



Composition and Layers of Earth's Atmosphere

For Prelims: Atmosphere & Its Layers, Composition of Earth's Atmosphere

For Mains: Significance of Atmosphere, Characteristics of Different Layers of Atmosphere

What is there to Know About the Atmosphere?

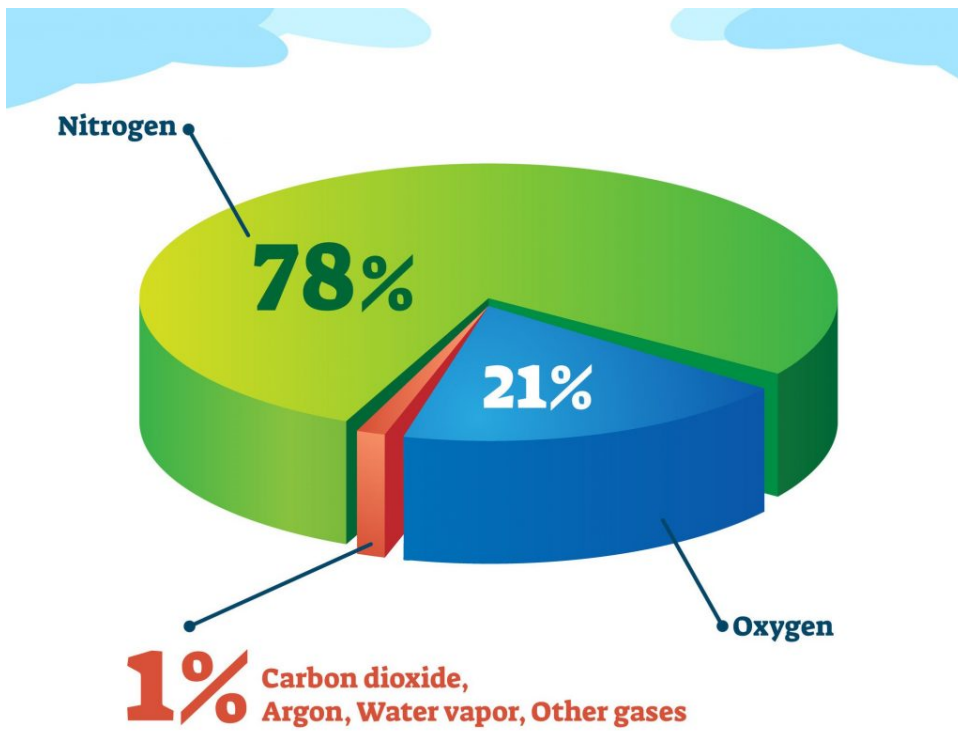
▪ About:

- One of the **main components of Earth's interdependent physical systems** is the atmosphere. An atmosphere is made of the layers of gases surrounding a planet or other celestial body.

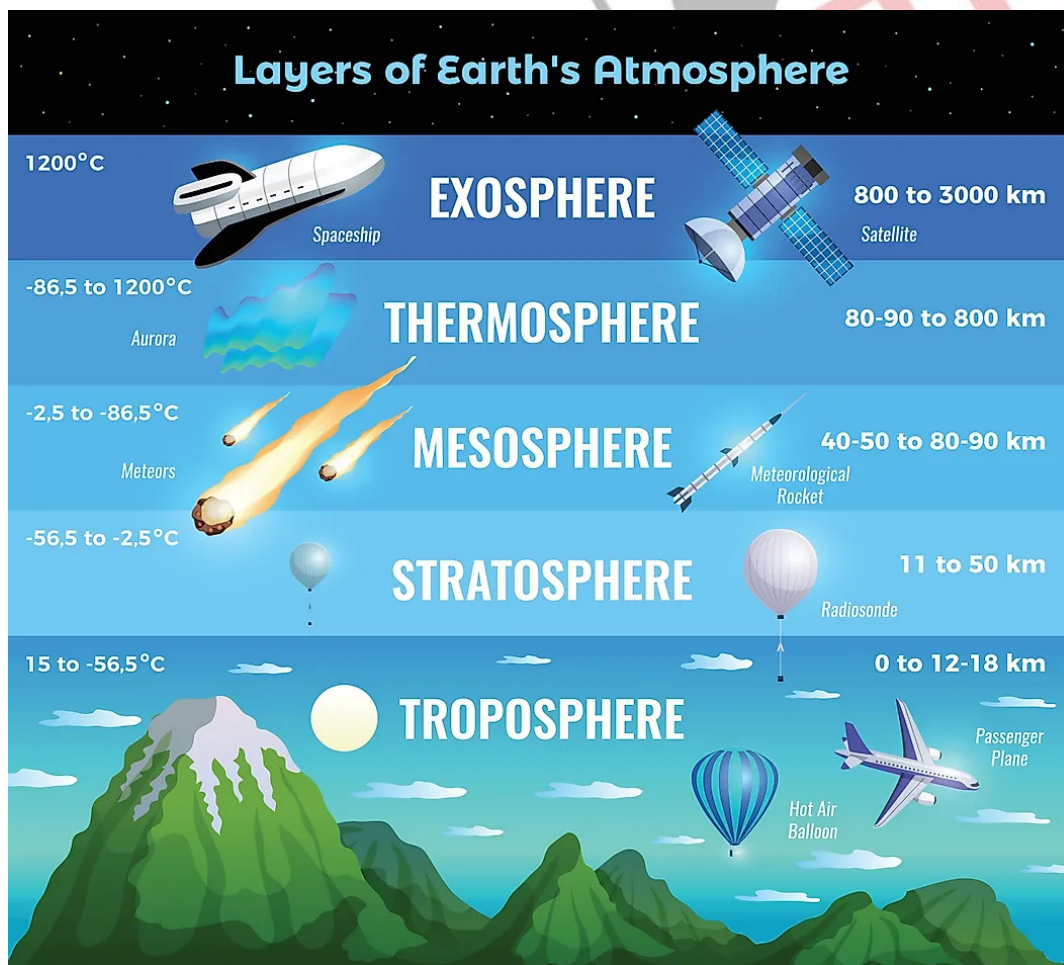
▪ Composition:

- Earth's **atmosphere is composed of about 78% nitrogen, 21% oxygen, and 1% other gases.**
 - **Nitrogen (N₂):** It is the most plentiful gas in the air. It is one of the primary nutrients critical for the survival of all living organisms.
 - **Oxygen (O₂):** Humans and animals take oxygen from the air as they breathe. Green plants produce oxygen during photosynthesis. In this way oxygen content in the air remains constant.
 - **Carbon dioxide (CO₂):** It is an important **heat-trapping gas, or [greenhouse gas](#)**, that comes from the extraction and burning of fossil fuels.
- These gases are **found in [atmospheric layers](#) defined by unique features such as temperature and pressure.**

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What are the Different Layers of the Atmosphere?

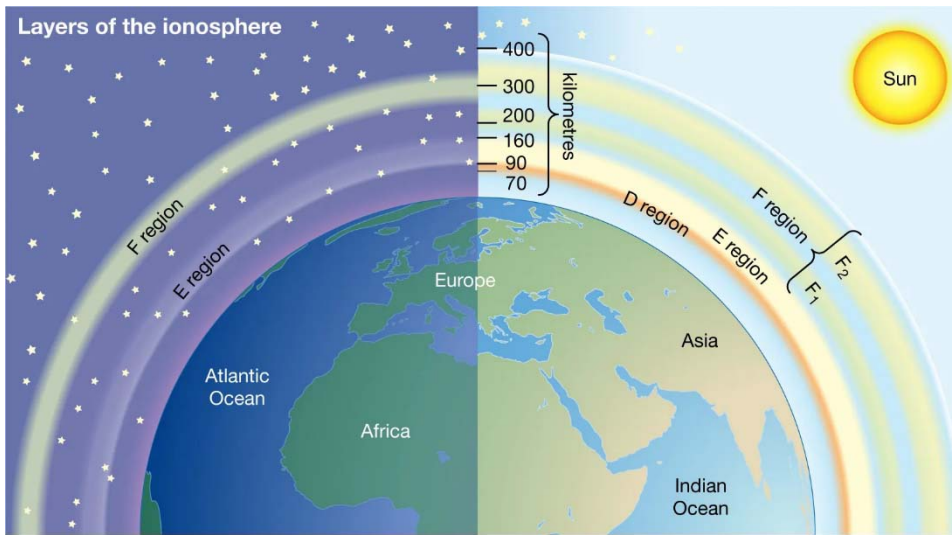


- **Troposphere:**

- Earth's troposphere extends from Earth's surface to, on average, about 12 kilometers in

height, with its height lower at [Earth's poles](#) and higher at the equator.

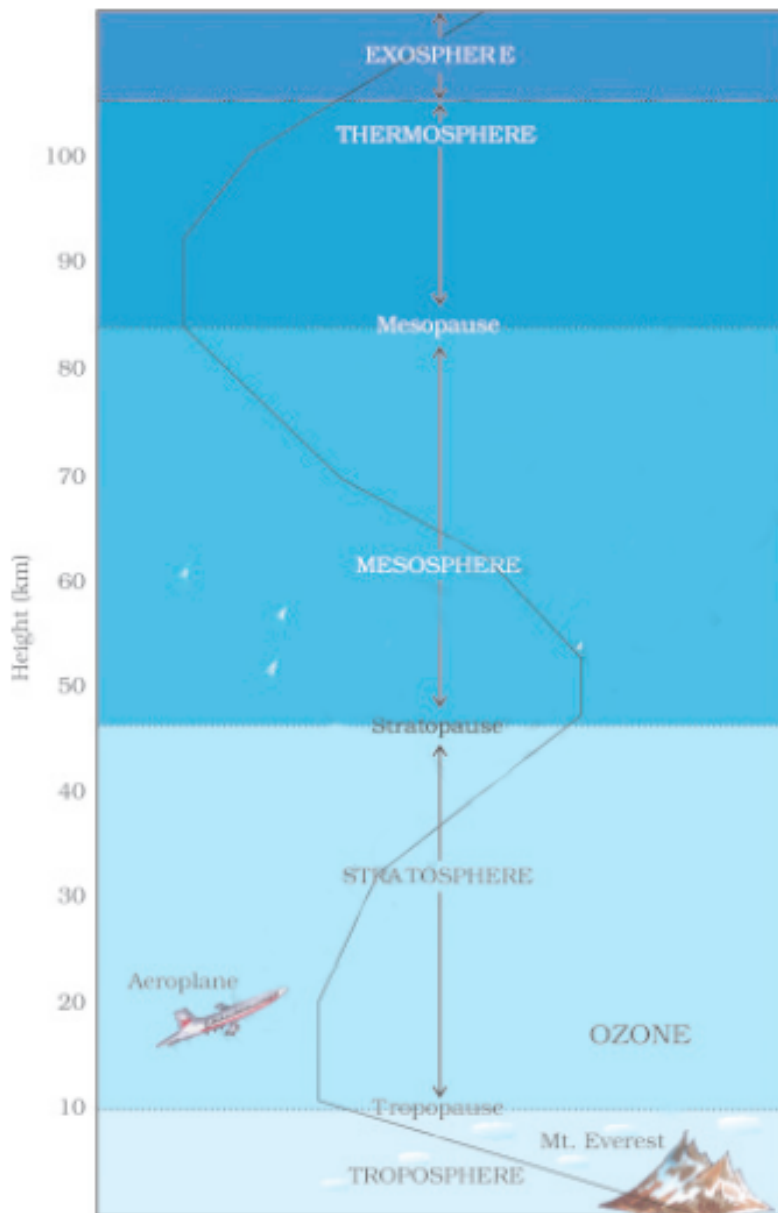
- Yet this very shallow layer is **tasked with holding all the air** that plants need for [photosynthesis](#) and animals need to breathe, and also **contains about 99% of all water vapor and aerosols** (minute solid or liquid particles suspended in the atmosphere).
- The **temperature in the troposphere also decreases with height**. On top of this layer is what is referred to as **tropopause**.
- It is the **densest atmospheric layer**, compressed by the weight of the rest of the atmosphere above it.
- Most of **Earth's weather happens here, and almost all clouds that are generated by weather are found here**.
 - Most **aviation takes place here**, including in the transition region between the troposphere and the stratosphere.
- **Stratosphere:**
 - Located between approximately 12 and 50 kilometers above Earth's surface, the stratosphere is perhaps **best known as home to Earth's ozone layer**.
 - In this region, **the temperature increases with height**. Heat is produced in the process of the formation of Ozone, and this **heat is responsible for temperature increase**.
 - It is **nearly cloud- and weather-free, but polar stratospheric clouds** (occur mainly at high latitudes during the winter) **are sometimes present** in its lowest, coldest altitudes.
 - It's also the **highest part of the atmosphere that jet planes can reach**.
- **Mesosphere:**
 - Located between about 50 and 80 kilometers above Earth's surface, the mesosphere **gets progressively colder with altitude**.
 - The top of this layer is the **coldest place found within the Earth system**, with an average temperature of about minus 85 °C (-120 °F).
 - The very scarce **water vapor present at the top of the mesosphere forms noctilucent clouds**, the **highest clouds in Earth's atmosphere**.
 - Most **meteors burn up in this atmospheric layer**. Sounding rockets and rocket-powered aircraft can reach the mesosphere.
 - The transition boundary which **separates the mesosphere from the stratosphere is called the stratopause**.
- **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.
- **Ionosphere:**
 - It is not a **distinct layer as the others mentioned above**. Instead, the ionosphere **overlaps the mesosphere, thermosphere, and exosphere**.
 - It's a very active part of the atmosphere, and **it grows and shrinks depending on the energy it absorbs from the sun**.
 - It is an **electrically conducting region capable of reflecting radio signals back to Earth**.
 - The electrically charged atoms and molecules **that are formed in this way are called ions, giving the ionosphere its name** and endowing this region with some special properties.



▪ **Exosphere:**

- It is located between about 700 and 10,000 kilometers above Earth's surface, the exosphere is the **highest layer of Earth's atmosphere** and, at its top, merges with the **solar wind**.
- Molecules found here are of extremely low density, so **this layer doesn't behave like a gas, and particles here escape into space**.
- While **there's no weather in the exosphere**, the aurora borealis and aurora australis are sometimes seen in its lowest part.
 - **Most Earth satellites orbit in this layer.**





▪ **Significance:**

- **Protection from Harmful Radiations:** The atmosphere protects life on Earth by shielding it from incoming [ultraviolet \(UV\) radiation](#), keeping the planet warm through insulation, and preventing extremes between day and night temperatures.
- **Weather and climate:** The atmosphere play a crucial role in determining weather and climate patterns, including temperature, precipitation, and wind. These **patterns have a significant impact on ecosystems, agriculture, and human activities.**
- **Regulates the Earth's Temperature:** The atmosphere helps regulate the Earth's temperature by trapping heat from the sun and preventing it from escaping into space. This **process, known as the greenhouse effect**, helps keep the planet warm enough to support life.
- **A Major Role in the Water Cycle:** The atmosphere helps regulate the Earth's water cycle by transporting water vapor from the oceans to the land, where it falls as precipitation.