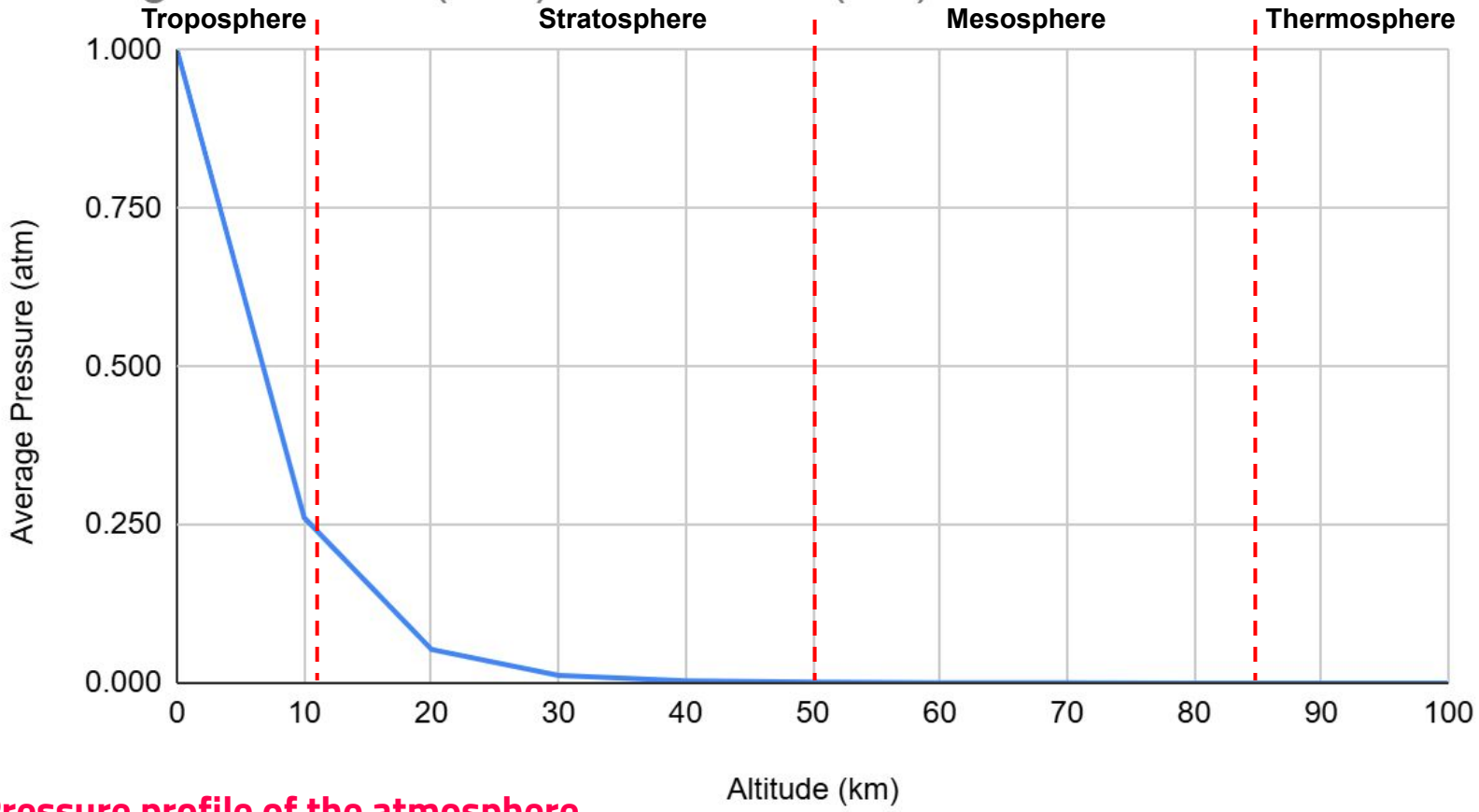
Lesson 2: Profile of the Atmosphere

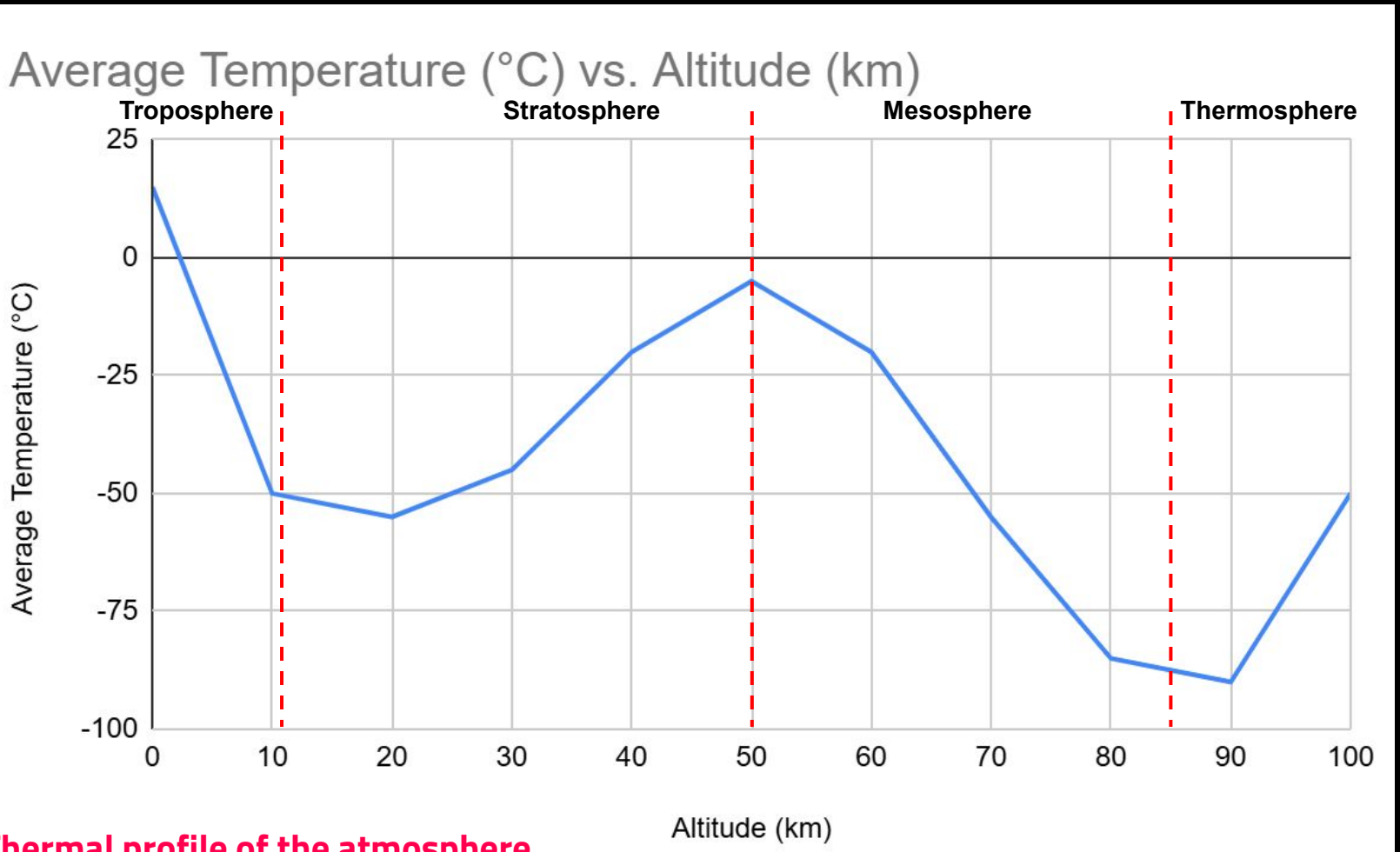
Learning Targets:

I can distinguish the different layers in terms of its characteristics.

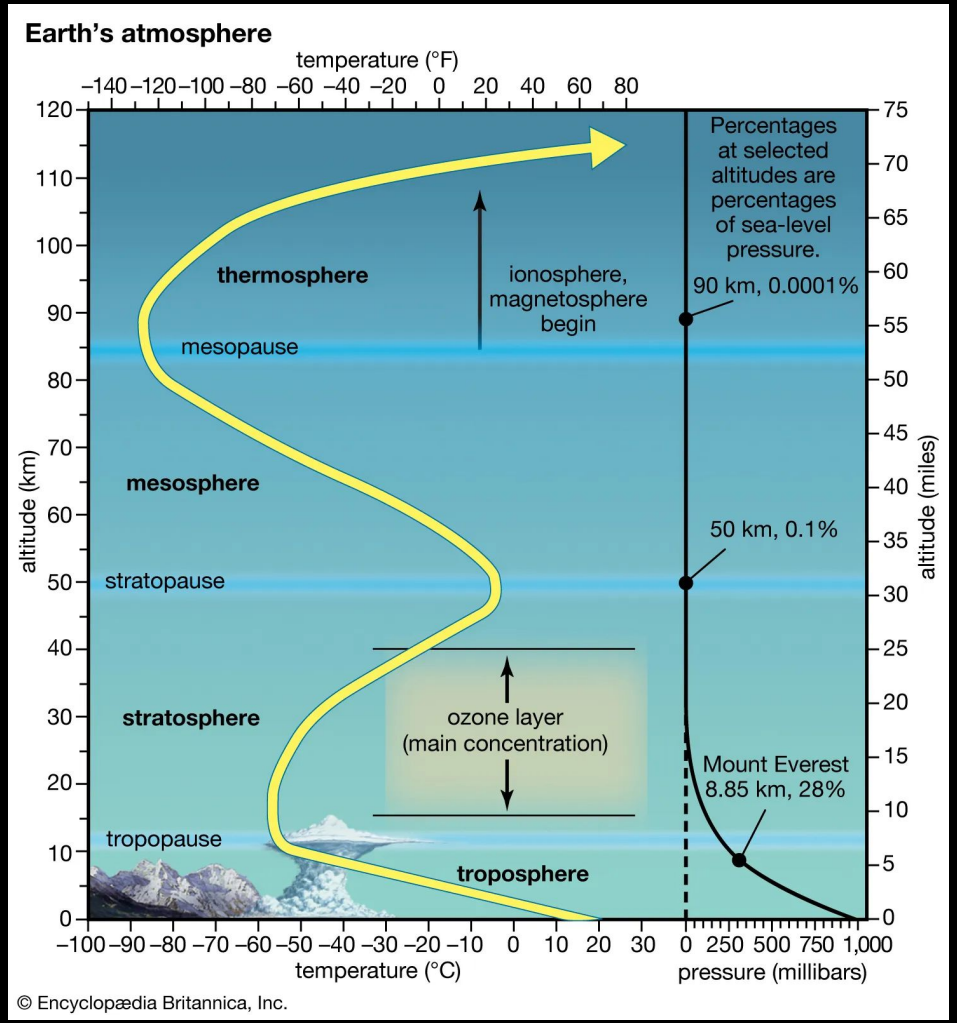
I can differentiate between the three mechanism of heat transfer in the atmoshere.



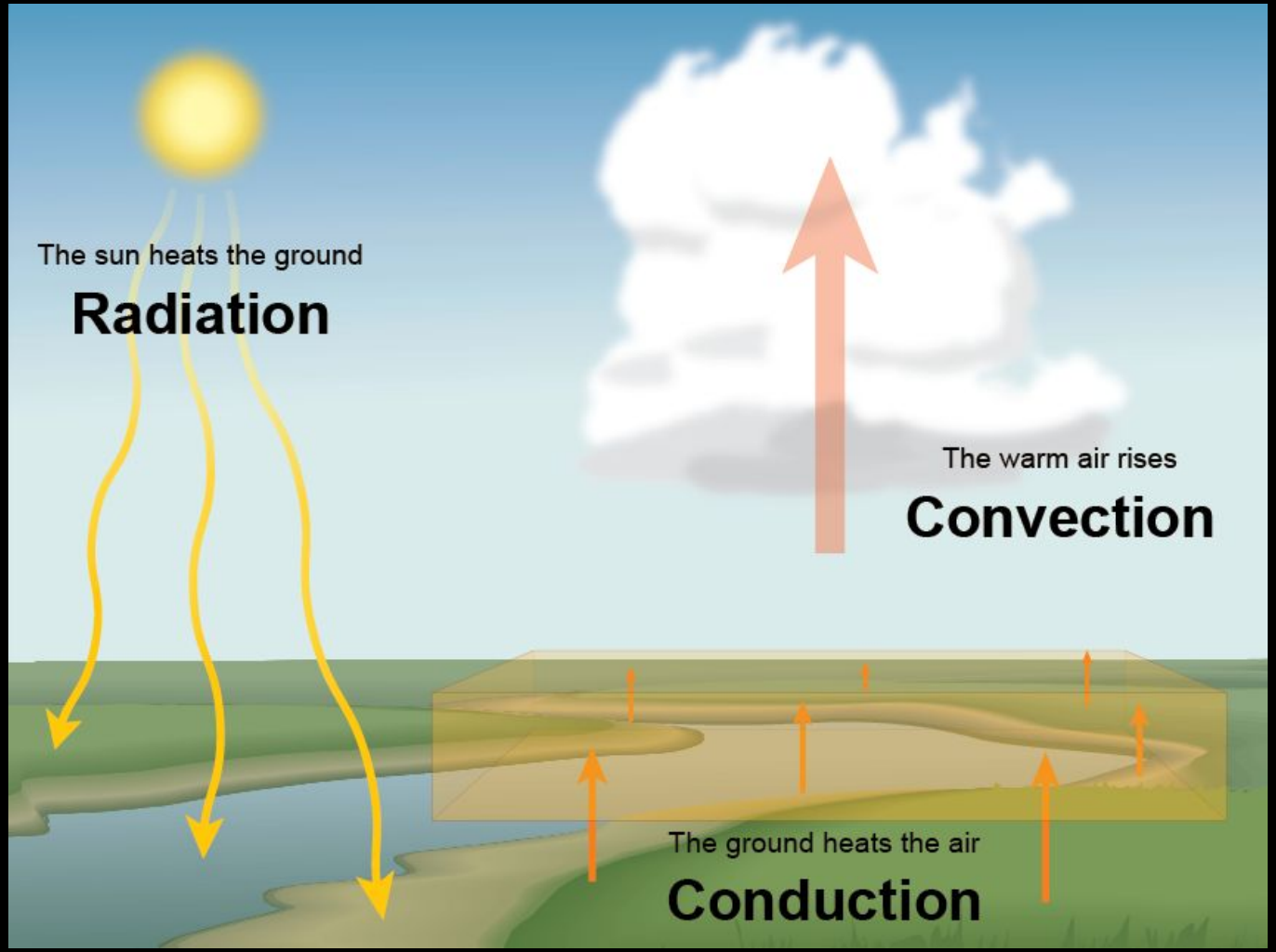
Pressure profile of the atmosphere



Thermal profile of the atmosphere



Troposphere	habitable zone; where all weather phenomena occurs
Stratosphere	where all commercial spend most their flight; ozone layer
Mesosphere	where meters burn upon entry; upper limit of research weather balloons
Thermosphere	interaction of high-energy solar radiation with atmospheric particles (aurora phenomenon); where satellites orbit the planet



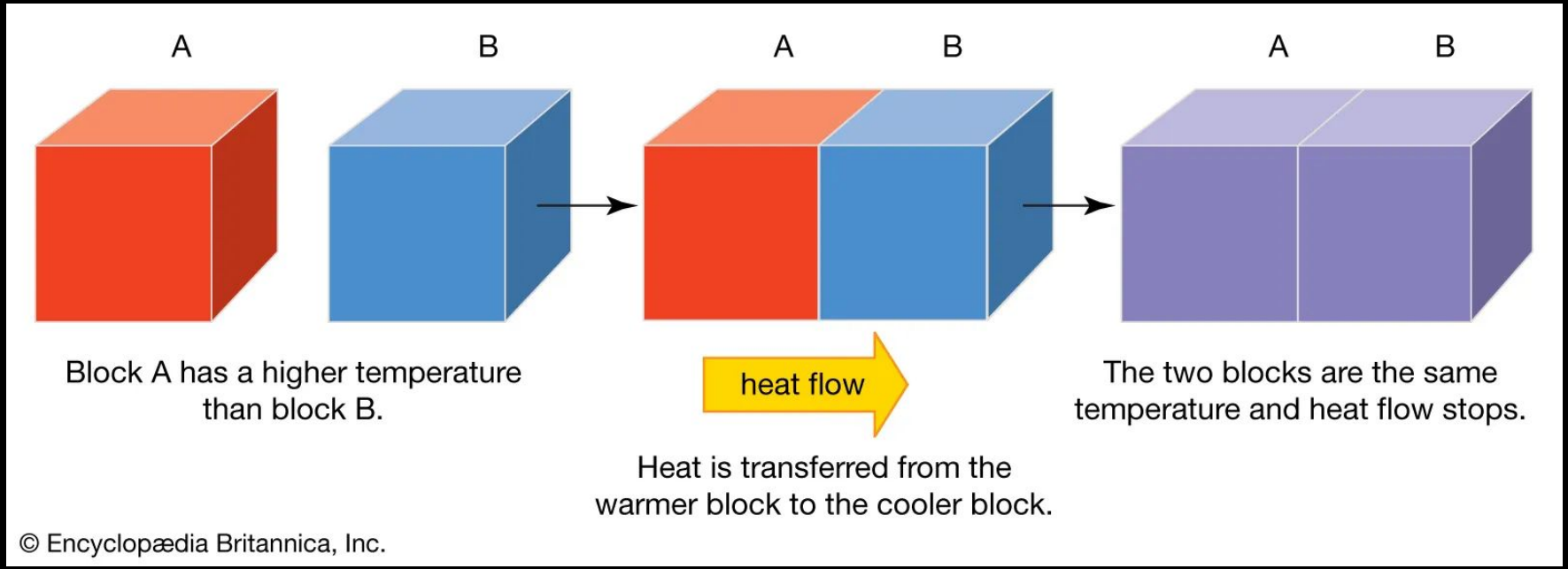
HEAT vs TEMPERATURE

The amount of energy possessed by a material arising from the internal motions of its atoms or molecules.

The average kinetic energy of a materials's atoms or molecules.

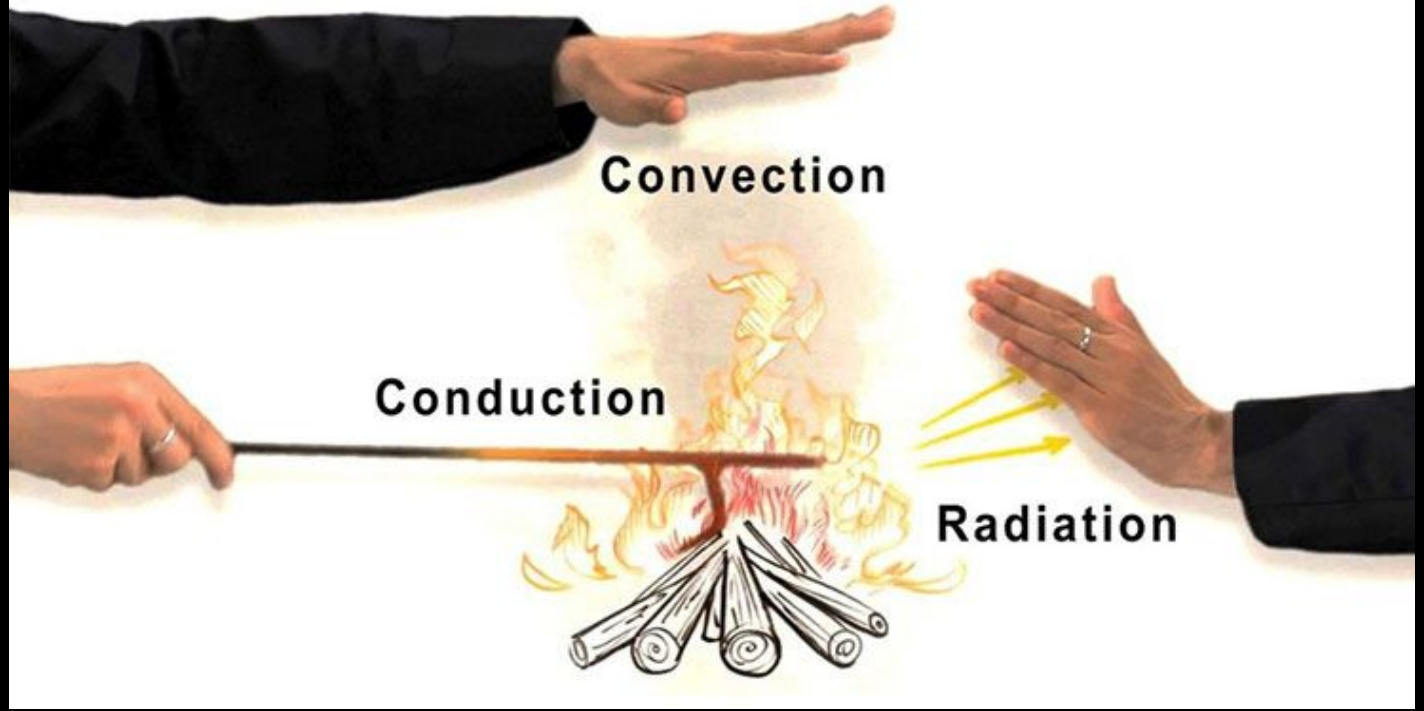
What do we actually mean when we say something is warmer or colder?

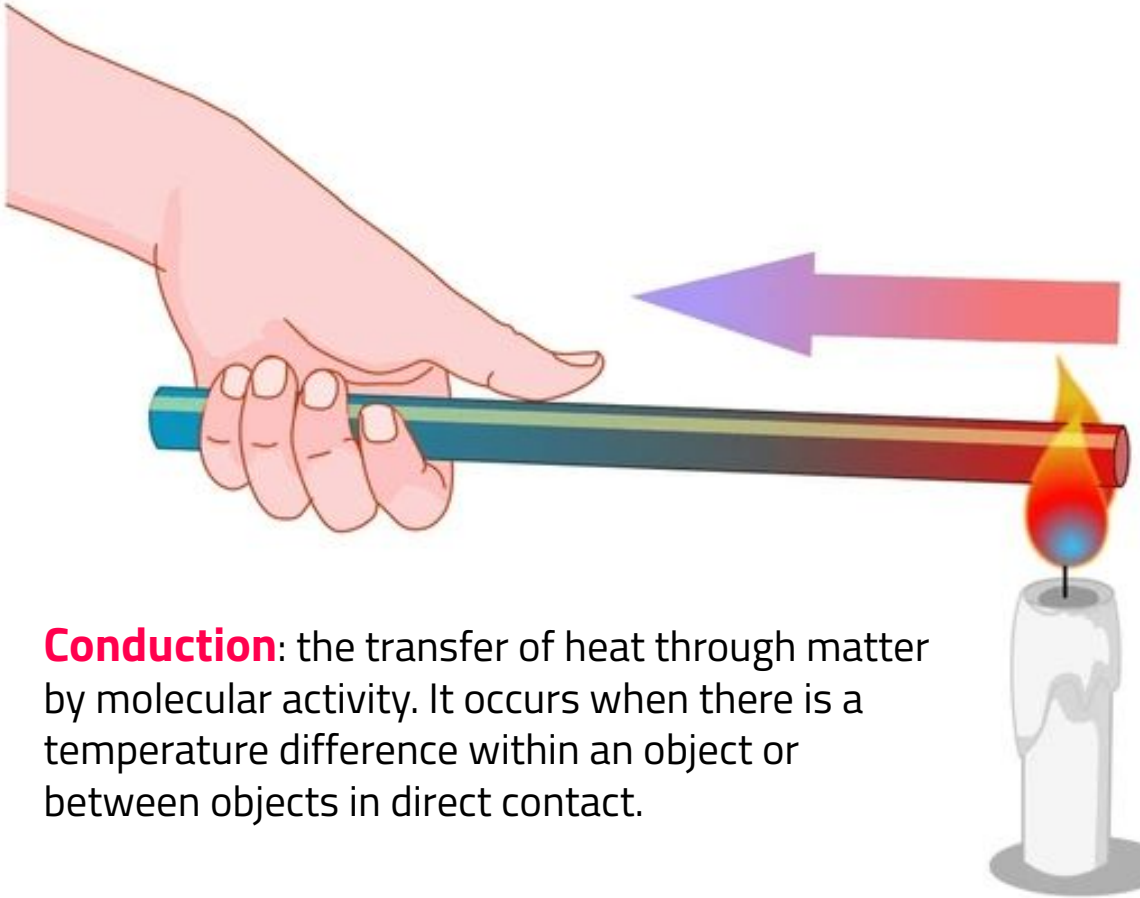
Principle of Heat Transfer: Heat always flows from the hotter region to the cooler one.



Methods of Heat Transfer

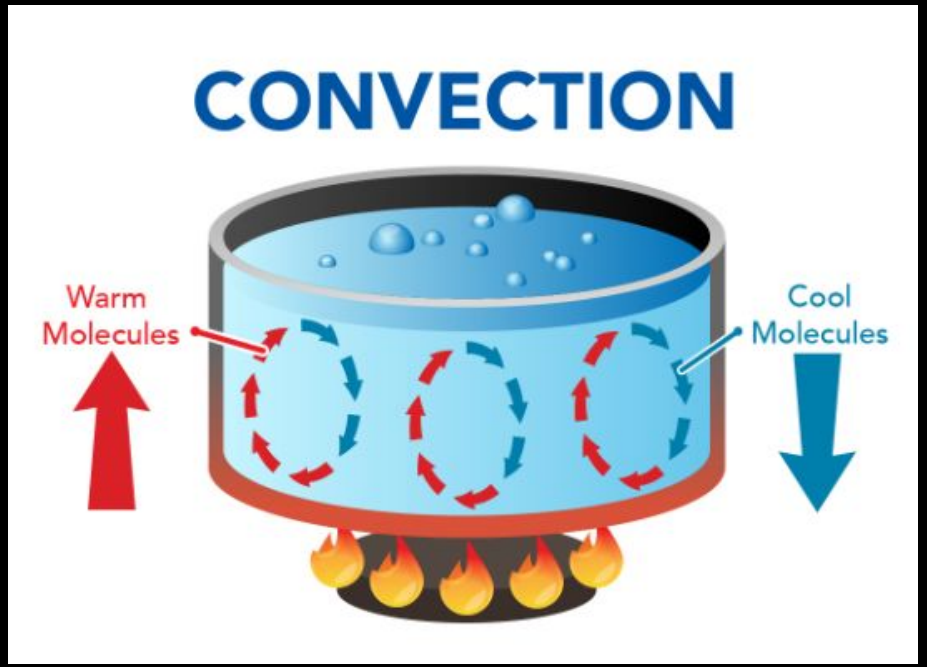
The process by which heat is imparted from one body to another, through conduction, convection, and radiation.

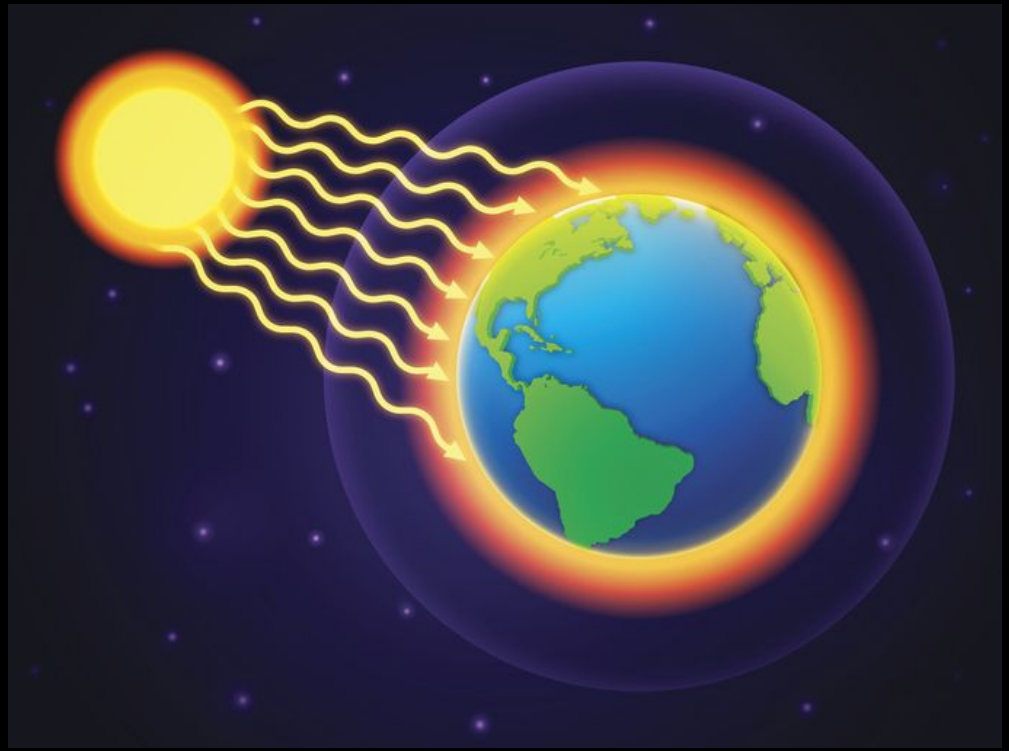




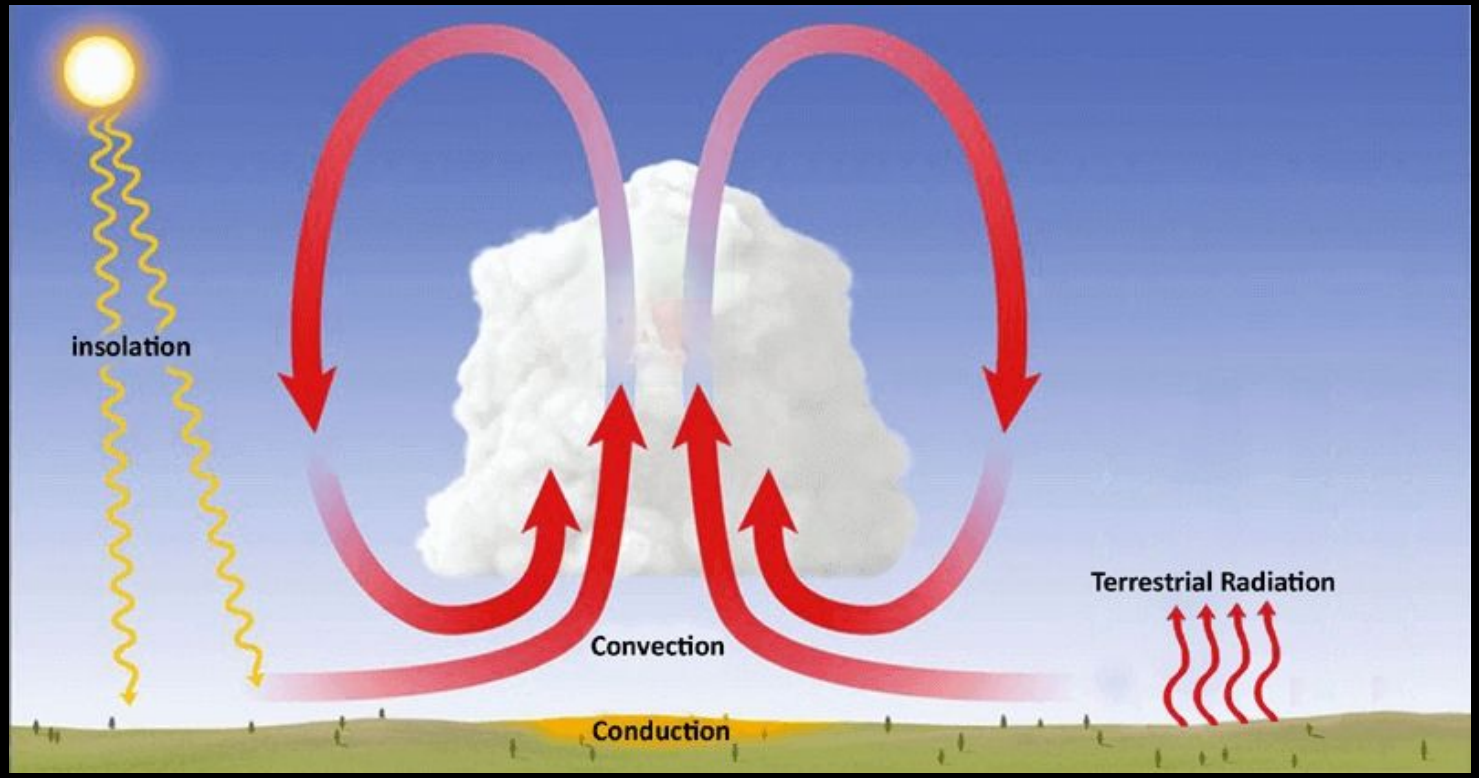
Conduction: the transfer of heat through matter by molecular activity. It occurs when there is a temperature difference within an object or between objects in direct contact.

Convection: the transfer of heat by mass movement or circulation within a fluid substance.



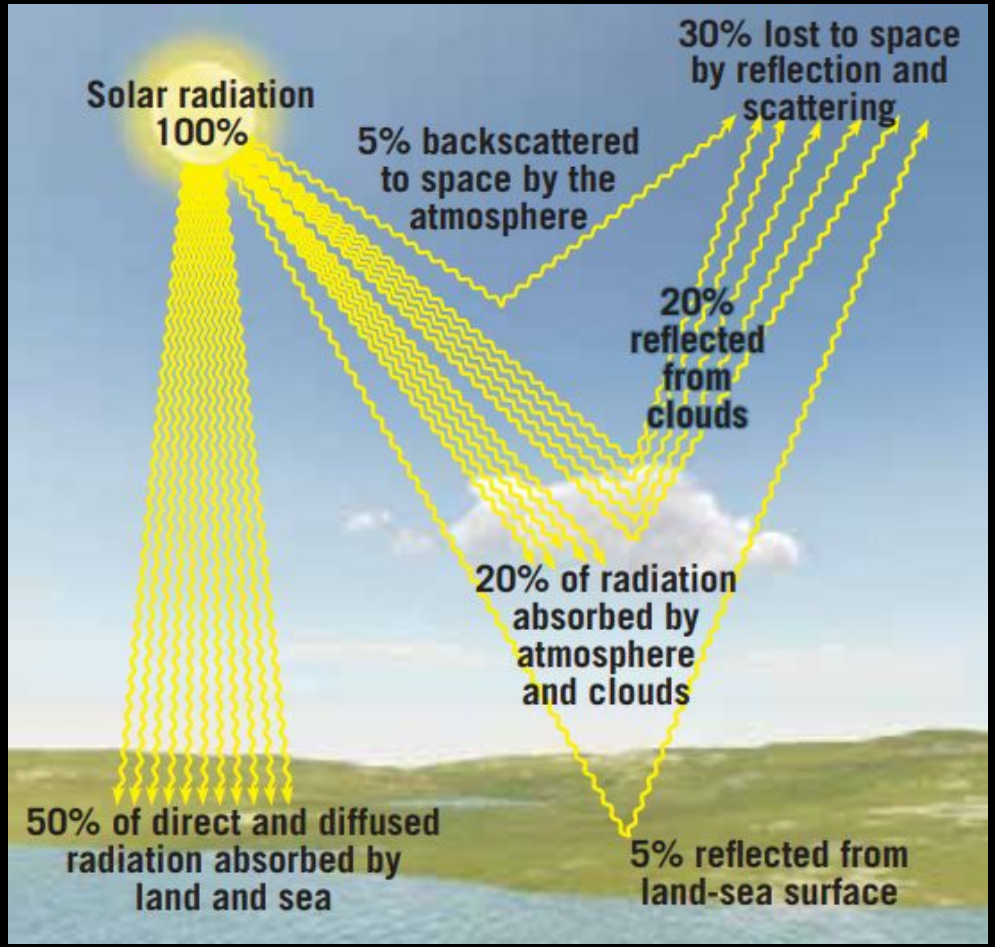


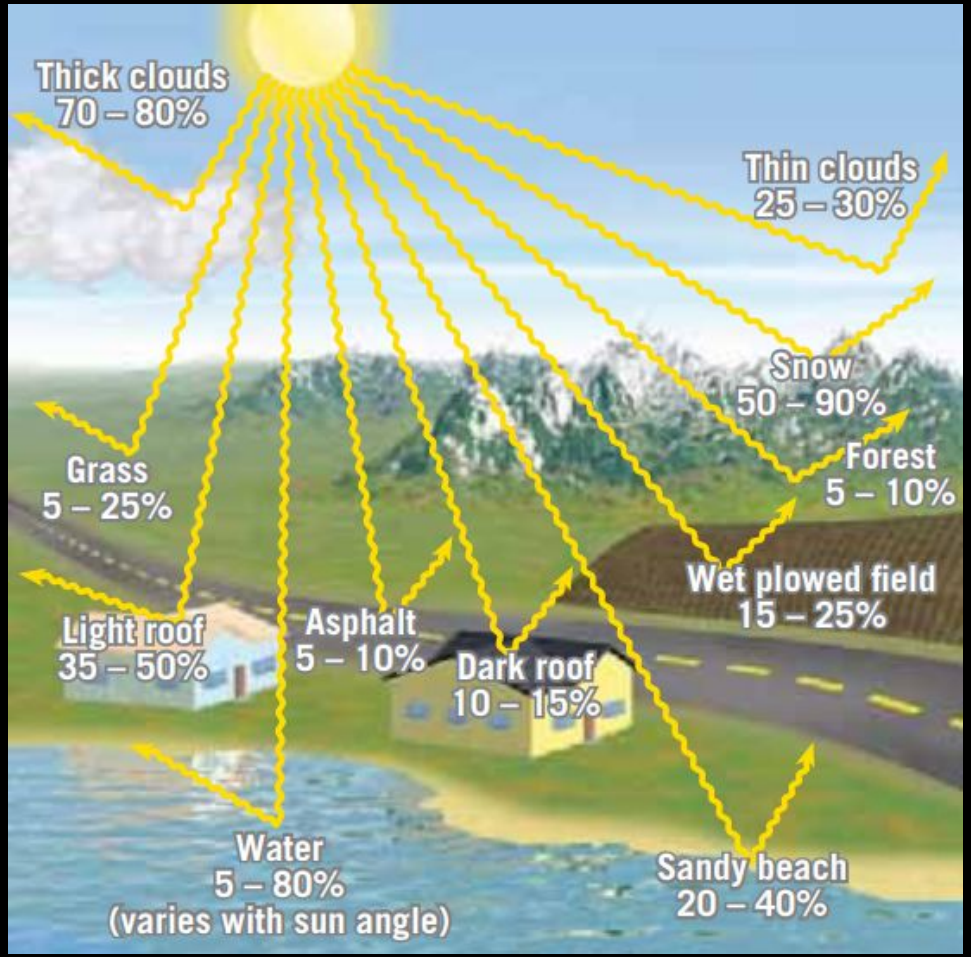
Radiation: the transfer of heat in the form of electromagnetic waves.



What is the primary mechanism that heats up the atmosphere?

What happens to solar radiation as it passes through the atmosphere?





How much solar radiation is absorbed by Earth's surface?

Albedo is a measure of the reflectivity of a surface, indicating how much sunlight is reflected back into space without being absorbed.

Albedo is influenced by time, place, cloud cover, and particulate matter in air.

DIFFERENCE BETWEEN TEMPERATURE AND HEAT INDEX

TEMPERATURE	HEAT INDEX
Measure of hotness or coldness of a matter	Feeling of hotness our body perceive
The cause of heat index when combined with humidity	The result of humidity combining with temperature

HUMIDITY

- Amount of water vapor in the atmosphere
- When humidity combines with air temperature, the result is what we cal heat index.

COMPARISON BETWEEN TEMPERATURE AND HEAT INDEX

LOCATION	TEMPERATURE	HEAT INDEX
LSU Munoz, Nueva Ecija	37°C	38°C
Tuguegarao City, Cagayan	36.9°C	41°C
NAIA, Pasay City	35°C	41°C

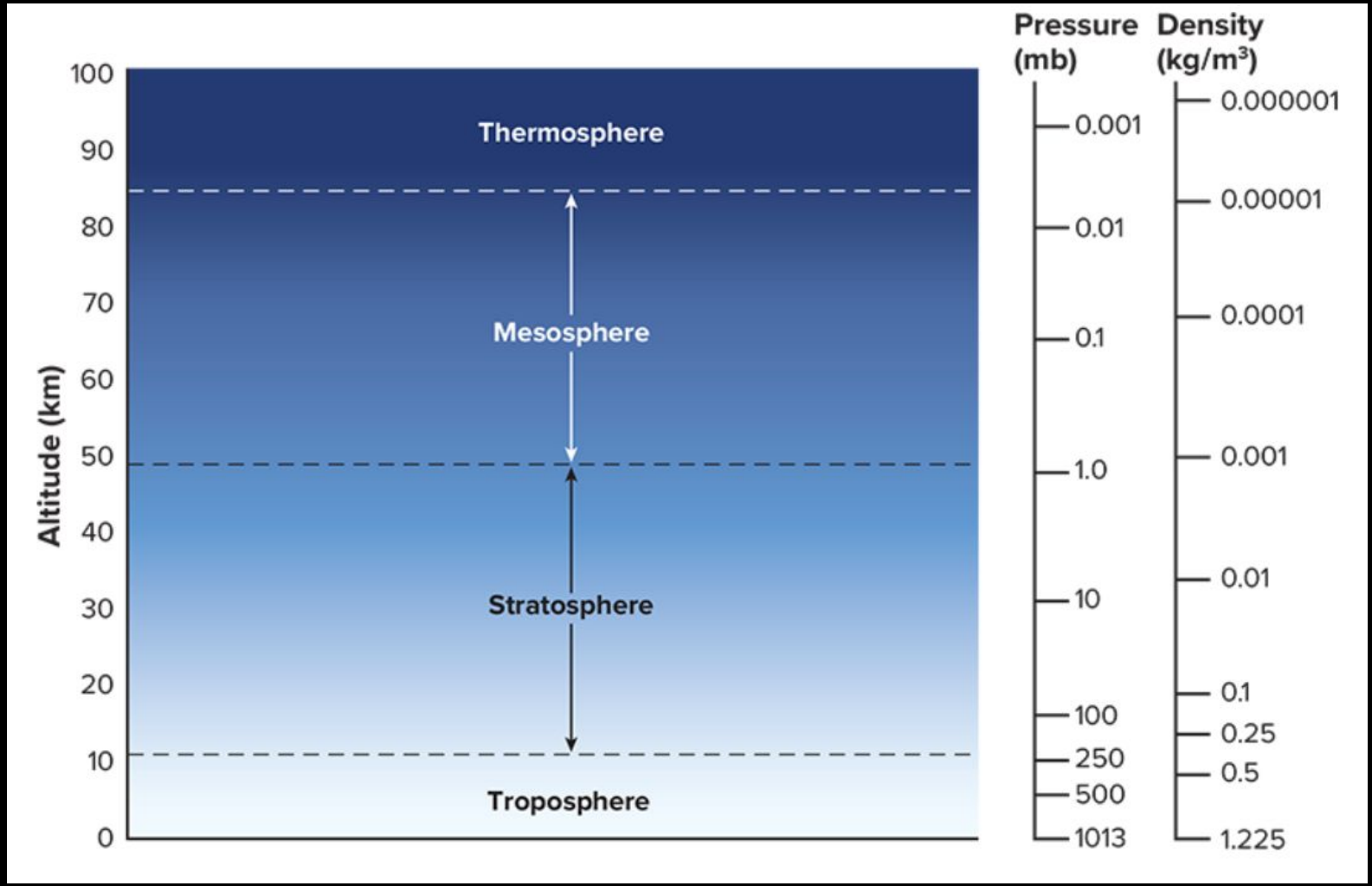
Source: Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGSA)
April 09, 2024

4 CLASSIFICATIONS OF HEAT INDEX

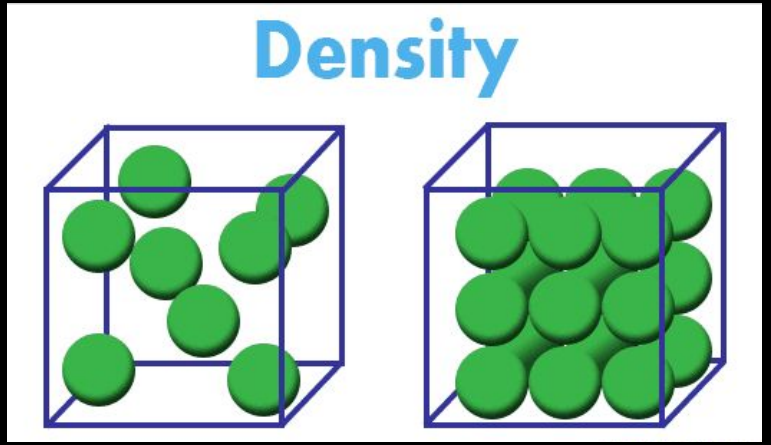
Classification	How will this classification affect the human body?
27-32°C (Caution)	It imposes minimal possibility of getting fatigue or heat cramps.
32-41°C (Extreme Caution)	It increases possible effects of heat index like heat cramps and heat stroke especially to the vulnerable ones such as the elderly and children.
41-54°C (Danger)	Heat cramps and heat stroke are possible in this category especially for those people that are exposed to prolonged heat outdoors.
54°C and above (Extreme Danger)	In this classification, heat stroke and other effects of extreme heat index is very likely.

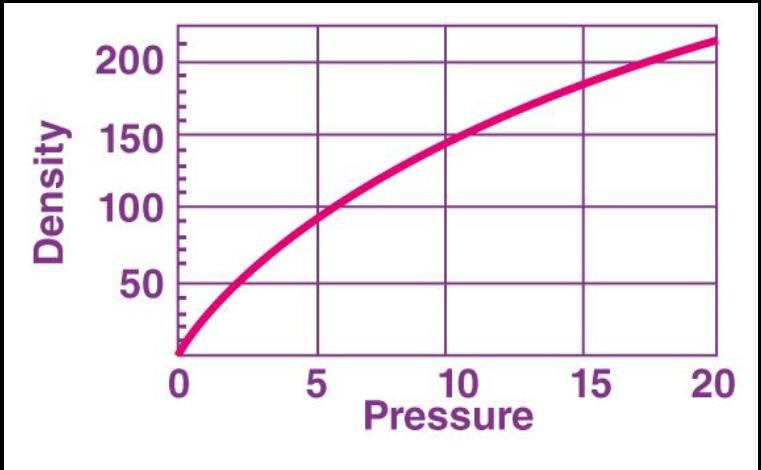
Learning Target:

I can describe the relationship between temperature, pressure, and density in the atmosphere.



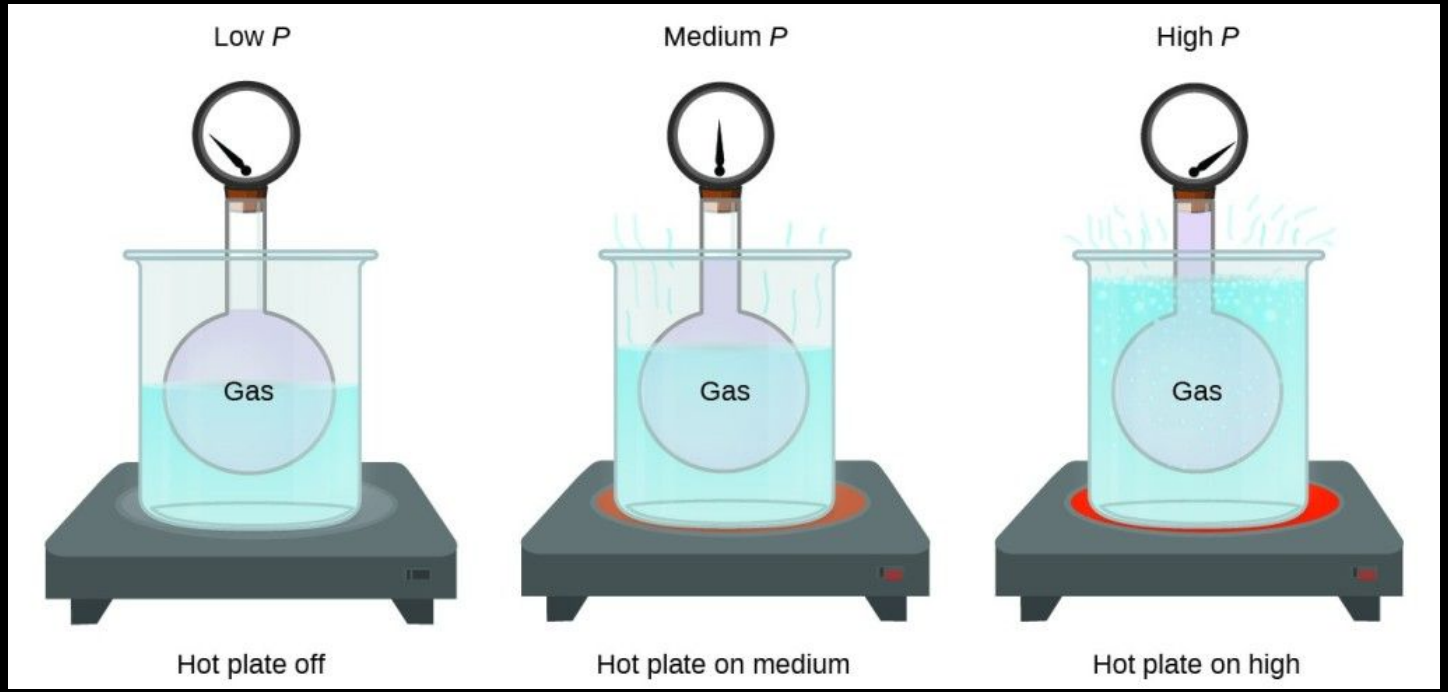
Density: the amount of matter in a given volume





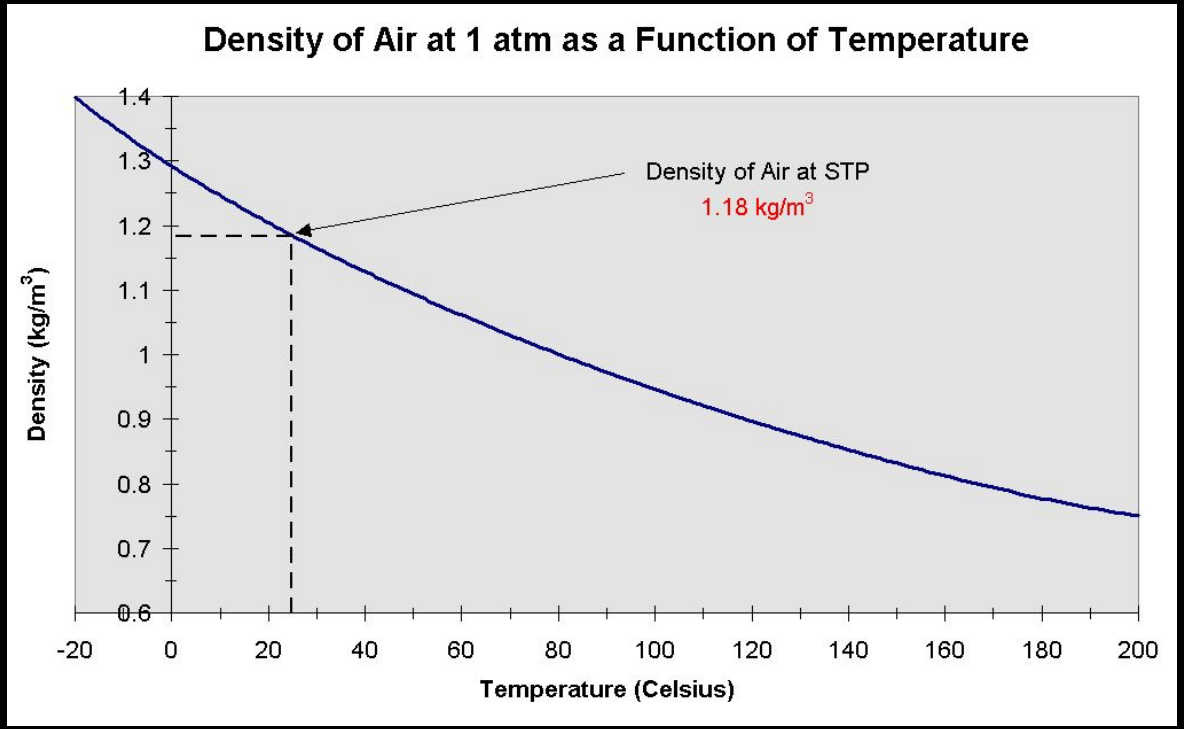
Pressure and density relation are direct.

How is temperature related to pressure?



For a constant volume and amount of air, the pressure and temperature are directly related.

How is temperature related to density?



Density decreases in proportion with increasing temperature.

Temperature, Pressure, and Density Relations in the Atmosphere

Density & Pressure → Directly related

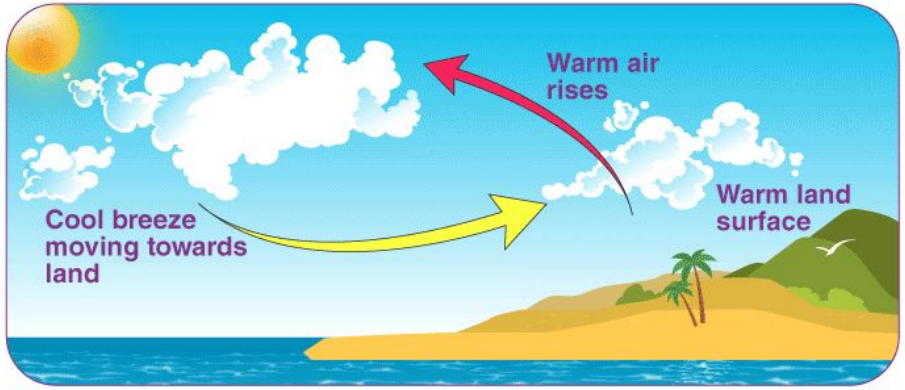
More air molecules packed into a given space exert a greater force (pressure) on the surrounding air.

Temperature & Density → Inversely related

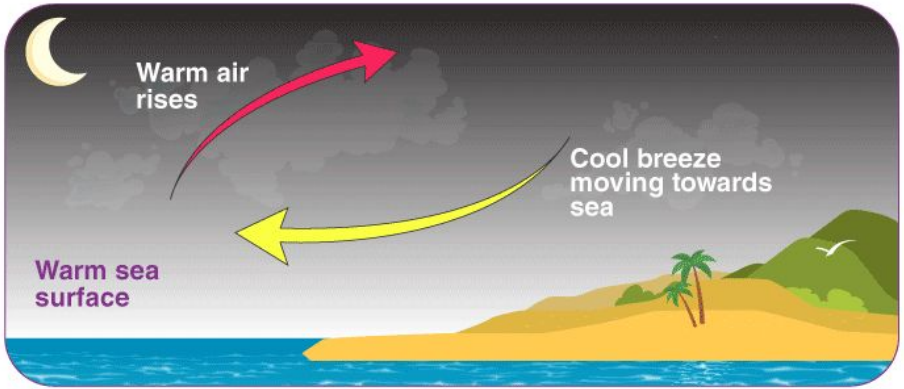
When air is heated, the molecules gain energy and move faster. This causes them to spread out, occupying more space.

Temperature & Pressure → Directly related (only at constant volume)

Higher temperatures often correlate with lower atmospheric pressure. As air warms, it expands and rises. This rising air creates a region of lower air density above, leading to lower pressure.



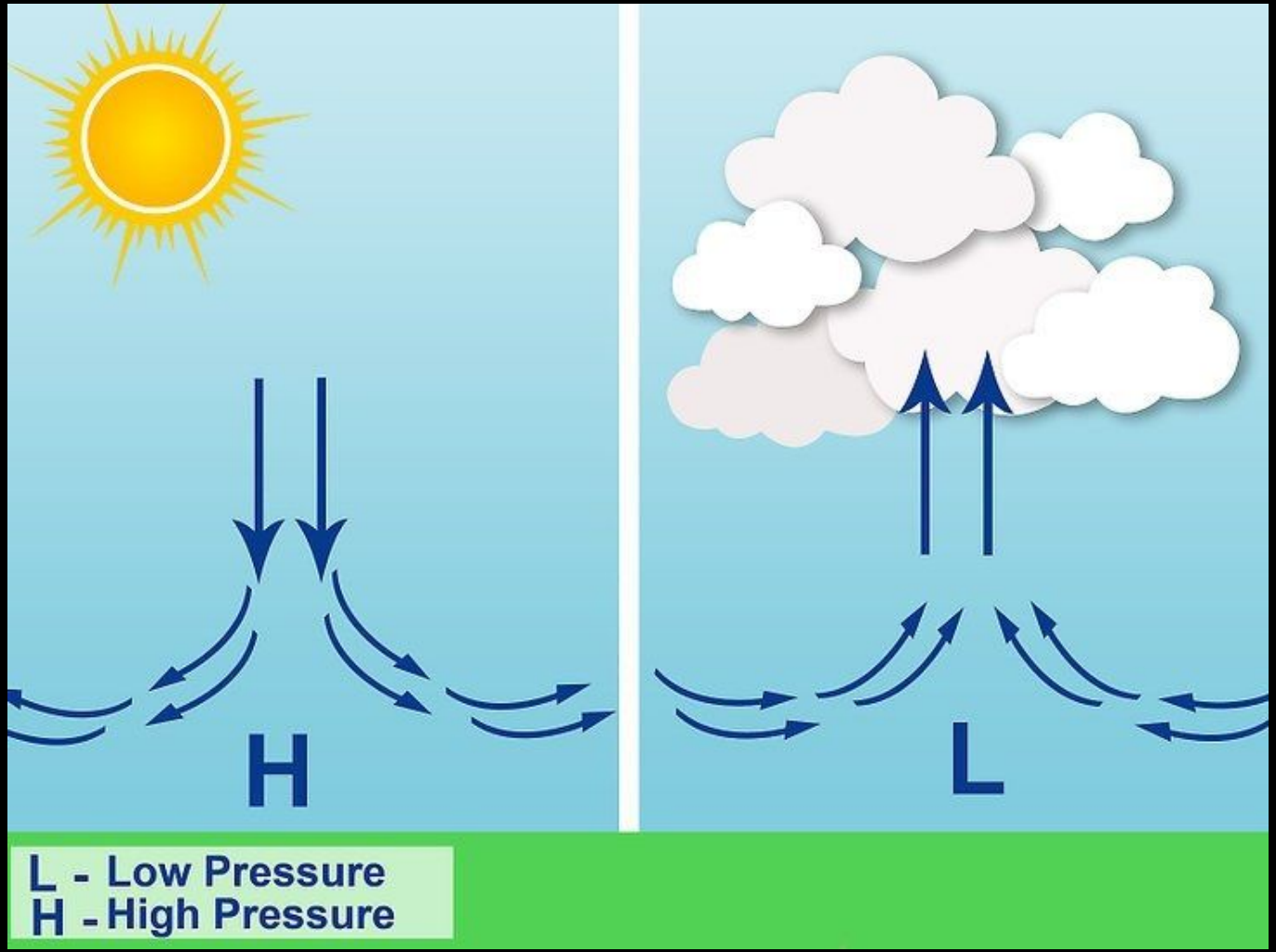
Sea breeze

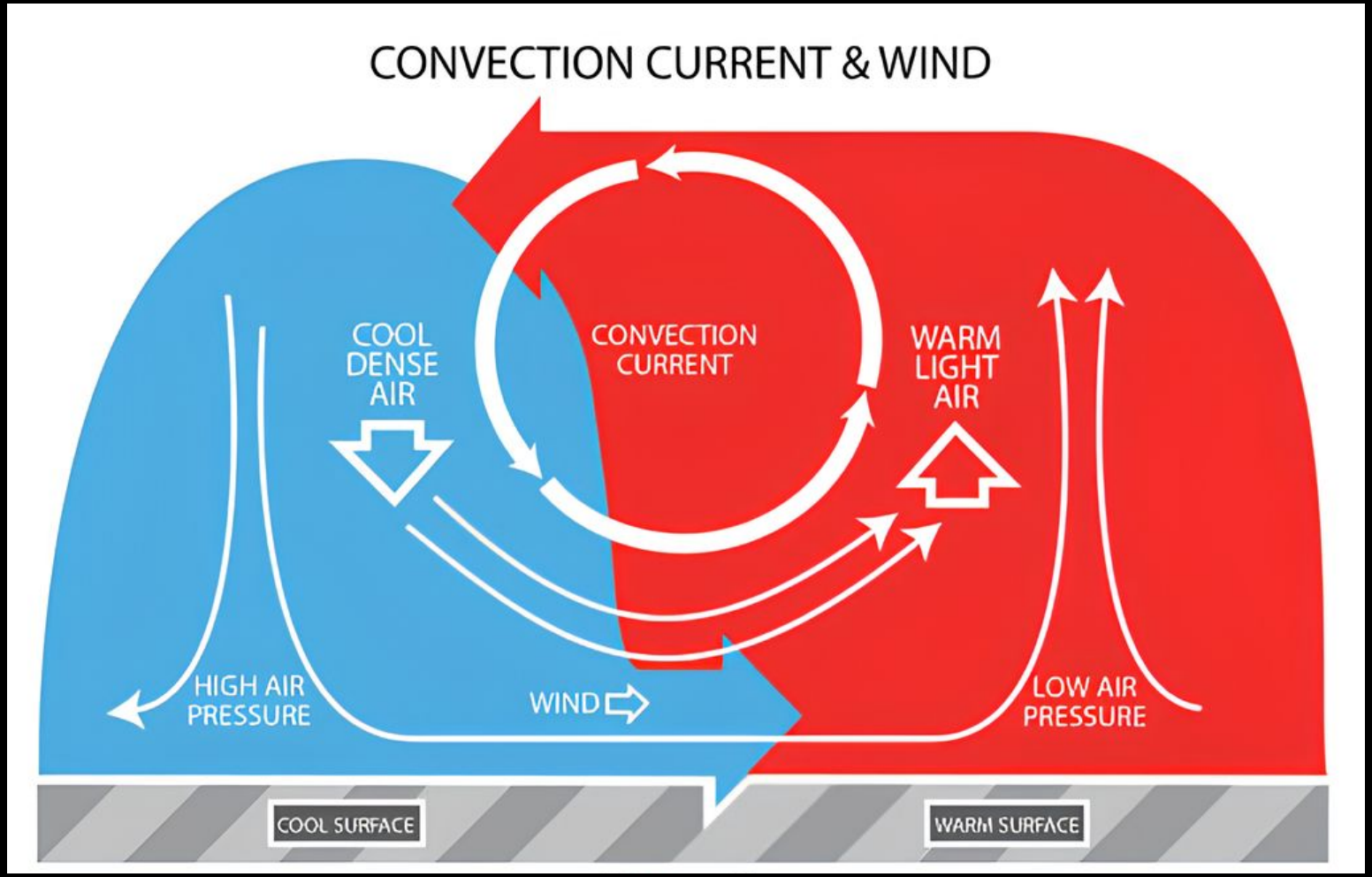


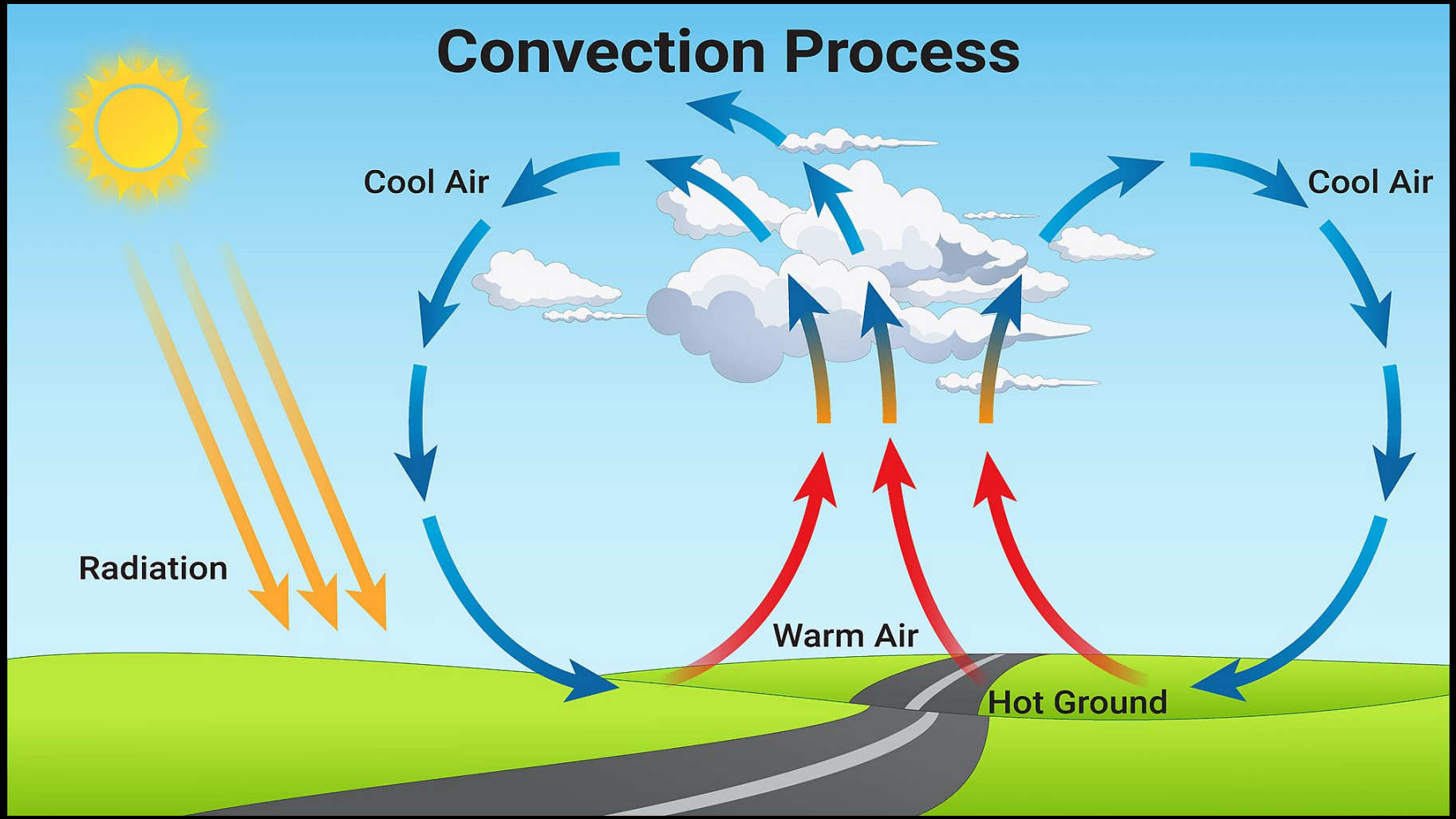
Land breeze

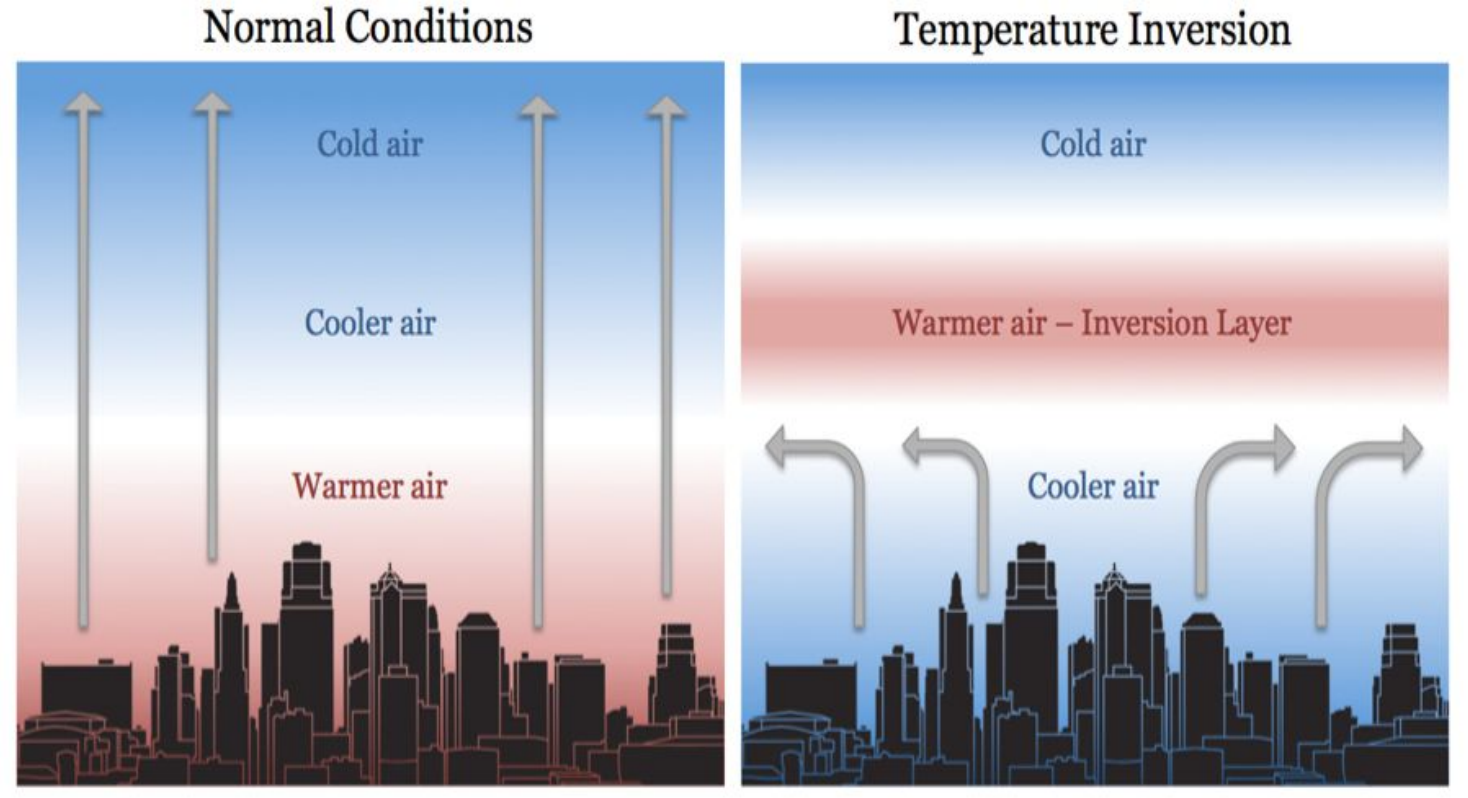
How do changes in temperature and pressure drive winds?

Wind arises from the uneven heating of the earth's surface, causing air to move from a region of high pressure to a region of low pressure.






Convection Process
Cool Air
Cool Air
Radiation
Warm Air
Hot Ground
©Michael Matias (2024)



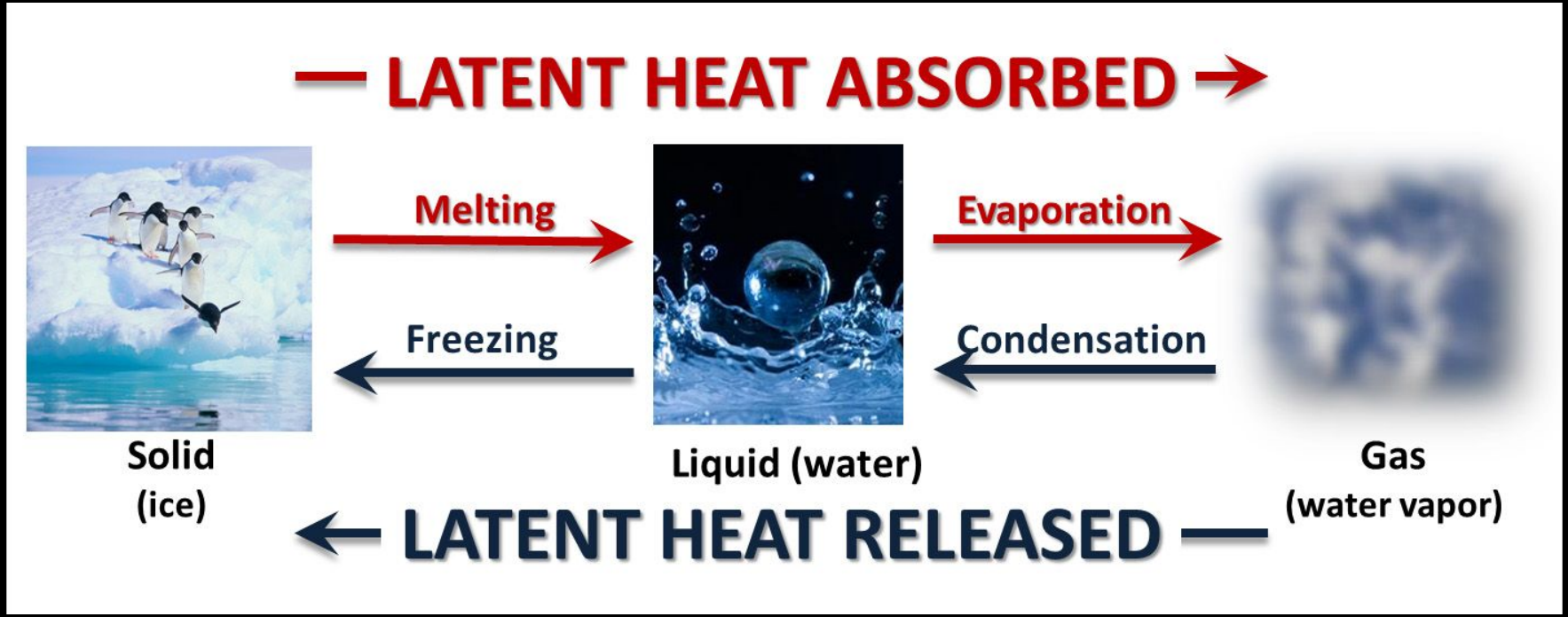
A temperature inversion is an atmospheric condition where temperature increases with altitude, which is the opposite of the usual trend in the troposphere where temperature typically decreases with height.

Why does it feel “warmer” just before it rains?

Humidity
amount of water vapor in the atmosphere at a given location

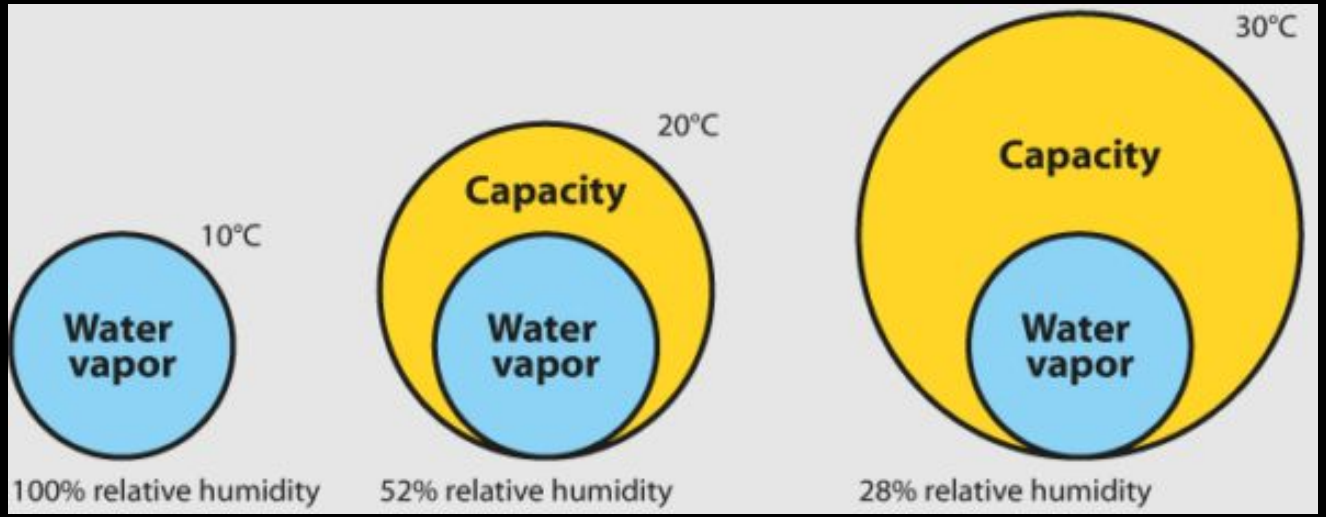
Relative humidity
the ratio of the actual amount of water vapor in the air to the maximum amount of water vapor the air can hold at a given temperature.

What is the significance of humidity in relation with weather?



Water is an excellent distributor of heat around the planet.

How does temperature relate to relative humidity?



Warmer air can hold more water vapor than colder air. If the temperature rises, but the amount of water vapor stays constant, the relative humidity will decrease because the air can now hold more moisture than it currently has.

Dew Point

The temperature at which air becomes saturated with moisture and water vapor begins to condense into liquid water (dew). This means that the dew point is the temperature at which the relative humidity reaches 100%.

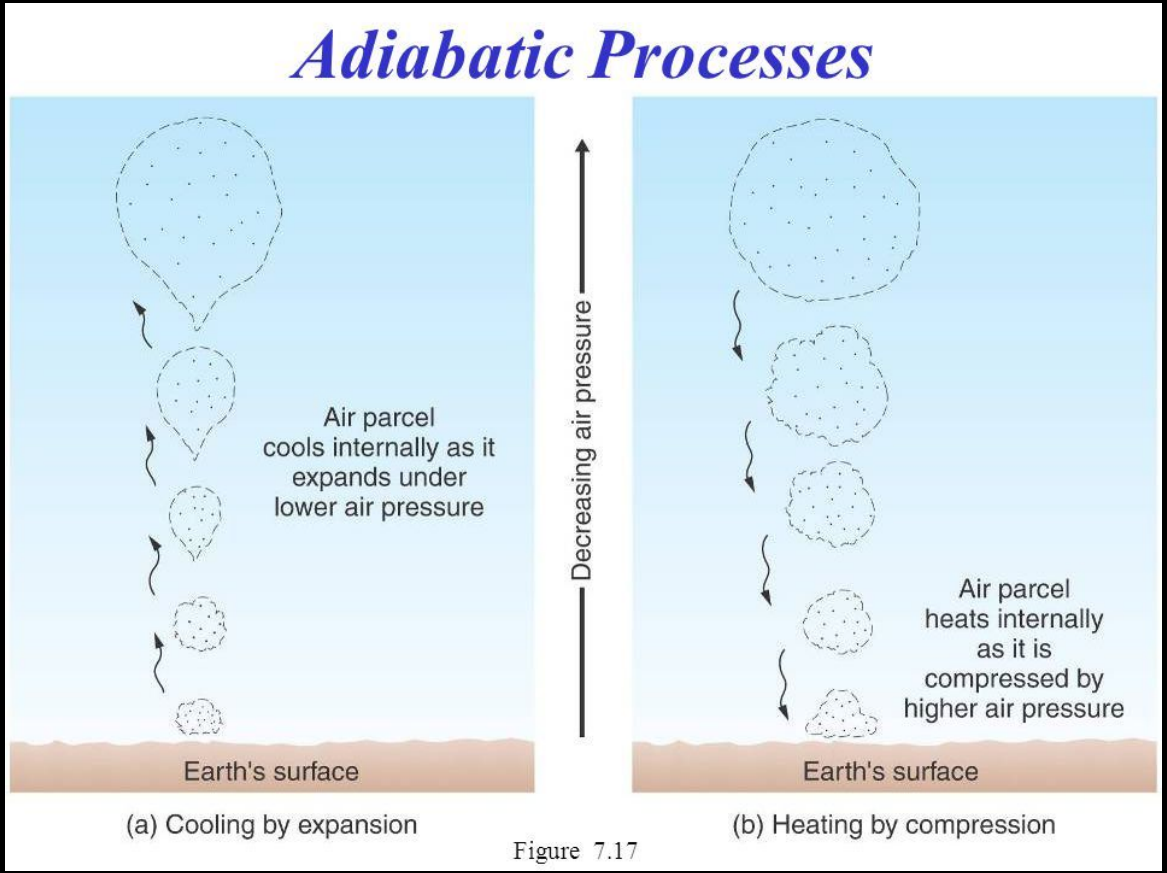


Figure 7.17

Adiabatic Process

The temperature change in a mass of air as it rises or descends without gainiing or losing heat from its surroundings.

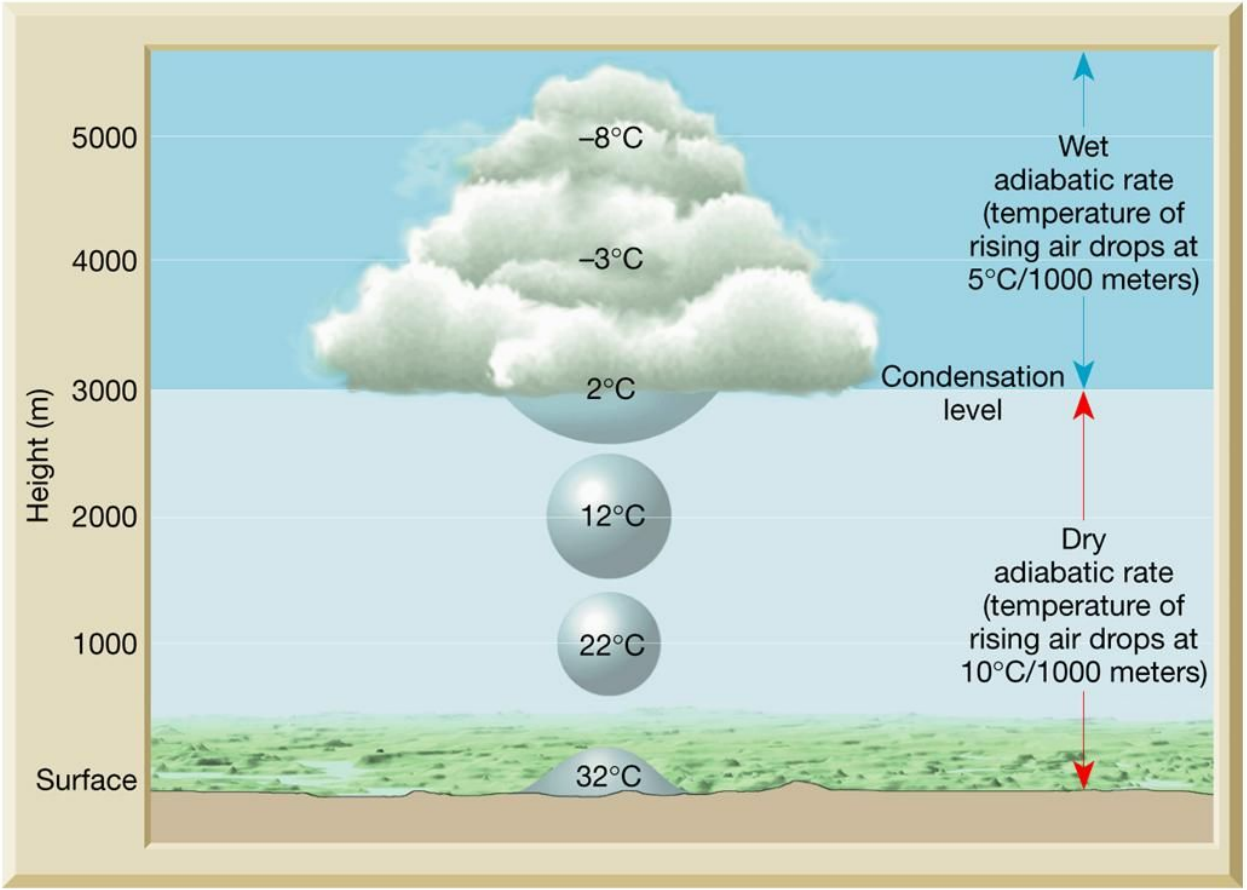
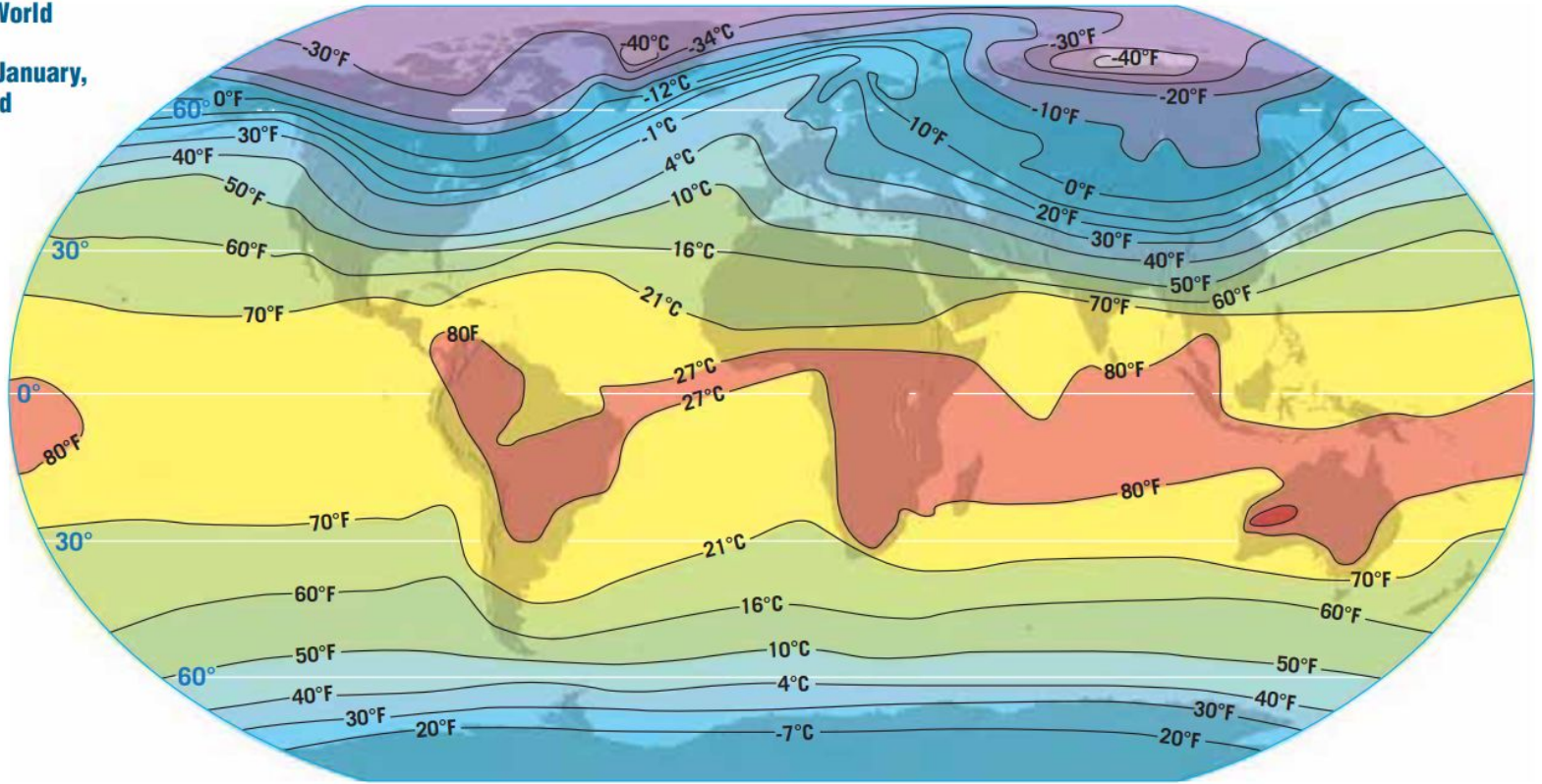
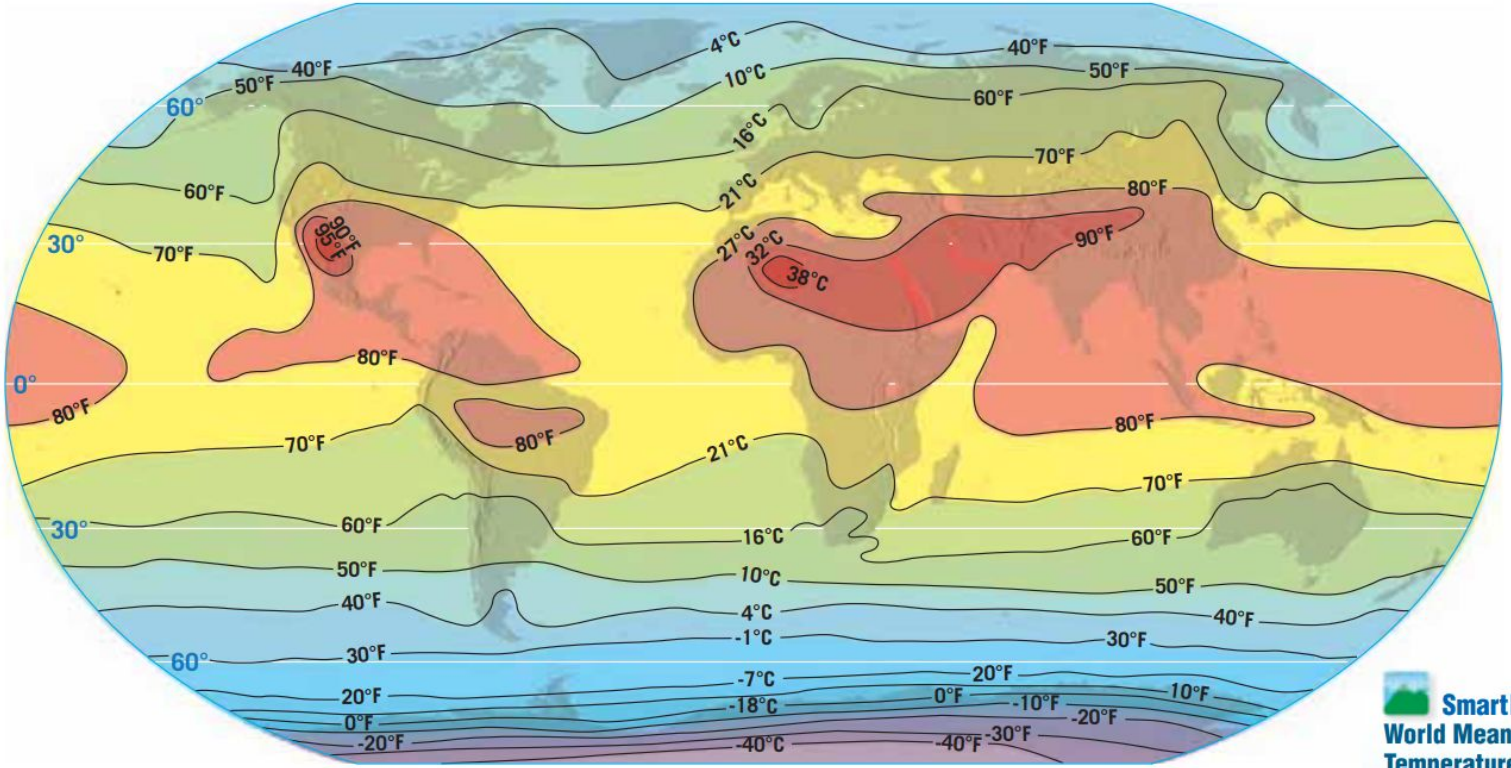


FIGURE 16.33 World Mean Sea-Level Temperatures in January, in Celsius (°C) and Fahrenheit (°F)





SmartFigure 16.34
World Mean Sea-Level Temperatures in July, in Celsius (°C) and Fahrenheit (°F)