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Module-I

Thermodynamics – I

Basic ideas on first law of thermodynamics and thermo-chemistry, Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law – Joule-Thompson coefficient and inversion temperature. Calculation of w, q, dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Kirchhoff's equation.

Module-II

Thermodynamics – II

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem.Thermodynamic scale of temperature.

Concept of entropy. Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Module-III

Thermodynamics – II

Third law of thermodynamics: Nernst heat theorem, statement and concept residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Module-IV

Chemical Equilibrium

Equilibrium constant and free energy.Thermodynamic treatment of law of mass action. Relationship between K_p,K_c and K_x. Homogeneous equillibria, Temperature dependence of equilibrium constant, Heterogeneous equillibria, Le Chaterlier'sprinciple.Reaction isotherm and reaction isochore – Clapeyron equation and Clausius – Clapyron equation, applications.

Essential readings:

1 The Elements of Physical Chemistry by P. Atkins, Oxford University Press

2 Principles of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publication Co