8.1.1 International standard atmosphere

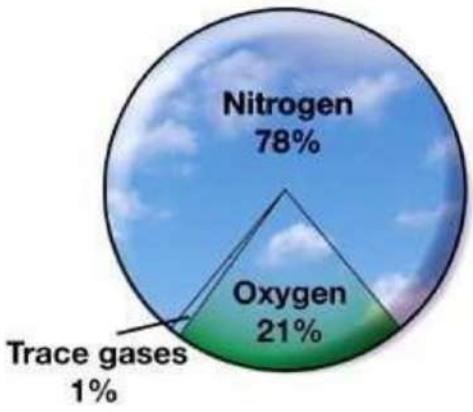
- *Earth's atmosphere is a layer of gases surrounding the planet.*
- *The Earth is surrounded by a blanket of air, which we call the atmosphere. It reaches over 560 kilometers from the surface of the Earth.*

Atmosphere:

- Absorbs the energy from the Sun,
- Recycles water and other chemicals,
- protects us from high-energy radiation and the frigid vacuum of space.
- The atmosphere protects and supports life.

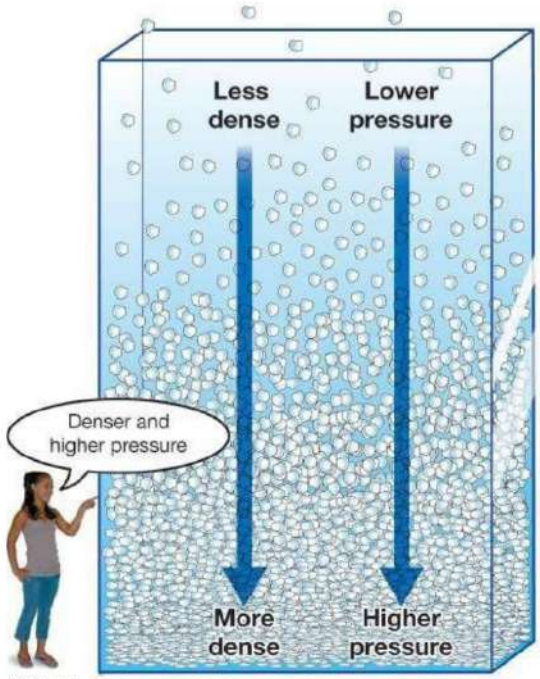
Earth's atmosphere

- Earth's atmosphere is made of a mixture of gases called air.
  - **Nitrogen** gas makes up about 78% of Earth's atmosphere.
  - The second most abundant gas is **oxygen**, which makes up 21% of Earth's atmosphere.
  - The third **Argon** (Ar, 0.9%).
  - **Carbon Dioxide** (CO_2, 0.03%).



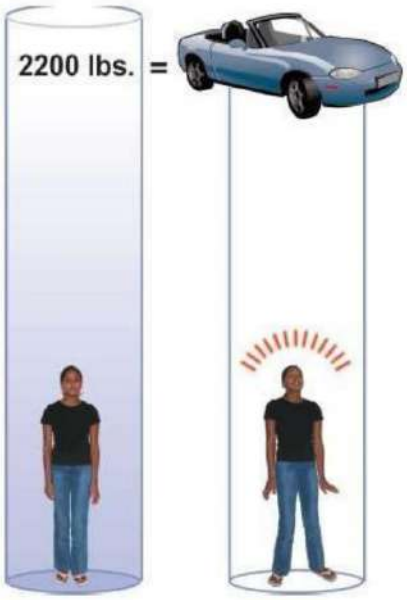
Pressure in the atmosphere

- **Atmospheric pressure** is the force per unit area exerted into a surface by the weight of air above that surface in the atmosphere of Earth.
- The gas molecules closest to Earth's surface are packed together very closely.
- This means pressure is lower the higher up you go into the atmosphere.



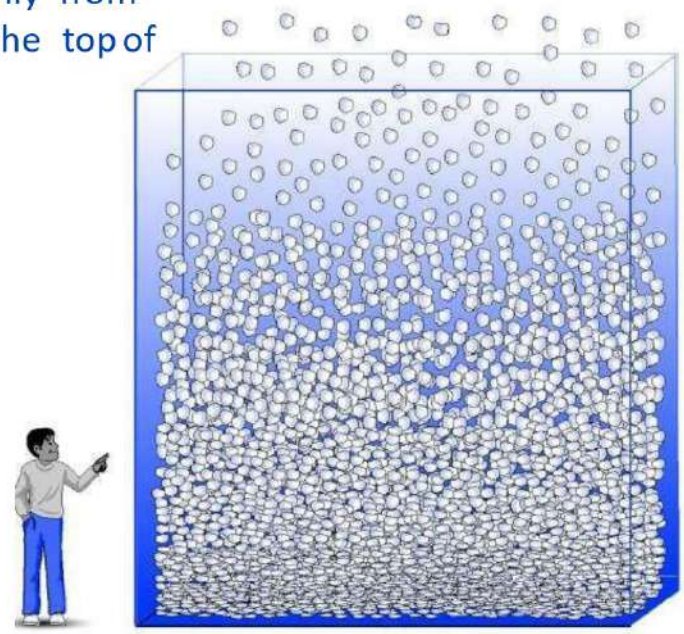
Pressure in the atmosphere

- At sea level, the weight of the column of air above a person is about 9,800 Newtons (2,200 pounds)!
- This is equal to the weight of a small car.



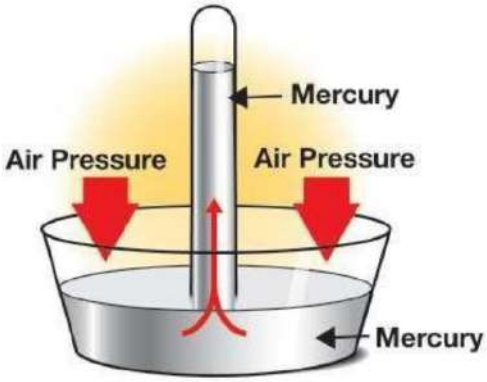
Pressure changes with altitude

Pressure varies smoothly from the Earth's surface to the top of the mesosphere.



Measuring Pressure

- A barometer is an instrument that measures atmospheric pressure.
- Long ago, mercury barometers were used
- Since mercury is a poisonous liquid, *aneroid barometers* are used today.

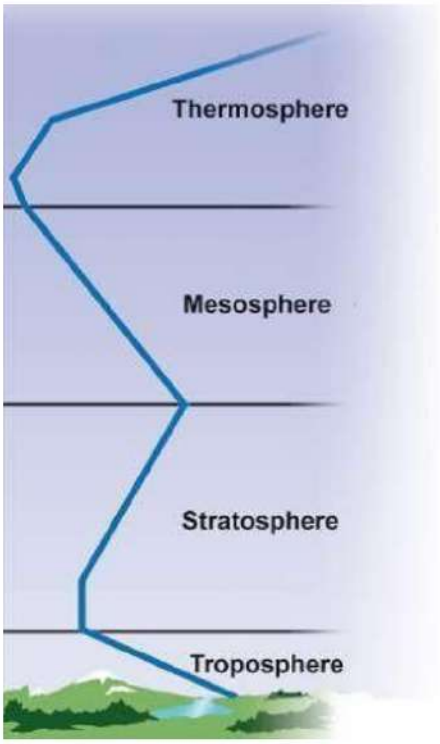


Layers of Atmosphere

Layers of Atmosphere

The atmosphere has four layers

- Thermosphere
- Mesosphere
- Stratosphere
- Troposphere



Layers of Atmosphere

Troposphere

- Lowest and thinnest layer
  - 16 km at equator, 8 km at poles
- 90% of the atmosphere's mass
- Temperature decreases with altitude
  - 6°C per kilometer
  - Top of troposphere averages – 50°C
- Where weather occurs
- Boundary between the troposphere, and the stratosphereis called the **tropopause**

View of troposphere layer from an airplane's window.

Layers of Atmosphere

Stratosphere

- Extends from 10 km to 50 km above the ground
- Less dense (less water vapor)
- Temperature increases with altitude
- Almost no weather occurrence
- Contains high level of ozone
  - Ozone layer
- Upper boundary is called stratopause.

Layers of Atmosphere

Mesosphere

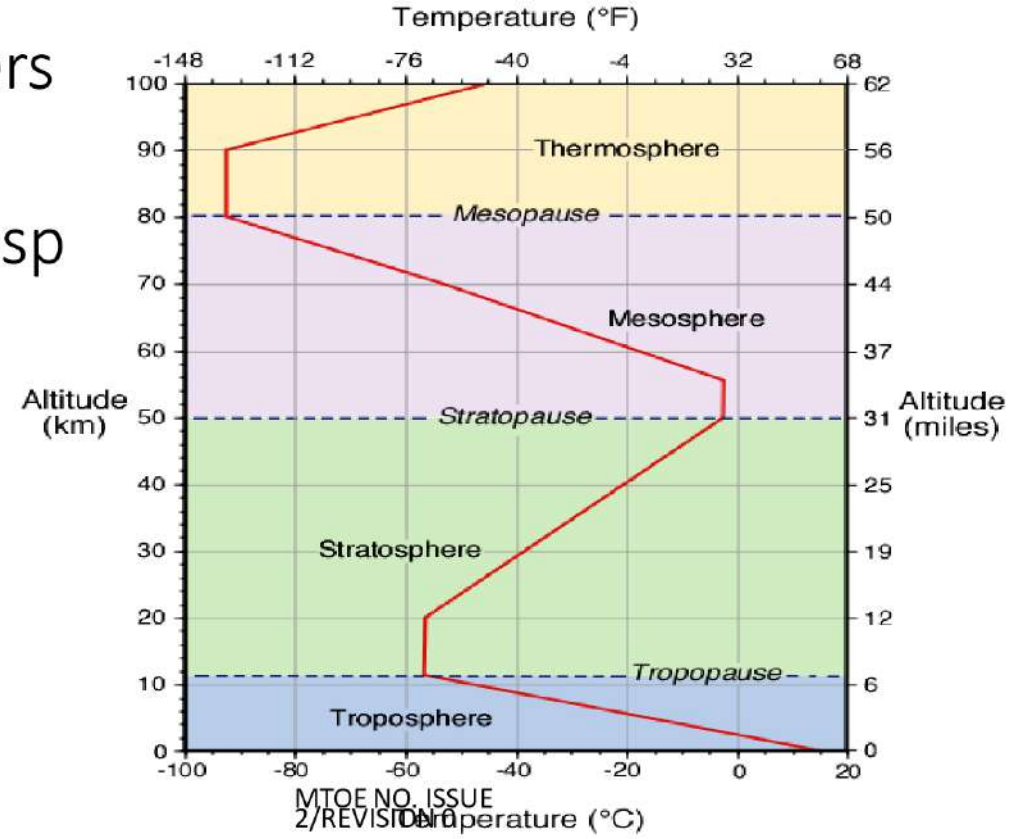
- Extends to almost 80 km high
- Gases are less dense.
- Temperature decreases as altitude increases.
  - Gases in this layer absorb very little UV radiation.

Layers of Atmosphere

Thermosphere

- Above the mesosphere and extends to almost 600 km high
- Temperature **increases** with altitude
- Readily absorbs solar radiation
- Temperature can go as high as 1,500 ^{o}C
- Reflects radio waves

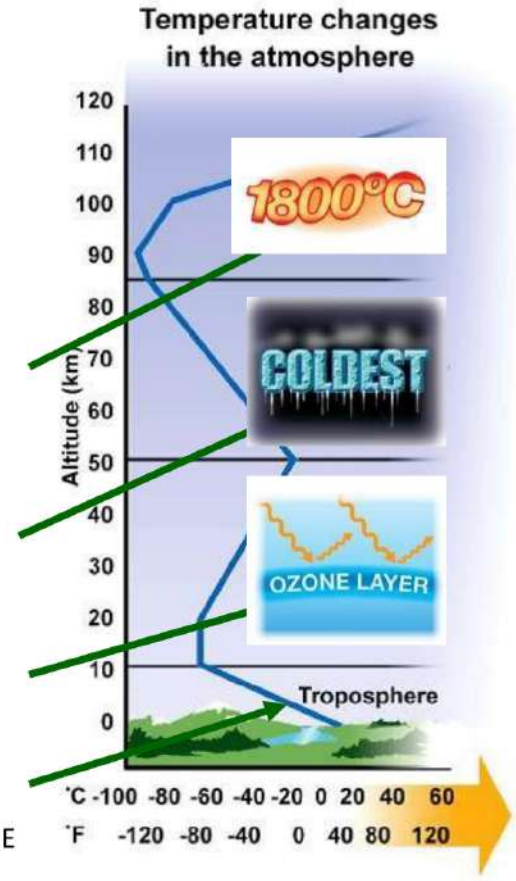
Layers of Atmosphere



the Atmosphere

The four layers of the atmosphere include:

1. the troposphere, where we live;
2. the stratosphere, which contains the ozone layer;
3. the mesosphere, where meteors burn; and
4. the thermosphere, where satellites orbit Earth.



Layers of the Atmosphere

- The exosphere begins at about 500 kilometers above Earth and does not have a specific outer limit.

- Satellites orbit Earth in the exosphere.