

Thermodynamics

Change in internal Energy $\Delta U = q + W$ (first law of thermodynamics)

Work $W_{\text{rev}} = - \int_{V_i}^{V_f} P_{\text{ex}} dV$

$$W_{\text{rev}} = -2.303 nRT \log \frac{V_f}{V_i}$$

Free Expansion $\Delta U = q - P_{\text{ex}} \Delta V$

q = Heat
 P_{ex} = External force

Enthalpy $\Delta H = \Delta U + \Delta n_g RT$

Heat Capacity $q = C \Delta T$ C = Heat capacity

Molar Heat Capacity $C_m = \frac{C}{n}$

Relation between C_p and C_v $C_p - C_v = R$

C_p = Heat capacity at constant Pressure
 C_v = Heat capacity at constant Volume

Enthalpy Change

$$\Delta_r H = (\text{sum of Enthalpies of products}) - (\text{sum of Enthalpies of reactants})$$

OR

$$\Delta_r H = \sum a_i H_{\text{product}} - \sum b_i H_{\text{Reactants}}$$

★ Relationship between standard Enthalpy to bond enthalpy

$$\Delta_r H^\ominus = \sum \text{Bond Enthalpy}_{\text{reactants}} - \sum \text{Bond Enthalpy}_{\text{products}}$$

★ Enthalpy of Solution $\Delta_{\text{sol}} H^\ominus = \Delta_{\text{lattice}} H^\ominus + \Delta_{\text{hyd}} H^\ominus$

★ Entropy change for reversible process $\Delta S = \frac{q_{\text{rev}}}{T}$

★ Total Entropy Change $\Delta S_{\text{total}} = \Delta S_{\text{system}} + \Delta S_{\text{surroundings}} > 0$

★ Gibbs function $G = H - TS$

★ Gibbs Energy $\Delta_r G^\ominus = -RT \ln K$ OR $\Delta_r G^\ominus = -2.303 RT \log K$

