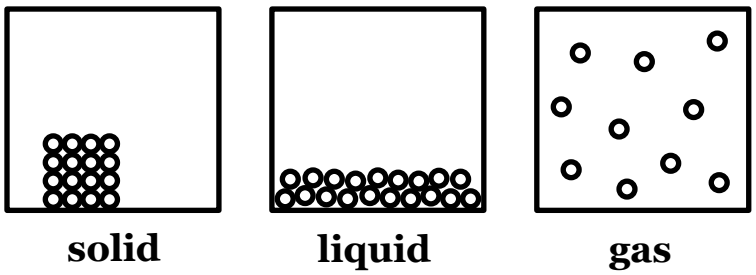
Physical Behavior of Matter

- Matter
  - Substance: composition cannot vary
    - Element: single type of matter contains only one type of atom
    - Compound: composed of two or more types of atoms chemically bonded in definite ratio
  - Mixture: composition can vary
    - Heterogeneous
    - Homogeneous (solution: see Table G for unsaturated, saturated, supersaturated)
  - Separating matter
    - Physical change: chemical identity remains unchanged
      - Separating by physical changes
        - Filtration (based on particle size)
        - Distillation (based on boiling point)
        - Crystallization (based on solubility or concentration differences)
        - Sublimation (based on vapor pressure differences)
        - Chromatography (based on polarity differences)
    - Chemical change: chemical identity changes
      - Five indications of chemical change
        - Heat or light evolved
        - Gas evolved
        - Precipitation
        - Color change
        - Odor change
  - Phases of matter
    - Solid
    - Liquid
    - Gas
    - Plasma
- Particle diagrams



Energy: must follow the law of conservation of energy

Mechanical energy: sum of the kinetic energy (KE) and the potential energy (PE)

Heat: energy that can be transferred, always moves from hot to not hot

Heat equations: (see Tables T and B)

$q = mH_f$

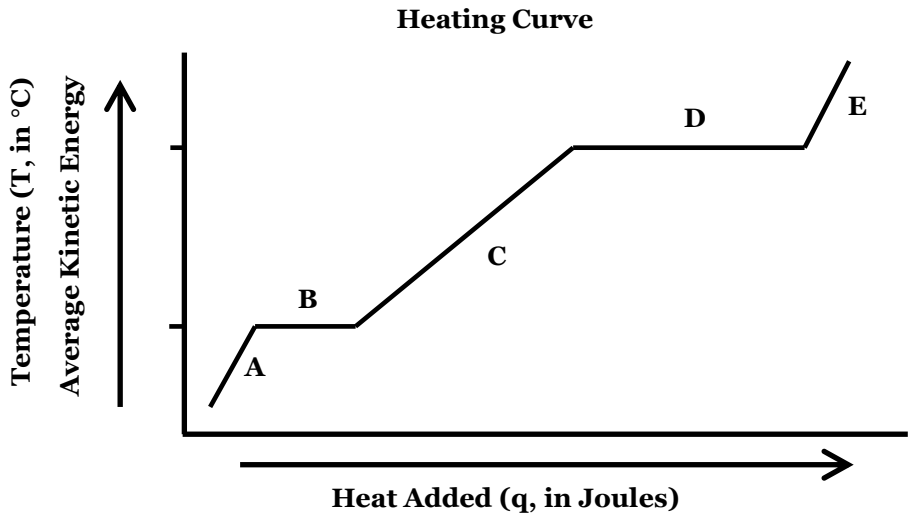
$q = mH_v$

$q = mC\Delta T$

Temperature: measure of the average kinetic energy (not a form of energy)

$K = °C + 273$ (see Table T)

Heating and Cooling curves



Remember: if heat is being used to change the temperature then it cannot melt or vaporize a substance at the same time

Heat is stupid: it can only do one thing at a time

Region A: all solid, temperature is rising as heat is added
Region B: solid and liquid, solid melting but temperature is constant (the MP)
Region C: all liquid, temperature is rising as heat is added
Region D: liquid and gas, liquid vaporizing but temperature is constant (the BP)
Region E: all gas, temperature is rising as heat is added

Phase changes

Solids

Liquids: Table H and vapor pressure

Gases

Kinetic Molecular Theory of gases (KMT)

Combined Gas Law: requires K temperature units

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$