

# B.Sc. I Paper 3

## Physical Chemistry

### Unit I

#### I Mathematical Concepts and Computers

##### (A) *Mathematical Concepts*

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like  $k_x$ ,  $e^x$ ,  $x^n$ ,  $\sin x$ ,  $\log x$ ; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; permutations and combinations. Factorials. Probability.

##### (B) *Computers*

General introduction to computers, different components of a computer, hardware and software, input-output devices; binary numbers and arithmetic; introduction to computer languages. Programming, operating systems.

### Unit II

#### II Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state.

*Critical Phenomena* : PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

*Molecular velocities*: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect).

#### III Liquid State

Intermolecular forces, structure of liquids (a qualitative description).

Structural differences between solids, liquids and gases.

Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

### Unit III

#### IV Solid State

Definition of space lattice, unit cell.

Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

#### V Colloidal State

Definition of colloids, classification of colloids.

Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number.

Liquids in liquids (emulsions): types of emulsions, preparation. Emulsifier.

Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

## Unit IV

### VI Chemical Kinetics and Catalysis

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction – differential method, method of integration, method of half life period and isolation method.

Radioactive decay as a first order phenomenon.

Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer.

Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy,

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Catalysis, characteristics of catalysed reactions, classification of catalysis, miscellaneous examples.