ATUL KUMAR [ECE]

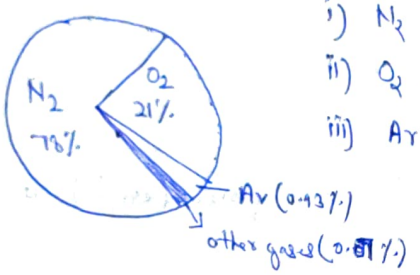
Advanced Environmental Chemistry (BSM-142)

→ A branch of science that deals with the study of chemical & biochemical phenomenon in environment is known as environmental chemistry.

* Environment : Everything surrounding us called Environment.

* Layers of environment : It consist of
  i) Atmosphere [layers of gases]
  ii) Hydrosphere [water, Seas, Ocean] Rivers
  iii) Lithosphere [mountain, Rocks, Sand]
  iv) Biosphere [All living component] for eg. plants & animals

* Composition of Environment :



① Major Component
  i) N_2 → 78%.
  ii) O_2 → 21%.
  iii) Ar → 0.93%.

② Minor Component
  i) H_2O vapours → 0.01%.
  ii) CO_2 → 0.032%.
  iii) He → 0.0005%.
  iv) CH_4 → 0.000002%.
  v) Trace Component
  eg. NH_3, H_2S, O_3, CO, SO_x, noble element. He, Ne, $(NO)_x$, H_2

→ Food Chain 1) Primary, 2) Secondary, 3) Tertiary } Consumer

→ Trace component [Con. less than 0.0000006] by volume.

* Components of Environment :

i) Biotic component

→ Living component
Biotic component are of three types ;
i) Producers or Autotrophes → They synthesize their own food.
  eg. Green Plants
ii) Consumers → They depends on producers for their food and also Heterotrophic.
  eg. Animals
iii) Decomposers → or detritivores
  eg. fungi & some bacteria.

ii) Abiotic component

→ NON-LIVING component
eg. Soil, water, Air, Rocks, Organic & Inorganic components.

* → Respiration :

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{Energy} \uparrow$$

36 ATP (Adenosine Triphosphate)

→ It is an exothermic process.

→ Glucose stored in the form of Glycogen in animal.

* Photosynthesis : ~~The layers~~ or It is the process by which plants/Microbes prepare their own food.

$$CO_2 + H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6O_2 \downarrow \text{Energy}$$

→ It is an endothermic process.

* Atmosphere of Earth : The layers of gases surrounding our planet (earth) is known as atmosphere.

→ It is retained by earth's gravity.

→ It is protective layer of earth.

* Structure of Atmosphere :

Atmosphere consist of 5 (five) layers :

1] Troposhsphere [Innermost layer] (CO_2, CH_4, O_2, N_2, H_2O Vapours)

2] Stratosphere [ozone (O_3) is present]

3] Mesosphere

4] Thermosphere or ionsphere

5] Exosphere [outermost layer]

* Imp Ozone (O_3) → It is present in stratosphere. It is depleted by CFC gases (chlorofluorocarbon (CF_2Cl_2)). It protect us from UV rays.

→ Respiration, photosynthesis, decaying of organic matter, acid rain etc.

* Function of Atmosphere :

1. To maintain the temperature of earth, for survival.
2. Provide O_2 for respiration
3. Provide CO_2 for photosynthesis
4. Protect us from harmful U.V Rays [or Solar Radiation]
5. Cloud formation takes place in atmosphere that causes rain.

CGXUVIMR → decreasing order of energy

* Composition of Atmosphere :

1) Major Constituent
N_2, O_2, Ar

2) Minor Constituents
CO_2, H_2O

3) Trace constituents [Con^n less than 0.0000006 ppm]

4) Dust particles
Sand, Smoke, oceanic Salt

*

→ Dust particles are found in lower layer of atmosphere and found in the form of sand, smoke and oceanic salt.

→ Dust particles helps in condensation of water vapour.

→ During condensation water vapours gets condense in the form of droplets around these dust particles, due to this cloud are formed and ~~resp~~ precipitation occurs.

* Structure of atmosphere :

It consist of five layer as mentioned above.

1) Troposphere: (where we live)

→ It is innermost layer of atmosphere (bottom layer)

→ It ranges from (0 to 18 km)

→ Temperature decreases with altitude [altitude :→ vertical height from sea level]

→ 75% air present in this layer. Mostly N_2, O_2
→ Temp. decreases by 6°C for every Km's of altitude.

→ Weather conditions happen is this layer.

→ "Vertical movement of air" takes place [Air current] or [turbulent]

→ Cloud formation takes place in this layer.

* Tropopause : The boundary b/w troposphere and Stratosphere.

→ The top or boundary of each layer is denoted by a 'pause', where the temp. pattern change

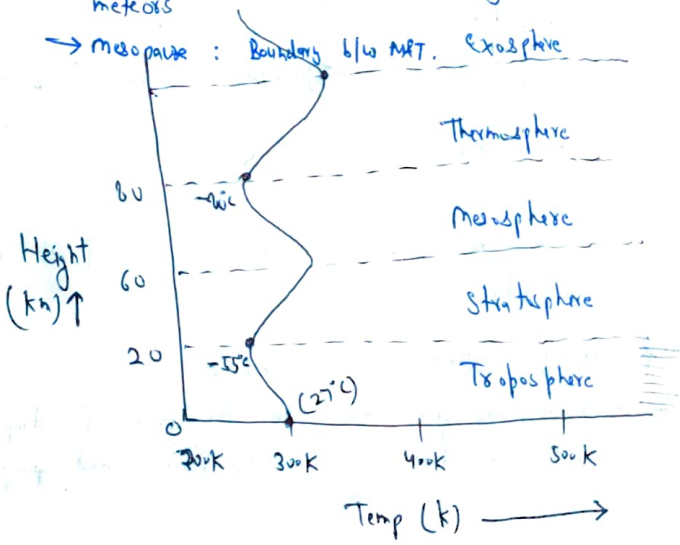
2) Stratosphere: It is second layer of atmosphere.

→ It is also known as ozone layer. Range → (18 to 50 km)
→ It protect us from harmful U.V radiation.
→ Most of the jet plane travel from this layer.
→ temp. increases due to absorbtion of radiation

* Stratopause: Boundary b/w stratosphere and mesosphere.

3) Mesosphere: It is the coldest layer of atmosphere extend upto 50 to 85 km

→ temperature decreases with increase of altitude
→ temperature decreases of about -80°C
→ ~~meteors~~ meteors burns up in this layers.
→ mesopause: Boundary b/w MST. Exosphere



* Space
Temp Variation
Tpm E
Mpm T
Mpm M
Tpm S
T
Temp
Earth Surface

* Ozone formation

$O_2 \longrightarrow O + O$

$O + O_2 \longrightarrow O_3$

→ It is poisonous
→ It collect and form a layer of O_2 in stratosphere and protect us from U.V ~~rays~~.

4) * Thermosphere: (Extend from 80 to 320 km) (Very thin air)

→ Temperature is very hot (hottest layer of atmosphere)
→ Temperature average about 980°C because the small ~~amount~~ amount of O_2 absorbs intense solar radiation (U.V)
→ Radiowaves are reflected in this layer. [Important for radio communication]
→ Ionisation of elements takes place in this layer, so it is also called ionosphere.

→ Thunderstorm & lightning takes place in this layer.

→ Thermopause: Boundary b/w Thermosphere & exosphere.

5) * Exosphere (It is extended upto 1000 km)

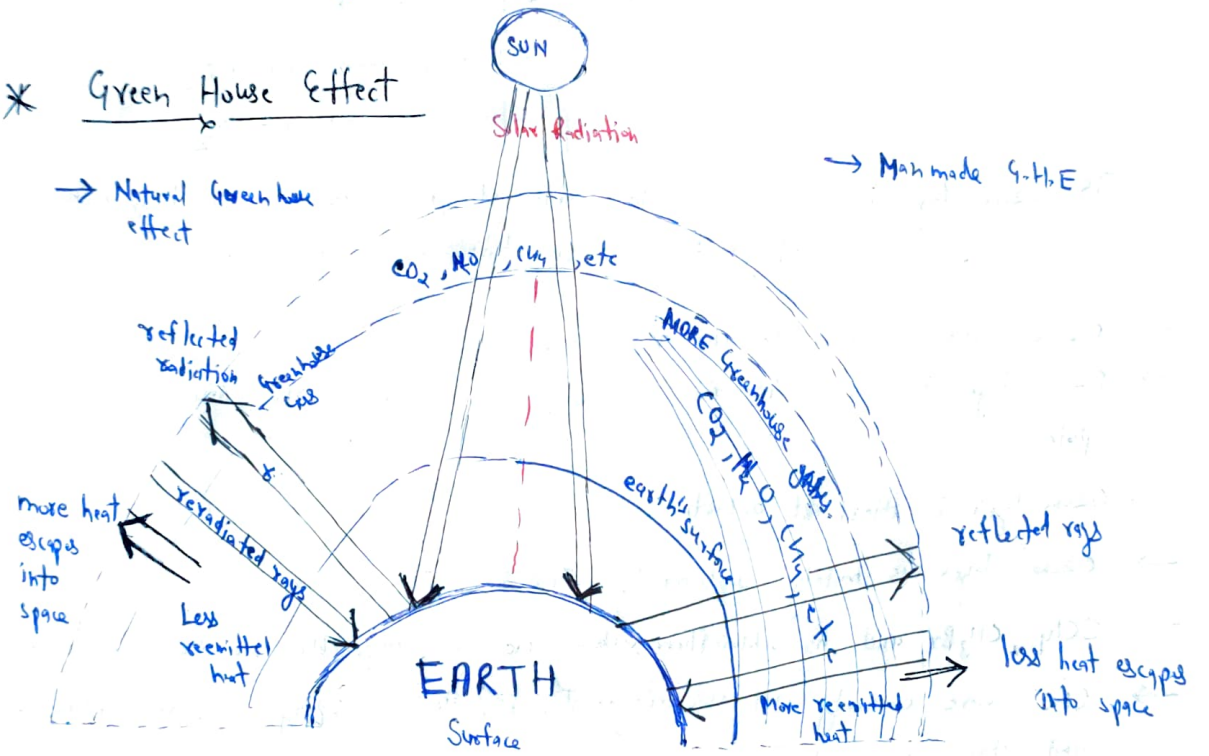
→ It is air-less zone (temp. ↓es with increase in height)

→ It contain hydrogen gas (H_2) in ionised state.

→ Uppermost region of atmosphere.

→ Gradually fades into outer space.

* Green House Effect



→ It occurs when gases in a earth atmosphere traps the sun's heat.

→ Green house effect is one of the thig that makes earth a comfortable place to live.

→ Green house effect is a natural process that warms the earth's surface.

when the sun's energy reaches the earth atmosphere some of its heat is reflected to space and some is absorbs and re-radiated by green house gases.

The absorbs energy warms the atmosphere and the surface of the earth.

→ Green house gases → CO_2, CH_4, N_2O, H_2O, O_3, CFC's (Nitrous oxide)
↳ Laughing gas

→ If GHE is not there, earth's temp. of about $-18^{\circ}C$.

→ Global warming caused by Green house effect (man made) / gas.

ice melts — Antarctica
Mount Everest
Ocean level increase
Tsunami

O_3 layer depletion

→ Formation of ozone layer

$O_2 \xrightarrow{\text{UV radiation}} O + O$

atom (Nascent oxygen)

$O_2 + O \longrightarrow O_3$

(ozone)

Reaction involved in O_3 layer depletion:

$CFC's \xrightarrow{h\nu} Cl\text{-atom}$

$Cl + O_3 \longrightarrow ClO + O_2$

$CF_2Cl_2 \xrightarrow{UV} Cl + CF_2Cl$

$Cl + O_3 \longrightarrow ClO + O_2$

$ClO + O \longrightarrow Cl + O_2$

→ The ozone layer is a region in the earth atmosphere that contain high conc. of ozone and protect the earth from the harmful U.V radiation.

→ Ozone occurs naturally in the atmosphere.

→ Ozone layer is thinest in the tropic, around equator and denser towards the pole.

→ Ozone layer is thinest at antarctica.

→ ozone layer is mainly depleted by CFC's.

→ CCl_4, CH_3Br and hydrochlorofluorocarbon. are also responsible for ozone layer depletion.

→ CFC's were commonly used as refrigerant, propellant in spray, fire extinguisher and shaving cream etc.

→ CFC's were also released by jet planes and aeroplane.

→ Cl atom act as initiator

→ CFC's are non-toxic, inert, non-carcinogenic

* Acid Rain

$CO_2 + H_2O \longrightarrow H_2CO_3$ (Carbonic Acid)

(In atmosphere) (water vapour)

(Responsible for slightly acidic nature of rain water)

$2SO_2 + O_2 \rightarrow 2SO_3$

$SO_3 + H_2O \longrightarrow \boxed{H_2SO_4}$ (P)

(from air pollution)

OR

$S + O_2 \longrightarrow SO_2 / SO_3$ (greater)

Formation of HNO_3 –

① → $2NO_2 + H_2O \longrightarrow HNO_2 + HNO_3$

(Nitrous Acid) (Nitric Acid)

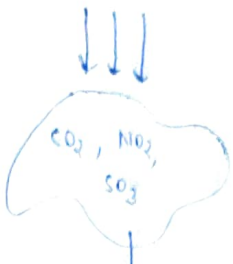
① ii) $N_2 + O_2 \longrightarrow$ or $2NO$ $NO + O_2 \longrightarrow NO_2$ (Reddish Brown haze)

③ $NO \xrightarrow{O_3} NO_2 + O_2$

$NO_2 + O_3 \longrightarrow NO_3 + O_2$

$NO_2 + NO_3 \longrightarrow N_2O_5$

$N_2O_5 + H_2O \longrightarrow \boxed{2HNO_3}$ ⑪



Present in rain water called acid rain.

Main cause : ~~H_2S~~ SO_3, NO_2

→ Term "acid rain" is generated by smith in 1962

→ Normal rainwater is always slightly acidic because CO_2 present in atmosphere get dissolved in water vapour to form Carbonic Acid (H_2CO_3)

→ Normal Acidicity of rain water is 5.6

→ Any rainfall have pH value less than 5.6, is defined as acid rain.

→ It is around pH value of 4.

→ Natural cause — Rotting vegetation ~~Carbon cycle~~
— Erupting volcano

→ Human activity — Industry
— Traffic
— Thermal power plant

→ Effect (Adverse)

① It effect human nervous, respiratory & digestive system

⑪ It causes skin cancer, contamination of heavy metals in the body.

⑪ effect on aquatic life — green algae
— fish

⑪ It retard the growth of a plant.

⑪ Demineralization of soil.

⑪ Building becomes faded & creates cracks.

+ Carbon cycle
+ Nitrogen cycle
+ Sulphur cycle
} PDF / Slides

Unit 02 → PDF + Unit 3 + Unit 4