

# Shri Pundlik Maharaj Mahavidyalaya Nandura Dist Buldana

---

Affiliated Sant Gadge Baba Amravati University Amravati.

## Department of Chemistry

### **B.Sc.-II Year, Semester-IV**

#### **4S Chemistry**

***Total Lectures: 84 Marks: 80***

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

#### **Unit I**

**14L**

**A] Chemistry of elements of transition series:** Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration (ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour. Study of 4d and 5d series elements-Electronic configuration. Comparison of 3d series elements with 4d and 5d series elements with respect to size, oxidation states, magnetic properties and color.

#### **B] Extraction of elements:**

Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram (only preliminary ideas).

#### **Unit II**

**14L**

#### **A] Inner transition elements:**

Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties : (i) Electronic configuration (ii) Atomic and ionic radii lanthanide contraction definition, cause and effect of lanthanide contraction (iii) Oxidation states (iv) Magnetic properties (v) Color of salts (vi) Complex formation behavior. Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides.

#### **B] General Principles of Metallurgy:**

# Shri Pundlik Maharaj Mahavidyalaya Nandura Dist Buldana

---

Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froth floatation and electromagnetic separation. Calcination, roasting, smelting and refining of metals. Meaning of terms hydrometallurgy and pyrometallurgy.

## Unit III

14L

### A] Polynuclear hydrocarbons:

Naphthalene - Haworth synthesis, orbital picture, Reactions\ – electrophilic substitution (orientation) Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols.

### B] Reactive methylene compounds:

Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid, succinic acid, glutaric acid, crotonic acid and malonyl urea. Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil.

### C] Carbohydrates:

Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of glucose to fructose and vice-versa, Introduction to fructose, ribose, 2-deoxyribose, maltose, sucrose. (their structures only determination not needed).

### A] Aromatic nitro compounds:

Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium.

### B] Amino Compounds:

Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides,  $\text{Br}_2(\text{aq})$  and  $\text{Br}_2(\text{CS}_2)$ , Carbylamine reaction, alkylation, Hoffmann's exhaustive methylation and its mechanism.

### C] Diazonium Salts:

# Shri Pundlik Maharaj Mahavidyalaya Nandura Dist Buldana

---

Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene, phenol, halobenzene, nitrobenzene, benzonitrile, coupling with phenol and aniline.

## D] Amino acids and Proteins:

Classification, Strecker and Gabriel phthalimide synthesis, Zwitterion structure, Isoelectric point, peptide synthesis, Structure determination of polypeptides by end group analysis.

## Unit V - Colligative Properties of Dilute Solutions:

14L

(i) Definition and examples of colligative properties. (ii) Elevation of boiling point, thermodynamic derivation of the relationship between elevation of boiling point and molar mass of a non-volatile solute. Cottrell's method for determination of elevation of boiling point. (iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute. Rast's method for determination of depression of freezing point. (iv) Abnormal behavior of solution. Van't Hoff's factor 'i'. Determination of degree of association and dissociation from Van't Hoff's factor. (v) Numericals.

## Unit VI- Crystalline state

14L

Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles. Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes, calculation of interplanar distance  $d(h,k,l)$  from Miller indices in a cubic system. Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.). Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C. Ratio of interplanar distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C. (No geometrical derivation). Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl. Anomalous behaviour of KCl towards X-ray. Numericals.

# Shri Pundlik Maharaj Mahavidyalaya Nandura Dist Buldana

---

## Semester- IV 4S Chemistry Practicals Total Laboratory sessions: 26 Marks: 50

### Exercise I: Inorganic estimations 14 Laboratory sessions

- 1) Chromatographic separation of binary mixture containing Cu(II), Co(II) and Ni(II) ions by paper chromatography and determination of  $R_f$  values.
- 2) Estimation of Zn(II) by complexometric titration.
- 3) To determine the strength of unknown calcium salt solution by complexometric titration.
- 4) Estimation of hardness of water by complexometric titration.
- 5) Colorimetric or spectrophotometric estimation of Cu(II) in commercial copper sulphate sample as ammonia complex.
- 6) To determine concentration of unknown  $\text{KMnO}_4$  solution from standard solutions of  $\text{KMnO}_4$  by colorimetrically or spectrophotometrically.

### Exercise II: Organic Chemistry Practicals 12 Laboratory Sessions

1. Isolation of casein from milk.
2. Isolation of nicotine from tobacco leaves.
3. Isolation of caffeine from tea leaves.
4. Isolation of lycopene from tomato juice.
5. Estimation of glucose.
6. Estimation of acetamide.
7. Determination of equivalent weight of an organic acid.

### Distribution of Marks for Practical Examination

Time: 6 hours (One Day Examination)

Marks: 50

Exercise-I ..... 18

Exercise-II ..... 18

Viva-Voce ..... 07

Record -..... 07

Total: 50

### 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 0-360oC 20 nos./batch   | 6. Thermometer 0-110oC 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/<br>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.  |
| 15. Potentiometer 02 nos./batch  | 16. Metzer Electronic one pan balance 01 nos./lab.                              |
| 17. Filtration flask with Buckner Funnels 100ml 10 nos./batch 250ml 05 nos./batch<br>500ml 02 nos./batch | 18. Desiccators 10 nos./batch   |
| 19. Magnetic Stirrer 10 nos./batch   | 20. Water Suction 10 nos./batch   |
| 21. Conductometer with Conductivity Cell 04 nos./batch   |   |
| 22. Colorimeter 02 nos./batch  | 23. pH Meter 02 nos./batch  |
| 24. Chromatographic Jar 05 nos./batch  | 25. Separating funnels 250ml, 500ml 05 nos./batch                               |
| 26. Hot Air Oven 02 nos./lab.  | 27. Hot-Cold Air Blower 01 no./lab.   |
| 28. Centrifuge machine (Electrically Operated) 02 nos./lab.  |   |
| 29. Deioniser/ Water Still (Electrically Operated) 01 no./lab.   |   |
| 30. Hot Plate/ Heating Mantle 05 nos./batch  | 31. Models of Elements (Seven Crystal types and<br>their symmetry) 01 no./batch |
| 32. Flame Photometer 02 nos./batch   | 33. Spectrophotometer 02 nos./batch   |
| 34. Shaking Machine 01 no./batch   | 35. Polarimeter 02 nos./batch   |

### Reference Book

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S.

## Shri Pundlik Maharaj Mahavidyalaya Nandura Dist Buldana

---

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 Nema, Agrawal, Solanki, Morkhade, Meshram, Berad.

17. Text book of Inorganic Chemistry by Bhadange, Pagariya, Deshmukh, Joshi, Bombatkar, Mandlik, Bokey Prakashan, Amravati.

18. Organic Chemistry by R.T. Morrison & R.T. Boyd, 6th edition, PHI.

19. Organic Chemistry by Pine, 5th edition.

20. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and

## Shri Pundlik Maharaj Mahavidyalaya Nandura Dist Buldana

---

Kapoor- Wiley Eastern.

21. Organic Chemistry by S.K. Ghosh.
22. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
23. Spectroscopy of Organic Compounds by P.S. Kalsi.
24. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
25. Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
26. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
27. Text book of Practical Organic Chemistry by A. I. Vogel.
28. Text book of Organic Chemistry by Wadodkar, Raut, Dighade, Thakre, Kale, Kadu, Chincholkar.
29. Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
30. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
31. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
32. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
33. Text book of Organic Chemistry by Deshmukh, Awinashe, Tayade, Wadekar, Meshram, Parhate, Bokey Prakashan, Amravati.
34. Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
35. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
36. Principles of Physical Chemistry: Maron and Prutton.
37. Principles of Physical Chemistry: Puri, Sharma and Pathaniya.
38. Physical Chemistry: P.W. Atkins, 4th Edn.
39. Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.
40. Physical Chemistry: Levine.

## Shri Pundlik Maharaj Mahavidyalaya Nandura Dist Buldana

---

41. Practical Physical Chemistry: Palit and De.
42. Practical Physical Chemistry: Yadao.
43. Practical Physical Chemistry: Khosla.
44. Laboratory Mannual of Physical Chemistry: W.J. Popiel.
45. Practical Chemistry: Dr. S.B. Lohiya, Bajaj publication, Amravati.
46. Text book of Physical Chemistry: Satpute, Kabra, Raghuwanshi, Wankhade, Jumle and Murarka.
47. Text book of Chemistry, B.Sc.-II, Third Semester & Fourth Semester, Nabh Prakashan