

Subtleties of Phase Changes

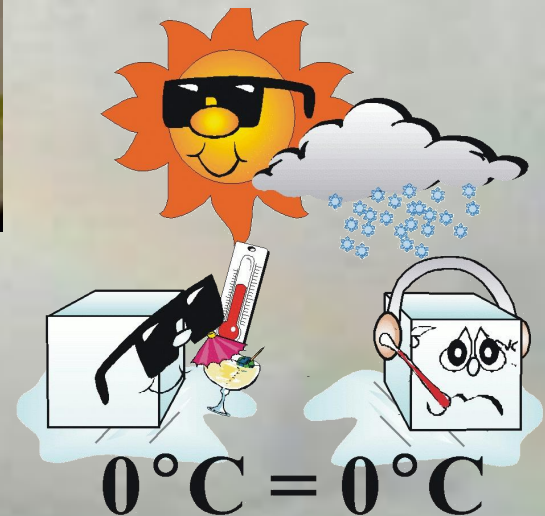
Heating/Cooling Curves

Freezing Point vs. Melting Point

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

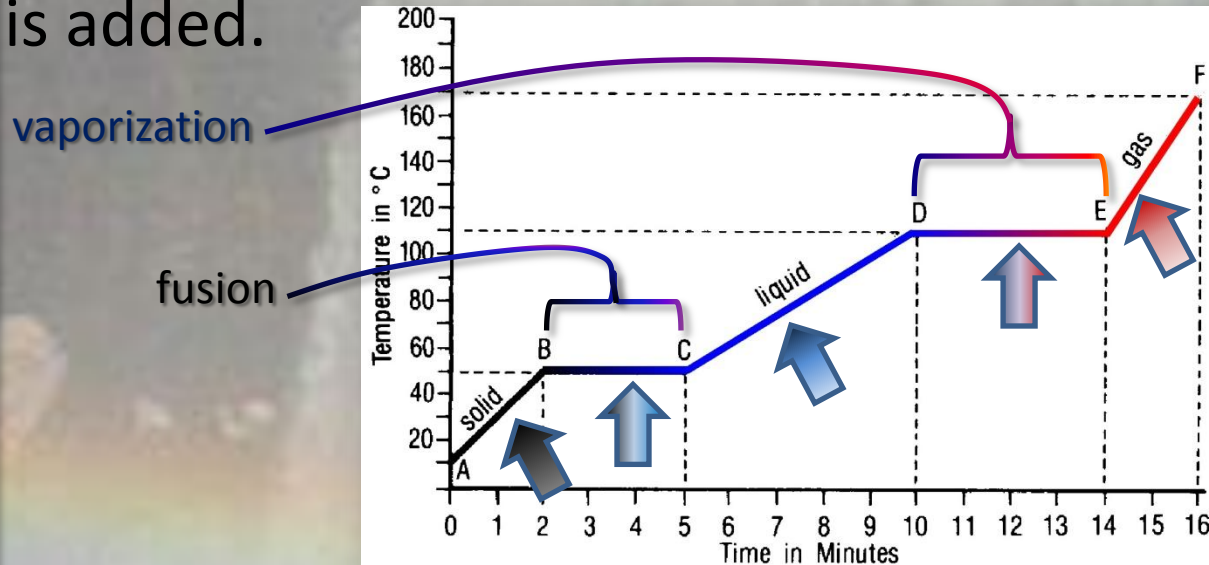


- How can they be the same?



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.

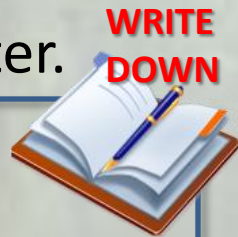


NOTE: A cooling curve is simply the reverse.

- 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

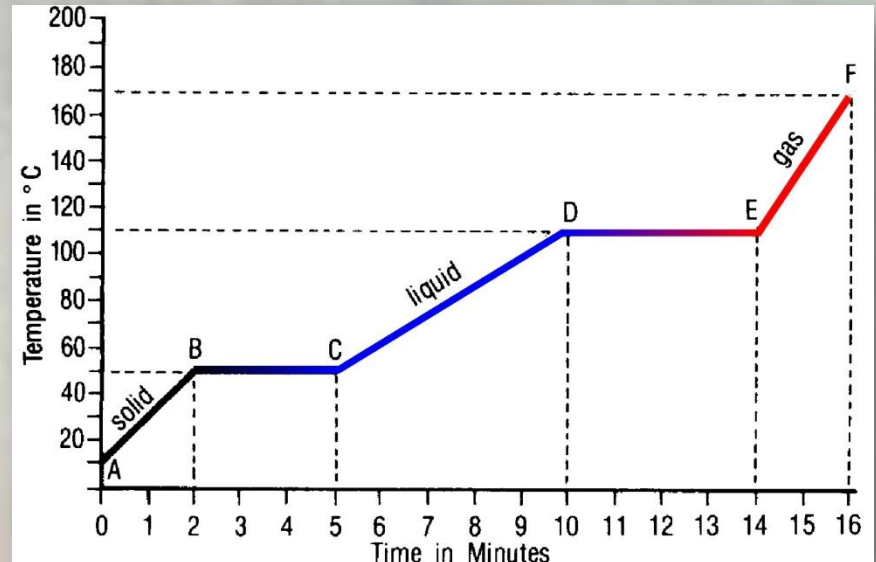
- How is it possible for heat to be absorbed without an increase in temperature?
- Keep in mind that *temperature* is the average kinetic energy of the molecules.
 - As the temperature goes up, the molecules move faster.
- During a phase change, the distance between the molecules changes markedly.
 -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



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?



$$(10 \text{ min} - 5 \text{ min}) \times 60 \text{ J/min} = 300 \text{ J}$$

- What is the heat of fusion?

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