2 + O_2 \longrightarrow 2SO_3$

$SO_3 + H_2O \longrightarrow H_2SO_4$

$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$

> Photochemical smog / L.A. smog

→ When sunlight reacts with Nitrogen oxides and volatile organic compounds (hydrocarbons / aldehydes / O_3 / CO etc) (brownish)

$N_2 + O_2 \longrightarrow 2NO$

In troposphere: $2NO + O_2 \longrightarrow 2NO_2$

$3NO_2 + H_2O \longrightarrow 2HNO_3 + NO$

$NO_2 + h\nu_{(UV)} \longrightarrow NO + O^{\cdot}$

$O_2 + O^{\cdot} \longrightarrow O_3$

Hydrocarbons $+ O_2 + NO \longrightarrow$ PAN

O & O_3 + Hydrocarbons → aldehydes

* Effects:

> Mostly poisonous

> Reduces visibility

- Irritation in eyes / nose / throat
- Breathing trouble
- Crop damage / animal damage
- Building corrosion

* Remedies

- Conserve energy
- Use ecological paints and cleansers
- Avoid burning trash / leaves etc.
- Properly inflate your tires.
- Use spill-proof gasoline containers.

MONITORING POLLUTANTS

* SAMPLING OF VAPOURS

- Grab Sampling - Fill water in container, empty it so air replaces
- Absorption in liquid - Eg: NO_2 in NaOH, CO_2 in KOH etc.
- Adsorption in solid - Eg charcoal
- Cold Trapping
- Combustion

* SAMPLING OF PARTICLES

- Filtration - (cellulose filter paper)
- High Volume Filtration
- Sedimentation
- Impingement
- Electrostatic precipitation
- Thermal precipitation

* STACK SAMPLING