Chemistry-1
Code: CH101
Contacts: 3L + 1T = 4
Credits: 4

Module 1

Chemical Thermodynamics -I

Concept of Thermodynamic system: Definition with example of dia thermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.

Introduction to first law of thermodynamics: different statements, mathematical form. Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas.

Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas. [3L]

Heat Capacity: Definition, Classification of Heat Capacity (C_p and C_v): Definition and General expression of $C_p - C_v$. Expression of $C_p - C_v$ for ideal gas.

Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas,

Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.

Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation, Kirchoff's law. [3L]

2^{nd} law of thermodynamics: Statement, Mathematical form of 2^{nd} law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature.

Evaluation of entropy: characteristics and expression, entropy change in irreversible cyclic process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases. [2L]

Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, Maxwell's Expression (only the derivation of 4 different forms), Gibbs Helmholtz equation.

Condition of spontaneity and equilibrium reaction. [2L]

Module 2

Reaction Dynamics

Reaction laws: rate and order; molecularity; zero, first and second order kinetics. Pseudounimolecular reaction, Arrhenius equation.
Mechanism and theories of reaction rates (Transition state theory, Collison theory).
Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics). [3L]

Solid state Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).

Role of silicon and germanium in the field of semiconductor. [2L]

Module 3

Electrochemistry

Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte).
Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions.
Conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs $AgNO_3$. [2L]

Electrochemical cell

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half cell, quinhydrone half cell and calomel half cell (construction, representation, cell reaction, expression of potential, Discussion, Application)
Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, Discussion, Application).

Application of EMF measurement on a) Ascertain the change in thermodynamic function (ΔG, ΔH, ΔS) b) ascertain the equilibrium constant of a reversible chemical reaction c) ascertain the valency of an ion. [3L]

Module 4

Structure and reactivity of Organic molecule

Electronegativity, electron affinity, hybridisation, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals.

Brief study of some addition, eliminations and substitution reactions. [3L]

Polymerization

Concepts, classifications and industrial applications.
Polymer molecular weight (number avg. weight avg. viscosity avg.: Theory and mathematical expression only), Poly dispersity index (PDI).
Polymerization processes (addition and condensation polymerization), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of T_m) and amorphicity (Concept of T_g) of polymer.

Preparation, structure and use of some common polymers: plastic (PE: HDPE, LDPE, LLDPE, UHMWPE)), rubber (natural rubber, SBR), fibre(nylon 6.6). Vulcanization.

Conducting and semi-conducting polymers. [5L]

Module 5

Industrial Chemistry

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC),
Coal analysis: Proximate and ultimate analysis.
Liquid fuel: Petroleum, classification of petroleum, Refining, Petroleum distillation, Thermal cracking, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Bio-diesel.
Gaseous fuels: Natural gas, water gas, Coal gas, bio gas. [5L]