PAPER V: UNIT – V

Atmosphere and its composition

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SYLLABUS

Unit – V: Ecology and Environment:

5.1 Concept of environment, Concept and scope of ecology.
5.2 Ecological factors- Climatic- Light, Temperature and Water.
5.3 **Atmosphere and its composition.**
5.4 Edaphic factor- Process of soil formation, soil profile, soil biota and their role.
5.5 Ecological Adaptations - Morphological and Anatomical adaptation in Hydrophytes, and Xerophytes.

ATMOSPHERE

An **atmosphere** from Greek

atmos = 'vapour', and

sphaira = 'ball' or 'sphere

It is a layer or a set of layers of **gases** surrounding a planet or other material body, that is held in place by the gravity of that body.

Earth's atmospheric gases scatter blue light more than other wavelengths, giving Earth a blue halo when seen from spac

ATMOSPHERE

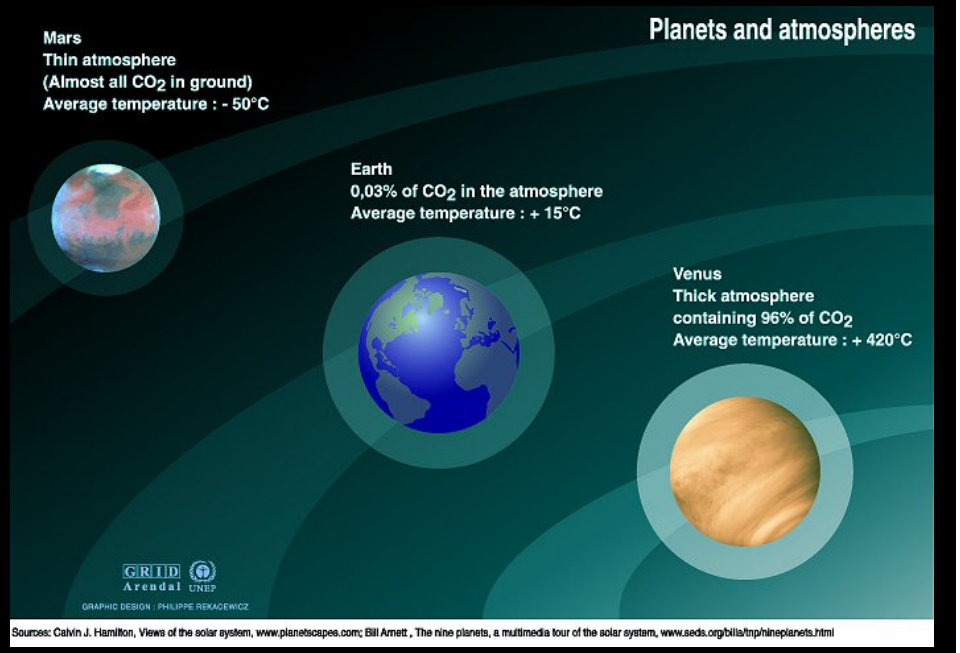
Our planet earth is enveloped by a deep blanket of gases extending several thousands of kilometres above its surface.

This gaseous cover of the earth is known as the atmosphere.

Like land (lithosphere) and water (hydrosphere), the **Atmosphere** is an integral part of the earth.

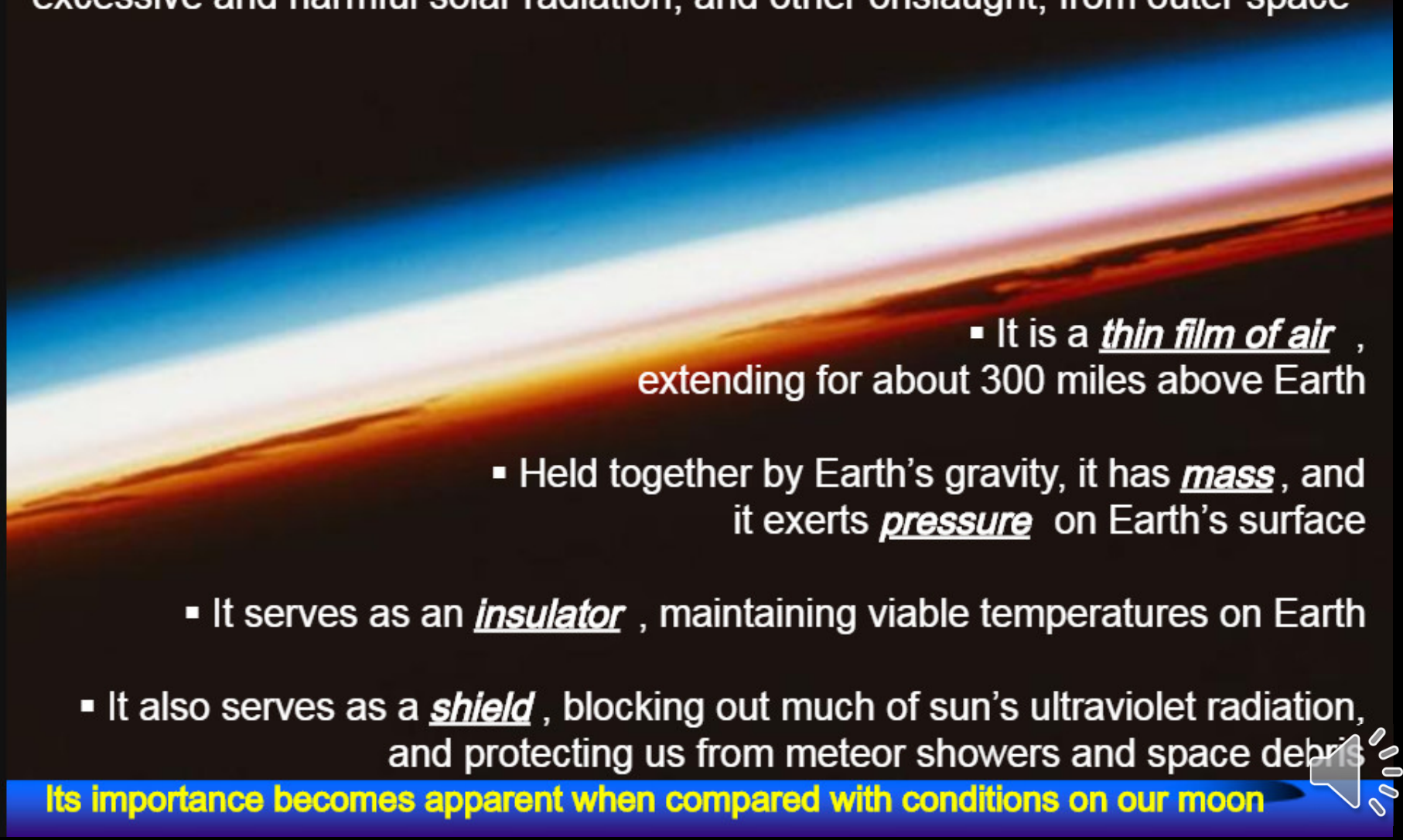
Compared to the earth's radius, the atmosphere appears to be only a very thin layer of gases.

However, because of the force of gravity, it is inseparable from the earth.



ATMOSPHERE

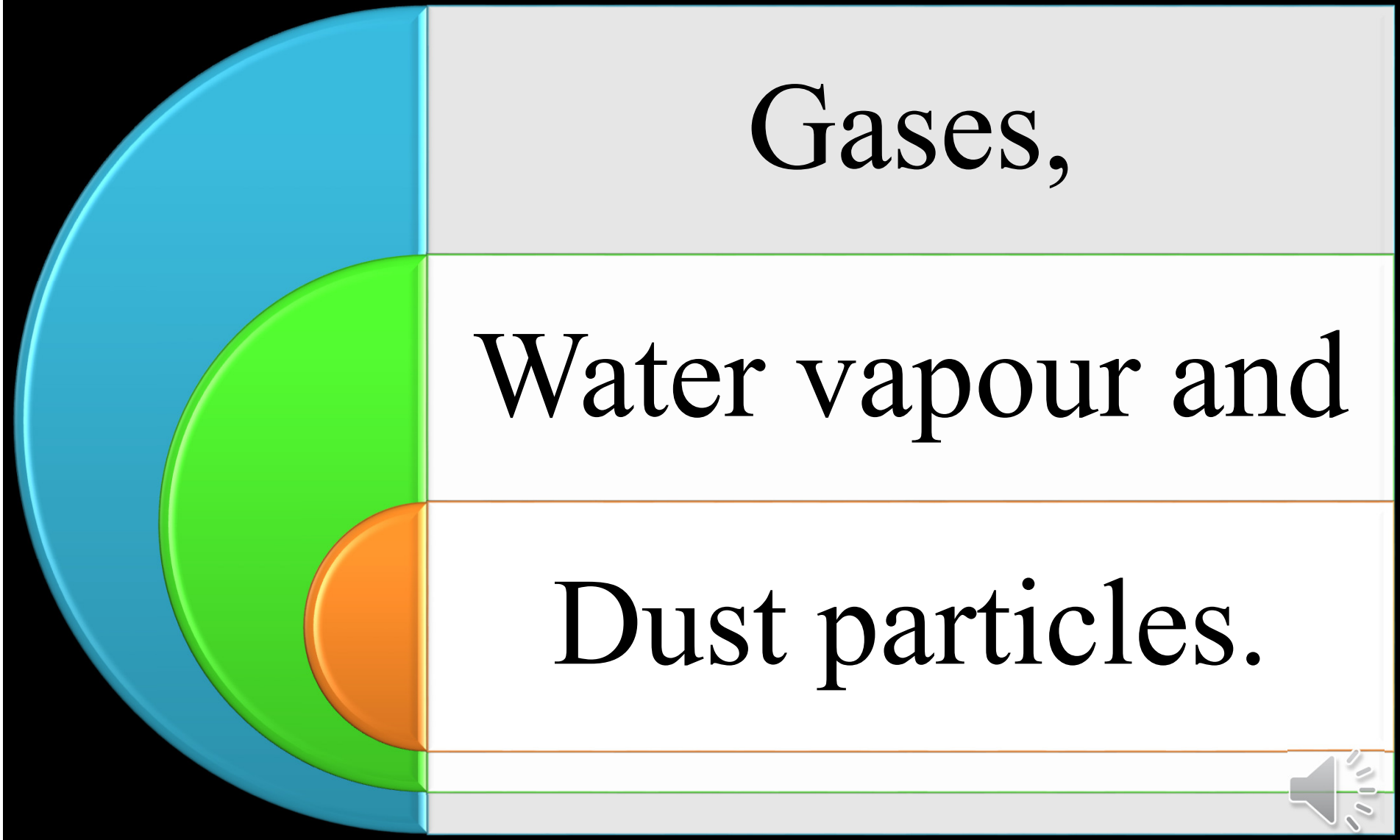
is a dynamic mixture of various gases that envelops earth and protects it from excessive and harmful solar radiation, and other onslaught, from outer space



- It is a ***thin film of air*** , extending for about 300 miles above Earth
- Held together by Earth's gravity, it has ***mass*** , and it exerts ***pressure*** on Earth's surface
- It serves as an ***insulator*** , maintaining viable temperatures on Earth
- It also serves as a ***shield*** , blocking out much of sun's ultraviolet radiation, and protecting us from meteor showers and space debris

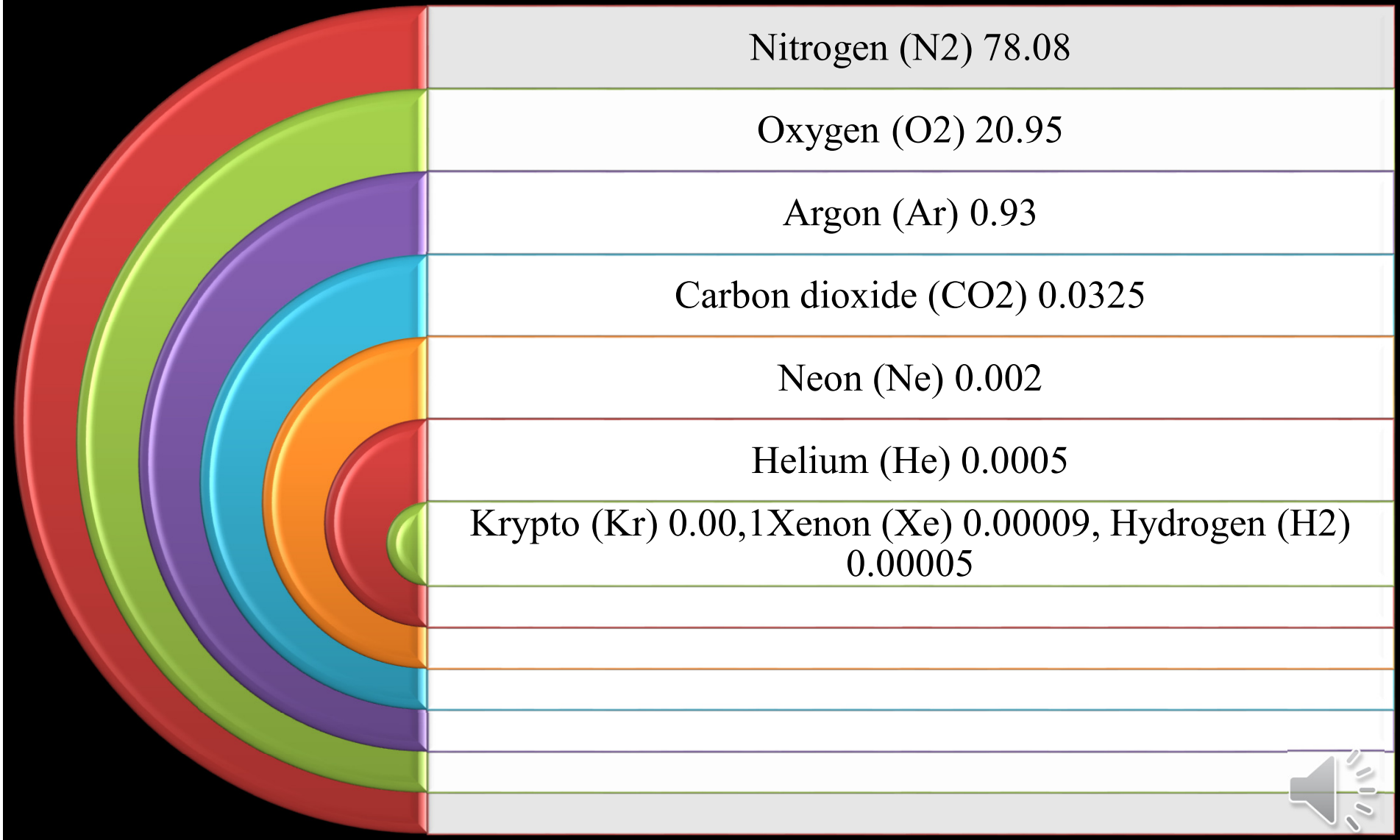
Its importance becomes apparent when compared with conditions on our moon

ATMOSPHERE AND ITS COMPOSITION



PERMANENT GASES OF THE ATMOSPHERE

CONSTITUENT % BY VOLUME



GASES – CO2

Carbon dioxide: meteorologically a very important gas.

Transparent to the incoming solar radiation but opaque to the outgoing terrestrial radiation.

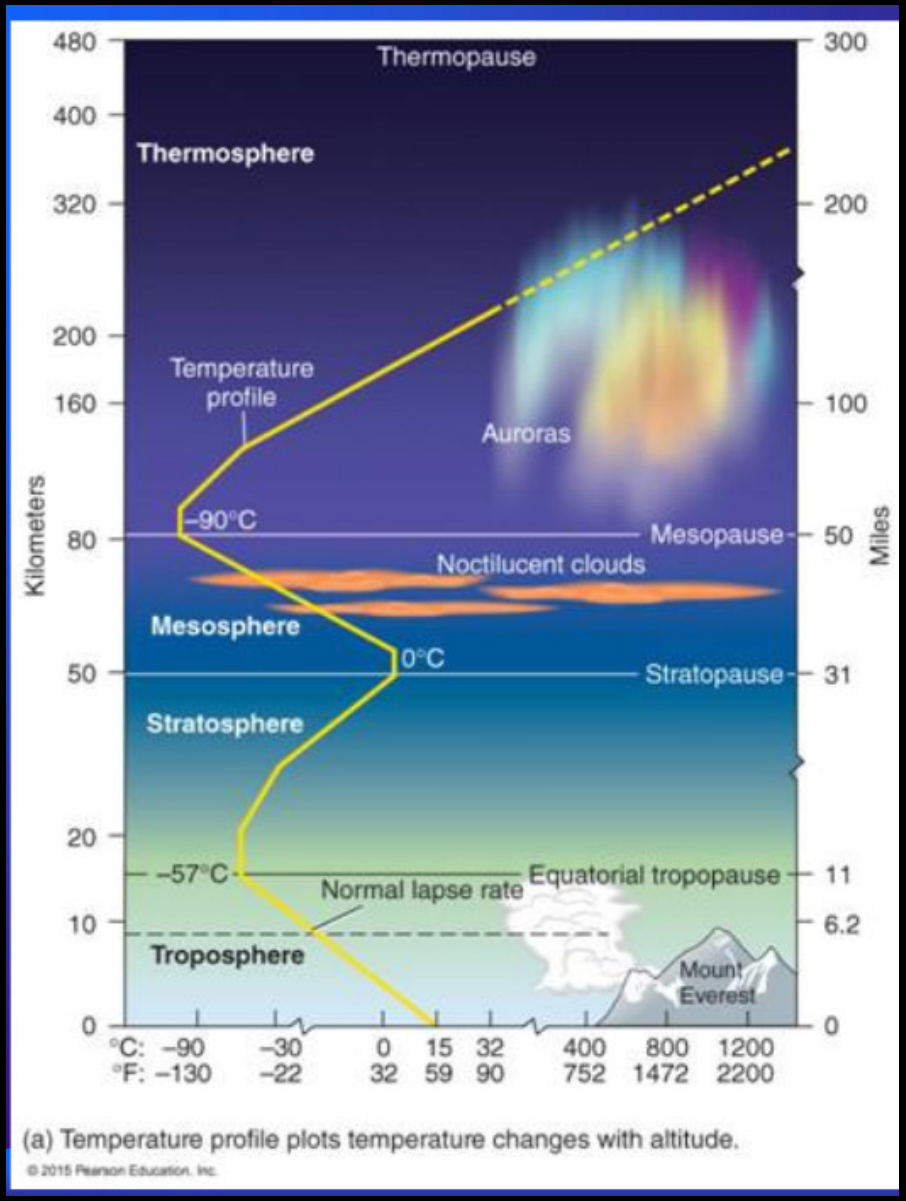
Absorbs a part of terrestrial radiation and reflects back some part of it towards the earth's surface.

Responsible for the **Green House Effect**.

The volume of other gases is constant but the volume of carbon dioxide has been rising in the past few decades mainly because of the burning of fossil fuels.

This has also increased the temperature of the air.

STRUCTURE OF ATMOSPHERE



(a) Temperature profile plots temperature changes with altitude.

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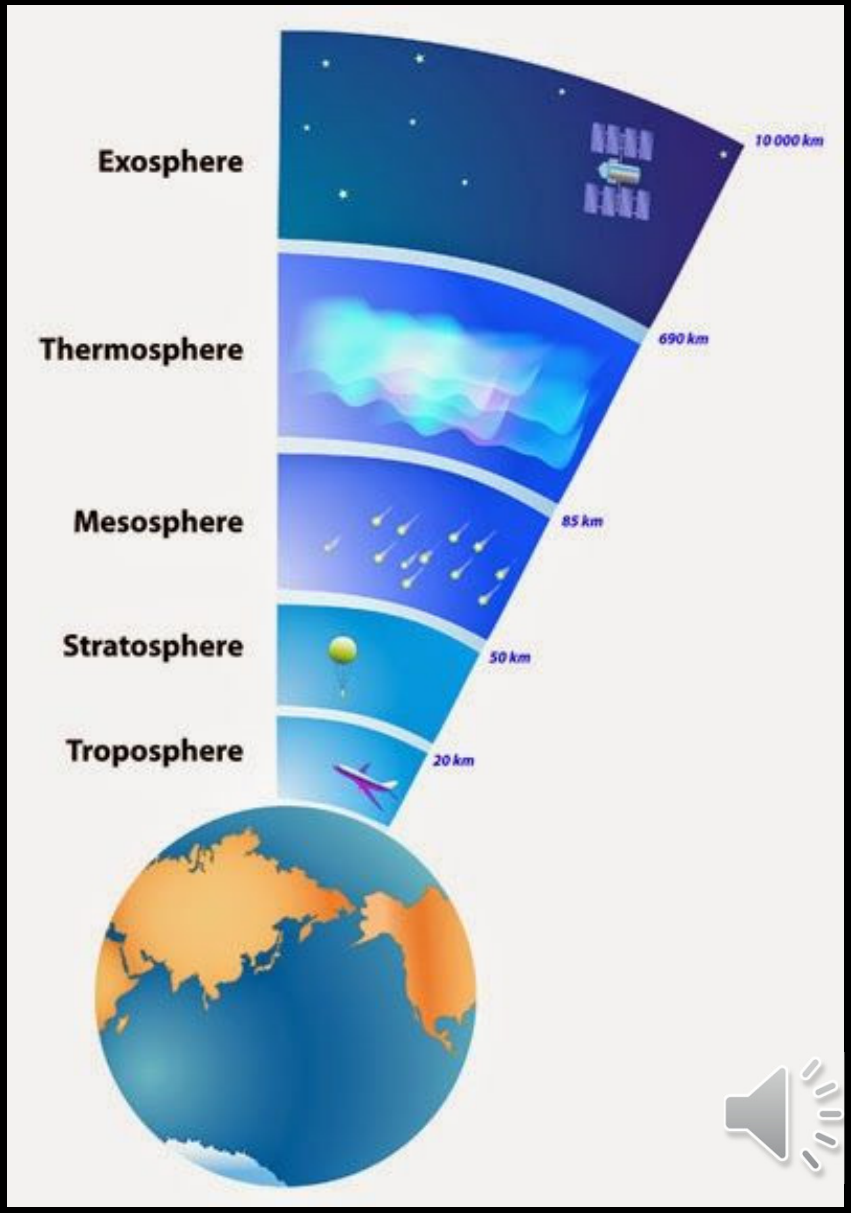
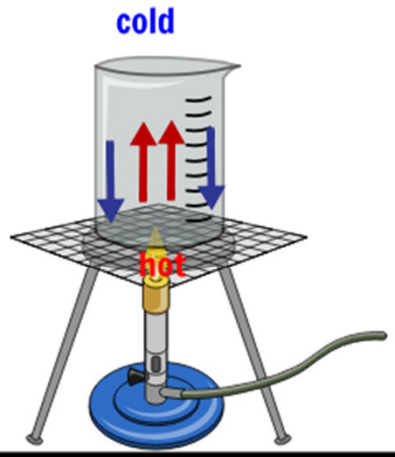
LAYERS OF THE ATMOSPHERE

- Troposphere:
- Stratosphere
- Ozonosphere
- Mesosphere
- Thermosphere
- Ionosphere
- Exosphere



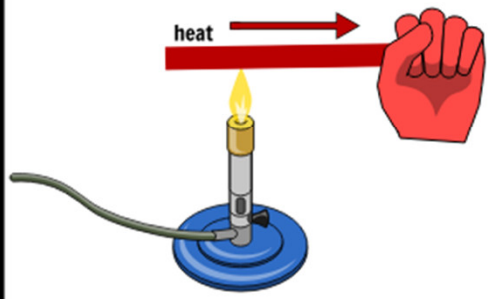
convection

the movement caused within a fluid by the tendency of hotter and therefore less dense material to rise, and colder, denser material to sink under the influence of gravity, which consequently results in transfer of heat.



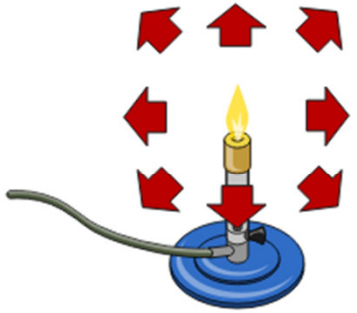
conduction

the process by which heat or electricity is directly transmitted through a substance when there is a difference of temperature or of electrical potential between adjoining regions, without movement of the material.



radiation

the emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles that cause ionization.



TROPOSPHERE

The first layer of the Earth's atmosphere with highest amount of gases.

Starts from the surface of the planet and vertically extends 12 Kms.

Temperature of troposphere decreases with altitude.

Troposphere is separated from stratosphere by the atmospheric boundary referred to as the **tropopause**

Constituent	Tropospheric mixing ratio
N_2 (Nitrogen)	78.08%
O_2 (Oxygen)	20.95%
H_2O (water vapor)	<3.00%
A (Argon)	0.93%
CO_2 (carbon dioxide)	345 ppmv
O_3 (ozone)	10 ppmv
CH_4 (methane)	1.6 ppmv
N_2O (nitric oxide)	350 ppbv
CO (carbon monoxide)	70 ppbv
CFC=s 11-12	0.2-0.3 ppbv

TROPOSPHERE

The word troposphere means **'turning sphere'**, which symbolizes the fact that, in this region, convective processes dominate over radiative processes.

The troposphere is indeed marked by strong convective over-turnings, whereby large parcels of warm air travel upwards to the tropopause, carrying water vapor and forming clouds as they cool down

The troposphere contains the bulk of atmospheric water vapor, the majority of clouds and most of the weather, both on a global and a local scale.

Because pressure decreases exponentially with altitude, it also contains over 75% of the total mass of the atmosphere.

Most importantly, however, it is in contact with the Earth's surface and therefore interacts directly with other climate subsystems, such as the biosphere (the land and vegetation), the hydrosphere (the oceans), the cryosphere (the ice caps), the lithosphere (the topography), and most all, with the human world

TROPOSPHERE: OZONE (O3)

Ozone (O_3) is another important gas in the atmosphere

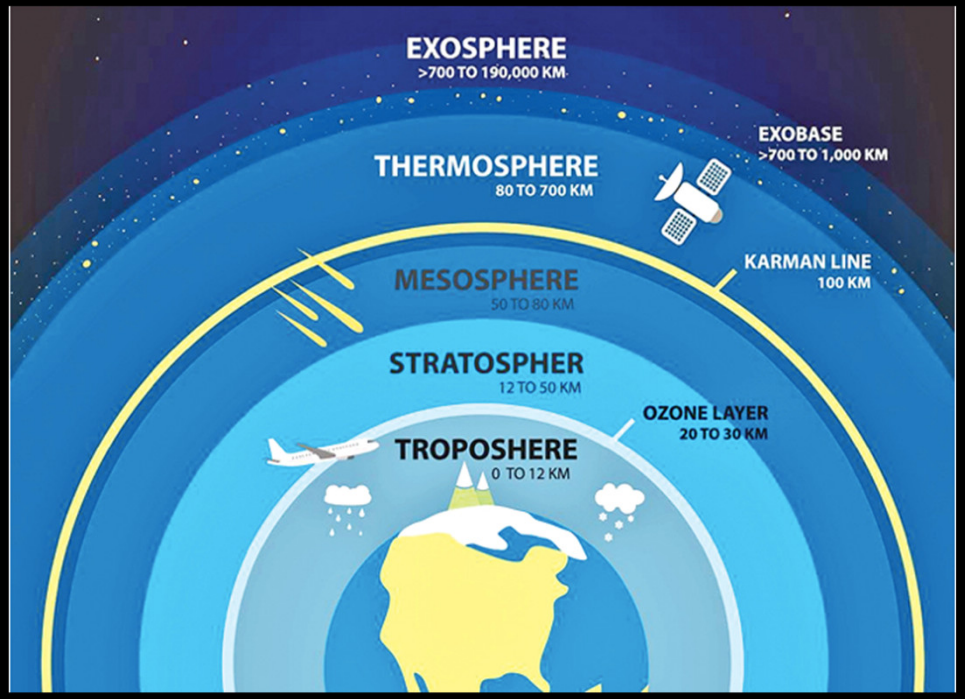
It forms less than **00005%** by volume of the atmosphere

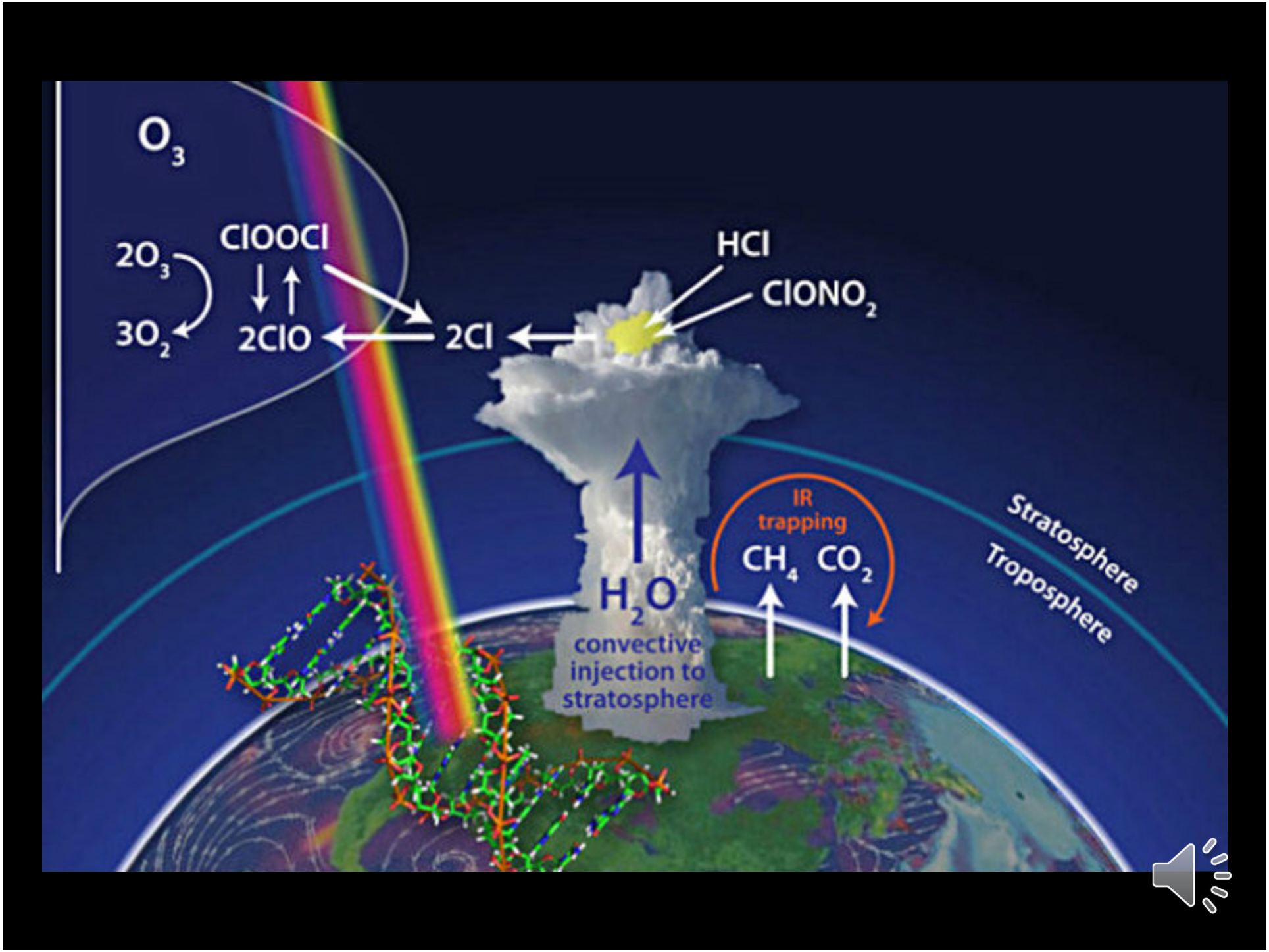
U**nevenly distributed**. It is between **20 km and 25** km altitude that the greatest concentrations of ozone are found.

It is formed at higher altitudes and transported downwards.

Ozone plays a **crucial role in blocking the harmful ultraviolet radiation** from the sun.

But the tropospheric ozone have negative impact on the life




O_3
$2O_3$
$3O_2$
ClOOCl
2ClO
2Cl
HCl
$ClONO_2$
H_2O
convective injection to stratosphere
IR trapping
CH_4
CO_2
Stratosphere
Troposphere

STRATOSPHERE: OZONE (O3)

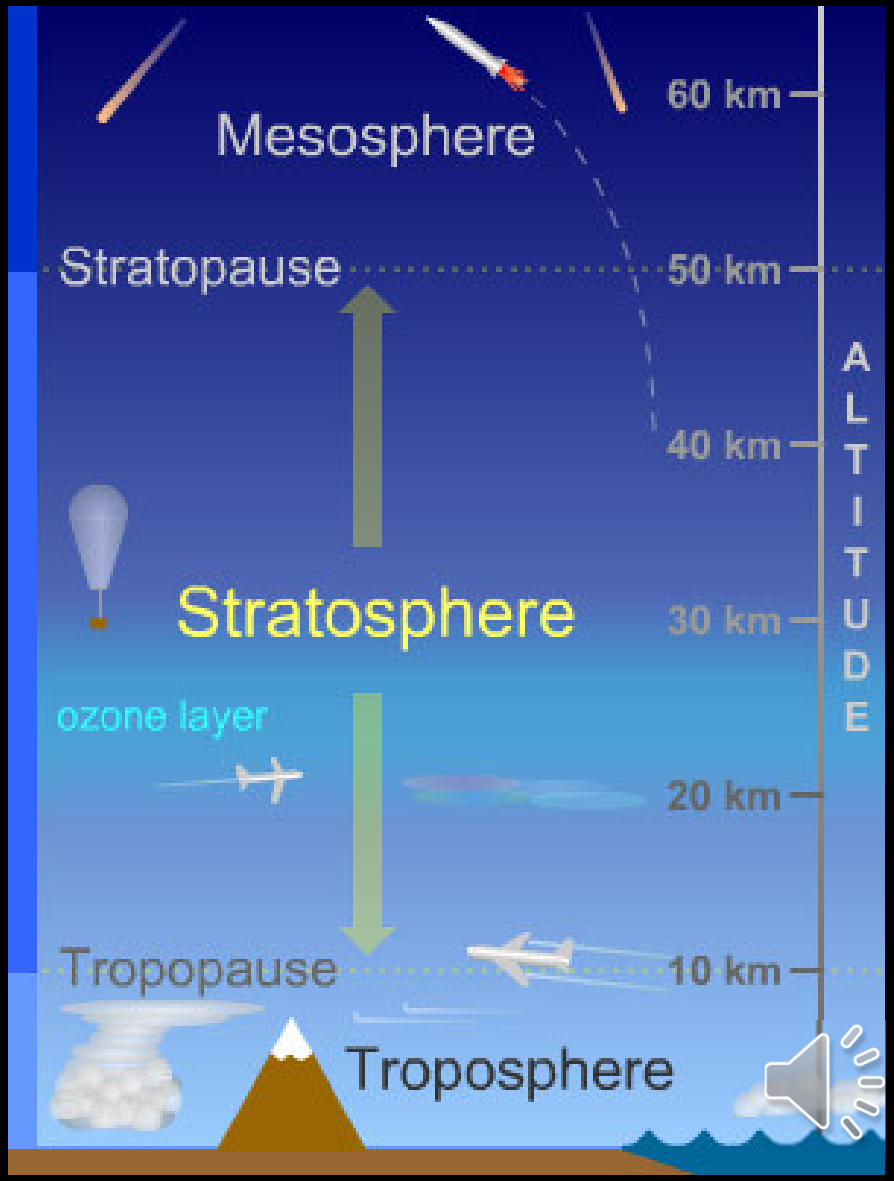
Stratosphere extends from tropopause to the 51 kms.

The temperature in this layer remains constant with altitude for the first 5.59 miles, but increases for next 12.42 to 31.06 miles.

The ozone layer, which is very crucial for lifeforms on the Earth, it blocks UV Radiations in this zone.

This is exactly the opposite of the behavior in the troposphere in which we live, where temperatures drop with increasing altitude.

Stratosphere is separated from mesosphere by the atmospheric boundary referred to as the stratopause.



MESOSPHERE

It extends from stratopause to a vertical distance of around 50 - 80 kms.

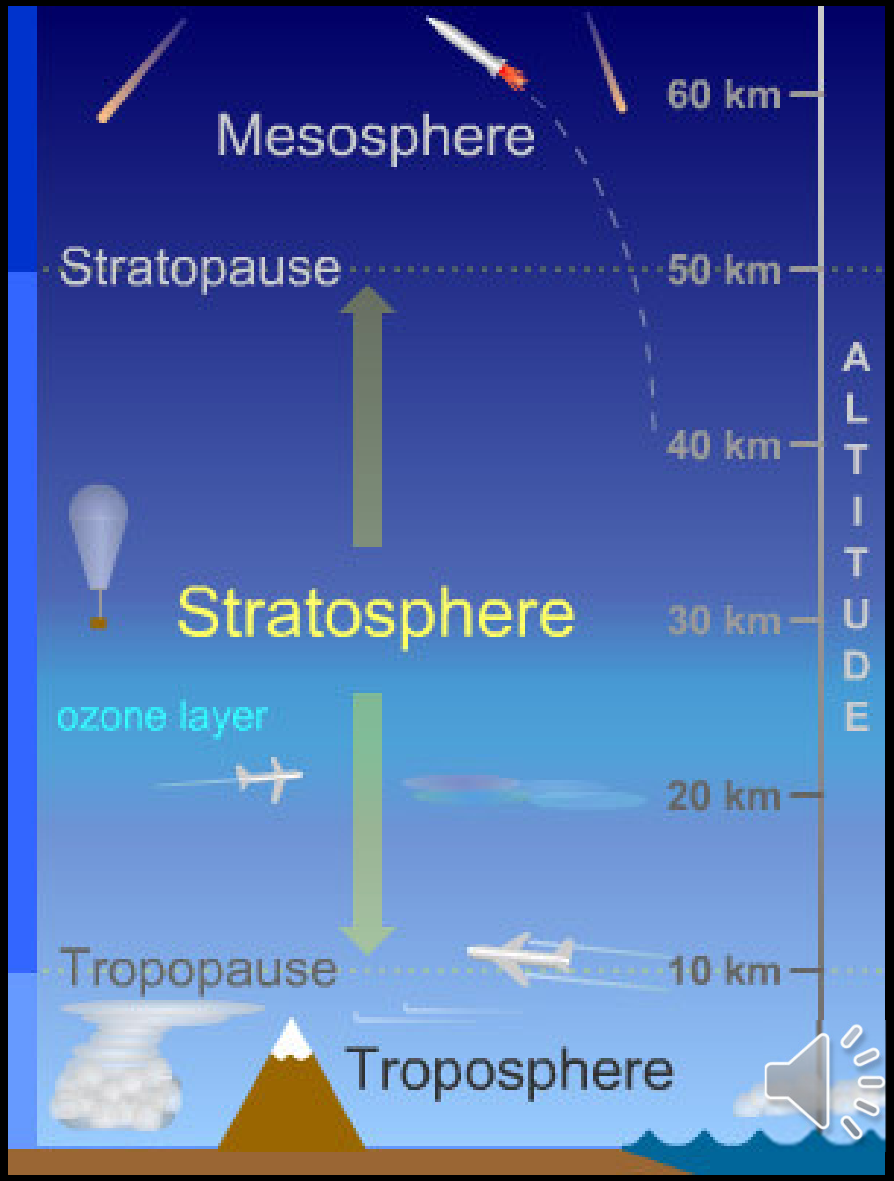
It terminates by the mesopause, which is also the coldest part of the Earth, with a temperature of around **-100°C** (-148.0°F).

Mesosphere is the layer wherein most of the meteors burn when they enter the atmosphere.

The mesosphere is difficult to study, so less is known about this layer of the atmosphere than other layers.

Weather balloons and other aircraft cannot fly high enough to reach the mesosphere.

Satellites orbit above the mesosphere and cannot directly measure traits of this layer.



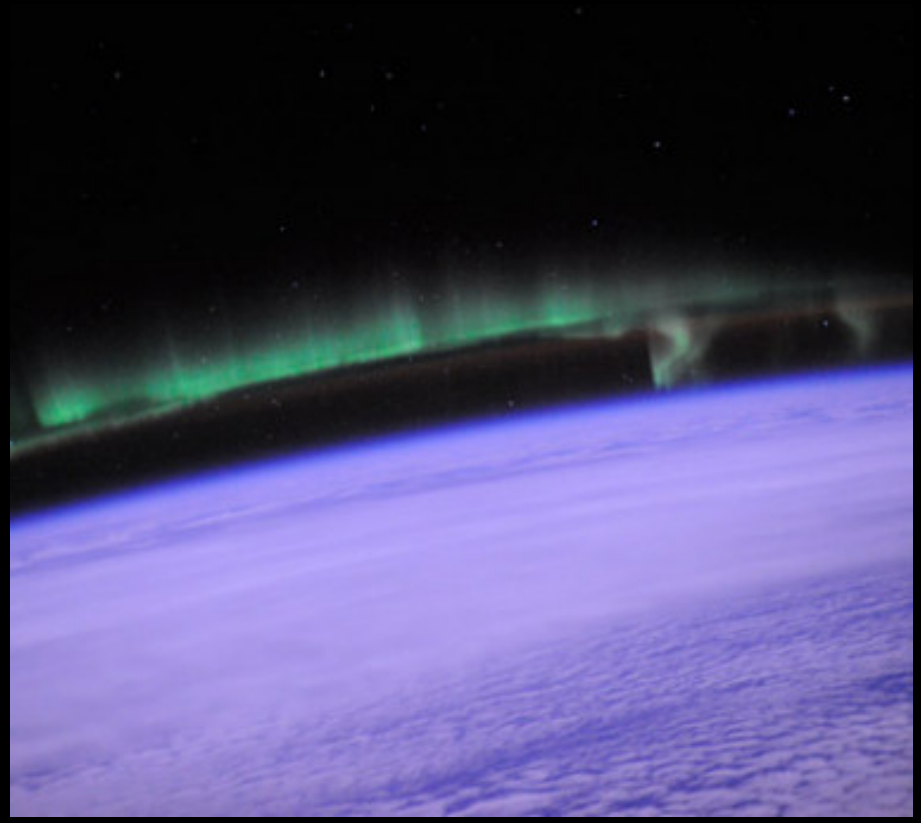
THERMOSPHERE

Largest layer of atmosphere extending from 50 to 700 Kms.

In this layer, the temperature increases with altitude and can reach up to **1200°C at times**.

The oxygen molecules in this zone contributes to the rising temperature by absorbing intense solar radiation.

Located within the thermosphere is ionosphere, a layer which contains electrically charged gas particles that help in transmission of radio signals.



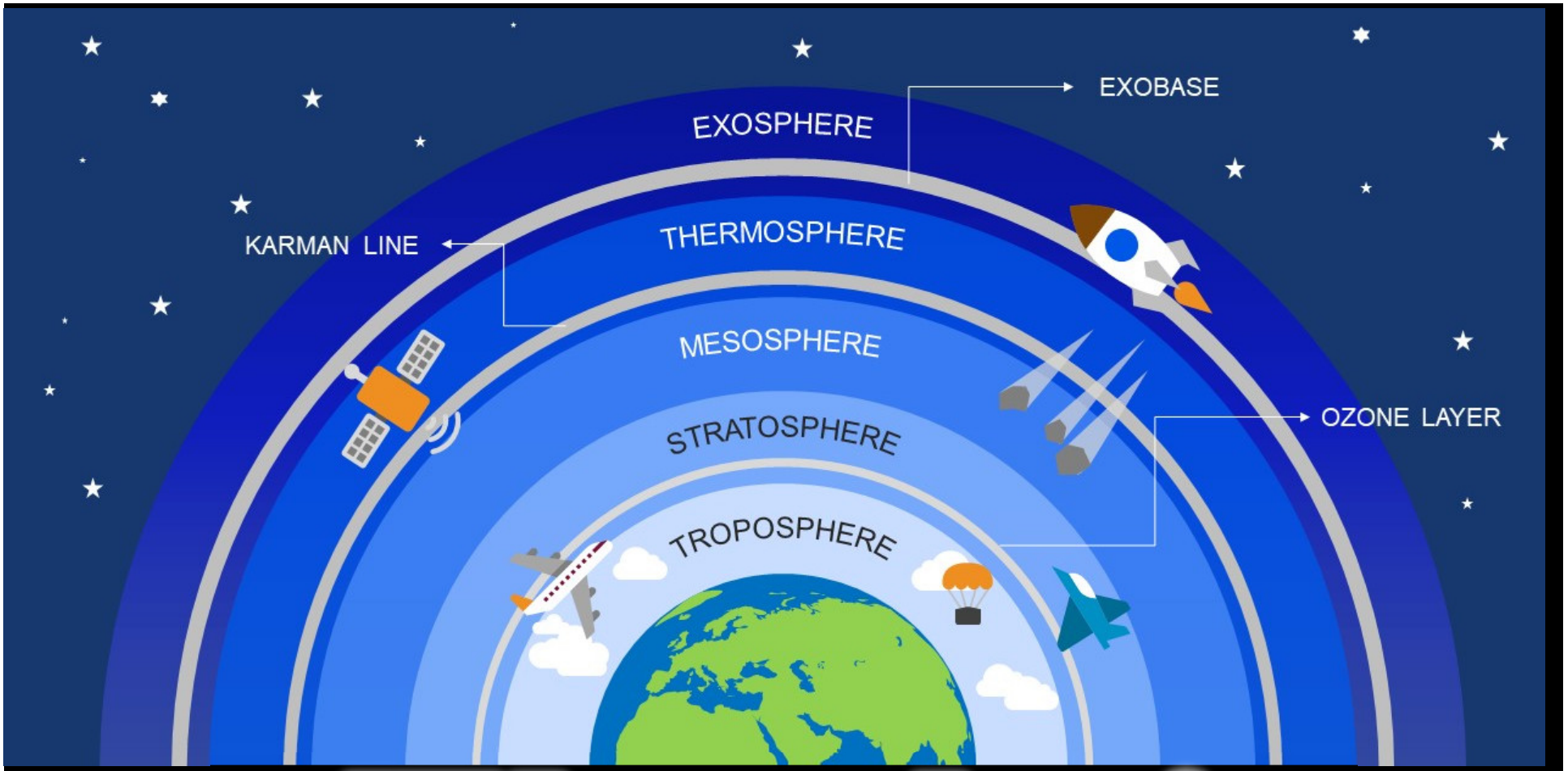
EXOSPHERE

The outermost layer of the atmosphere, exosphere extends from thermospause into the space.

This layer is mainly made up of hydrogen and helium.

Though the definite boundary of this layer is not known, scientists believe that it extends for a vertical distance of 700 to 10,000 kms.

That, however, is not supported by substantial evidence, so thermosphere is referred to as the biggest among all these layers of the planet's atmosphere.



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