Structure & composition of Atmosphere

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Atmosphere

- Gaseous layer which is extend up to 1600 Km from the earth surface but majority (~99% of it’s mass is prevailing within 38 Km

Composition

Constituent	Percent by Volume	Concentration in Parts Per Million (PPM)
Nitrogen (N_2)	78.084	780,840.0
Oxygen (O_2)	20.946	209,460.0
Argon (Ar)	0.934	9,340.0
Carbon dioxide (CO_2)	0.036	360.0
Neon (Ne)	0.00182	18.2
Helium (He)	0.000524	5.24
Krypton (Kr)	0.000114	1.14
Hydrogen (H_2)	0.00005	0.5

CO2

- Carbon dioxide is meteorologically a very important gas.
- It is transparent to the incoming solar radiation (insolation) but opaque to the outgoing terrestrial radiation.
- It absorbs a part of terrestrial radiation and reflects back some part of it towards the earth's surface.
- Carbon dioxide is largely responsible for the greenhouse effect.
- When the volume of other gases remains constant in the atmosphere, the volume of the carbon dioxide has been rising in the past few decades mainly because of the burning of fossil fuel

Water vapour

- The amount of water vapour decreases with altitude. It also decreases from the equator (or from the low latitudes) towards the poles (or towards the high latitudes).
- Its maximum amount in the atmosphere could be up to 4% which is found in the warm and wet regions.
- Water vapour absorbs part of the incoming solar radiation (insolation) from the sun and preserves the earth's radiated heat. It thus acts like a blanket allowing the earth neither to become too cold nor too hot.

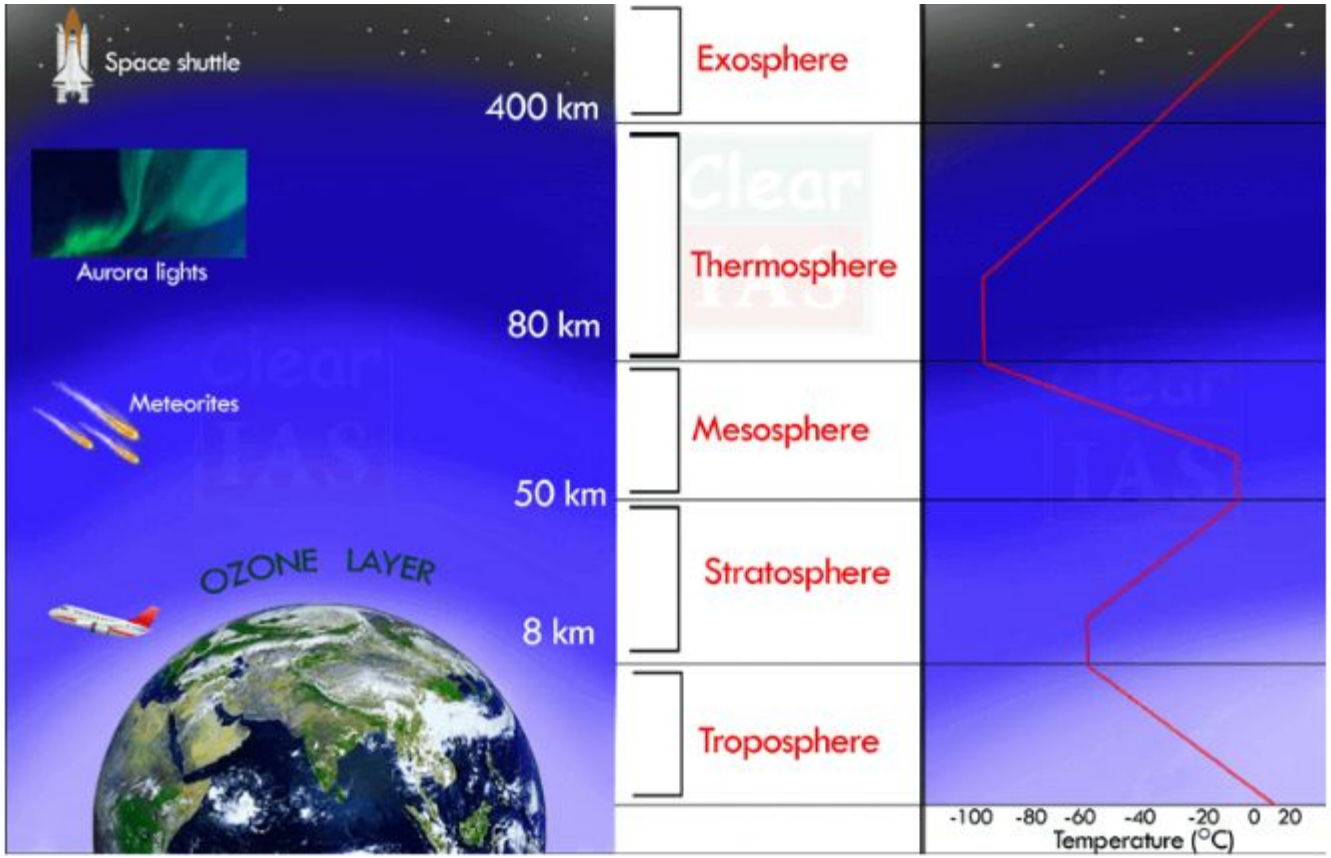
Ozone

- Ozone is another important component of the atmosphere found mainly between 10 and 50 km above the earth's surface.
- It acts as a filter and absorbs the ultra-violet rays radiating from the sun and prevents them from reaching the surface of the earth.
- The amount of ozone gas in the atmosphere is very little and is limited to the ozone layer found in the stratosphere.

Dust/Particulates

- sand, smoke-soot, oceanic salt, ash, pollen, etc.

ATMOSPHERE: Structure



Troposphere

The environmental temperature decreases with increasing height of the atmosphere. It decreases at the rate of 1 degree Celsius for every 165 m of height. This is called Normal Lapse Rate.

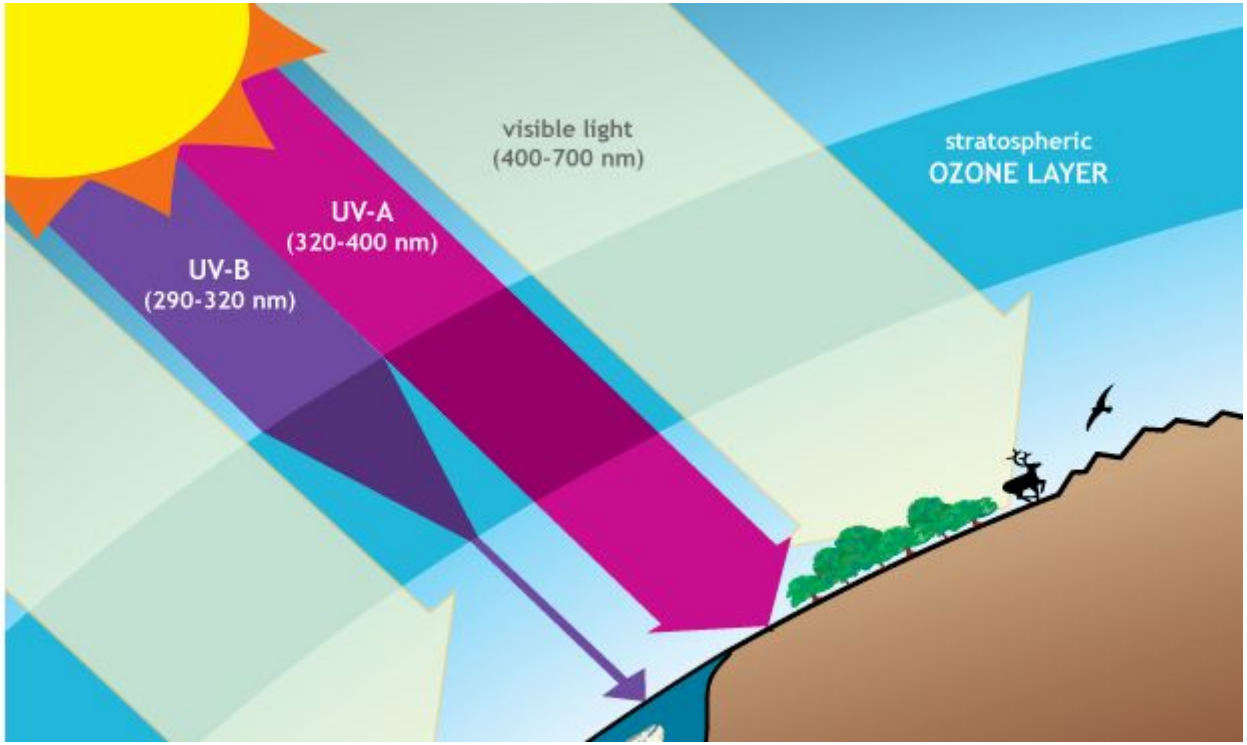
Troposphere

The zone separating troposphere from the stratosphere is known as tropopause. The air temperature at the tropopause is about – 80 degree Celsius over the equator and about – 45 degree Celsius over the poles. The temperature here is nearly constant, and hence, it is called tropopause.

Stratosphere

- It extends up to a height of 50 km.
- The temperature remains almost the same in the lower part of this layer up to the height of 20 km. After this, the temperature increases slowly with the increase in the height. The temperature increases due to the presence of ozone gas in the upper part of this layer.
- Weather related incidents do not take place in this layer. The air blows horizontally here. Therefore this layer is considered ideal for flying of aircraft.
- The upper limit of the stratosphere is known as stratopause.
- One important feature of stratosphere is that it contains a layer of ozone gas.
- The relative thickness of the ozone layer is measured in Dobson Units.
- It is mainly found in the lower portion of the stratosphere, from approximately 20 to 30 km above the earth's surface.

Stratospheric Ozone



MESOSPHERE

- It extends up to a height of 80 km.
- In this layer, the temperature starts decreasing with increasing altitude and reaches up to –100 degree Celsius at the height of 80 km.
- Meteors or falling stars occur in this layer.
- The upper limit of the mesosphere is known as mesopause.

Thermosphere

- 80 and 400 km above the mesopause.
- It contains electrically charged particles.
- The temperature here starts increasing with heights.

Exosphere

- The exosphere is the uppermost layer of the atmosphere.
- **Gases are very sparse in this sphere** due to the lack of gravitational force. Therefore, the density of air is very less here.

Test your understanding

- What is normal lapse rate?
- Temperature in tropopause is constant (T/F)
- Co2 increases constantly than other gases in the atmosphere. Why?
- Conc. Of Co2 & H2 in the atmosphere is--------&_____

ERB Earth’s radiation Budget

- How does the sun's energy help maintain Earth's energy budget?
- The absorbed sunlight drives photosynthesis, fuels evaporation, melts snow and ice, and warms the Earth system. Solar power drives Earth's climate. Energy from the Sun **heats the surface, warms the atmosphere, and powers the ocean currents**.1

ERB Earths radiation Budget

- What does Earth's energy budget depend on?
- Earth's energy budget depends on many factors, such as atmospheric aerosols, greenhouse gases, the planet's surface albedo (reflectivity), clouds, vegetation, land use patterns, and more.

ERB

- Why is Earth's energy budget is vital in establishing the Earth's climate. When the energy budget balances, the temperature on the Earth stays relatively constant, with no overall increase or decrease in average temperature. Earth energy budget important?

Energy Budget equation

- What is the energy budget equation?
- The equation is: **Sunlight absorbed** + **IR from surface + Thermals + Evapotrans** = IR emitted to space + IR emitted to ground The Sun is the source of energy for the Earth system.