Shri Shivaji Education Society Amravati's

Shri Pundlik Maharaj Mahaviydalaya Nandura, Dist- Buldana

Affilated Sant Gadge Baba Amravati University Amravati

Department of Chemistry

Class:- B.Sc-I, Semester 1

Code of the Course/Subject:-Chemistry (CHE) Theory, (Total Number of Periods): 84

Course Outputs:

By the end of this course, the students would be able to:

1. Solve the conceptual questions using the knowledge gained by studying periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.
2. Apply concepts of acids and bases as well as non-aqueous solvents and their industrial usage.
3. Compare different reaction intermediates, functional group chemistry through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
4. Choose correct synthetic approach to prepare derivatives of industrially important molecules
5. Solve different numerical problem of varying difficulty associated with gaseous and liquid state.
6. Apply the concepts from advanced mathematics to solve the derivation of different chemical formulae.

Theory Syllabus

Unit	Content
Unit I	**Periodicity of Elements:** **Periods: 14** s and p block elements: Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle. Shapes of s and p orbitals. Electronic configuration for s and p block elements. Detailed discussion of the following properties of the elements, with reference to s and p-block. (a) Nuclear charge and number of shell and its variations (b) Atomic and ionic radii and their variations (d) oxidation states (e) Ionization potential, Successive ionization potential and its variations. (f) Electron affinity and its trends. (g) Electronegativity and its variations. Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties. Diagonal relationships: Li with Mg, B with Al. Abnormal behavior of nitrogen.

Unit II	**A) Acids and Bases-** **Periods: 14** Arrhenius, Bronsted-Lowry, and Lewis's theory of 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. **B) Nonaqueous Solvents**-Requirements of a good solvent. Water as a universal solvent. Physical properties of solvents namely liquid range, dielectric constant, dipole moment, heat of vaporization and solubility behavior. Classification of solvents. Acid base, precipitation, redox, solvolysis and complexation reactions in liquid ammonia. Merits and demerits of liquid ammonia as a solvent.
Unit III	**Basics of Organic Chemistry:** **Periods: 14** **A) Electronic Displacement and Reactive Intermediates:** Inductive, Electromeric, Resonance, Mesomeric effects, Hyperconjugation and their applications, dipole moment, homolytic and heterolytic fission with suitable examples. Electrophiles and nucleophiles. Types, shape and their relative stability of carbocations, carbanions, free radicals and carbenes and nitrene. **B) Aliphatic Hydrocarbons:** Formation and reaction of alkanes, Formation of alkenes and alkynes by elimination reactions (with mechanism of E1, E2, E1cb), Saytzeff andHofmann eliminations, Reactions of alkenes and alkynes, Diels-Alder reaction. **C) Structural isomers:** Definition, classification, and examples.
Unit IV	**Aromatic Compounds:** **Periods: 14** **A)Structural Properties:** Aromaticity and Huckel's rule (Benzenoid and Non-Benzenoid compounds), Kekule and Dewar structures, Molecular orbital diagram ofbenzene, Anti-aromatic and non-aromatic compounds. **B)Orientation effect:** Effect of substituent groups, Activating and deactivating group,Theory of reactivity and orientation on the basis of inductive and resonance effects. **C)Electrophilic aromatic substitution:** Halogenation, nitration, sulphonation andFriedal Craft's alkylation/acylation with their mechanism.
Unit V	**Gaseous State:** **Periods: 14** Postulates of kinetic theory of gases, Maxwell-Boltzmann distribution of velocities (only qualitative treatment), RMS velocity, Average velocity, Most probable velocity, Relationship between RMS velocity and Average velocity, RMS velocity and Most probable velocity, Mean free path, Collision diameter, Collision number or Collision frequency, Deviation of real gases from ideal behaviour, Explanation of deviations, Derivation of van der Waal's equation for real gases. Critical phenomenon, Andrew's experiment (isotherms of carbon dioxide)

	Critical constant Pc, Tc, Vc in terms of van der Waal's constant (a, b) Derivation of reduced equation of state, Law of corresponding state, Numerical.
Unit VI	**A)Liquid State: Periods: 14** Definition of surface tension, Its SI unit and effect of temperature on surface tension,Derivation of expression for relative surface tension by stalagmometer method. Applications of surface tension. Viscosity, definition of coefficient of viscosity, Its SIunit and effect of temperature on viscosity, Derivation of expression for relativeviscosity by Ostwald's viscometer method, Applications of viscosity. **B)Physical Properties and Molecular Structure:** **I.Electrical Properties:** (i)Polar and non-polar molecules. Dipole moment. (ii)Induced polarization and orientation polarization. Clausius Mossotti equation (onlyqualitative treatment). (iii)Measurement of dipole moment by temperature and refractitivity 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. **II.Magnetic Properties:** (i)Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism,ferromagnetism and antiferromagnetism. (ii)Volume, specific, mass and molar susceptibility. Relationship between molarmagnetic 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)Numerical
***SEM:**	**A)**Create models for periodic table or periodic properties, or shape of orbitals, categorization ofacids and bases on the basis of various theories, Compare applications of non-aqueous solvents. **B)** Analyze the role of reaction intermediates in different organic reactions, classification of aromatic and non-aromatic compounds with justification. **C)** Numerical associated with gaseous and liquid state, Applications of van der Waal's equation for other gaseous constants and parameters, Prediction of molecular structures using physical properties, Data collection and analysis for surface tension and viscosity coefficient of different liquids.
COs:	By the end of this module, the students will be able to: 1. Create models associated with periodic table 2. Associate reaction intermediates and functional group chemistry with different types of reaction mechanisms. 3. Solve numerical problem associated with gaseous and liquid state.

Activities:	Model creation, Chart preparation, memory maps, Class tests, assignments, project, survey, group discussion, industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.

List of Practical/Laboratory Experiments
(Organic & Physical)
(No. of Periods/Week):- Total 26 per Semester
Code of the Course/Subject:- CHE (PR) (Chemistry Practical)

Course Outcomes

At the end of Lab/Practical course, students would be able to

- Synthesise different types of organic compounds.
- Perform the process of filtration, crystallization, melting point, waste management.
- Understand the effect of orientation effect of a group
- Skilfully determine the surface tension, viscosity of liquid.
- Predict the endothermic or exothermic process from heat of solution of a salt.

1. Preparation of Acetyl derivative of aromatic primary amine (aniline or toluidine).
2. Preparation of Benzanilide (Benzoylation).
3. Preparation of Benzoic acid from Benzamide (Hydrolysis).
4. Preparation of Benzoic acid from benzaldehyde (Oxidation).
5. Preparation of phenyl–azo–β–naphthol dye (Diazotisation)
6. Base catalysed Aldol Condensation (Synthesis of dibanzal propanone).
7. Preparation of p-nitroacetanilide from acetanilide.
8. Determination of surface tension of a given liquid using Stalagmometer
9. Determination of the parachor value of -CH2- group (methylene) using Stalagmometer
10. Determination of coefficient of viscosity of aqueous solution of ethanol or polymer at room temperature
11. Determination of unknown percentage composition of given glycerol solution from standard 2%, 4%,6%,8% and 10% solutions of glycerol
12. Determination of the heat of solution of KNO3 (5% solution)

Note:

a) Student should perform the single stage preparation with the help of given procedure.

b) Melting point and percentage yield should be reported.

c) The sample should be submitted.

d) Students should recrystalize the sample with suitable solvent.

e) Students should know the reaction and its mechanism of given single stage preparation.

Distribution of Marks for Practical Examination

Time: 4 hours (One Day Examination) **Marks: 50**

Exercise-I …….. 18

Exercise-II ……..18

Viva-Voce ……. 07

Record ……...07

Total: 50

Course Material/Learning Resources

Text books:

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- Vishal Publications, Delhi.
2. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
3. A Text Book of Chemistry for first Semester of B.Sc. by AUCTA Association and DnyanPath Publication, Amravati

Reference Books:

1. Inorganic Chemistry by A.K. De, Wiley East Ltd.
2. Inorganic Chemistry by Meisler and Tarr, 4th Edition, Pearson Pub.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan, S. Chand & Co.
4. Concise Inorganic Chemistry by J.D. Lee, ELBS.
5. Inorganic Chemistry by J.E. Huheey- and Kettle, Harper & Row.
6. Advanced Inorganic Chemistry, Vol-I, Satya Prakash, Madan, Tuli, Basu.
7. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
8. Organic Chemistry by S.K. Ghosh.
9. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
10. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
11. Organic Chemistry by TWG Solomons, 8th edition, John Wiley
12. Organic chemistry by R. K. Bansal
13. Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
14. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
15. Principles of Physical Chemistry: Maron and Prutton.
16. Principles of Physical Chemistry: Puri, Sharma, and Pathania.

17. Physical Chemistry: P.W. Atkins, 6th Edn.
18. Physical Chemistry: Levine
19. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
20. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
21. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman. 6
22. Practical Physical Chemistry: Palit and De.
23. Practical Physical Chemistry: Yadao.
24. Practical Physical Chemistry: Khosla.
25. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.

Weblink to Equivalent MOOC on SWAYAM if relevant:
Weblink to Equivalent Virtual Lab if relevant:
Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

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