**SYLLABUS FOR COMPUTER BASED RECRUITMENT TEST (CBRT)**
**FOR THE POST OF ASSISTANT PROFESSORS IN GOVERNMENT COLLEGE**
**(CHEMISTRY(PHYSICAL))**
**UNDER**
**DIRECTORATE OF HIGHER EDUCATION**
**(Advt No. 13 Year 2020)**

**I.** General English including Grammar **- 05 marks**

**II.** General Knowledge, Current Affairs and Events of National and International Importance **- 10 marks**

**III.** Logical Reasoning and Analytical Ability **- 10 marks**

**IV. Core:** **- 50 marks**

**Spectroscopy :** Rotational and vibrational spectra. Moment of inertia and rotational spectra of rigid and non – rigid diatomic molecules. Vibrational excitation effect.. Rotational spectra of symmetric - top molecules. Strak effect. Vibrational energy of diatomic molecules. Anharmonic oscillator, overtones and hot bands. Diatomic vibrator – rotator (P, Q and R – branches of diatomic vibrator – rotator).

**Theory of nuclear magnetic resonance** NMR phenomenon, the chemical shift and its measurement. The fine structure (spin – spin coupling). Factors influencing chemical – shift and spin – spin coupling. Non - first – order spectra. Relaxation phenomena in NMR: spin – spin and spin – lattice relaxation processes. Line –width and rate processes. The nuclear Overhauser effect. An introduction to Fourier Transform NMR (FTNMR). Theory of Electron Spin Resonance (ESR) phenomenon. Fine and hyperfine structure of ESR. Zero – field splitting of ESR signal

**Kinetics of complex reactions:** Reversible / opposing reactions, consecutive / successive reactions, simultaneous side / parallel reactions, chain / free radical reactions viz. thermal (H2 – Br2) and photochemical H2 – Cl2) reactions. Rice – Herzfeld mechanism of dissociation of organic molecules viz. dissociation of ethane, decomposition of acetaldehyde as 3/2 or ½ order reactions.

**Theories of reaction rates:** The kinetic theory of collisions, transition state theory, comparison of collisions and transition state theories in simple gas reactions, steric factor, transmission – coefficient, steady – state hypothesis / transient phase theory, Lindmans theory of unimolecular reaction, the thermodynamic formulation of reaction rates

**Thermodynamics.** Gibb's and Helmholtz free energy functions and their significance. Partial molal quantities. Partial molal free energy and its variation with temperature and pressure. Determination of partial molar volume. Thermodynamic criteria for the fugacity of the process in terms of entropy change, internal energy change, enthalpy and free energy (Gibb's and Helmholtz ) change. Gibb's and Helmholtz equation and its utility in thermodynamics of cell reaction. Thermodynamics of ideal solutions.

**Non–Equilibrium Thermodynamics**: Basic principles of non – equilibrium thermodynamics: rate laws, second law of thermodynamics for open system, law of conservation of mass, charge and energy. Phenomenological equations for single and

coupled flows. Onsager reciprocity relation. Theorm of minimum entropy production.

**Electrochemistry:**Ionic conduction: non – ideal behaviour of electrolytic solutions. Electrolytical potential. Derivation of Debye – Huckel Limiting Law. Extended Debye – Huckel Law. Structure of solutions. Detailed treatment of ion – solvent interactions (ion solvation), solvation number. Energy conduction. Ion – ion interactions (ion – association). Bjerrum's theory of ion – association

**Basic Quantum Chemistry** : Operators in quantum mechanics. Eignvalues and eignfunctions. Hermitian operator and its application. Postulates of quantum mechanics. Angularmomentum of a one – particle system, and its commutative relations. Schreodinger wave equatuion and its formulation as an eignvalue problem. The uncertainty principle. UNIT – IV Quantum mechanical treatment of translational motion of a particle, particle in one and three dimensional boxes, harmonic – oscillator, rotational motion of a particle: particle on a ring, particle on a sphere, rigid rotator and hydrogen atom. Graphical presentation of orbitals (s, p and d), radial and angular probability distribution plots.

**Photochemistry:** Photophysical processes of electronically excited molecules. Intensity distribution in the electronic vibrational species. Franck – Condon principle a quantum – mechanical treatment. Excited state dipole moment and acidity constant. Dissociation and pre – dissociation of diatomic molecules

**X- ray diffraction:** Indexing of powder and crystal photographs. Determination of Bravais lattice, point group and space group. Determination of space group with examples. Electron diffraction: The scattering of electron by gases (Wierl equation), visual method, radial distribution method and applications. Neutron diffraction: Introduction, differences between neutron and X- ray diffraction. Application to structure modification and magnetic compounds.

**Superconductivity:** Experimental survey, occurrence of superconductivity, destruction of superconductivity by magnetic fields (Meissner effect). Thermodynamic effects of superconducting species (entropy, thermal conductivity and energy gap). Quantum tunnling. Theoretical survey (thermodynamics of superconducting transition, London equation, coherence length). BCS theory of superconductivity

**Solid State Reactions:** General principles: experimental procedures, kinetics of solid state reactions, vapour phase transport methods, interaction or ion exchange reaction, electrochemical reduction methods, preparation of this films, growth of single crystal, high pressure and hypothetical method.

**Note:**

**Duration for C.B.R.T : 75 Minutes**

**Maximum Marks for C.B.R.T : 75 Marks**

Uploaded by GPSC on 09/03/2021