

**F.Y.B.Sc. ( REVISED SYLLABUS)-2003****CHEMISTRY PAPER I****( TOTAL MARKS : 70 )****UNIT-I ( PHYSICAL CHEMISTRY : UNIT I-III )**

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|--|--------------|
| (a) Thermodynamics :   | 5            |
| Iso-thermal changes and adiabatic changes ( PV, PT and TV relationship ), Second law of Thermodynamics, State Function. Heat capacities, Cp, Cv, gas constant, entropy of the gases, Joule Thomson Effect, Kirchoff's law, bond energy and Resonance energy.   |              |
| (b) Chemical Kinetic :   | 4            |
| Molecularity and order of reaction, general order of reaction pseudo first order, Second order reaction (a=b) (a ≠ b). Third order reaction, methods of determining the reaction rate—differential method, method of integration, method of half life period and isolation method.   |              |
| (c) The Gaseous State :  | 5            |
| Deviation from ideal behaviour, causes of deviation, Van-der-waals equation and its applicability, method of limiting densities, critical state. Determination of critical constants, continuity of states Relation between critical constants and Vander-waals constants, law of corresponding states. The liquification of gases. Maxwell's distribution of molecular velocities, collision number mean free path. |              |

**UNIT-II**

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| Lonic Equilibrium :   | 14 |
| Electrical conductance, specific conductance. Equivalent conductance, Molar conductivity, cell constant, and its determination. Incomplete dissociation. Degree of dissociation. Ostwald's dilution law and its limitations. Kohlraush law and its application. Application of ionic conductance, ionic mobilities. Interionic attraction theory, self ionisation of solvent, Kw. pH scale. Hydrolysis including relation between $K_a$ , $K_b$ , $K_w$ , $K_a$ , $K_b$ etc., Buffer solutions, Indicators—theory and useful range acidimetric and alkalimetric titrations. |    |

**UNIT-III**

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| (a) Nuclear Chemistry :   | 7 |
| Radio activity, $\alpha$ , $\beta$ and $\gamma$ -rays. Range of particles. Theories of Radio-activity. Law of radioactive disintegration, Isotopes, Isobars, Isotones, Isomers. Half-life period. Average life, Soddy's group displacement law Radio active equilibrium. Geiger Nattal Law. Mechanism of radioactivity, Radioactive change, Radio active series, Nuclear size, Packing fraction, Binding energy. Stability of Nuclear energy. Fission and Fusion (explanation from the point of view of energy changes) |   |
| (b) Wave Mechanics and Structure of atom :  | 7 |
| The uncertainty principle, the wave equation and wave functions its interpretation significance of $\psi$ and $\psi^2$ . Limitations of acceptable wave functions. Normalised and orthogonal (orthonormal) wave functions, Eigen values, and Eigen function. Rules for filling the orbitals with electrons (and electronic configuration of elements).  |   |
| (Inorganic Chemistry : Unit IV and V).  |   |

**UNIT IV**

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| (a) Bonding and Structure :  | 14 |
| Ionic Solids and lattice energy (Born-Haber Cycle), Covalent bond-Sidwick-Powel Theory-VSEPR theory-Examples using the VSEPR theory ( $NH_3$ , $H_2O$ . $ClF_3$ , $SF_3$ , $I_3$ , $SF_6$ $IF_7$ etc.) hybridization of atomic orbitals Rules of Rehybridization-Types of Rehybridisation and shapes of some hybrid molecules. The metallic bond-Theories of Bonding in metals EST, VBT and MOT. Conductors, insulators and semiconductors and Super conductivity (as per J. D. Lee IV <sup>th</sup> Edition). |    |

## UNIT V

- (a) Co-ordination Chemistry : 8  
 Werner's theory, labile and inert complexes, stability of complex compounds, factors influencing the stability of complexes (Properties of Metal, Properties of ligand) Isomerism : stereochemistry Bonding-in Complexes (inner and outer complexes). Chelation, Theoretical aspects of co-ordination chemistry (electroneutrality principles, valency bond approach, crystal field theory).
- (b) Metallurgy of Ag, Zn, Pb Electroplating (General Principles). 6  
 Hydrides of boron, diborane, borazine, borohydrides, fullerenes.

## Reference Books :

1. 'Physical Chemistry' P. W. Atkins, 5<sup>th</sup> edn, Oxford, 1994, 7<sup>th</sup> edn, 2002.
2. 'Physical Chemistry' by R. A. Alberty and R. J. Silbey, John Wiley. 1995.
3. 'Physical Chemistry' by G. H. Barrow, 5<sup>th</sup> edn., MacGraw Hill, 1988, 6<sup>th</sup> edn., 1966.
4. 'Physical Chemistry' by W. J. Moore 4<sup>th</sup> edn., Orient Longmans 1969
5. 'Source Book on Atomic Energy' by Glasstone, 1969.
6. 'Modern Inorganic Chemistry' by G. F. Liporni, ELBS, 4<sup>th</sup> edn., collins Educational, 1983.
7. 'Inorganic Chemistry', D. F. Shriver, P. W. Atkins and C. H. Longford, 3<sup>rd</sup> Ed., ELPS Oxford University Press, 1999.
8. 'Nuclear and Radio Chemistry' by G. Friedlander, J. W. Kennedy, E. S. Macias and J. M. Miller, 3<sup>rd</sup> edn., John Wiley, 1981.
9. 'Essentials of Nuclear Chemistry', H. J. Arnikar, 4<sup>th</sup> Ed., New Age International, 1995.
10. 'Concise Inorganic Chemistry', I. D. Lee, Chapman and Hall, 5<sup>th</sup> ed., 1996.
11. 'Inorganic Chemistry', D. F. Shriver and P. W. Atkins, 3<sup>rd</sup> Ed., Oxford, 1999.

**CHEMISTRY PAPER--II**  
**( REVISED SYLLABUS )--2003**

## UNIT--I

- (a) Estimation (of Nitrogen by) Kjeldhal with Boric acid. Molecular weight (acid by Ag-salt method and base by chloro-platinate method. Rast method) 4
- (b) Fission of covalent bond, type of reagents and reaction mechanisms such as SN<sup>1</sup>, SN<sup>2</sup>, Nucleophilic and electrophilic addition and electrophilic aromatic substitution (Elementary treatment only). 5
- (c) Stereochemical aspect of organic molecules, introduction, chirality, chiral and achiral molecules, optical isomerism, enantiomer and distereoisomers w.r.t. lactic acid, tartaric acid. 2-3-dibromopentane, conformational analysis of C<sub>2</sub>H<sub>6</sub>, n-butane and cyclo R. S. and E, Z nomenclature. Meso compounds, resolution of enantiomers, inversion are racemization. 5

## UNIT--II

- (a) Alkanes : nomenclature, preparation. (Hydrogenation of alkene-alkyne reduction of R-X. Wurtz's reaction Hydrolysis of R-Mg-X Wurtz's Decarboxylation of acid. Kolbe's process) and reactions (only halogenation free radical mechanism). 3
- (b) Unsaturated hydrocarbons. Alkenes and Alkynes structure and nomenclature, preparations (dehydration dehalogenation dehydrohalogenation) and reaction (with H<sub>2</sub>X<sub>2</sub>HX) HOCl, H<sub>2</sub>SO<sub>4</sub> and Hydroboration oxidation reactions with KMnO<sub>4</sub> Bayer's test O<sub>3</sub> and polymerisation. In case of alkyne reactions, given by alkenes need not be repeated. Reaction of terminal acetylenes i.e. acetylide formation. Reaction with H<sub>2</sub>SO<sub>4</sub>, Hg<sup>2+</sup>. 4
- (c) Chemistry of halogen compounds : Introduction, classification, structure, nomenclature, preparation, properties and in relations at C<sub>2</sub>H<sub>5</sub>I, C<sub>6</sub>H<sub>5</sub>CH<sub>2</sub>Cl and C<sub>6</sub>H<sub>5</sub>Cl. 3
- (d) Alkyl and Aryl Halides : 4

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides. S<sub>N</sub>2 and S<sub>N</sub>1 reactions with energy profile diagrams. Polyhalogen compounds : chloroform. carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition

mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides Vs. allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

### UNIT-III

- (a) Alcohol phenol and ethers : Structure and nomenclature, properties preparation and reaction CO-H bond and C-O bond fission, oxidation of carbinol and aromatic ring reactions of phenol. Reaction of other Epoxide and polyhydric alcohols (only-nomenclature no detailed study). 4
- (b) Aldehydes and ketones : structure and nomenclature, properties, preparation and reaction of HCHO, CH<sub>3</sub>CHO, C<sub>6</sub>H<sub>5</sub>CHO, CH<sub>3</sub>COCH<sub>3</sub> thalofom reaction addition with HCN, NaHSO<sub>3</sub>, R-Mg-X, H<sub>2</sub>O/ROH. Reaction with Ammonia derivatives (NH<sub>2</sub>-Z) Aldo condensation. Oxidation reduction and polymerisation. 5
- (c) Acids and Acid derivatives : Structure and Nomenclature, Properties preparation and reactions off HCOOH, CH<sub>3</sub>COOH, C<sub>6</sub>H<sub>5</sub>COOR. Formation of acid chloride, amide, ester, anhydride (to be treated in brief). And Nomenclature of dibasic acids and preparations and reactions of oxalic acid. 5

### UNIT-IV

- (a) Lipids : Occurrence and composition of fats. Hydrolysis of fats, soap miceller, fats as sources of pure acids and alcohols. detergents, unsaturated fats, hardening of oils, drying Oils. 4
- (b) Amino acids : Structure, classification, synthesis (Amination, Strecker's methods. Gabriel phthalamide method. Azalacetone method) Zwitter ion, isoelectric point reaction with N in hydriene). 5
- (c) Protein and polypeptides : Peptides synthesis, geometry of peptide linkage. Determination of structure of peptide terminal residue analysis, partial hydrolysis, structure of protein (primary and secondary). 5

### UNIT-V

- f-block elements : Lanthanides and Actinides 14
- (a) Lanthanides : 7  
Electronic structure, oxidation states, magnetic properties, colour and spectra lanthanides contraction. Isolation methods ion-exchange and solvent extraction methods.
- (b) Actinides : 7  
Electronic structure, oxidation states, colour and Absorption spectra of actinide ions : Magnetic properties, actinide contraction. Nuclear synthesis of Transuranium elements, chain reaction, importance of uranium, comparison with lanthanide as per L.D. Lee, 4<sup>th</sup> edn.

### Reference Books

1. 'Organic Chemistry', R. Morrison and R. Boyd 6<sup>th</sup> edn., Prentice Hall, 1992.
2. 'Organic Chemistry', T. W. Graham Solomons and C. B. Fryhle 7<sup>th</sup> edn., John Wiley, 2000.
3. 'Modern Principles of Organic Chemistry', J. L. Kee. and E. N. Marvell, 3<sup>rd</sup> edn.
4. 'Organic Chemistry', P. Y. Bruce, Pearson Education (1<sup>st</sup> Indian Reprint) Delhi, 2002.
5. 'A Text Book of Organic Chemistry', R. K. Bansal, 3<sup>rd</sup> Ed., 2002, New Age International, New Delhi.
6. 'Organic Reactions and their Mechanism', P. S. Kalsi, 2<sup>nd</sup> Ed., 2000, New Age International, New Delhi.
7. 'Concise Inorganic Chemistry', L. D. Lee, 4<sup>th</sup> edn., Chapman and Hall, ELBS, 1991 and 5<sup>th</sup> edn., 1996.
8. 'Inorganic Chemistry' by A. G. Sharp, 3<sup>rd</sup> edn., ELBS, Longman, 1990.
9. 'Inorganic Chemistry', D. F. Shriver and P. W. Atkins, 3<sup>rd</sup> edn., Oxford, 1999.

**F. Y. B.Sc. CHEMISTRY-PRACTICALS****(USE OF ELECTRONIC BALANCE WILL BE PREFER)**

1. (a) Preparation of standard solutions of  $\text{KmnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ ,  $\text{Na}_2\text{S}_2\text{O}_3$ , EDTA. Succinic acid, Oxalic acid,  $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$  and weighing of substance.  
(5 marks. Weight should be checked by examiner )
- (b) Following exercise may be set using above prepared standard solutions : (15 marks)
  1.  $\text{Na}_2\text{C}_2\text{O}_4$ ..... $\text{KmnO}_4$
  2.  $\text{KmnO}_4$ ..... $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  /  $\text{FeSO}_4 (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ .
  3. EDTA- $\text{CaCl}_2$ ,  $\text{MgCl}_2$
  4. Succinic acid..... $\text{NaOH}$  /  $\text{KOH}$ .
  5.  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  /  $\text{FeSO}_4 (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ ..... $\text{K}_2\text{Cr}_2\text{O}_7$ .
  6.  $\text{K}_2\text{Cr}_2\text{O}_7$ ..... $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  /  $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$
  7.  $\text{Na}_2\text{S}_2\text{O}_3$ ..... $\text{I}_2$ .
  8.  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ..... $\text{Na}_2\text{S}_2\text{O}_3$  (Iodomerry).
2. A powder in water or a mineral acid containing not more than one basic and one acidic radical should be given. Both dry and wet texts ( semi-micro method ) should be done : (20 marks)  
Candidates should be form the analysis of atleast 2 compounds of followingion :  
 $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$ ,  $\text{Mg}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Ca}^{+2}$ ,  $\text{Fe}^{+2}$ ,  $\text{Fe}^{+3}$ ,  $\text{Al}^{+3}$ ,  $\text{Cr}^{+3}$ ,  $\text{Zn}^{+2}$ ,  $\text{Mn}^{+2}$ ,  $\text{Mn}^{+3}$ ,  $\text{Co}^{+2}$ ,  $\text{Hg}^{+2}$ ,  $\text{Pb}^{+2}$ ,  $\text{Cu}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Cd}^{+2}$ ,  $\text{As}^{+3}$ ,  $\text{Sb}^{+3}$ ,  $\text{Bi}^{+3}$ ,  $\text{Sn}^{+2}$ ,  $\text{Ag}$  in the form of sulphide, suiphate, carbonate, phosphate, chromate, chloride, bromide, iodide, nitrate and oxide.
3. Candidates are expected to perform the following tests for the Organic Compounds : (20 marks)
  - (a) Nature : acidic, basic, phenolic, neutral based on solubility tests.
  - (b) Element Present : Sodium fusion test. C. H. N. S. X.
  - (c) Boiling Point / Melting Point.
  - (d) Identification of one organic compound from the following (candidate must perform atleast 15 Organic Compounds).
 

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| Acid         | - Acetic acid, oxalic acid, salicylic acid, benzoic acid, succinic acid |
| Phenol       | - Phenol, $\alpha$ -Naphthol, $\beta$ -Naphthol                         |
| Base         | - Aniline, Nitroaniline (any)   |
| Neutral      | - Ethanol, Glycerol   |
| Aldehyde     | - Benzaldehyde  |
| Ketone       | - Acetone, Acetophenone   |
| Amide        | - Urea, Benzamide, Thiourea   |
| Halogen      | - Chloroform, Bromobenzene  |
| Hydrocarbon  | - Naphthalene   |
| Nitrobenzene | - Nitrobenzene, m-dinitro-benzene                                       |
| Ester        | - Methyl ester, Ethyl-ester.  |
4. Five short objective Questions 5
5. For certified Journal 5