

9. Electricity and Magnetism Vol. II ó Berkley Physics Course
10. Electricity and Magnetism ó D.N.Vasudeva
11. Electricity and Magnetism ó Brijlal & Subramaniam
12. Electrodynamics ó S.L.Gupta & R.Singh
13. Electricity & Magnetism ó Reitz & Millford
14. Electricity & Magnetism ó A.S.Mahajan & A.A.Rangawala (TMH)
15. Principle of electricity & Magnetism ó Panofsky & Philips
16. Electricity & Magnetism ó S.S.Atwood
17. Electromagnetic waves & radiating systems ó E.C. Jordan

## 9. CHEMISTRY

### 2S Chemistry

**Total Lectures: 84**

**Marks: 80**

**Note:** Figures to the right hand side indicate number of lectures.

#### Unit I

**14L**

- A] Polarisation-Definition, polarising power, polarizability, effect of polarization on nature of bond. Fajan's rules of polarisation and its applications. **[4]**
- B] Covalent bonding-Directional nature of covalent bond. Hybridisation, types of hybridisation to explain geometries of  $\text{NH}_4^+$  ion,  $\text{PCl}_5$ ,  $\text{SF}_6$  and  $\text{IF}_7$ . **[4]**
- C] **Acids and Bases**-Theory of solvent systems and Lux-Flood concept of acids and bases. Hard and soft acids and bases. Pearson's HSAB or SHAB principle with important applications. **[6]**

#### Unit II

**14L**

- A] **P-Block Elements**-Comparative study of 16<sup>th</sup> and 17<sup>th</sup> group elements with reference to electronic configuration, ionization energy and oxidation states. Oxidising properties of halogens with reference to oxidation potential. Interhalogen compounds, structure and bondings. Introduction to fluorocarbons. **[6]**
- B] **Noble Gases**-Inertness of noble gases. Compounds of noble gases-only structure and bonding in  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$ ,  $\text{XeO}_3$  and  $\text{XeO}_4$ . **[2]**
- C] **Nonaqueous Solvents**-Requirements of a good solvent. Water as an universal solvent. Physical properties of solvents namely liquid range, dielectric constant, dipole moment, heat of vaporisation and solubility behaviour. Classification of solvents. Acid base, precipitation, redox, solvolysis and complexation reactions in liquid ammonia. Merits and demerits of liquid ammonia as a solvent. **[6]**

**[6]**

#### Unit III

**14L**

- A] **Alkyl Halides:** Synthesis of vinyl chloride from acetylene and allyl chloride from propylene, Reactions of both with aqueous and alcoholic KOH, Comparison of reactivity of vinyl and allyl chloride. **[4]**
- B] **Aryl Halides:** Synthesis chlorobenzene from benzene, phenol and benzene diazonium chloride, Synthesis of benzyl chloride from toluene and benzyl alcohol, Reactions of both with aqueous KOH,  $\text{NH}_3$  and sodium ethoxide, Comparison of reactivity of chlorobenzene and benzyl chloride. Benzyne intermediate mechanism. **[4]**
- C] **Alcohols:** Dihydric alcohols: Ethylene glycol- Preparation from ethylene, ethylene chloride and ethylene oxide, Reactions- with Na,  $\text{PCl}_5$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{ZnCl}_2$ , conc.  $\text{H}_2\text{SO}_4$  and dehydration with heat. Trihydric alcohols: Glycerol- Preparation from propylene, Reactions- with Na, HCl,  $\text{PCl}_5$ ,  $\text{HNO}_3$  and  $\text{KHSO}_4$ . Pinacol- pinacolone rearrangement (mechanism). **[6]**

#### Unit IV

**14L**

- A] **Phenols:** Methods of formations a) from aniline b) from cumene. Acidic character, Reaction of Phenols- a) Carboxylation (Kolb's reaction), b) Fries Rearrangement, c) Claisen Rearrangement and d) Reimer ó Tiemann reaction. **[6]**
- B] **Ethers:** Diethyl ether- Preparation by Williamson's synthesis and continuous etherification process, Reactions-with cold and hot HI. **[4]**
- C] **Epoxides:** Synthesis of ethylene oxide from ethylene and styrene oxide from styrene. Ring opening reactions of both catalysed by acid and alkali. **[4]**

#### Unit V - Physical Properties and Molecular Structure

**14L**

##### A] **Electrical Properties:**

- (i) Polar and non-polar molecules. Dipole moment.
- (ii) Induced polarization and orientation polarization. Clausius-Mossotti equation (only qualitative treatment).
- (iii) Measurement of dipole moment by temperature and refractivity methods.
- (iv) Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene. **[7]**

**B] Magnetic Properties:**

- (i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism.
- (ii) Volume, specific, mass and molar susceptibility. Relationship between molar magnetic susceptibility and magnetic moment.
- (iii) Relationship between magnetic moment and number of unpaired electrons.
- (iv) Gouy's balance method for determination of magnetic susceptibility.
- (v) Application of magnetic moment in the determination of molecular structure.
- (vi) Numericals. [7]

**Unit VI - Chemical Kinetics****14L**

Explanation of terms like rate of reaction, order of a reaction and molecularity. Definition with one example of zero, first and second order reaction. Half life period of a reaction.

Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction. Examples of first and second order reaction and their kinetics study with modified rate equation viz. the reactions (i) decomposition of  $\text{H}_2\text{O}_2$ , (ii) reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI, (iii) hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of canesugar.

Determination of order of a reaction by integration, graphical, equifractional change, vant Hoff's differential method and Ostwald's isolation method. Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numericals. [14]

**Semester II****2S Chemistry Practicals****Total Laboratory Sessions: 26****Marks: 50****Exercise I: Organic Qualitative Analysis****16 Laboratory Sessions**

Complete analysis of simple organic compounds containing one or two functional groups and involving following steps:

- 1) Preliminary examinations
- 2) Detection of the elements

- 3) Detection of functional groups
- 4) Determination of m.p./ b.p.
- 5) Preparation of derivative and its m.p./ b.p.
- 6) Performance of spot test if any.
- 1) Acids : Oxalic acid, Benzoic acid, Salicylic acid, Phthalic acid.
- 2) Phenols : Resorcinol,  $\alpha$ -naphthol,  $\beta$ -naphthol.
- 3) Aldehydes : Benzaldehyde, Glucose.
- 4) Bases : Aniline, *p*-Toluidine
- 5) Nitro compounds: *m*-Dinitrobenzene.
- 6) Amides : Benzamide, Urea, Acetamide.
- 7) Hydrocarbons: Naphthalene, Anthracene.
- 8) Halogen compounds : Chloroform, Chlorobenzene.

**Exercise II: Physical Chemistry Experiments****10 Laboratory Sessions**

- 1) To determine surface tension of a given unknown liquid by Stalagmometer (Density measurement is must).
- 2) To determine coefficient of viscosity of unknown liquid by Ostwald's viscometer (Density measurement is must).
- 3) To compare cleaning power of detergent samples by Stalagmometer.
- 4) To determine parachor value of  $-\text{CH}_2-$  group by Stalagmometer.
- 5) To determine unknown percentage composition of given ethanol-water mixture by viscometer.
- 6) To determine activation energy of a reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI.
- 7) To determine heat of solution of  $\text{KNO}_3$ .

**Distribution of Marks for Practical Examination**

Time: 6 hours (One Day Examination)				Marks: 50
Exercise-I	í	í	í ..	18
Exercise-II	í	í	í ..	18
Viva-Voce	.í	í	í .	07
Record	.í	í	í .	07
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				Total: 50

**Books Recommended:**

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
2. Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.

4. Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J.D. Lee, ELBS.
7. Inorganic Chemistry by J.E. Huheey- Harper & Row.
8. Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
10. Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.
11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic complex compounds by Murmann, Chapman & Hall.
13. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut.
15. Co-ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorganic Chemistry by Marathe, Bhadange, Mopari and Kubade.
17. Organic Chemistry by R.T. Morrison & R.T. Boyd, 6<sup>th</sup> edition, PHI.
18. Organic Chemistry by Pine, 5<sup>th</sup> edition.
19. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor-Wiley Eastern.
20. Organic Chemistry by S.K. Ghosh.
21. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
22. Spectroscopy of Organic Compounds by P.S. Kalsi.
23. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
24. Organic Chemistry by TWG Solomons, 4<sup>th</sup> edition, John Wiley.
25. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
26. Text book of Practical Organic Chemistry by A. I. Vogel.
27. Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahajan, Toshniwal.
28. Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
29. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.

30. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
31. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
32. Physical Chemistry: Walter, J. Moore, 5<sup>th</sup> edn., New Delhi.
33. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
34. Principles of Physical Chemistry: Maron and Prutton.
35. Principles of Physical Chemistry: Puri and Sharma.
36. Physical Chemistry: P.W. Atkins, 4<sup>th</sup> Edn.
37. Text book of Physical Chemistry: P.L. Sony O.R. Dhurma.
38. Physical Chemistry: Levine.
39. Practical Physical Chemistry: Palit and De.
40. Practical Physical Chemistry: Yadao.
41. Practical Physical Chemistry: Khosla.
42. Laboratory Manual of Physical Chemistry: W.J. Popiel.
43. Practical Chemistry: Dr. S.B. Lohiya, Bajaj publ., Amravati.
44. Text book of Physical Chemistry: Satpute, Kabra, Raghuwanshi, Wankhade, Jumle and Murarka.
45. Text book of Chemistry, B.Sc.-I, Second Semester, Bokey Prakashan, Amravati

#### LIST OF EQUIPMENTS / APPARATUS REQUIRED FOR THE CHEMISTRY PRACTICALS FOR B.Sc.

1. Abbe's Refractometer	02 nos./batch
2. Viscometer	10 nos./batch
3. Stalagmometer	10 nos./batch
4. Melting Point Apparatus	10 nos./batch
5. Thermometer 0-360°C	20 nos./batch
6. Thermometer 0-110°C	20 nos./batch
7. Analytical balance	15 nos./batch
8. Weight box	15 nos./batch
9. Density Bottles	20 nos./batch
10. Kipp's Apparatus	02 nos./batch
11. Quick fit Distillation Assembly/ Multipurpose assembly	10 nos./batch
12. Sintered Glass Crucible	20 nos./batch
13. Silica Crucible	20 nos./batch
14. Vacuum Suction Pump	02 nos./Lab.