20-1-20

www.Google.com.pk

Enviornmental Chemistry

CHEM- 431.

Introduction:

i) Atmosphere:

position, pollutants, sources, reaction effect

(ii) Hydrosphere (iii) Lithosphere (iv) Biosphere

(v) Anthrosphere (vi) Instrumental analysis.

Environment:-

⇒ Anything sorround us including living or non-living.

⇒ Complex of all physical, chemical and biotic factors which effect the living organisms and ultimately determine their survival.

⇒ Fossil fuels contains sulpher thus not environment friendly

⇒ Oxides of N, S and C Sources are burning

⇒ H_2SO_4 repute marbels because $CaCO_3$ converts in $CaSO_4$

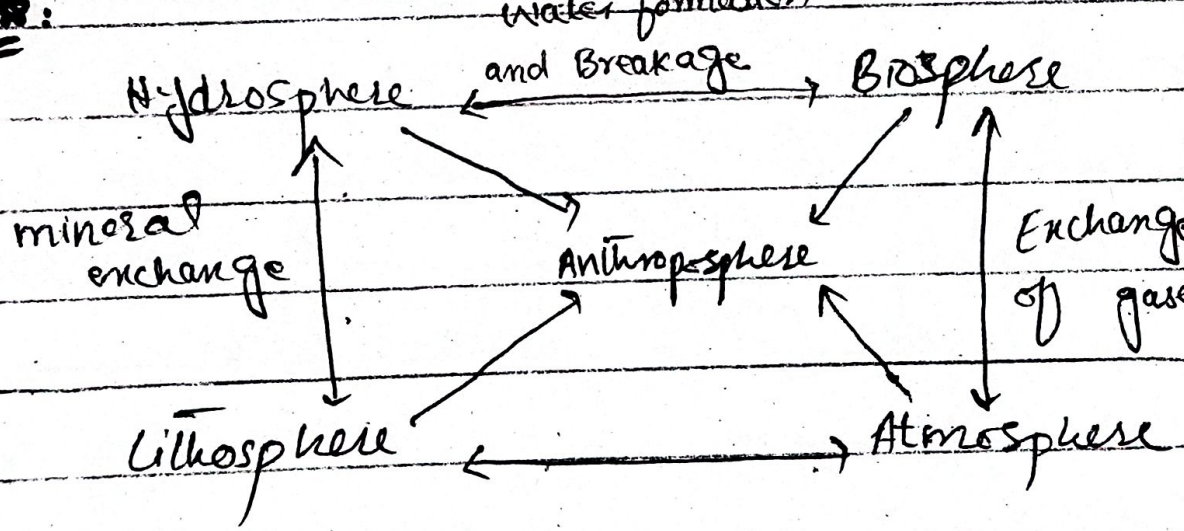
⇒ Biodiesel contains minimum

amount of "S" that is environmental friendly.

Environmental Chemistry:

⇒ "Scientific study of sources, reactions, transportation, effects, rate of species and effects of human activities on these processes called Environmental chemistry OR interaction of human activities"

*:



⇒ All 5-Components of environmental chemistry are inter-linked.

⇒ Components also called Segments of environment.

Anthropic ⇒ = انسان

Anthropophere: OR Anthrosphere

"That component of Environment with which human being interacts and effect its composition called anthropophere or anthrosphere".

⇒ Anthropogenic or Anthronic effects caused by anthrosphere.

Biosphere:

⇒ part of Environment which contain all living organisms.

Hydrosphere:

⇒ part which has water.

Lithosphere: (اوپری والم حصہ)

⇒ Component of environment consist of outermantle and crust of the earth is called lithosphere.

Atmosphere:

⇒ Blanket of gases, surrounding the earth surface called atmosphere.

Atmosphere:

Blanket of gases surrounding the earth surface which protects the life on earth from hazard radiations and maintain heat balance is called atmosphere.

Composition:

→ **Major Components:**

→ N_2 78%

→ O_2 20.9%

→ water vapour 0.1 — 5%

Minor Components:

Ar .9%

CO_2 0.03 — 5%

Traces:

Helium

neon

ozone

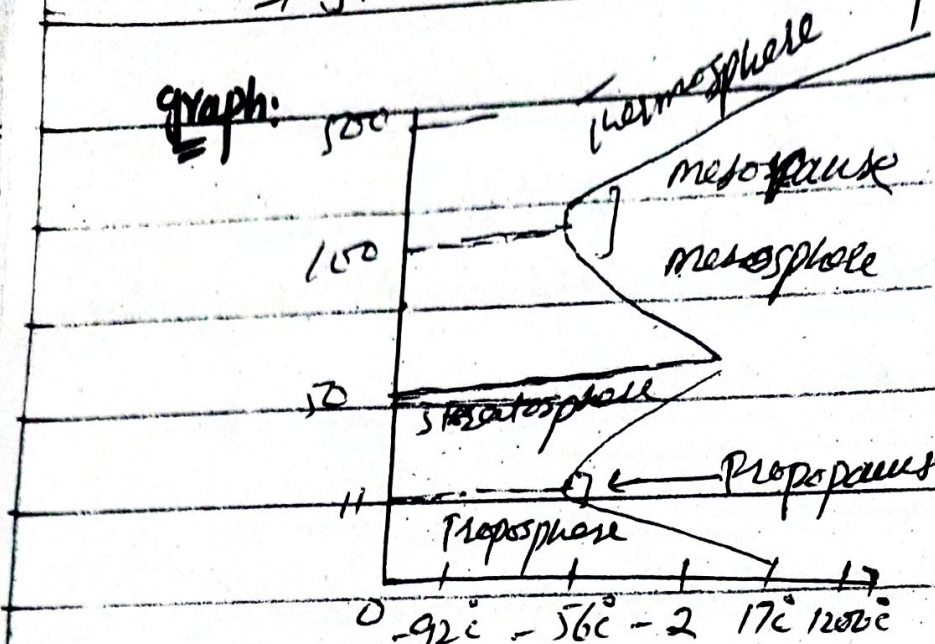
Structure:

Divided into different layers on the basis of temprature.

Generally 4 layers.

⇒ It is extended upto 500km.

graph:



Layers:

i) Troposphere ii) Stratosphere

iii) Mesosphere iv) Thermosphere

Tropo lowest

⇒ **Troposphere:**

→ 1st layer

→ width is about 0-11km

→ Hydrogen, oxygen, nitrogen present gases

→ mass of atm. 70-80 %

due to gravity. Density of increases by decreasing temp and gases move back towards earth.

→ Height increases conc. of gases decreases because temp. decreases with increasing Height (the negative lapse rate)

→ conc. of gases decreases by increase of height.

→ temp negative, lapse rate (6.5°)

→ all weathering processes takes place in it.

→ gases flow from higher to lower temp

→ Turbulent atmosphere in it.

to turbulent atmosphere gases flow from high temp to temp and atmosphere is not constant.

→ R/s are fast in it and residence ~~suspended~~ rate of particals is low due to turbulent atmosphere.

→ Life is possible in this region.

→ Aeroplane are generally move in this region.

→ Temprature changes from 17°c — -56°c and conc. of gases remains very low.

→ At 1-2km region where temp remains constant.

Tropopause:

→ The upper part of troposphere where temp change or lapse rate becomes equal to zero is called tropopause. It extends 1-2km in Height.

→ 6.5 digree/km temp decrease generally 6.5°c/km

ii) **Stratosphere:**

⇒ Height is about 11-50 km.

Normal

→ Temp lapse rate is positive means increasing height temp also increases

→ Temp lapse rate is -56°C to -2°C.

→ Due to ozone layer its temp increases

ozone conc. is about 2000ppm

→ Ozone have high conc. at about 2000ppm

→ 25-30km which is called ozone layer. (IR, UV, Radio etc)

⇒ Ozone absorb radiations due to which temp. increases. More conc. of ozone temp. is also increases

⇒ Ozone formation and breaking takes place in it means reversible reaction takes place

$$O_3 \rightleftharpoons O_2 + O$$

⇒ Lighter gases also present in small quantity

→ High radiations like cosmic radiations or high energy ultraviolet radiations are used to break the oxygen molecules

$$O_2 \longrightarrow O + O$$

⇒ Ozone is oxidizing agent. It oxidizes to oxygen

oxygen radicals near UV region. oxygen radical is involved in fading of colour. spoilage of plastic or rubber is due to oxygen radical.

$$C_3 \xrightarrow{\text{Near UV}} C_2 + O$$

→ Respiratory deases also take place

$$O_2 + O \longrightarrow O_3$$

→ Residence time increases due to less turbulant atmosphere or

→ Near UV radiations are used to break the ozone molecule.

⇒ Distance b/w gas molecule is greater in it due to high temp and Residence

⇒ No weathering process in it. long terms global effects of species in it due to greater residence time.

Replenish Times of gases:

C_{O_2} = 4-8 years

O_2 = 3500 years

N_2 = 100 million years.

Replenish → old conc. vanishes and new molecules formed.

Ozone is major pollutant in Stratosphere, and major component in troposphere.

Mesosphere:

Extends 50 - 85 km

Negative lapse rate means temp. decrease with increase of Height

2°C ——— -92°C

Due to less conc. of uv-abs. Species temp. parties decreases.

General Species due to which temp is same level maintain are

O_2^+, NO^+

Distribution of species depends upon the mass.

Lighter gases

Thermosphere:

→ Temp increases from -92°C — 12

→ +ve lapse rate

→ 85 - 500km

→ species present O^+, O_2^+, NO^+, other different gases (Helium, radicals

where species are present so temp. increases

→

Ionosphere:

→ Region b/w upper mesosphere and lower thermosphere where conc. of ions is present this layer of ions is called ionosphere.

→ It is present in upper mesosphere and lower thermosphere.

⇒ It is Imp. for radio transmission, Radio waves reflects the ions and M.C.Q Come back to the earth surface.

⇒ How temperature of earth is maintained? Earth radiation Balance.

Sun: ⇒ outer surface or photosphere 5500° approximately 6000°C. ⇒ Inner surface temp 15M °C due to fusion Rx.

⇒ Solar flux on earth 1340 watt m^{-2} min^{-1}

Ionosphere:-

Combined region of lower thermo-sphere and upper mesosphere where conc. of ions is

greater.

⇒ This ion layer helps in importance of radio transmission.

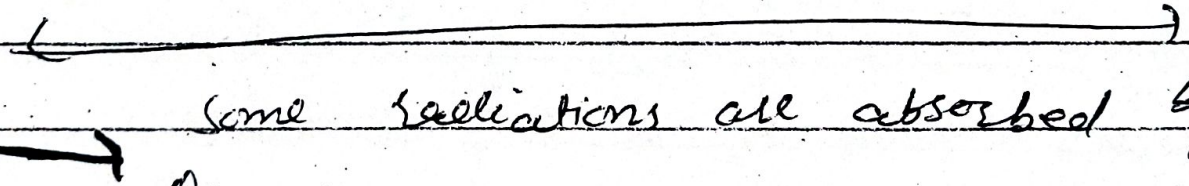
⇒ Radio Signals transfer b/c of these ions.

⇒ Radiowaves strike with the layer of ions and strike back to the earth surface.

⇒ Temp. of exosphere increases b/c region moves nearer to Sun.

⇒ How the temp. of earth is maintain or Earth Radiation Balance?

Outer surface or Photosphere of Sun's temp is 5500°C approximately 6000°C



Some radiations are absorbed by O_3

Earth radiations Balance:

outer surface / photosphere

Prevents some

→ Some radiations absorbed by O_3 e.g Cosmic, far U.V etc and UV/visible reached to earth.

→ 66% light absorbed by earth and 34% reflects back called

Albedo phenomenon:

→ Not 100% radiations reached to earth 34% reflects back b/c of direct/dust → solid particals suspended in air and they reflect back 34% of light.

→ If ratio of dust particals increases in air then more reflection takes place and temp. of earth decreases

→ 66% light absorbed by earth and then emits this light in form of I.R light (i.e 2240 μm radiations) in short earth absorb UV/VIS radiations and emits I-R radiations. These I.R radiations absorbed by CO_2 and H_2O (Green House gases present in environment). H_2O absorb more radiations of I.R than CO_2. Due to this temp. of blanket of

gases of earth surface increased, and other remaining radiations (IR) which can not absorbed by CO_2 or H_2O vapours emitt out of the environment.

→ 99% of 100% light absorbed by earth then even dust particals be evaporated.

→ Other phenomenons which help in maintaining the temp of earth are:

CO_2 / H_2O vapours are important in maintaining the temp of earth at least upto 17°C but if conc. of CO_2/H_2O vapours increased by some phenomenon then earths ~~Ghost~~ temp increases b/c now absorption of I.R radiations increased. This is named as Global Warming.

→ Earth temp increases b/c of carbon emmisions and due to this weather changes, contamination

Omni

(ii)

of crops, deforestation, flood or sea level increases occur.

⇒ Maldeep (Island - ද්වීපය) is above only 3-meter to sea level.

⇒ If CO_2/H_2O vapours are Completely ~~disappeared~~ disappeared or not present in the environment then earth will become cold and temp decreased.

⇒ So, the ratio of H_2O (0.1 - 5%) and CO_2 (0.03%) should be maintained to maintain temp of earth.

S.O 2

⇒ Two factors which are helpful in maintaining the ratio of CO_2/H_2O vapours.

i) Industries

Burning of fossil fuels increases Carbon emmission (CO_2 emmission increases). And by increasing amount of CO_2

Temp of earth and global warming increases.

ii) Agriculture:

⇒ By cultivating more crops ~~as~~ as we get more crops by agriculture, the ratio of CO_2 decreases in atmosphere b/c of photosynthesis man. CO_2 converts in glucose

⇒ But still yet, 1/4o effects occur on CO_2 conc by increasing agriculture

⇒ Industries more effect the CO_2 by burning fossil fuel (petroleum) or burning of wood (deforestation).

By deforestation and soil erosion conc of CO_2 increases in atmosphere and then earth's Temp. increases.

Soil erosion i.e flood.

⇒ Other factors maintaining temp. of earth are:

(i) Radiation balanced → absorbed radiations emitted in form of I.R rays in atmosphere

(ii) Conduction of Heat:-

⇒ when temp increases at a place, the molecules/atoms absorb that heat, collision done and transfer heat from one place to other

⇒ Temp increases or decreases gradually, because of the collision of molecules which transfer heat by collision from one place to another

⇒ Conduction occur longitudnaly and altitudely (in both direction)

Conduction of Heat:

Heat is conducted from one area of earth surface to the other area due to atoms, molecules collision

(3)

(گیس منتقل کرنا)

iii) **Convection:**

⇒ When pressure difference created air masses/currents flow from one place to another

⇒ movement of air masses/currents takes place from area of higher pressure to lower pressure

⇒ Suspended particals in atmosphere reflects back or scatter 34% radiations coming from Sun

⇒ If the amount of these particals increases, reflection increases and earth's Temp. decreases.

⇒ Dark particals do not reflect the light, they absorb the light while black particals can reflect.

⇒ Dark particals increases earth's Temp. while black/metal dust particals decreases the temp of the earth.

→ Particals ratio should be maintained in atmosphere to maintain earth's temp

4-2-2020

Particals Matter in Atmosphere:

→ events, problems.

Particulate → composed of small discrete particals

In clean/pure air particulate matter is several hundred particals/cm^3 diff phenomenons are used to form such particals.

e.g. Validation, evaporation of sea water etc. (ورزش)

→ In polluted air more than one lacs/10^5 particals/cm^3.

→ Size of particals suspended in air is 0.1 — 10 μm in diameter. If size increases, particals start to settle down due to gravity.

→ mass of clean air = 10 μg/m^3

→ — — polluted air = 60 — 2000 μg

→ particals exist in two phase.
→ Chemical nature and size of particals are more important than no. of particals
→ 0.1 — 1 micron are colloidal particals.
→ Solid particals / colloidal particals suspended in air called Aerosols.
→ Chemical nature and size of Aerosol partical matter here.
So → particals of natural origin with diameter of less than 2 micron are called Aitken particals → ① they are important for reflection of light and ② to maintain heat balance on earth.
→ other particals in atmosphere are most natural so they are → hazardness So they consider as pollutants.
e.g. → Smoke, dust, organic particals through vegetation are Aitken particals.

Effects of particals having size 0.1 – 1

particals less than 2 um

1. ✓ ⇒ they are involving in Electric (light produced in atmosphere) fog, cloud formation
2. ✓ ⇒ they are involved in heat balance of earth by reflection of light
3. ✓ ⇒ Served as nuclei for ice crystals and water droplets
4. ✓ ⇒ Involved in many chemical reactions i.e neutralization reactions in atmosphere, metal oxides are catalyst, in photochemical oxidation reactions etc.

⇒ Conc of particals very less to ale

⇒ **Inorganic Particulate Matter** (solid or liquid matter particles)

⇒ CaO, H_2SO_4 drops, HNO_3, halides (HBr, HCl), NO_3^{-1}, NO_2^{-1}, $(NH_4)_2SO_4$, NH_3, $CaSO_4$ etc are suspended inorganic particals

environment

Relating to the study of the origion and development of Human beings

Produced:

⇒ Produced by Anthropogenic Source generally they are form by combustion of fuels in thermal power Stations and industries

⇒ burning of pyrite containing coal.

H_2SO_4 Production ⇒ $3FeS_2 + 8O_2 \longrightarrow Fe_3O_4 + 6SO_2$

⇒ SO_2 Produced, reacts with water droplets suspended in air and cause H_2SO_4 which is major component of acid rain

⇒ $SO_2 + H_2O$ (Suspended in air) $H_2O \longrightarrow H_2SO_4$

⇒ H_2SO_4 components dissolve in water and reached to earth back.

⇒ H_2SO_4 particals involve in diff chemical reactions i.e

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

⇒ $CaO + H_2SO_4 \longrightarrow CaSO_4 + H_2O$.

⇒ then secondary pollutants forming start

⇒ H_2SO_4 reacts with marbels present in coal and diff products formed.

$$H_2SO_4 + CaCO_3 \longrightarrow CaSO_4 + H_2O + CO_2$$

⇒ Some fraction of CaO formed by burning of marbels.

$$CaCO_3 \xrightarrow{Heat} CaO + CO_2$$

Leaded gasoline

⇒ ⇒ $CaCO_3$ present in ash of fuel, coal ⇒ by burning of leaded gasoline.

$$Pb(C_2H_5)_4 + O_2 + \text{halogen scavengers} \xrightarrow{} Pb(C_2H_5)_4 + O_2 + \text{halogen scavengers} + \text{gasoline}$$

$$\downarrow$$

$$PbBr_2 + PbCl_2 + PbBrCl + CO + H_2O$$

⇒ If halogen scavenger is not used then Pb in form of oxides and reduced in particles form, reached in lungs and causes diff diseases that's why halogens scavengers used in engine which converts tetra-ethyl lead in form of $PbBr_2$

pbcls.

Nitrates form by nitrifying / denitsifying matrix and fallues involve in secondary reaction.

→ Nitrogen has much band energy ($N \equiv N$) = 946 KJ/mol for burning.

→ Burning of "N" in region where temp. is very high and "N" involve in burning when temp = 1000 KJ/mol

→ In internal combustion engine, temp can exceed to 3000°C. So, when oxygen taken from the atmosphere for burning then "N" also burn with it and oxides of Nitrogen formed and after reaction with water vapours converts in Nitric acid which is 2nd major component of acid rain.

→ Nitrogen oxides formed by gasoline burning in engine.