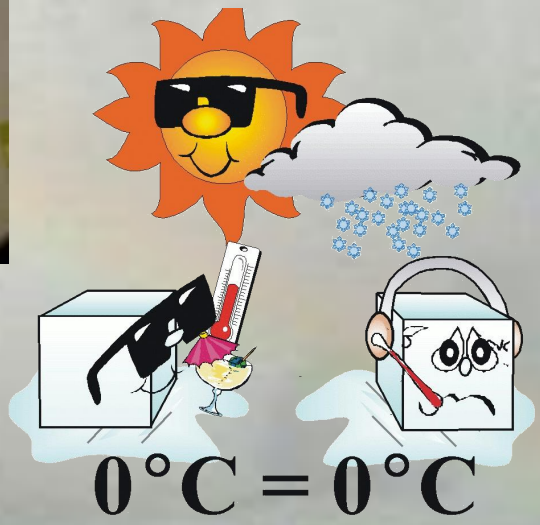
Heat and Potential Energy

Heating/Cooling Curves

Freezing Point vs. Melting Point

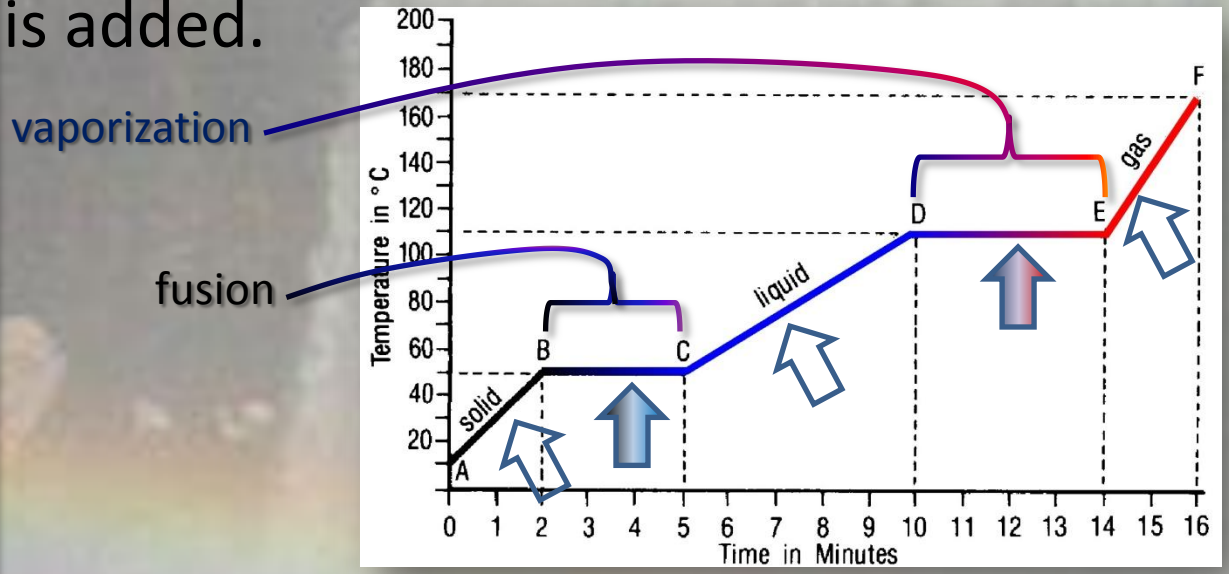
- What is the freezing point of water? 0°C
- What is the melting point of ice? 0°C

- How can they be the same?



Phase Change vs. Temperature Change

- Below is a *heating curve*, a graph showing how the temperature of a substance changes over time as heat is added.

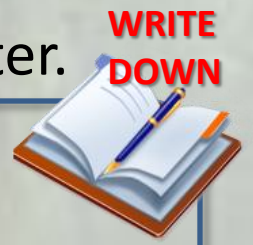


NOTE: A cooling curve is simply the reverse.

- As heat is added to a substance in a given phase, the temperature increases.
- Heat can also cause a substance to change from solid to liquid (fusion), and from liquid to gas (vaporization).
- During the phase change, there is no change in temperature.

An Explanation

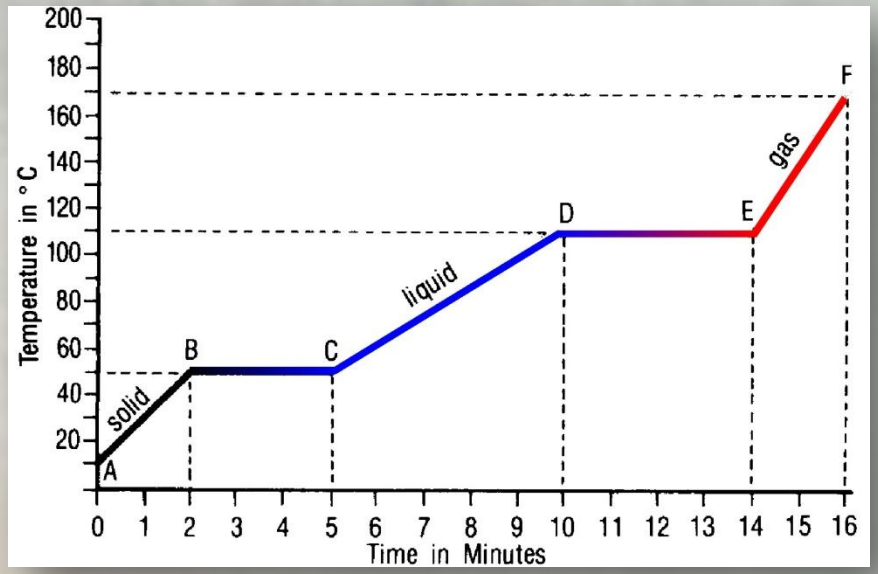
- How is it possible for heat to be absorbed without an increase in temperature?
- Keep in mind that *temperature* is the average kinetic energy of the molecules.
  - As the temperature goes up, the molecules move faster.



- During a phase change, the distance between the molecules changes tremendously.
  - When the molecules spread out, their potential energy increases.
  - When the molecules move closer together, their potential energy decreases.
- Energy absorbed or released as potential energy does not affect the temperature which is kinetic energy.

Reading a Heating Curve

The heating curve below shows what happens when a 20.0 g sample of a substance absorbs 60 J of heat per minute.



- During which lettered intervals is the phase changing? **BC and DE**
- What is the boiling point? **110°C**
- How much heat is absorbed heating the liquid from its melting point to its boiling point?

  (10 min – 5 min) × 60 $^{J}/_{min}$ = 300 J
- What is the heat of fusion?

  $$\frac{(5\text{ min} - 2\text{ min}) \times 60\ {}^{J}/_{min}}{20.0\text{ g}} = 9\ {}^{J}/_{g}$$