Heat Capacity & Specific Heat

Mr. Sudbury

Heat Capacity & Specific Heat

- How much "heat" does it take to change the temperature of something.
- The amount of heat that can be transferred depends on:
  - The nature of the material (specific heat).
  - The mass of the material changing temperature.
  - The size of the temperature change. (ΔT)

Specific Heat (c_p)

- ***Specific heat*** is the amount of energy *(usually in Joules)* required to raise the temperature of 1 grams of substance 1°C of K.
- Specific heat (c_p) is different for different substances.
- Specific heat is typically measured in units of:

$$\frac{J}{(g \cdot °C)} \qquad \frac{cal}{(g \cdot °C)}$$

Specific Heat Table

- Higher numbers means it takes more heat energy to change the temperature of the substance.
- Lower numbers mean that it takes less heat energy to change the temperature of the substance.

Specific Heats of Some Common Substances	
Substance:	**Specific Heat (J/(g·°C))**
Water (l)	4.18
Water (s)	2.06
Water (g)	1.87
Ammonio (g)	2.09
Benzene (l)	1.74
Ehtanol (L)	2.44
Ethanol (g)	1.42
Aluminum (s)	0.897
Calcium (s)	0.647
Carbon, Graphite (s)	0.709
Copper (s)	0.385
Gold (s)	0.129
Iron (s)	0.449
Mercury (l)	0.140
Lead (s)	0.129

Specific Heat

$$c_p = \frac{Q}{m \cdot \Delta T}$$

- c_p = specific heat
- Q = energy lost or gained
- ΔT = "Change in" temperature. ($T_f - T_i$)

$$Q = m \cdot c_p \cdot \Delta T$$

Specific Heat Practice Problems

- Determine the specific heat of a material if a 35g sample absorbed 48J as it was heated from 293K to 313K.
- How many joules of heat are needed to heat a 45g sample of water from 60°C water to 85°C?

Specific Heat Practice Problems

- What is the mass of a beaker of water that absorbs 100 J of heat and the temperature rises 3.5°C.
- What is the change in temperature of a 200 g pot of water that releases 1200 J of energy. (Hint: Released energy = −Q)

The End

- Summary
  - Specific Heat
    - The amount of energy required to change the temperature of 1g of a substance 1°C or K.
  - Depends on:
    - Mass
    - Type of substance &
    - ΔT

$$Q = m \cdot c_p \cdot \Delta T$$