Chapter Summary: Thermochemistry

Energy: The ability to do work. **Units**: Joules, calories
Thermochemistry: Study of energy changes in a system during chemical or physical changes.
Internal Energy (U): Total energy of a system.
Heat (q): Quantity of energy transferred between a system and its surroundings. (Remember a system does not have heat, it has energy).
Work (w): Energy transferred between a system and surrounding.

First Law of Thermodynamics: Energy cannot be created not destroyed only exchanged between a system and surrounding.

Heats of Reaction

Exothermic: Heat released into the system (q = negative)
Endothermic: Heat absorbed from the system (q = positive)
Heat of reaction: Heat exchanged in a reaction system and the surroundings at a fixed temperature.

Enthalpy (H): Sum of internal energy and the pressure and volume of a system.

1) Is an extensive property i.e. dependent on quantity of matter (density),
2) Depends on the present state,
3) Has a unique value.

Calorimetry

Heat Capacity: Amount of heat required to change the temperature of a system by 1 ^{o}C or 1 K.
Specific Heat: Amount of heat required to change the temperature of 1 g of substance by 1 ^{o}C or 1 K.

$$\text{Specific heat} = q / m\Delta T \qquad \text{OR} \qquad q\ (\text{energy}) = m \times \text{specific heat} \times \Delta T$$

Hess's Law: Heat of reaction is constant, no matter how many steps it takes for the reaction to occur.

Standard Enthalpy of Formation: Heat change that occurs in one 1 mole of compound, formed from its constituent elements in their standard states.
For a hypothetical equation:

$$aA + bB \longrightarrow cC + dD$$

$$\Delta H^{o}_{rxn} = [c\Delta H_f^{o}(C) + d\Delta H_f^{o}(D)] - [a\Delta H_f^{o}(A) + b\Delta H_f^{o}(B)]$$

In general: $\Delta H^{o}_{rxn} = \Sigma n\Delta H_f^{o}(\text{products}) + \Sigma n\Delta H_f^{o}(\text{reactants})$ (n = number of moles, Σ = sum of)

Key Words

Energy, Heat, Work	Exothermic Endothermic	Enthalpy of reaction	Heat of reaction
Calorimetry	Specific heat Heat capacity	Hess's Law	Heat of formation