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COMPOSITION OF ATMOSPHERE

WHAT IS ATMOSPHERE ?

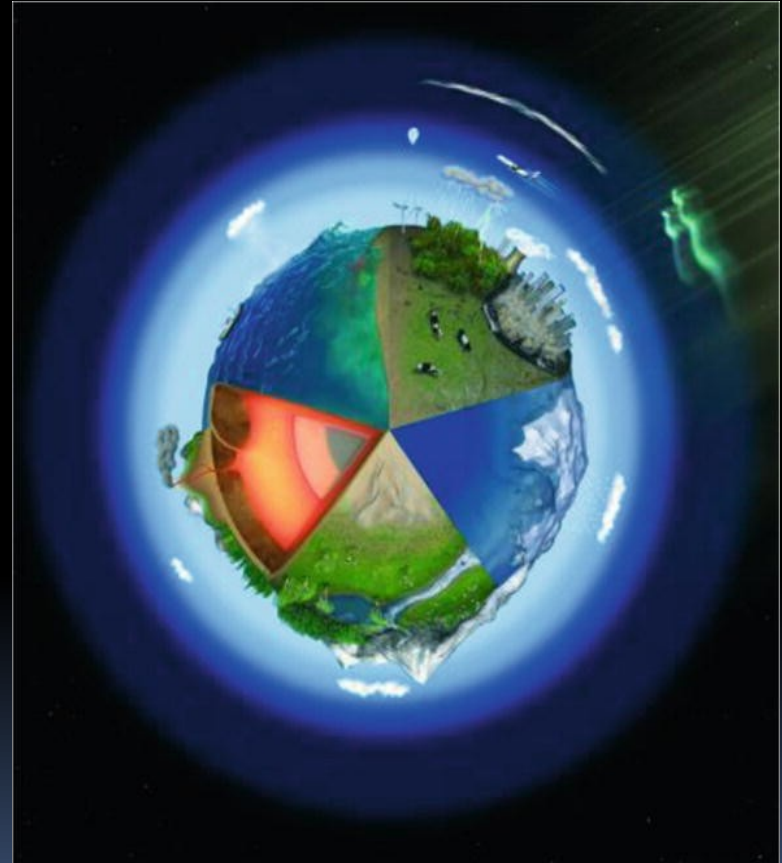
- We all know that earth is a unique planet due to the presence of life. The air is one among the necessary conditions for the existence of life on this planet. The air is a mixture of several gases and it encompasses the earth from all sides. The air surrounding the earth is called the atmosphere.

INTRODUCTION

- Atmosphere is the air surrounding the earth.
- The atmosphere is a mixture of different gases. It contains life-giving gases like Oxygen for humans and animals and carbon dioxide for plants.
- It envelops the earth all round and is held in place by the gravity of the earth.
- It helps in stopping the ultraviolet rays harmful to the life and maintains the suitable temperature necessary for life.
- Generally, atmosphere extends up to about 1600 km from the earth's surface. However, 99 % of the total mass of the atmosphere is confined to the height of 32 km from the earth's surface.


COMPOSITION OF ATMOSPHERE

- The atmosphere is made up of different gases, water vapour and dust particles.
- The composition of the atmosphere is not static and it changes according to the time and place.



PERMANENT GASES OF ATMOSPHERE

<i>Constituent</i>	<i>Formula</i>	<i>Percentage by Volume</i>
Nitrogen	N ₂	78.08
Oxygen	O ₂	20.95
Argon	Ar	0.93
Carbon dioxide	CO ₂	0.036
Neon	Ne	0.002
Helium	He	0.0005
Krypton	Kr	0.001
Xenon	Xe	0.00009
Hydrogen	H ₂	0.00005

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- The atmosphere is a mixture of different types of gases.
 - Nitrogen and oxygen are the two main gases in the atmosphere and 99 percentage of the atmosphere is made up of these two gases.
 - Other gases like argon, carbon dioxide, neon, helium, hydrogen, etc. form the remaining part of the atmosphere.
 - The portion of the gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost negligible quantity at the heights of 120 km.
 - Similarly, carbon dioxide (and water vapour) is found only up to 90 km from the surface of the earth.




CARBON DIOXIDE

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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 fuels. This rising volume of carbon dioxide is the main reason for global warming.



OZONE GAS


- 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.
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WATER VAPOUR

- Gaseous form of water present in the atmosphere is called water vapour.
- It is the source of all kinds of precipitation.
- 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 reaches in the atmosphere through evaporation and transpiration. Evaporation takes place in the oceans, seas, rivers, ponds and lakes while transpiration takes place from the plants, trees and living beings.
- 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

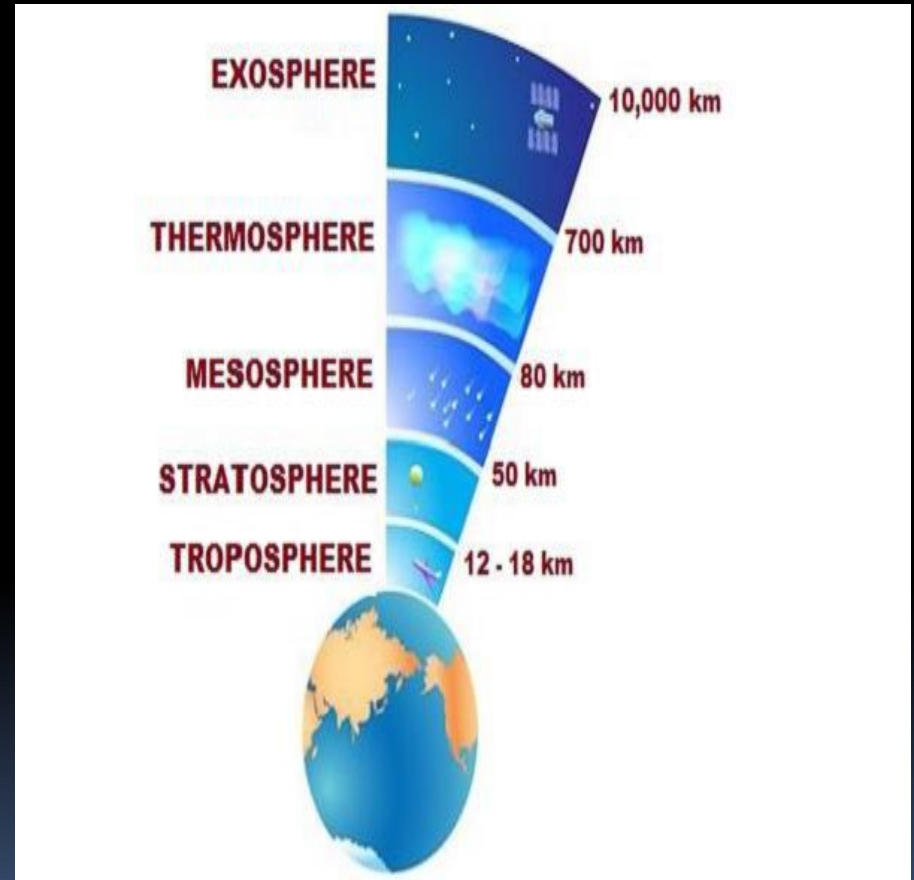


DUST PARTICLES

- Dust particles are generally found in the lower layers of the atmosphere.
 - These particles are found in the form of sand, smoke-soot, oceanic salt, ash, pollen, etc.
 - Higher concentration of dust particles is found in subtropical and temperate regions due to dry winds in comparison to equatorial and polar regions.
 - These dust particles help in the condensation of water vapour. During the condensation, water vapour gets condensed in the form of droplets around these dust particles and thus clouds are formed.
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STRUCTURE OF ATMOSPHERE

- **The atmosphere is comprised of layers based on temperature. These layers are the troposphere, stratosphere, mesosphere and thermosphere. A further region at about 500 km above the Earth's surface is called the exosphere.**



- The structure of the atmosphere is classified into the following layers

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- Troposphere: 0 to 12 km
- Stratosphere: 12 to 50 km
- Mesosphere: 50 to 80 km
- Thermosphere: 80 to 700 km
- Exosphere: 700 to 10,000 km

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TROPOSPHERE

- It is the lowermost layer of the atmosphere.
- The height of this layer is about 18 km on the equator and 8 km on the poles.
- The thickness of the troposphere is greatest at the equator because heat is transported to great heights by strong convectional currents.
- Troposphere contains dust particles and water vapour.
- This is the most important layer of the atmosphere because all kinds of weather changes take place only in this layer.
- The air never remains static in this layer. Therefore this layer is called 'changing sphere' or 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.
- 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

Stratosphere is the second-lowest layer of the Earth's Atmosphere that goes up to 50 km.


Stratosphere contains **Ozone** (O_3) Layer that absorbs the ultraviolet rays (coming through the Sun rays) and protects life on the Earth.

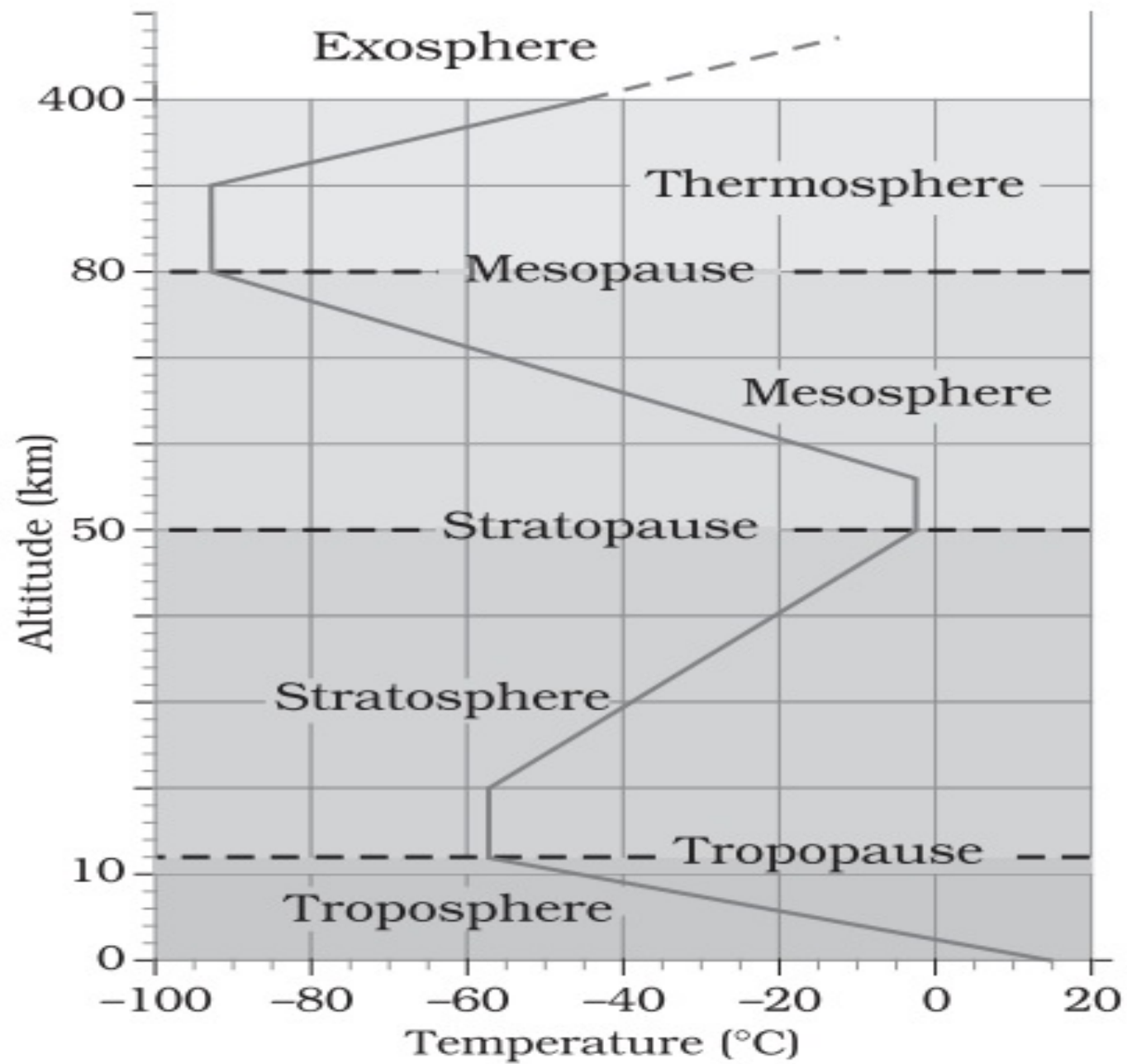
As the ultraviolet radiation absorbs in Stratosphere, therefore the temperature rises with increasing altitude.

The **Stratopause** is the transitional zone that separates Stratosphere and Mesosphere.



MESOSPHERE

- The Mesosphere is found above the stratosphere.
 - It is the coldest of the atmospheric layers.
 - The mesosphere starts at 50 km above the surface of Earth and goes up to 80 km.
 - The temperature drops with altitude in this layer.
 - By 80 km it reaches -100 degrees Celsius.
 - Meteors burn up in this layer.
 - The upper limit is called Mesopause which separates Mesosphere and Thermosphere.
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THERMOSPHERE

- It is located between about 80 and 700 kilometers above Earth's surface, whose **lowest part contains the ionosphere**.
 - Because this layer is **much closer to the sun, it can reach temperatures up to 2,000 °C (3,600 °F)**
- In this layer, temperatures increase with altitude due to the very low density of molecules found here. **It is both cloud- and water-vapor-free.**
- The **aurora borealis** (Northern lights) and **aurora australis** (Southern lights) are sometimes seen here.
 - The **International Space Station (ISS)** orbits in the thermosphere.

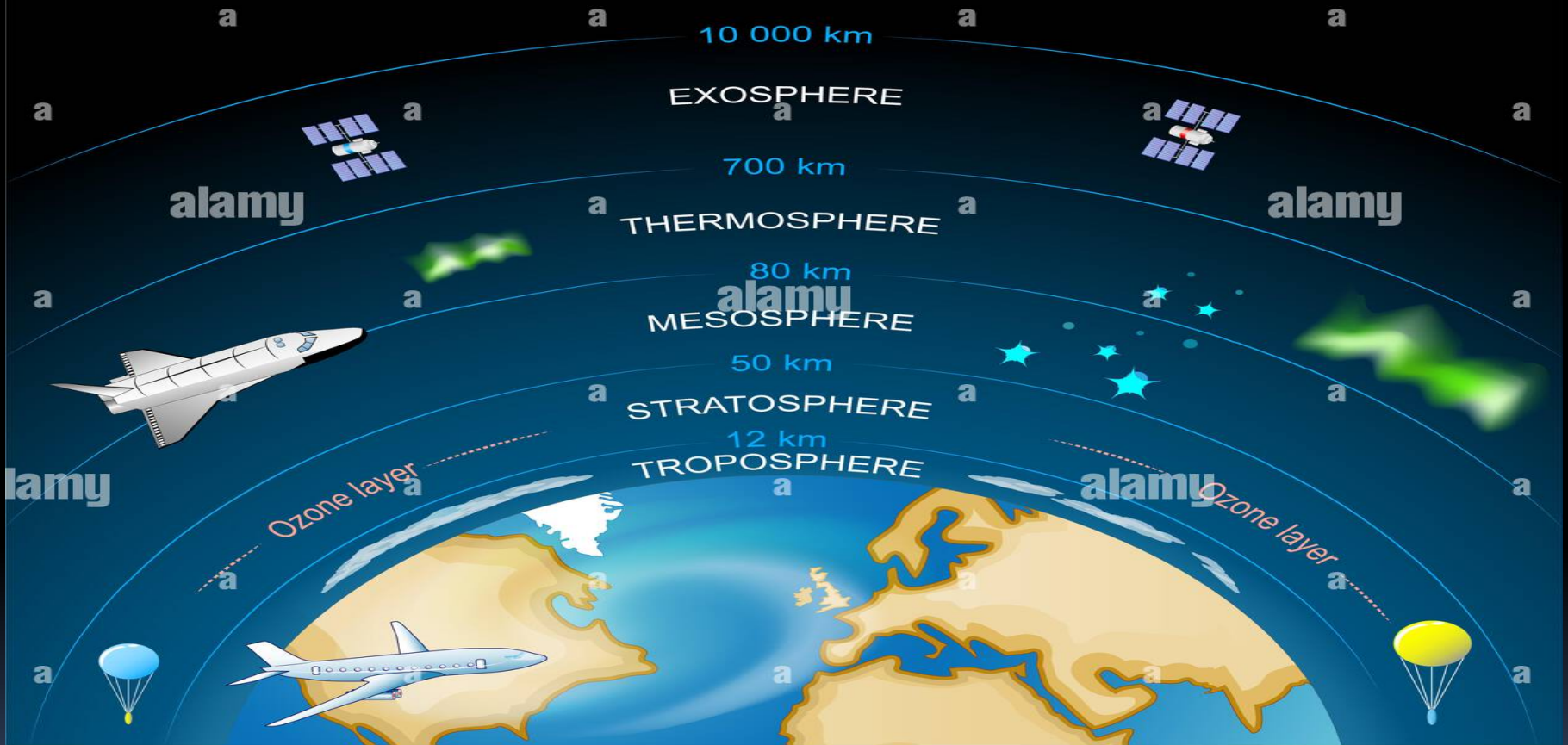


EXOSPHERE

The exosphere is the outermost layer of Earth's atmosphere. It extends from an altitude of about 600 kilometres (about 372 miles) to an altitude of about 20,000 kilometres (about 12,427 miles). The exosphere is where most of the satellite's orbit is. The temperature in the exosphere generally decreases with height. This is because there is very little mixing in this layer and the sun's ultraviolet radiation heats it.




The atmosphere of Earth





The Hottest Layer of Atmosphere



The thermosphere is the hottest layer of Earth's atmosphere. It extends from about 90 km to 600 km above the planet's surface. The air in this layer is so thin that the molecules do not collide often. Instead, they are free to zip around at high speeds. At these high altitudes, the air is heated by ultraviolet radiation from the Sun. This makes the thermosphere the hottest layer of Earth's atmosphere, even though it is also the farthest from the Sun.



The Coldest layer of the earth

The atmosphere is made up of several layers, each with its unique characteristics. The layer closest to Earth's surface is the troposphere. This is where we live, and it experiences a wide range of temperatures. The air is warmer near the ground, where the Sun's heat is absorbed, and cooler at higher altitudes. The air in the troposphere can get as cold as -93°C !

