Tolani College of Arts and Science, Adipur

Managed by: Gandhidham Collegiate Board, Adipur

Affiliated to: KSKV Kachchh University, Bhuj

Detailed Syllabus for Lab Assistant (Specific Subject: Chemistry)

1. **Fundamentals of Organic Reactions**: Fission of covalent bond, types of reagents, Substitution Nucleophilic Unimolecular reaction mechanism (SN1), Substitution Nucleophilic Bimolecular reaction mechanism (SN2), Electrophilic Aromatic Substitution –Elementary treatment only (Nitration, Sulfonation, Halogenation & Friedel-Crafts Alkylation and Acylation).
2. **Alkanes:** (Saturated Hydrocarbons): Introduction, IUPAC nomenclature, Reduction of R-X, Woortz's reaction, Hydrolysis of R-Mg-X, Decarboxylation of acid, Kolbe's electrolytic process, Free radical mechanism (Chlorination of Methane).
3. **Alkenes & Alkynes:** (Unsaturated Hydrocarbons) Introduction, IUPAC nomenclature, Preparations (dehydration, dehalogenation, dehydro halogenation), Reactions with H2, X2, HX, HOCl, H2SO4, and Hydroboration; Oxidation reactions: (i) with cold alkaline KMnO4 (Bayer's reagent), (ii) Oxidative cleavage with acidified or hot KMnO4, (iii) Ozonolysis(O3); Polymerization; Reactions of terminal Acetylenes: (i) Addition of water, (ii) Na / liquid NH3.
4. **Thermodynamics:** Zeroth law, first law, Second law of thermodynamics; proof of 2nd law (Carnot's Cycle); Entropy of Gas and calculation of entropy for different processes; Kirchhoff's equation.
5. **Analytical Techniques:** Introduction, Types of analysis – Physical, Chemical and instrumentation. Physical analysis – Specific gravity, Melting point, Boiling point, Crystallization, Purification of compounds etc. Chemical analysis – Quantitative and Qualitative analysis of organic and inorganic compounds, Instrumental analysis – Spectroscopic, Chromatographic PH measurement, Conductivity, Turbidity etc.
6. **Atomic structure:** Fundamental particles, Rutherford Model of an atom, Nature of electromagnetic radiation, emission spectrum of hydrogen atom, concept of energy levels (orbits). Drawbacks (weaknesses) of Bohr's model, modern concept of structure of atom (elementary idea only) concept of orbits and orbitals, main four quantum numbers, electronic configuration of elements, Aufbau Principle, Pauli's principle, Hund's rule.
7. **Classification of elements and periodicity in properties:** The need of classification of elements, the significance of (i) Mendeleev's periodic law (ii) Atomic number and periodic law, present (modern) form of the periodic table. The IUPAC nomenclature for the elements with Z >100, electronic configuration of the elements and periodic table. Types of elements: s, p, d and f

block elements, periodic trends in properties; Ionization energy, electron affinity, atomic radii, valency.

8. **Actinides:** Electron configuration, Oxidation states, Magnetic properties, Color and absorption spectra of actinide ions, actinide contraction, Nuclear synthesis of trans uranic elements, Chain reaction, importance of Uranium, Comparison with lanthanide.
9. **Organic compounds with functional group containing nitrogen:** Nitro compounds: Electronic structure of nitro group, nomenclature, important method of preparation, physical properties and chemical reactions, Amine compounds: Electronic structure of primary, secondary and tertiary amine group, nomenclature, important method of preparation, physical properties, basic character of amine, chemical reactions; separation of primary, secondary and tertiary amines. Diazonium salt Preparation and chemical reactions of benzene diazonium chloride, importance of diazonium salt in synthetic organic chemistry.
10. **Fundamental of Forensic Science & Basic Principles and significance of Forensic Science.**
11. **Nature and Scope of Biochemistry**: What is biochemistry, development of biochemistry, what is biochemical approach, scope of biochemistry, applications of biochemistry, Biochemical literature.
12. **Carbohydrates:** classification, monosaccharide, structures of pentose and hexose's, anomeric carbon, mutarotation, simple chemical reactions of glucose, **Disaccharides**: reducing and non-reducing sugars-sucrose, maltose and lactose, polysaccharides: elementary idea of structures of starch and cellulose.
13. **Metals, Alloys and Corrosion:** Introduction, Physical properties of metals, Definition and purpose of alloy, Classification of alloys. Alloys Steel and its applications. Non-Ferrous alloys and its industrial applications. Introduction to Corrosion, Theories of corrosion, Protection of metals from corrosion – organic and inorganic materials, Inhibitors, Cathodic protection.
14. **Cements:** Introduction, Classification of cement and properties, chemical composition of cement, Standards, Manufacturing of Portland cement, chemical constituents of Portland cement, Setting and hardening of cement, PCC & RCC.
15. **Polymers:** Classification of polymers, General method of polymerization, addition and condensation, free radical, cationic and anionic polymerization, copolymerization, natural rubber, vulcanization of rubber, synthetic rubbers, (examples of monomer only) condensation polymer, molecular mass of polymers (high lightening level of complexity only), Bio polymers, and biodegradable polymers, some industrially important polymers.
16. **Basics of drugs and formulation analysis:** Weights, balances, importance of analysis, quality control and quality assurance, analytical methods (classification, validation parameters), requirements – chemicals (types, purification, checking purity), glass wares (types, calibration, cleaning), sampling techniques, sampling error minimization. Units of concentrations, Errors science, errors minimization.

17. Volumetric analysis (Titrimetric analysis):

- **Acid-base titrations**: Relative strength and its effect on titration, common ion effect, pH, Henderson Hesselbach equation, buffers, neutralization curve, acid base indicators, theory of indicators, back titrations, biphasic titrations, pharmacopoeial applications, hydrolysis of salts, ionic products of water and law of mass action.
- **Redox titrations:** Theory of redox titrations, redox indicators, types of redox titrations, iodometry, cerrimetry, mercury metry, diazotization, nitrite titrations, 2, 6-dichlorophenol indophenol titrations, titration curve and calculations of potentials during course of titrations.
- **Argentometric or precipitation titrations:** Mohrs, Fajans and Volhard methods.
- **Non-aqueous titrations:** Non-aqueous solvents, titrants and indicators, Differentiating and leveling solvents.
- **Complexometric titrations:** Theory of the titrations, titrant, indicators and pharmacopoeial applications.
- **Miscellaneous titrations:** Karl-Fischer titrations, Kjeldahl method.

18. Gravimetric analysis: Stability, solubility products, types of precipitations, precipitation techniques, pharmacopoeial applications.

19. Current Trends and Recent Advancements in the Above Fields.