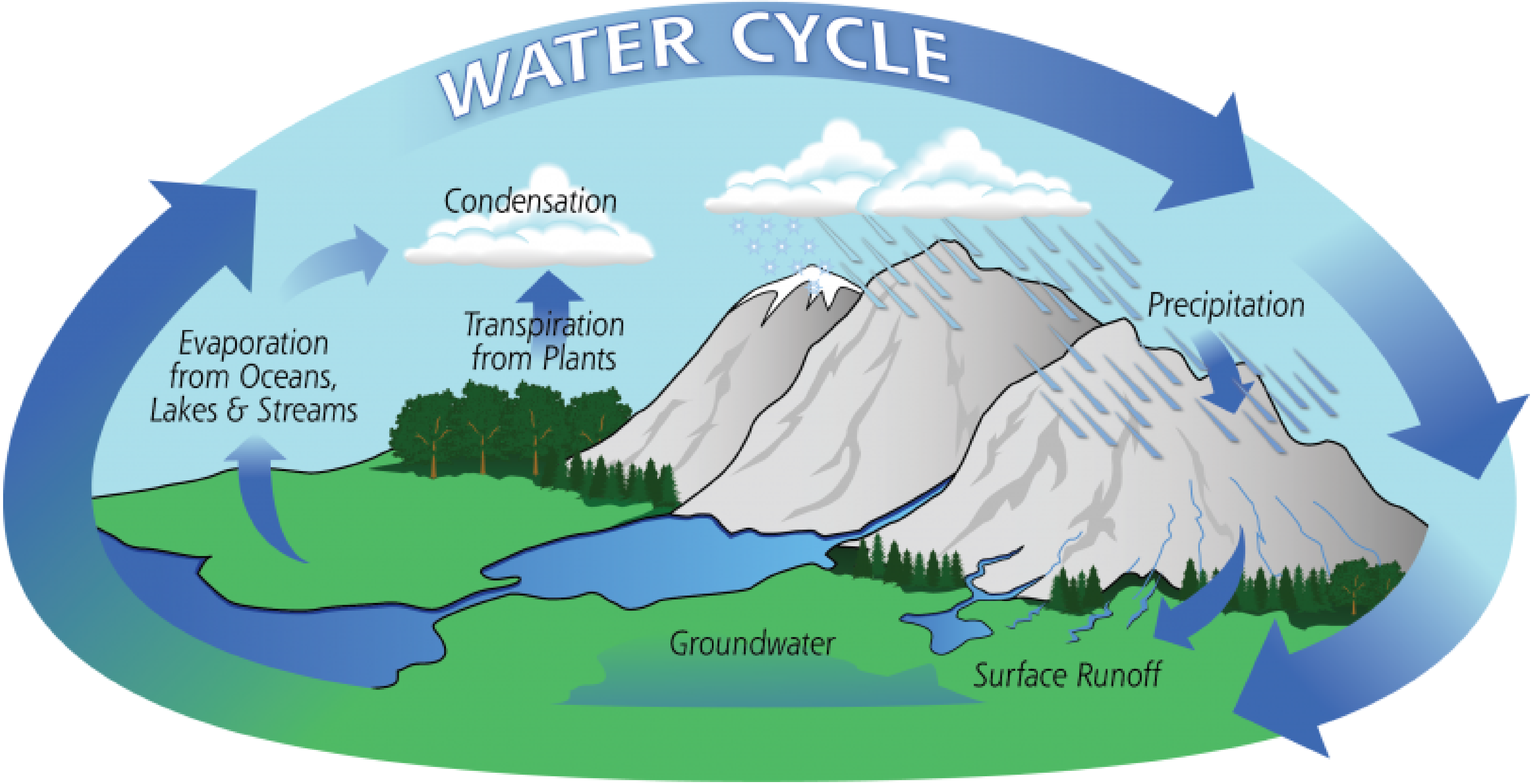
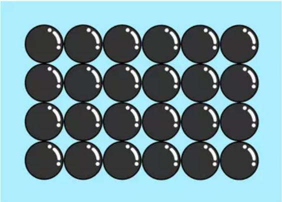
Atmospheric Water

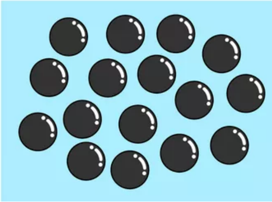


Water Phases

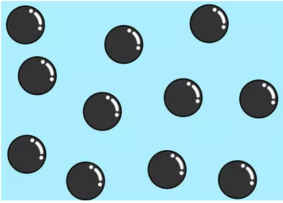
- Solid

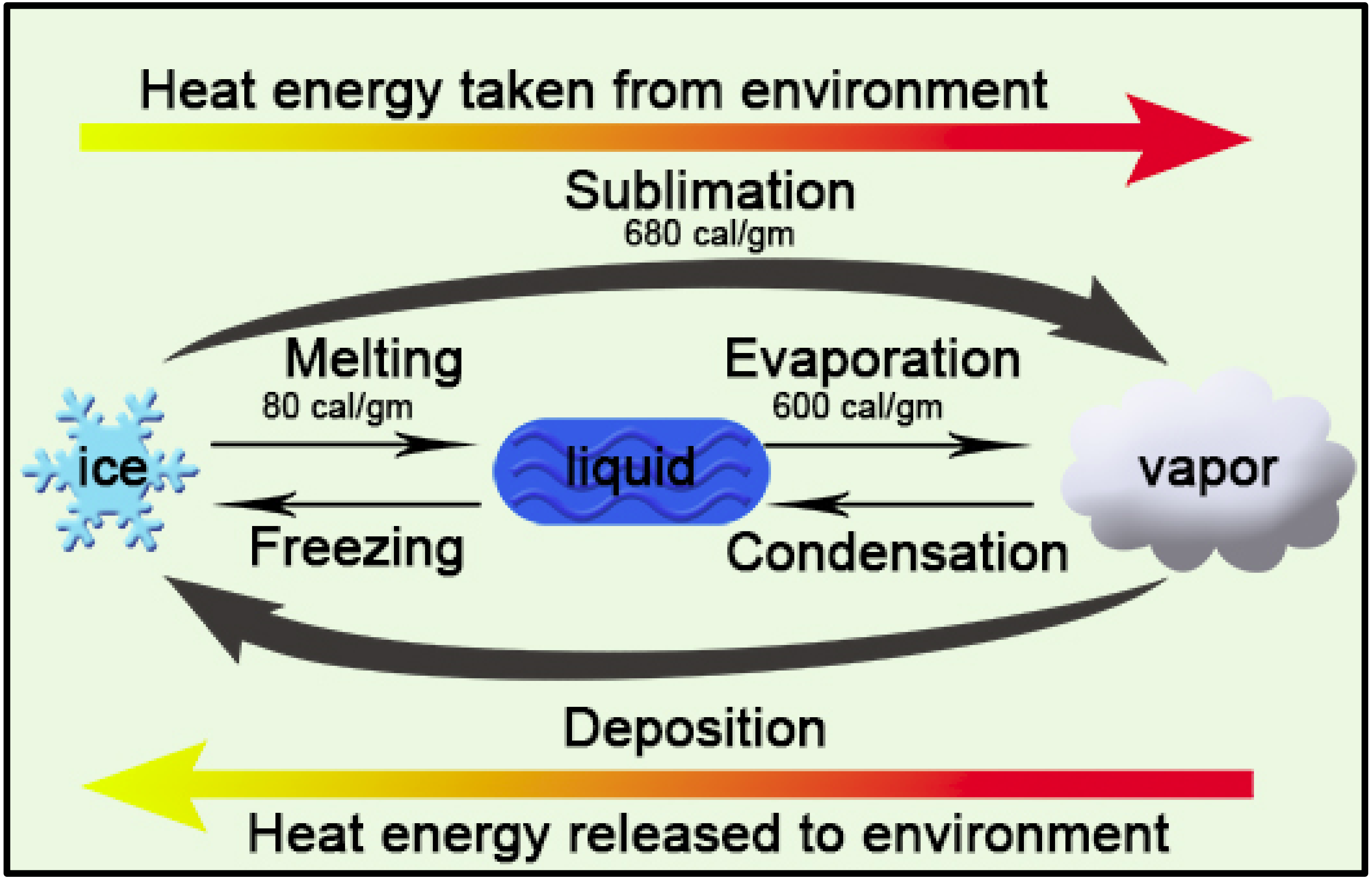


- Liquid



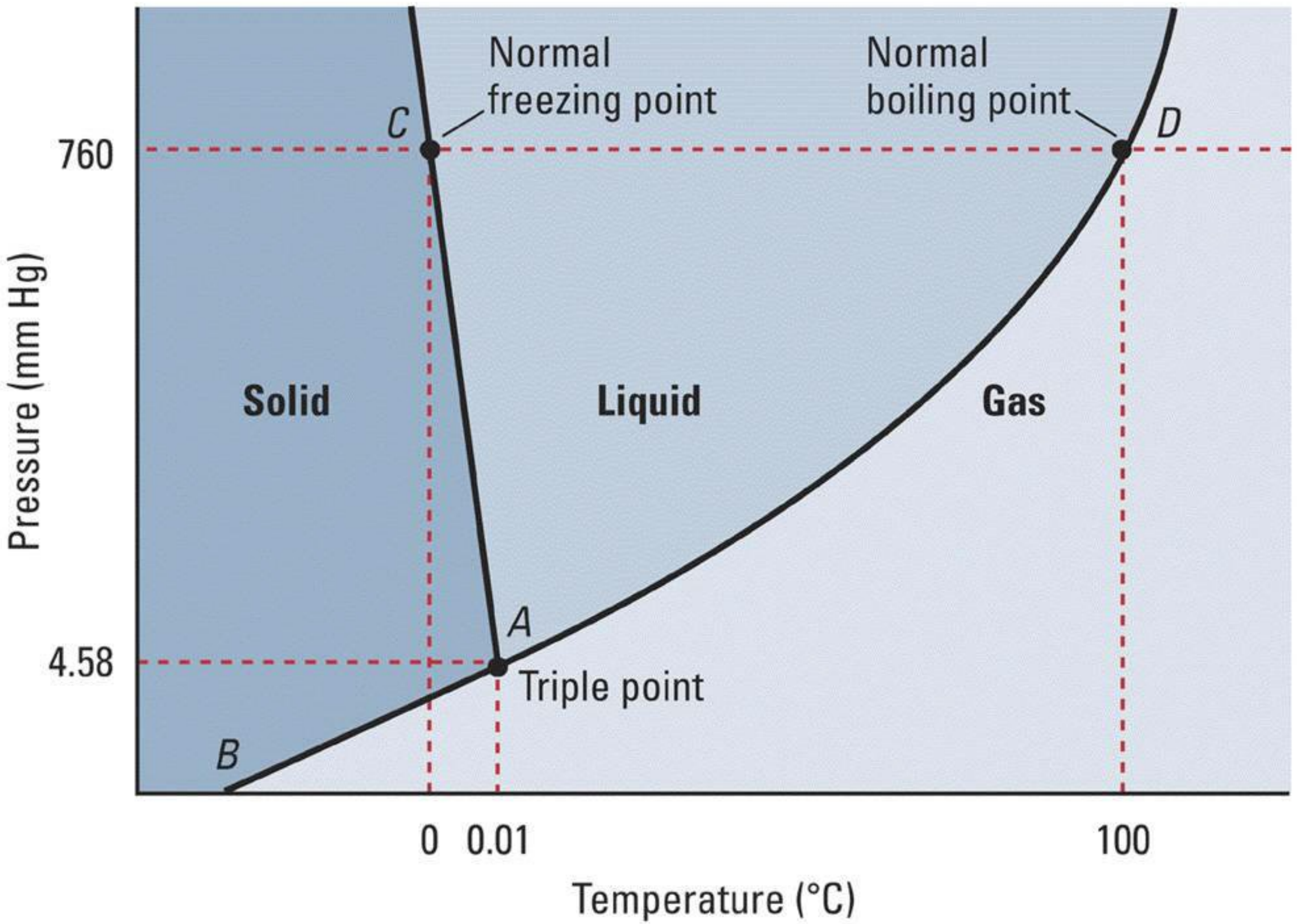
- Gas (Vapor)





Gas: Water Vapor

- The amount of vapor in the air is what we refer to as humidity.
- Humidity is characterized in a number of different ways.



Humidity

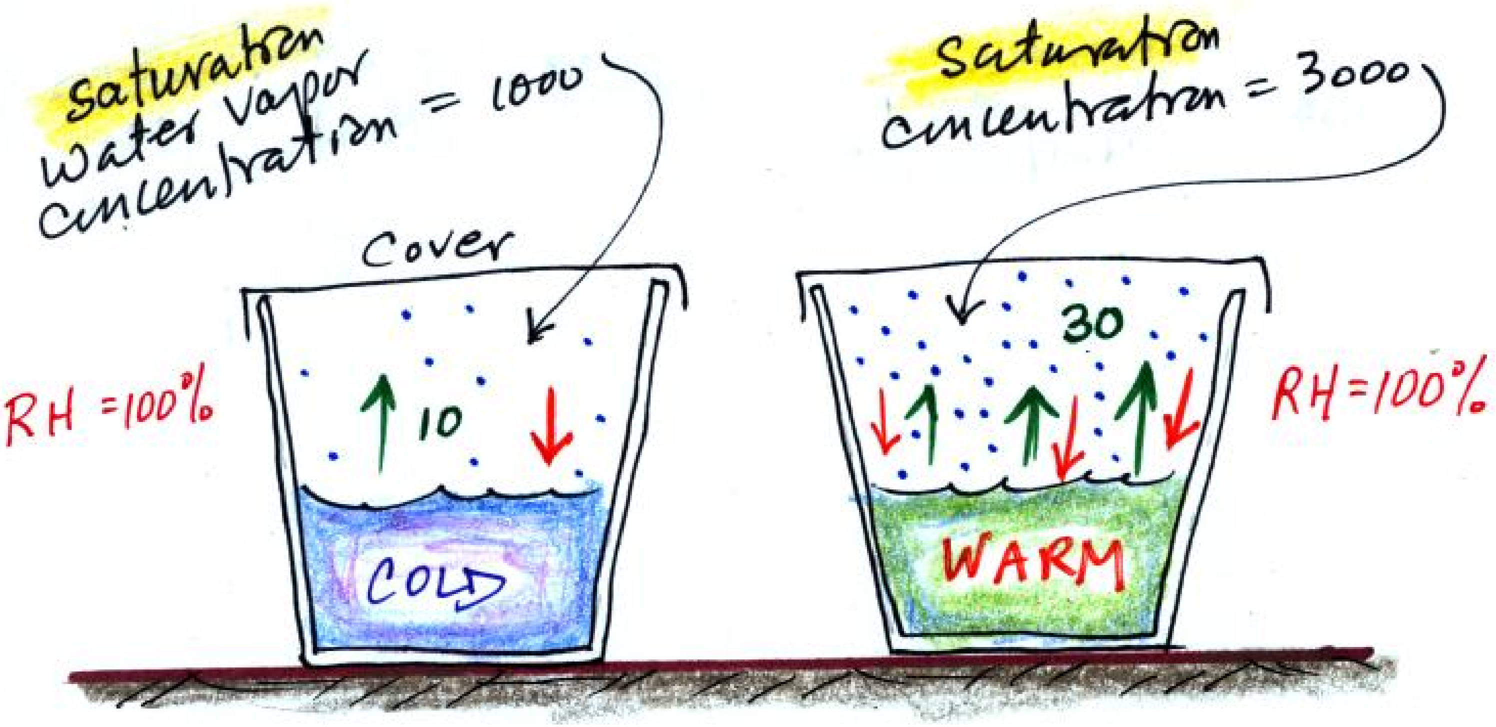
- Dew Point Temperature (°C)
- Relative Humidity
  (vapor press/sat. vapor press) (%)
- Absolute Humidity
  (mass wv/volume) (g m-3)
- Specific Humidity
  (mass wv/mass tot.) (g kg-1)
- Mixing Ratio
  (mass wv/mass dry air) (g kg-1)
- Vapor Pressure
  (mb)

Saturation

- When air is in equilibrium with a pure, plane water surface, it is said to be saturated.
  - Equilibrium
    - No net changes occurring in temperature or composition of the system under consideration.
    - For example, no warming or cooling and there is no change in the number of water molecules in the vapor state or in the liquid state.
  - Purity
    - The water in the liquid state consists only of water.
    - There are no dissolved substances.

Saturation in the Air

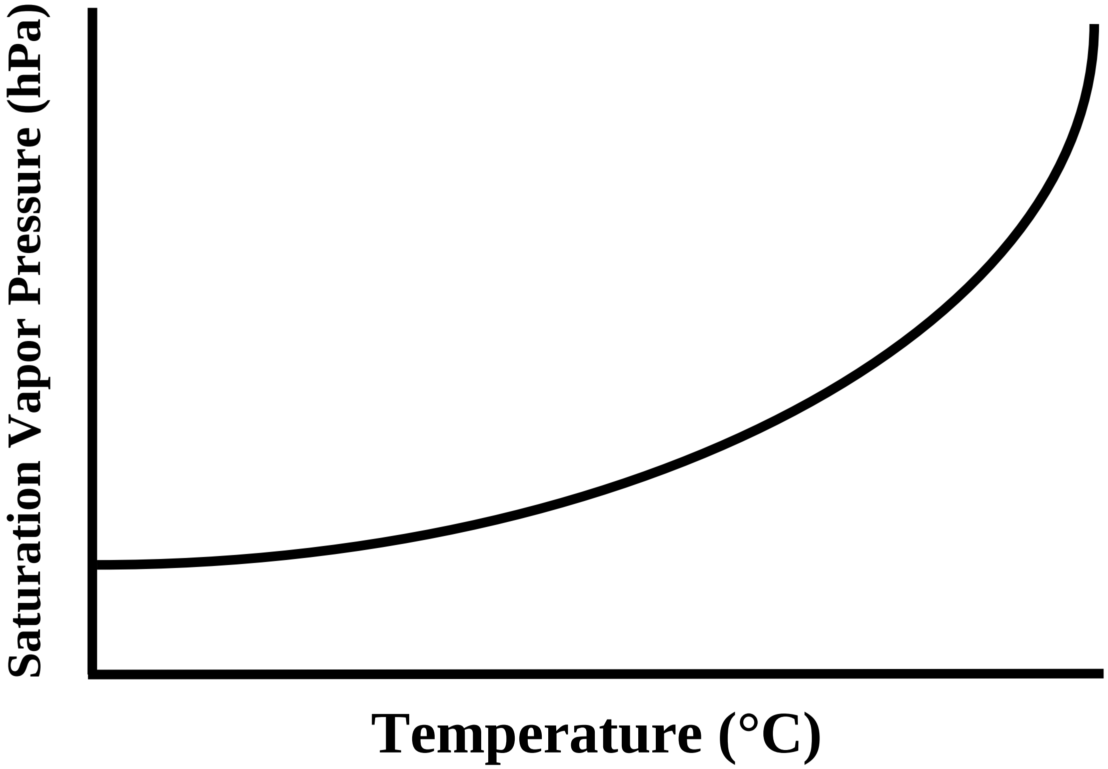
- Vapor amount in the air at saturation is a function of temperature.



- One representation of the dependence of saturation vapor pressure (e_s) on temperature is given by the Clausius Clapeyron equation.

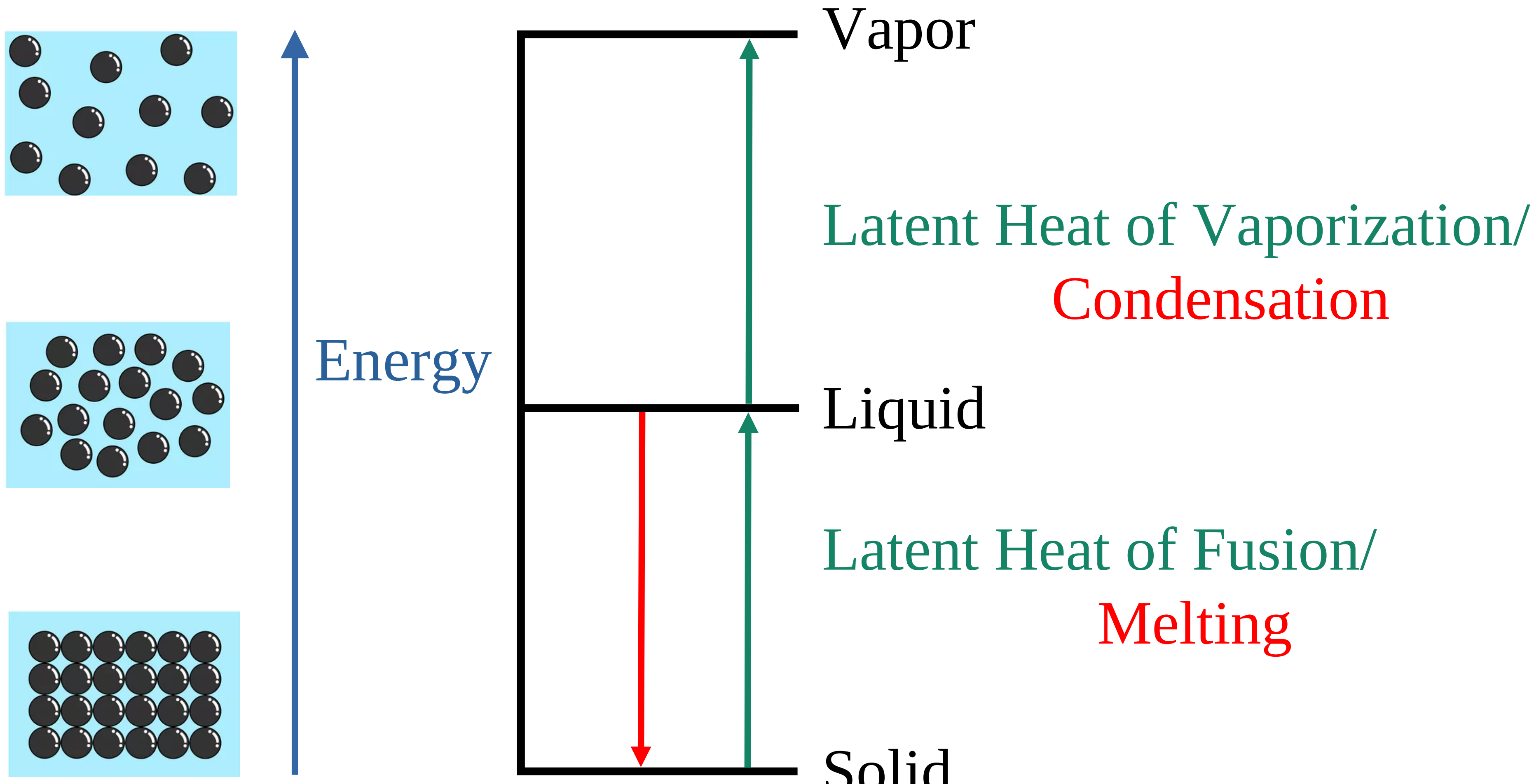
Clausius Clapeyron Equation/Relationship

$$\ln(e_s) = -(m_v L/R^*T) + \text{const}$$



- Only a function of temperature.
- Roughly doubles for each 10 °C increase in Temperature.
- Curvature of the relationship is important.

Three States of Water



Cloud in a Jar