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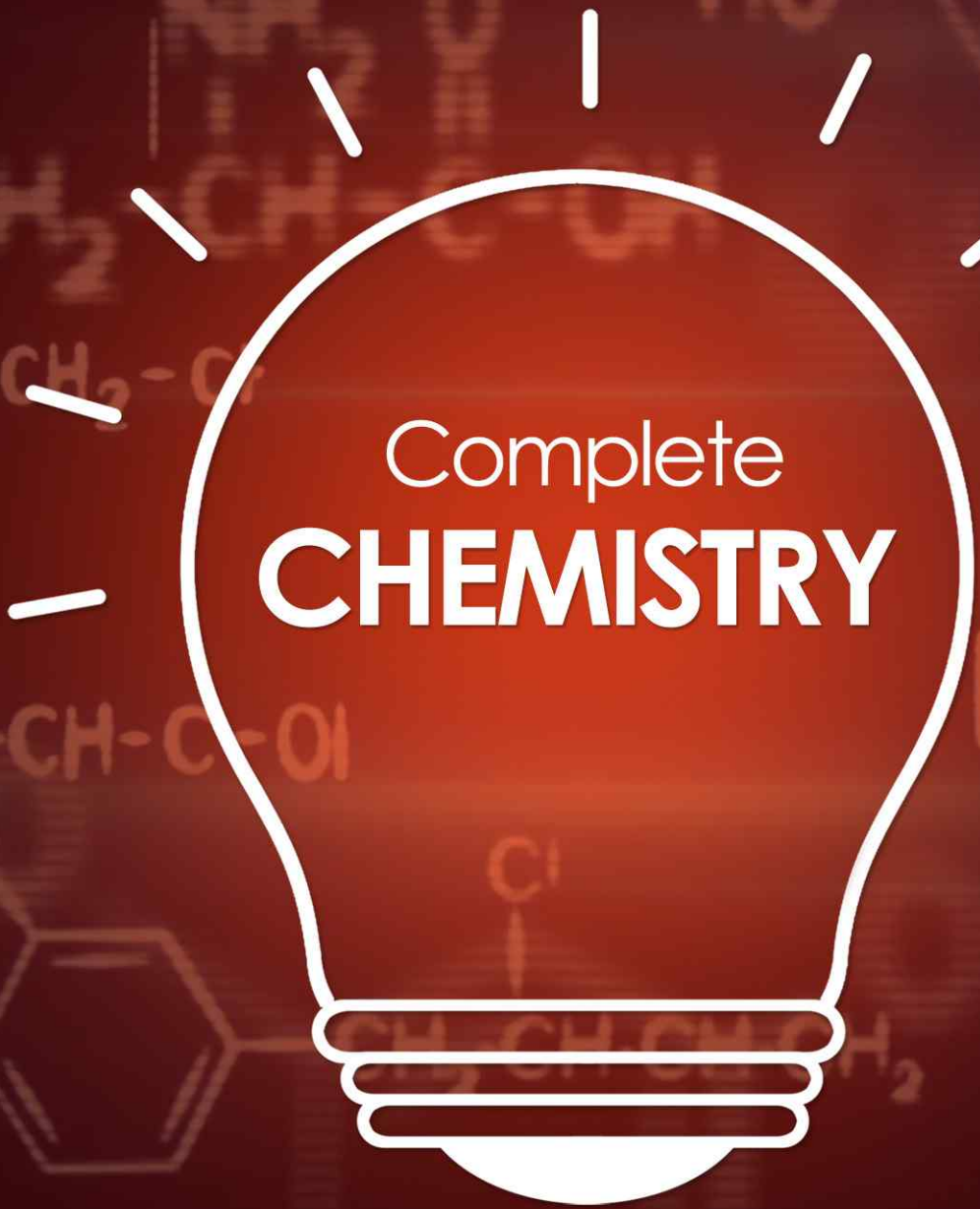


Complete CHEMISTRY

IIT-JEE · NEET · CBSE eBOOKS

CLASS 11&12th

CLASS 11th

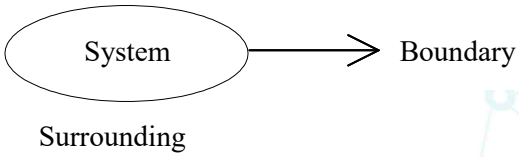
Thermodynamics and Thermochemistry

Thermodynamics

01. Introduction

The study of energy transformations is the subject matter of thermodynamics.

Some Basics Terms



Types of system

(I) **Based or exchange of mass and energy**
- (i) **Isolated system :** It cannot exchange matter and energy with the surrounding.
- (ii) **Closed system :** It can exchange energy but not matter.
- (iii) **Open system :** It can exchange matter.

(II) **Based on system composition**
- (i) **Homogeneous system :** Made up of one phase only
- (ii) **Homogeneous system :** More than one phase.

02. Properties of a System

Particular set of its measurable quantities.
Intensive property : value does not depend on the size (or mass) of the system.
Extensive property : value depends on the size (or mass) of the system.
Variables like P,V , T are *State Functions* or *Stage Variables* because their values depends only on initial and final state.

Path function

Function which depends on the path .
State functions : Pressure, volume, temperature, Gibb's free energy, internal energy, entropy
Path function : Work, heat, Loss of energy due to friction

03. Reversible and Irreversible Process

S.No.	Reversible process	Irreversible process
1.	Driving force is infinitesimally small.	Driving force is large and finite. PV
2.	A reversible heat transfer take place across temperature difference dT	Irreversible heat transfer take place across difference ΔT
3.	It is an ideal process.	It is a real process
4.	It take infinite time for completion of process.	It take finite time for completion of process.

Cyclic Process $\Delta E = 0$ and $\Delta H = 0$
Isochoric Process $\Delta V = 0$
Isobaric Process $\Delta P = 0$

04. Work

PV- Work analysis :
For small displacement dx due to force F, work done on the system.

$dw = F.dx$

Also $F = PA$

$dW = PA.dx$

$V = (\ell - x)A$

$\Rightarrow \quad dV = -A.dx \qquad \Rightarrow \quad dW = -P_{ext.}dV$

$$\Rightarrow \quad W_{PV} = -\int_{V_1}^{V_2} P_{ext} dV$$

- **Isothermal Process** $dT = 0$
- **Adiabatic process** $q = 0$

05. Heat

Heat is defined as the energy that flows into or out of a system.
(i) $q_V = nC_V dT$ (for constant volume process)
(ii) $q_p = nC_p dT$ (for constant volume process)
(iii) $C_{p,m} - C_{v,m} = R$
(iv) C_v & C_p depends on temperature even for an ideal gas. ($C = a + bT + cT^2$.....)

06. Internal Energy (E & U)

$U = U_{Kinetic} + U_{Potential} + U_{Electronic} + U_{nuclear} + ...$

NOTE ☞ (i) U is a state function & is an extensive property.
(ii) $\Delta E + q_v$, heat supplied to a gas constant volume, since all the heat supplied goes to increase the internal energy of the gas.
(iii) $U = f(T, V)$
(iv) $dU = C_V\, dT$
(v) $\Delta U + \int C_V .\, dT$