

Atmosphere - Composition and Structure [UPSC Geography]

The earth's atmosphere is a life-supporting atmosphere. Questions can sometimes be asked in UPSC prelims regarding the composition of the earth's atmosphere. Hence, [IAS Exam](#) aspirants should know the relevant facts about the atmosphere's composition.

Salient Facts about Earth's Atmosphere

The atmosphere is described as the air that surrounds the earth.

1. The thickness of the earth's atmosphere is about 480 km. 99 percent of the thickness lies up to the height of 32 km from the earth.
2. With increasing altitude, the air pressure decreases.
3. The atmosphere has a mixture of gases that sustains life on earth.
4. The earth's gravity helps hold the atmosphere in place.
5. The major role of the atmosphere is to contain the entry of ultraviolet rays.

As per NASA, the composition of the earth's atmosphere is as mentioned below:

1. Nitrogen — 78 percent
2. Oxygen — 21 percent
3. Argon — 0.93 percent
4. Carbon dioxide — 0.04 percent
5. Trace amounts of neon, helium, methane, krypton and hydrogen, as well as water vapour

Composition of the Atmosphere

The atmosphere is a layer of gas or layers of gases that envelope a planet and is held in place by the gravity of the planetary body. A planet retains an atmosphere when the gravity is great and the temperature of the atmosphere is low.

- The atmosphere of earth is composed of nitrogen (78%), oxygen (21%), argon (0.9%), carbon dioxide (0.04%) and trace gases. A variable amount of water vapour is also present in the atmosphere (approx. 1% at sea level) and it decreases with altitude.
- Carbon dioxide gas is largely responsible for the greenhouse effect. It is transparent to the incoming solar radiation but is opaque to the outgoing terrestrial radiation. It absorbs a part of terrestrial radiation and reflects back some of it towards the earth's surface.
- Dust particles are also present in the atmosphere. They originate from different sources like fine soil, smoke-soot, pollen, dust and disintegrated particles of meteors. Dust and salt particles act as hygroscopic nuclei around which water vapour condenses to produce clouds.

Composition of the Atmosphere – Ozone Gas

- Present around 10-50 km above the earth's surface and acts as a sieve, absorbing UV (ultraviolet rays) from the sun.
- Ozone averts harmful rays from reaching the surface of the [earth](#).

Composition of the Atmosphere – Water Vapour

- Water vapour is a variable gas, declines with altitude.
- It also drops towards the poles from the equator.
- It acts like a blanket letting the earth from becoming neither too hot nor too cold.
- It also contributes to the stability and instability in the air.

Composition of the Atmosphere – Dust Particles

- Dust particles are in higher concentrations in temperate and subtropical regions due to dry winds in contrast to the polar and equatorial regions.
- They act as hygroscopic nuclei over which water vapour of the atmosphere condenses to create clouds.

Composition of the Atmosphere – Nitrogen

- The atmosphere is composed of 78% nitrogen.
- Nitrogen cannot be used directly from the air.
- Biotic things need nitrogen to make proteins.
- The Nitrogen Cycle is the way of supplying the required nitrogen for living things.

Composition of the atmosphere – Oxygen

- The atmosphere is composed of 21% oxygen.
- It is used by all living things and is essential for respiration.
- It is obligatory for burning.

Also read: [Oxygen Cycle](#)

Composition of the Atmosphere – Argon

- The atmosphere is composed of 0.9% argon.
- They are mainly used in light bulbs.

Composition of the Atmosphere – Carbon Dioxide

- The atmosphere is composed of 0.03% carbon dioxide.
- Plants use it to make oxygen.
- It is significant as it is opaque to outgoing terrestrial radiation and transparent to incoming solar radiation.
- It is also one of the gases responsible for the greenhouse effect.

Structure of the Atmosphere

The atmosphere is divided into five different layers depending upon the temperature conditions – troposphere, stratosphere, mesosphere, thermosphere and exosphere.

Troposphere

- It is the lowermost layer of the atmosphere.
- The average height of the troposphere is 13 km; its height is about 8 km near the poles and about 18 km at the equator. At the equator, its thickness is greatest because heat is transported to great heights by strong convection currents.
- All the climatic and weather changes take place in this layer of the atmosphere.
- The temperature decreases with the increase in height; for every 165 m of height, the temperature decreases by 1°C (normal lapse rate).
- Tropopause is a zone that separates the troposphere from the stratosphere. The temperature in this zone is nearly constant (-80°C over the equator and about -45°C over the poles) and hence, it is called the tropopause.

Stratosphere

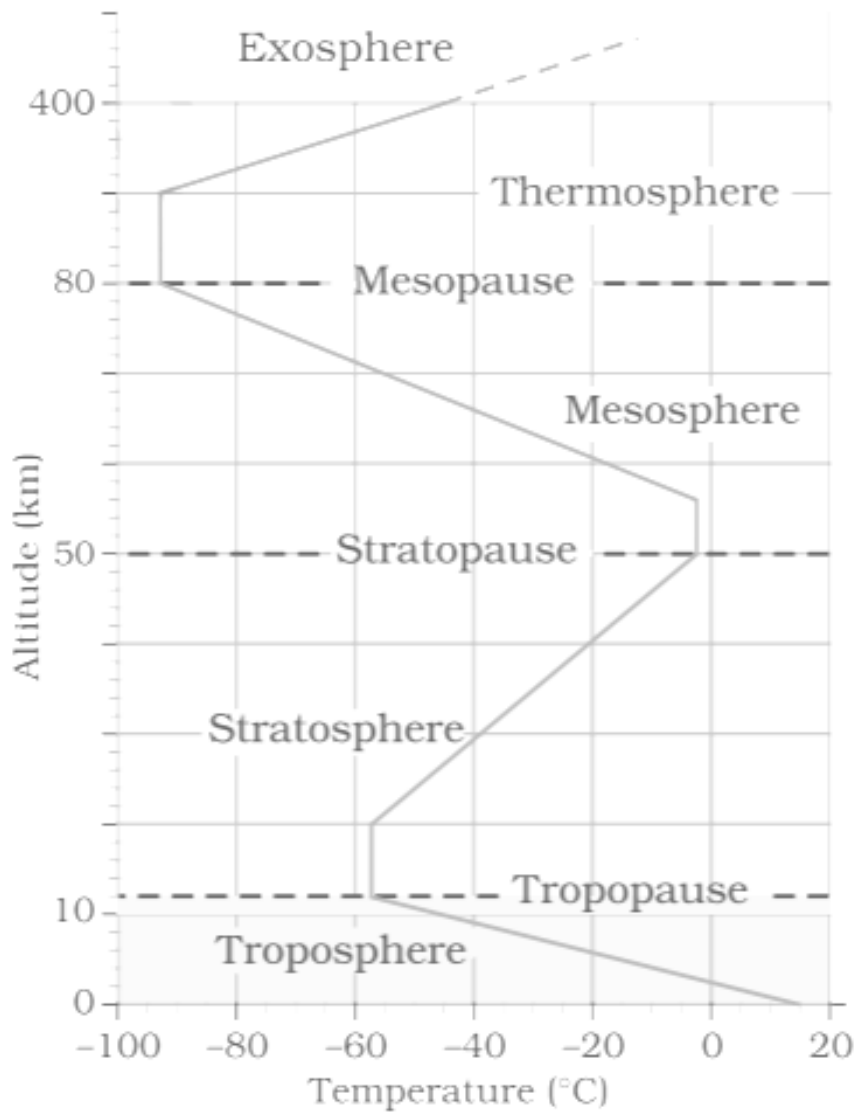
- It is the second layer of the atmosphere, just above the troposphere and extends up to a height of 50 km.
- This layer of the atmosphere contains the ozone layer which absorbs ultraviolet radiation from the sun and protects life from harmful forms of energy. The UV radiations absorbed by the ozone layer gets converted into heat, that is why the stratosphere gets warmer with increasing altitude (unlike the troposphere).
- Weather-related phenomena are absent in this layer of the atmosphere, that is why aeroplanes fly in the stratosphere for a smooth ride.
- Stratopause separates the stratosphere and mesosphere.

Mesosphere

- Mesosphere is the third layer of the atmosphere which extends up to a height of 80 km.
- In this layer, temperature decreases with increasing altitude and drops down to minus 100°C at the height of 80 km.
- Meteorites burn in this layer on entering the atmosphere from outer space.
- Its upper limit is mesopause which separates the mesosphere and thermosphere.

Thermosphere

- The ionosphere lies within the thermosphere. It is located between 80 and 400 km above the mesosphere and contains electrically charged particles called ions, hence the name ionosphere.
- In this layer of the atmosphere, temperature increases with increasing height.
- Radio Waves transmitted from the earth are reflected back to the earth by this layer.
- Satellites orbit in the upper part of the thermosphere.



Exosphere

- The uppermost layer of the atmosphere above the thermosphere is called the exosphere.
- This layer gradually merges with outer space.