

Ch-17Composition and structure of the atmosphere

Atmosphere - the blanket of air surrounding the earth is known as atmosphere. It was held to the earth by gravity.

Importance of atmosphere -

- i) The atmosphere protects the earth from harmful ultraviolet radiations and infrared rays of the sun.
- ii) It has oxygen and nitrogen, the life sustaining gases.
- iii) It helps in retaining the necessary warmth on the earth and helps in the circulation of water vapour - the source of rainfall.

Characteristics of atmosphere -

- i) It is in a gaseous state.
- ii) It has both vertical as well as horizontal movements.
- iii) It exerts pressure (It has weight)

Composition of the atmosphere -

The atmosphere is a mixture of many gases and tiny solid particles.

It is made up of nitrogen (78%), oxygen (21%) and carbon dioxide (0.03%), other gases

such as water vapour, helium, hydrogen, argon etc (0.07%).

### Nitrogen -

- i) It dilutes oxygen and slows down the process of oxidation.
- ii) It is essential for all living beings, plants obtain it from the soil and animals obtain nitrogen by eating plants or other animals (as they cannot use it directly from the atmosphere)

### Oxygen -

- i) It helps in burning.
- ii) It helps in survival of living beings through respiration.

### Carbon dioxide -

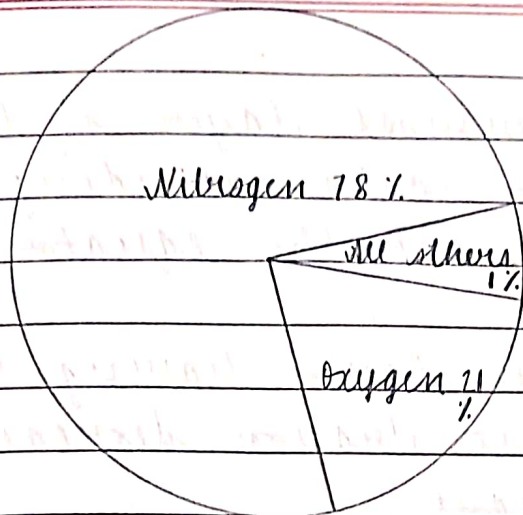
- i) It is needed by plants to prepare their food.
- ii) Carbon dioxide along with dust particles and water vapour keep the lower atmosphere warm even at night (greenhouse effect).

### Water Vapour -

- i) It is responsible for all the forms of precipitation hence <sup>helps in</sup> the circulation of fresh water.

### Dust Particles -

- i) They act as nuclei <sup>for water vapour</sup> to form rain drops around water <sup>them</sup> vapour.
- ii) They scatter sun's radiation during sunrise and sunset.



### Composition of the Atmosphere

### Functions of the Atmosphere -

- i) Since air has weight and exerts pressure, it remains in contact with land and water due to which exchange of gases takes place on a regular basis.
- ii) The atmosphere is most dynamic entity in which large masses of air are being moved up and down across the surface.
- iii) The energy of the sun is responsible for keeping atmosphere in a dynamic state.

(Structure)

### Layers of the Atmosphere -

On the basis of characteristics of temperature and pressure the atmosphere can be divided into 4 layers -

- i) Troposphere
  - ii) Stratosphere
  - iii) Mesosphere
  - iv) Thermosphere
- [ Ionosphere  
Exosphere

### Troposphere -

- i) It is the lowermost layer of the atmosphere nearest to the earth extending from the earth to 18 km at the equator and 8 km at the poles.
- ii) It is the densest layer having 75% of the atmosphere. <sup>the</sup> Concentration decreases with increase in height.
- iii) The temperature in this layer also decreases with an increase in altitude by  $1^{\circ}\text{C}$  for every 166 meters of ascent. This is called normal lapse rate.
- iv) All weather changes take place in this layer.
- v) The upper limit of the troposphere is called tropopause.

### Stratosphere -

- i) Extends from 8 or 18 km to 50 km in the atmosphere.
- ii) The ozone layer lies between 20-50 km which absorbs the ultra-violet solar radiation.
- iii) The temperature of the lower layer is constant whereas at higher levels it increases with height. ( $-60^{\circ}\text{C}$  at the base to  $0^{\circ}\text{C}$  at stratopause)
- iv) Since there are no weather changes in this layer it is ideal for flying jet aircrafts.
- v) The upper limit of stratosphere is known as stratopause.

### Mesosphere -

- i) It extends from 50-80 km in the atmosphere
- ii) It is the coldest layer of the atmosphere reaching to a minimum of  $+100$  &  $-110^{\circ}\text{C}$  at mesopause.
- iii) Due to meteoric dust particles there are wispy clouds formed in this layer.
- iv) The upper limit of mesosphere is known as mesopause.

### Thermosphere -

- i) It consists of two layers namely ionosphere and exosphere

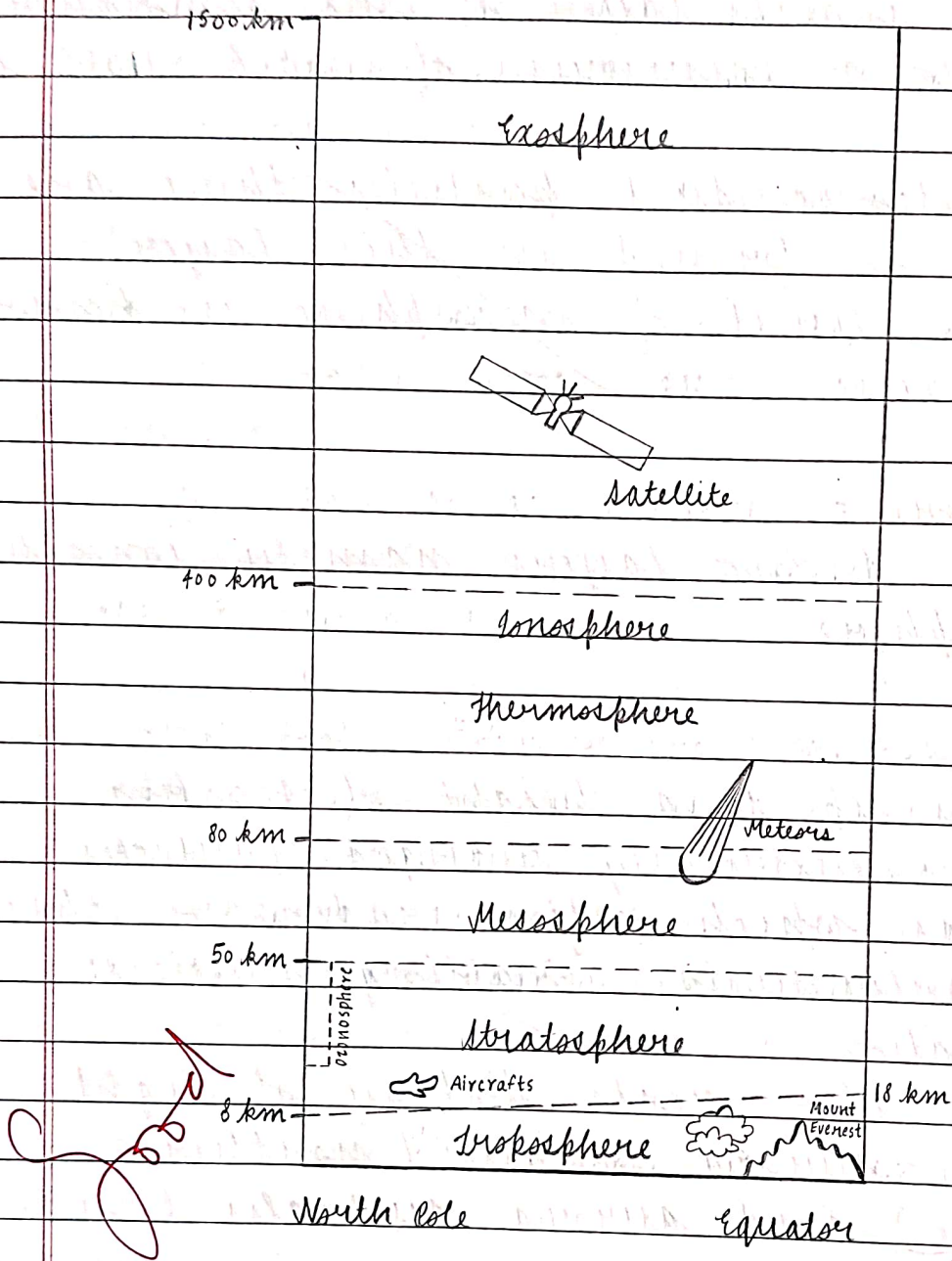
#### - Ionosphere

- i) It extends up to a height of 400 km.
- ii) It contains electrically charged particles called ions which reflect radiowaves back to the earth's surface enabling wireless communication.
- iii) These ions also create display of light known as aurora borealis (northern hemisphere) and aurora australis (southern hemisphere).

#### - Exosphere

- i) It extends from 400 to 1500 km above the <sup>earth</sup> surface.
- ii) In this layer the temperature increases with height.
- iii) The density is extremely low since it has lighter gases like hydrogen and helium.

iv) It merges gradually with inter planetary space



Structure of the Atmosphere

## Ozone and its Depletion

Ozone - Ozone is a form of oxygen ( $O_3$ ).

- It is present in trace amounts generally but in the stratosphere it is present in significant amount between 20-50 km above sea level.
- The ozone layer protects the earth and its biosphere from the extra heat.

Ozone hole - An ozone hole is an ozone depleted area.

- The largest ozone hole was noticed in September 2000 above Antarctica.
- It is because due to the bitterly cold Antarctic winter the stratospheric ice clouds promote production of chemically active chlorine and bromine. This in turn leads to ozone destruction when sunlight returns in Antarctic spring.

Causes of ozone depletion -

1. CFC (Chlorofluoro carbons) & HCFC (Hydro-chlorofluoro carbons) used in refrigerators, jet aircraft, automobile exhausts, air conditioners etc.
2. Large eruption of sulphur dioxide from volcanoes.
3. Solar storms and solar flares.

Global Warming -

The rise in average mean temperature of the earth on account of enhanced concentration of greenhouse gases in the atmosphere.

Causes of global warming -

i) Destruction of ozone layer -

The ozone layer in the stratosphere protects the earth from ultraviolet rays of the sun and its depletion contributes to global warming.

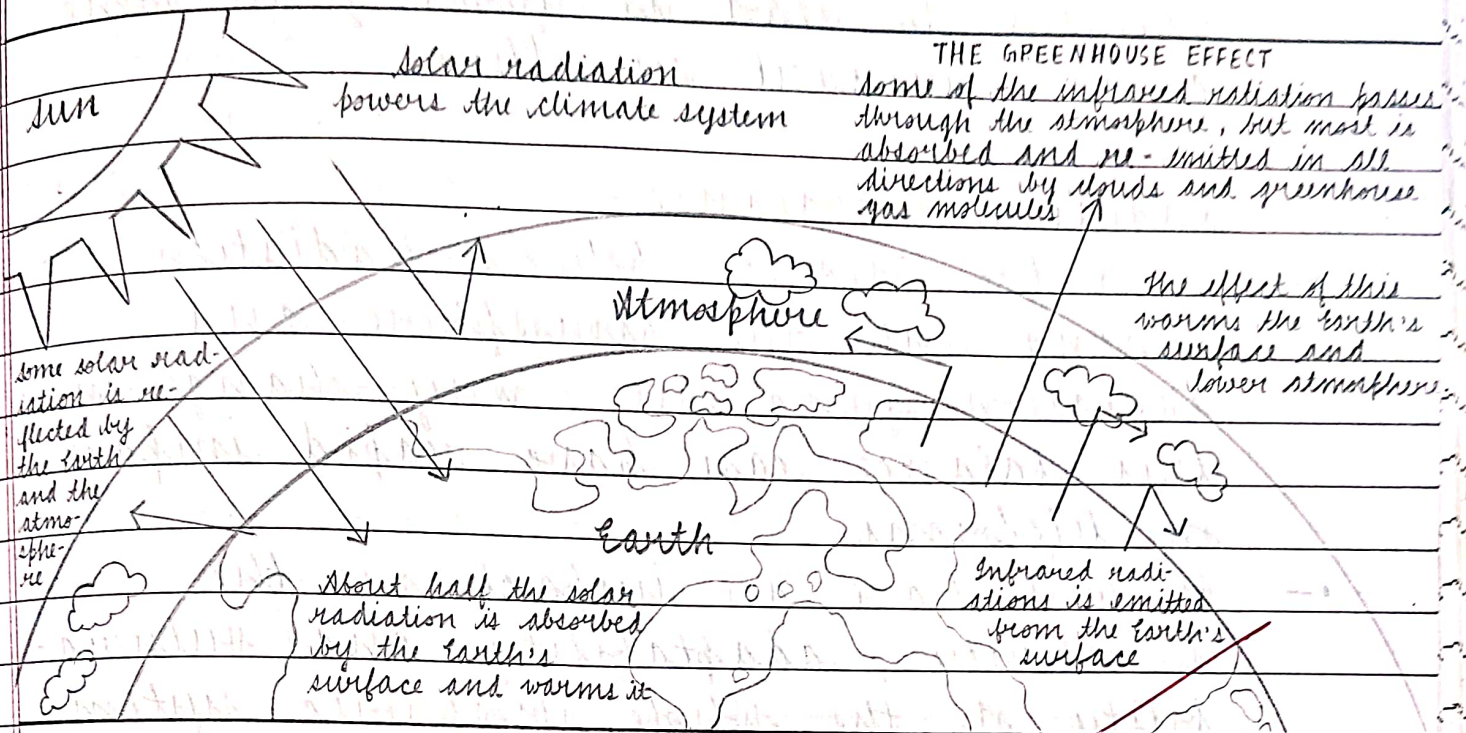
ii) Greenhouse effect in the atmosphere -

- - The increase in temperature due to the concentration of green house gases is known as green-house effect (GHE)
- - Excess accumulation of some gases like  $\text{CO}_2$ , Methane ( $\text{CH}_4$ ), CFC,  $\text{O}_3$  and water vapour are responsible for disturbing the energy balance, thus increasing heat on earth.

iii) Deforestation -

- - Trees are essential for absorbing excess carbon dioxide in the air. Deforestation results in increase in the amount of carbon dioxide in the atmosphere.
- - Deforestation also leads to soil erosion. The dust in the atmosphere plays a key role in reflecting terrestrial radiation.

## back to the earth.



## Impact of global warming -

### i) Rise in sea level -

- Because of global warming, the ice reserves have melted and the sea level has risen by about 10 to 25 cm.
- It can have disastrous effects on human habitations on sea coasts as one-third of human population lives within 60 km of a coastline.
- Many towns and cities could even be submerged under water.

### ii) Precipitation change -

- Warming of atmosphere will considerably increase its moisture carrying capacity. This would cause widespread changes in rainfall patterns.

- These changes in rainfall patterns are expected to lead to flooding in some areas, drought in others.

### iii) Radiation Imbalance -

- It is the balance between radiation coming into the atmosphere and radiation going out. Any change in this balance can have rapid impact on lifeforms.
- It will have an impact on the sensitivity, adaptability and vulnerability of the whole biospheric system.
- Many species are expected to shift slowly poleward.
- Increase in temperature may cause large-scale death of trees and their replacement by scrub vegetation.
- Many species may not be able to migrate fast enough and may disappear.

### iv) Agriculture -

- Climate change will bring about substantial changes in cereal production.
- There will be more shortage of cereals.

### v) Water Resources -

- The global freshwater conditions may worsen by 2025 more due to population pressure than due to climatic factors.

vii) Diseases -  
1- temperature and precipitation are two important causative factors of diseases like malaria which may reappear in different forms as a result of change in the climate.

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