

STRUCTURE OF ATMOSPHERE

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The Atmosphere is a thick gaseous envelop which surrounds the earth from all sides and is attached to the earth surface by gravitational force.

The modern knowledge about the atmosphere is based on the information obtained through rockets, radar and satellites. The effective height of the Atmosphere is estimated between 16 and 29 thousand kilometers from the sea level but the height of the Atmosphere upto 800 km is most important. About 50% of the Atmosphere lies below the altitude of 5.6 km and 97% of the Atmosphere is confined to the height of only 29 km. The upper limit of the Atmosphere, though unknown is considered to be 10,000 km from sea level. The Earth's atmosphere consists of a few zones or layers like spherical shells. On the basis of the characteristics of temperature and air pressure there are four layers from earth's surface upward. :-

- ① Troposphere
- ② Stratosphere
- ③ Mesosphere
- ④ Thermosphere

TROPOSPHERE :- The lower most layer of the atmosphere is known as troposphere and is the most important layer because almost all the weather phenomena (eg: fog, cloud, dew, frost, rainfall, etc.) occur in this layer. Thus, the troposphere is of almost significance for all the life forms including man in the biosphere ecosystem because these are concentrated in the lowest part of the atmosphere.

Temperature decreases with increasing height at the rate of 6.5°C per thousand metre. This rate of decrease of temp is called normal lapse rate. The average height of the troposphere is about 16 km over the equator and 6 km over the poles. The upper limit of the troposphere is called Tropopause which is about 1.5 km thick. The height of tropopause is 17 km over the equator and 9-8 km over the poles. There is also seasonal variation in the height of tropopause. Its height is 17 km during Jan and July over the equator and the temp at this height is 70°C . The height of tropopause during July & Jan over 45° North latitude is 15 km (temp -60°C) and 12.5 km (temp 58°C) respectively. The height decreases further poleward as it is 10 km during July (45°C) and 9 km during Jan (58°C) over the north pole. Since temperature decreases upward at the rate of 6.5°C per thousand metre of hence it is natural that temp. at the height of 17 km over the equator becomes much lower than the height of 9-10 km over the poles.

② Stratosphere → The layer is just above the troposphere. But there is a contrasting opinion about the height & thickness of this layer. The average height over the middle latitude has been determined to be 25-30 km, whereas, it is estimated to be 80 km by others. On an average, the upper limit of the stratosphere is taken to be 50 km. There is also contrasting opinion about the change & no change of the temp. with increasing height in this sphere. A few scientist believe that the stratosphere is isotherm. There is no change in temp. with increasing height while others hold that temp gradually rises upward.

as it becomes 0°C or 32°F at height of 50 km, the upper limit of stratosphere known as stratopause

Ozone layer: This is lower portion of the stratosphere having O_{max} concentration of ozone (O_3), is called Ozonosphere, which is confined between the height of 15 km to 35 km from sea level through the upper limit has been fixed at 55 km. Ozone consist of three atoms isotopes of oxygen or a tri-atomic form of oxygen i.e. (O_3) is faintly blue crystalline gas with a characteristics of pungent odour.

The Ozone gas is unstable because the creation and destruction of this gas is gradual & continuous natural process. It acts as a protective cover for the biological communities in the biosphere because it absorbs almost all the ultraviolet rays of solar radiation & thus protects the earth surface from becoming too hot. Recently, the researches have shown that there is gradual depletion of ozone gas in the atmosphere due to human activities. It may be pointed out

that combining of atmospheric oxygen O_2 with individual oxygen molecule results in the creation of ozone ($\text{O}_2 + \text{O} = \text{O}_3$). whereas, the breaking of ozone into O_2 and O results in the depletion or destruction of ozone. The main culprit of ozone destruction are halogenated gas like chloro-fluoro carbons, nitrogen oxides & halons,

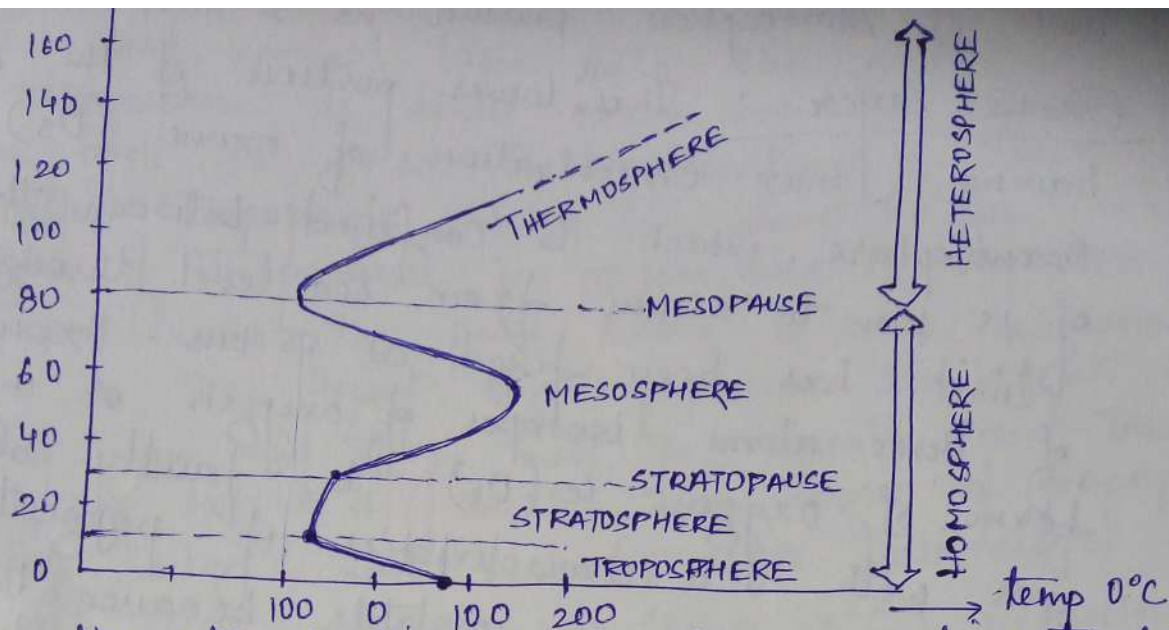


fig: Stratification of Atmosphere according to A.N. Strahler

③ Mesosphere → It extends between 50 km - 80 km. Temp. again decreases with increasing height. In fact, the rise of temp. with increasing height in the stratosphere stops at stratopause. The uppermost limit of mesosphere (80 km) temp. becomes 80°C . This limit is called mesopause above which temp. increases with increasing height.

④ Thermosphere → The part of the atmosphere beyond mesopause is known as Thermosphere where ~~air~~ temp. increase rapidly with increasing height. It is estimated that the temperature at its upper limit becomes 1700°C . It may be pointed out that this temperature can't be measured by ordinary thermometer because the gases become very light due to extremely low density. That is why, one doesn't feel warm when one stretches one's arm in the air. Thermosphere is further divided into 2 layers: —

(a) Ionosphere (80 km - 640 km)

(b) Exosphere (beyond 640 km height from sea level)