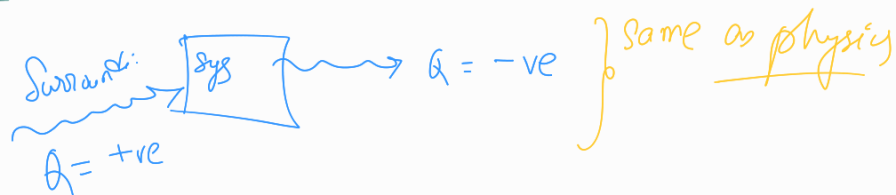


Thermodynamics

NOTE:- Basic terms in thermodynamics of physics is same as Chemistry.

Differences →



Work done on the system → +ve

Work done by the system → -ve

$$(i) \quad W_{rev} = - \int_{V_1}^{V_2} P_{ex} dV$$

$$(i) \quad \left. \begin{aligned} W_{rev} &= -nRT \ln \frac{V_2}{V_1} \\ W_{rev} &= -nRT \ln \frac{P_1}{P_2} \end{aligned} \right\} \begin{array}{l} \text{for isothermal} \\ \text{reversible expn.} \end{array}$$

$$(ii) \quad W_{irr} = -P_2(V_2 - V_1)$$

Work done in irreversible expansion

⊗ Work done by the gas is -ve.

$$(iv) \quad W = -P \Delta V = -\Delta n RT$$

Work done in a chemical reaction.

Concept of Enthalpy

$$\Delta H = \Delta U + P \Delta V$$

$$\Delta H_{rxn} = \Delta H_{pro} - \Delta H_{reactant}$$

$$dU = n C_v dT$$

$$dH = n C_p dT$$

few key points regarding → Lattice Energy and Born-Haber cycle

Sublimation → $\Delta H = +ve$

Breaking bonds → $\Delta H = +\frac{1}{2}(\quad)$

Ionisation Enthalpy → +ve

e^- affinity → -ve

Forming from isolated cation anions → -ve

Sum of all energy = 0 (to get ΔH_L)

↓
- ΔH_L (Lattice Enthalpy)

Concept of Entropy

$$\Delta S = \frac{\Delta H}{T} = \frac{nR \ln\left(\frac{V_2}{V_1}\right)}{T} = nR \ln\left(\frac{V_2}{V_1}\right).$$

↓
always +ve

$\Delta S > 0 \rightarrow$ Spontaneous

$\Delta S < 0 \rightarrow$ Non-spontaneous

$\Delta S = 0 \rightarrow$ Equilibrium

Gibbs free Energy

$$\Delta G = H - T \Delta S$$

$\Delta G < 0, K > 1 \rightarrow$ Spontaneous

$\Delta G > 0, K < 1 \rightarrow$ Non-spontaneous

$\Delta G = 0, K = 1 \rightarrow$ equilibrium

$$T = \frac{\Delta H}{\Delta S}$$

(i) if $\Delta H > 0, \Delta S > 0$

then $T > \frac{\Delta H}{\Delta S} \rightarrow$ Spontaneous

$T < \frac{\Delta H}{\Delta S} \rightarrow$ Non-spontaneous

(ii) if $\Delta H < 0, \Delta S < 0$

$T < \frac{\Delta H}{\Delta S} \rightarrow$ Spontaneous

$T > \frac{\Delta H}{\Delta S} \rightarrow$ Non-spontaneous

Also,

$$\Delta G = -RT \ln K$$

or, $\Delta G = -2.303 RT \log K$