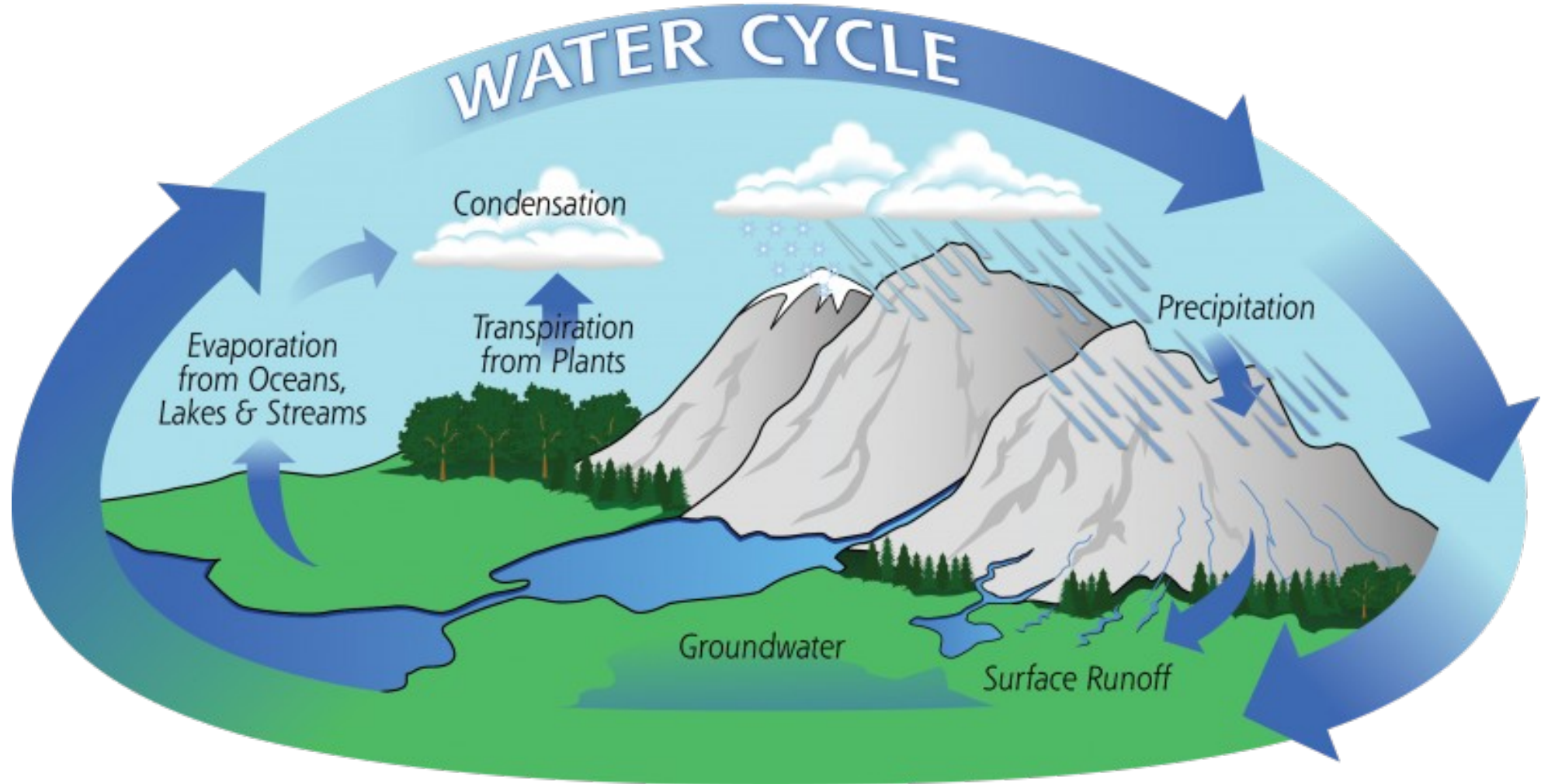
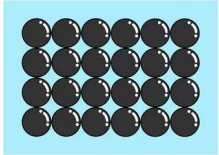


Atmospheric Water

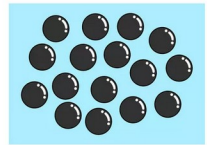


Water Phases

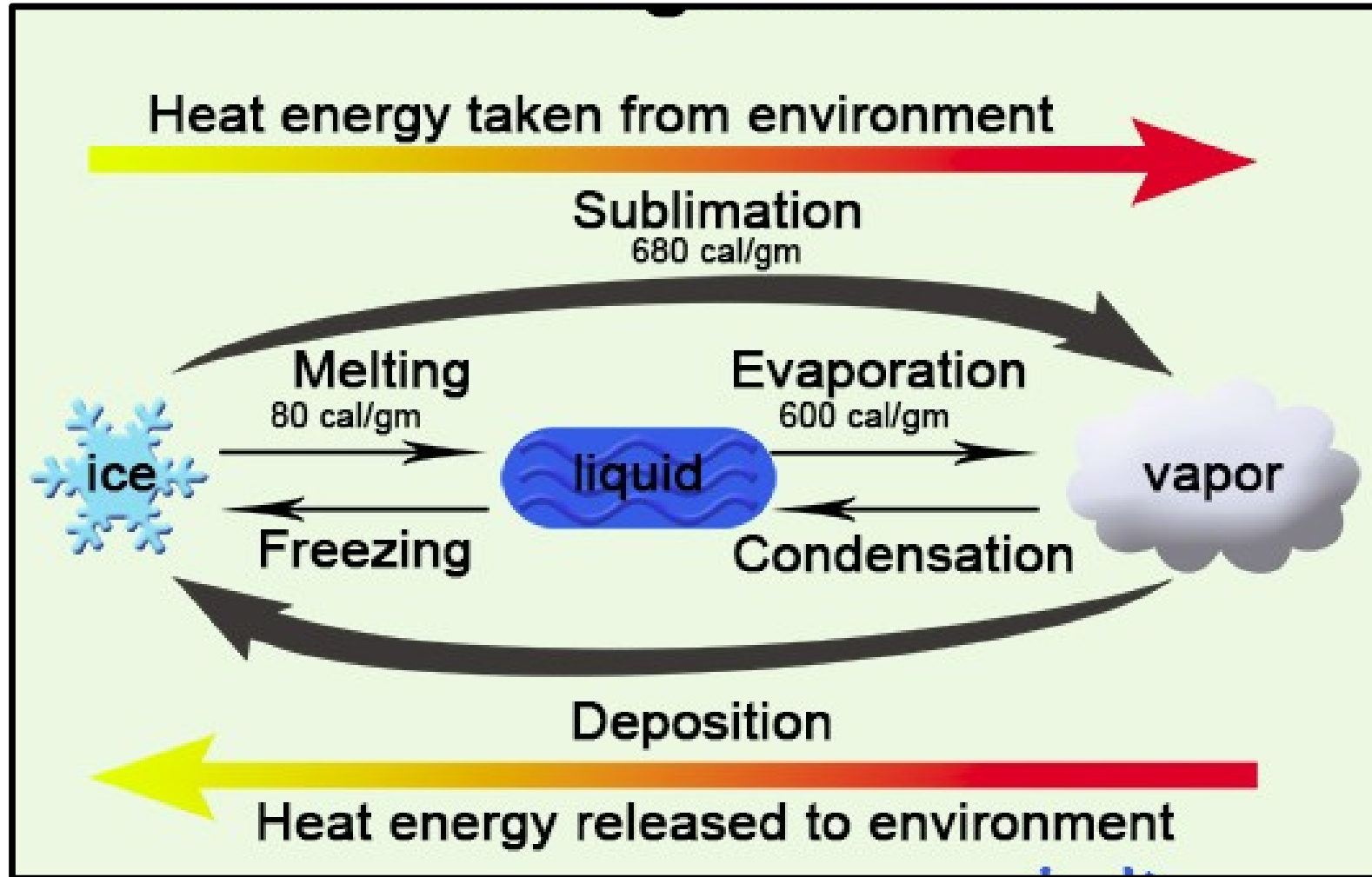
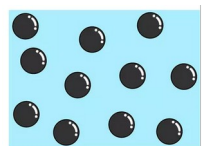
- Solid



- Liquid

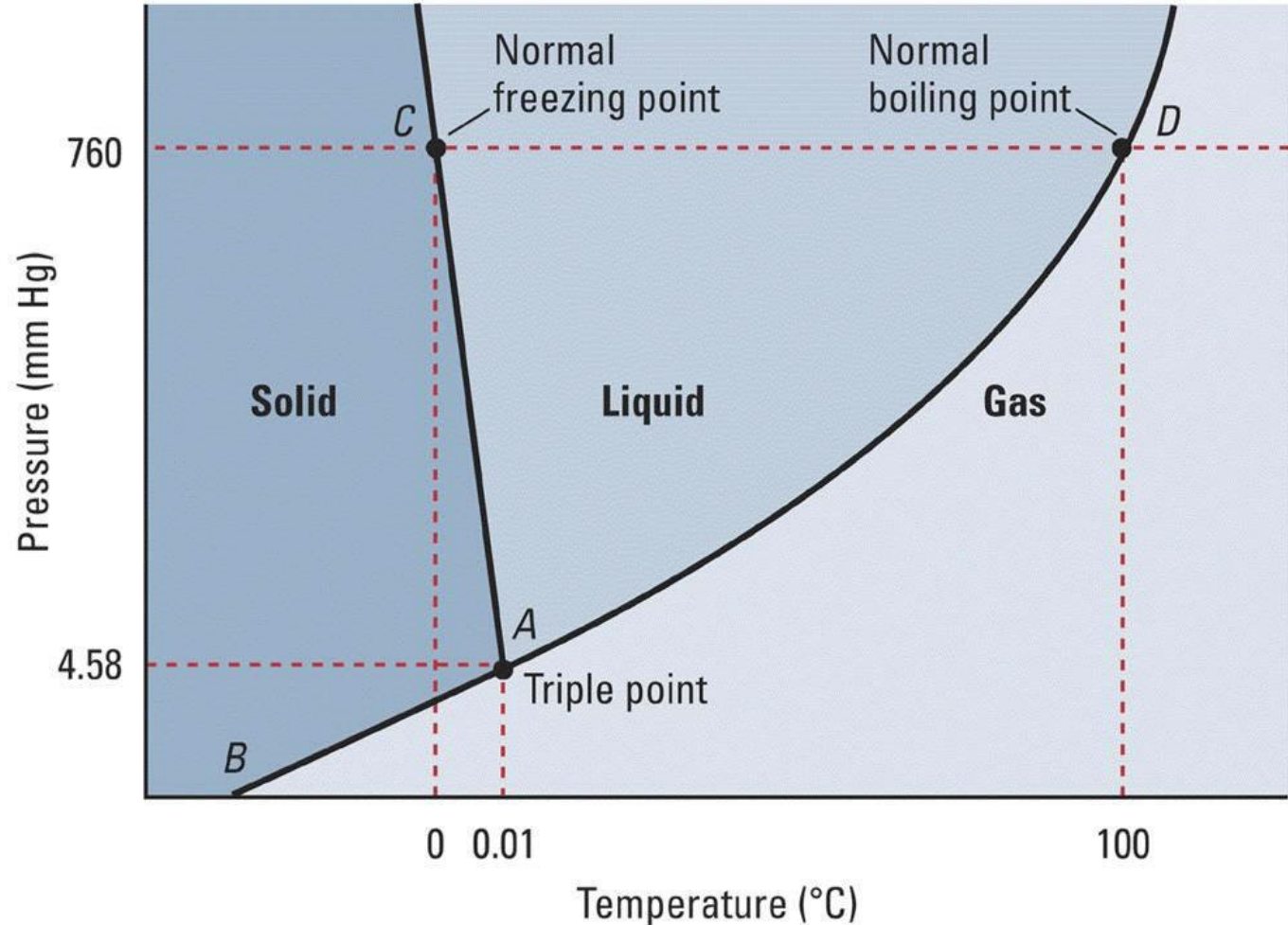


- Gas



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 ($^{\circ}\text{C}$)
- Relative Humidity
(vapor press/sat. vapor press) (%)
- Absolute Humidity (g m^{-3})
(mass water vapor/volume)
- Specific Humidity (g kg^{-1})
(mass water vapor / mass total)
- Mixing Ratio (g kg^{-1})
(mass water vapor / mass dry air)
- 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.

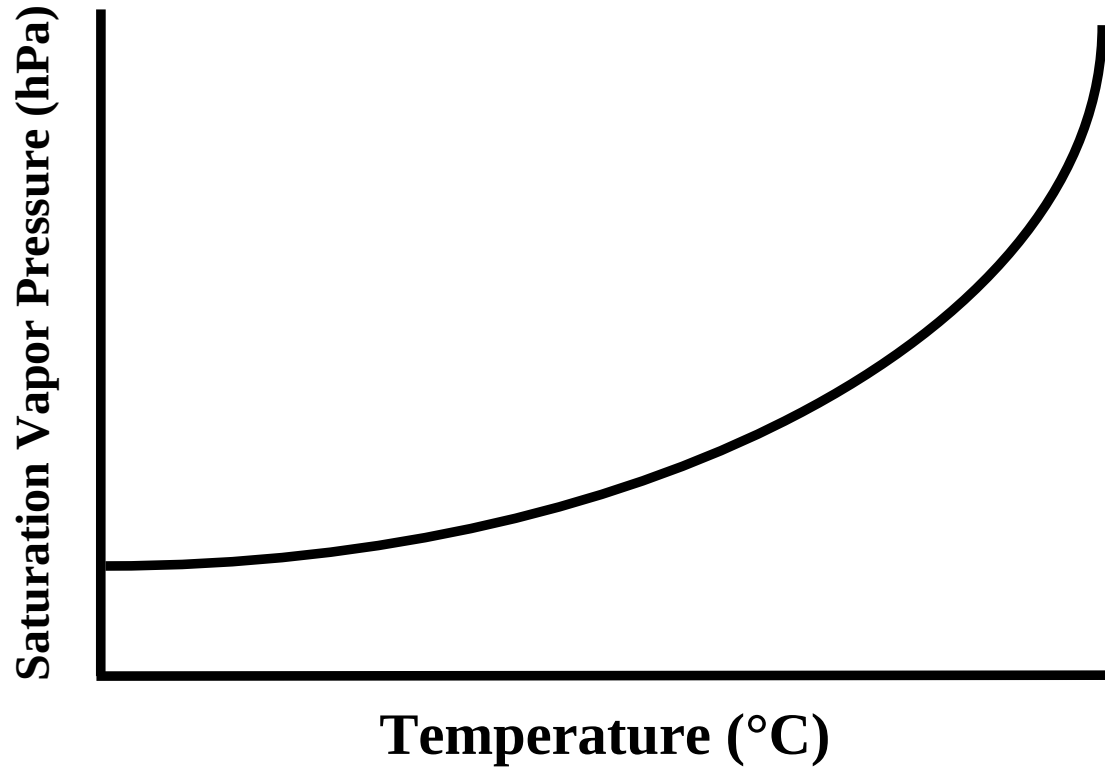
Saturation in the Air

- 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



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

Clausius Clapeyron Equation/Relationship

$$e_s \approx e_o \cdot \exp \left[\frac{L}{\mathcal{R}_v} \cdot \left(\frac{1}{T_o} - \frac{1}{T} \right) \right]$$

e_s – Saturation Vapor Pressure

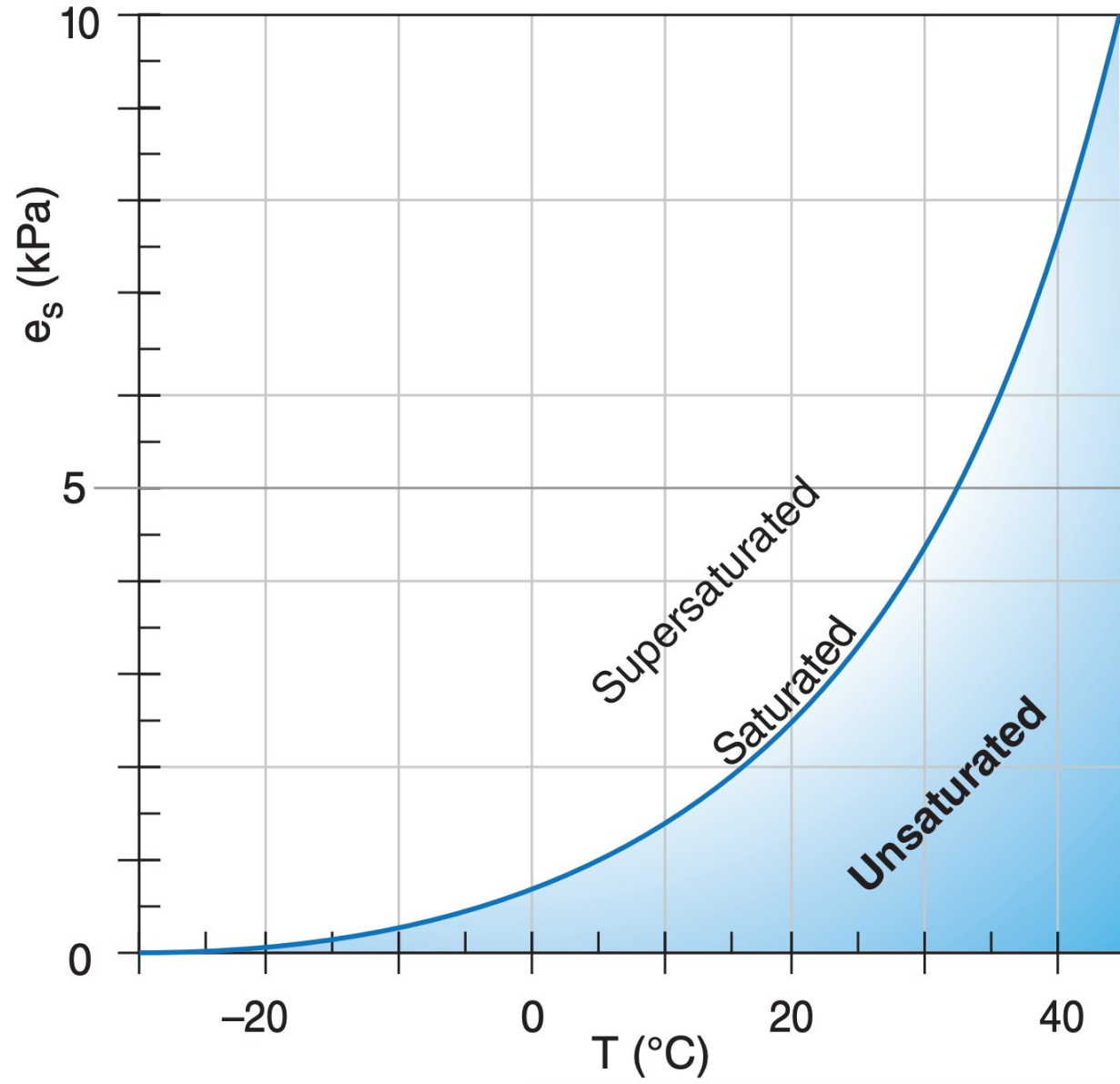
e_o – 0.6113 kPa

$\mathcal{R}_v$ – 461 J K⁻¹ kg⁻¹

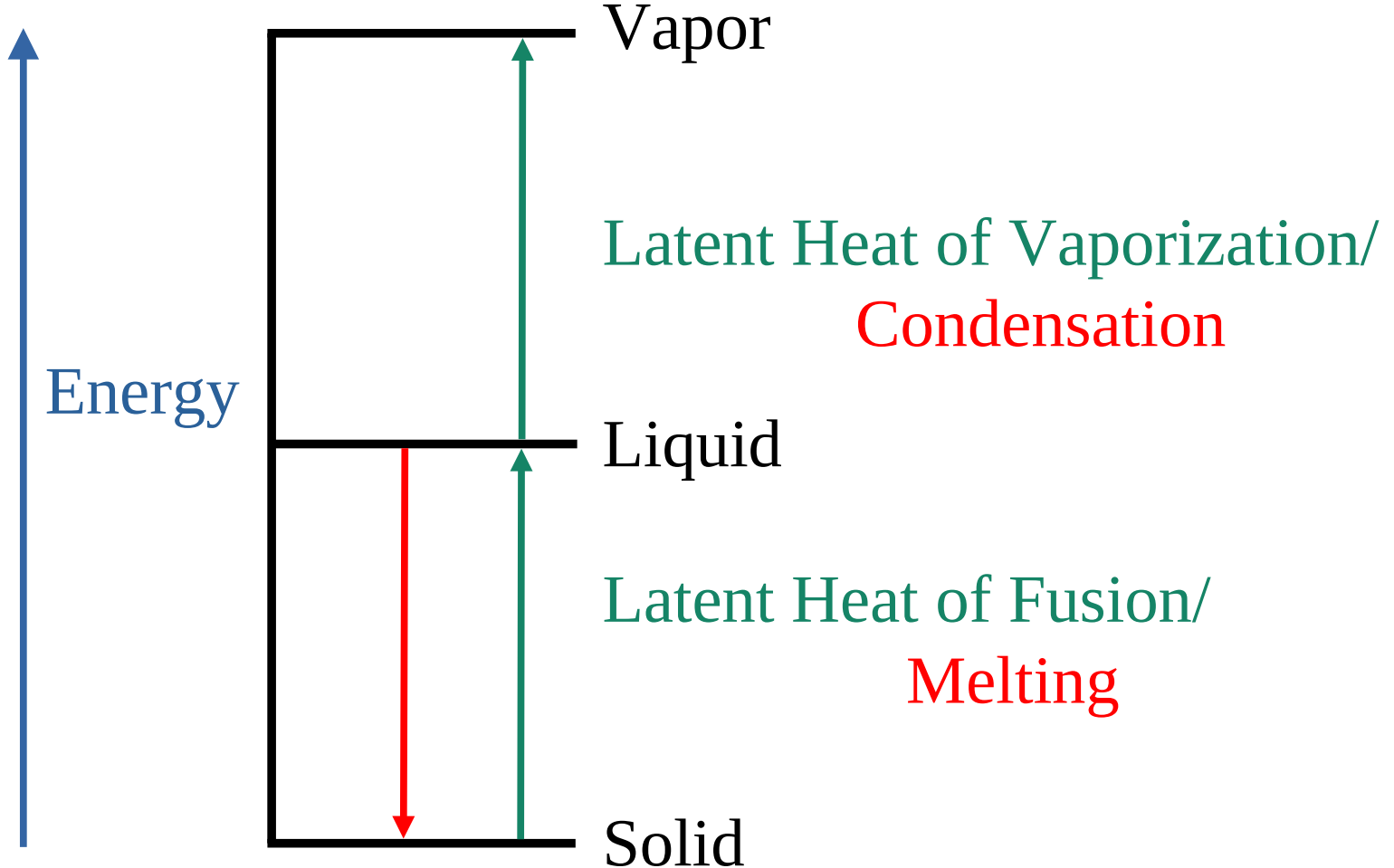
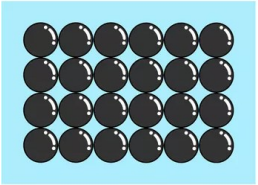
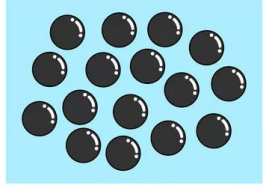
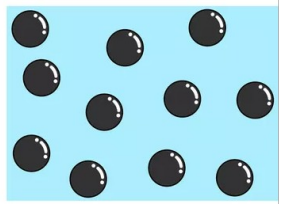
L – Latent Heat

T – Temperature (K)

T_o – 273.15K



Three States of Water



Cloud in a Jar

