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વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
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તા.૨૬-૦૯-૨૦૨૫નાં No.: GAD/NT/GIA/Emp. Notice/25862/2025 લેબોરેટરી

આસિસ્ટન્ટ (રસાયણશાસ્ત્ર) સંવર્ગની સ્પર્ધાત્મક પરીક્ષા સંદર્ભે Detailed અભ્યાસક્રમની અગત્યની સૂચના

લેબોરેટરી આસિસ્ટન્ટ (રસાયણશાસ્ત્ર) માટે સંબંધિત વિષય અને તેની ઉપયોગીતા અંગેના પ્રશ્નનો:

PART: B **TOTAL MARKS:120**

No	Topics	Marks
1.	**Alkanes and Cycloalkanes** **IUPAC nomenclature of branched, unbranched and cycloalkanes having functional groups: -OH, -O-, -CHO, >C=O, -COOR, -COOH, -CONH2, -NO2, -X, NH2, Classification, Isomerism, methods of formation, Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids. Physical properties and chemical reactions of alkanes, Free radical halogenations of alkanes, Baeyer's strain theory and its limitations, Ring strain in small rings (Cyclopropane and cyclobutane), Theory of strainless ring.**	**5**
2	**Alkenes, and alkynes:** **Nomenclature, method of preparation, Markovnikov and Saytzeff rules, polymerization of ethylene, styrene and vinyl chloride, Hydroboration, Oxidation, Epoxidation, Ozonolysis, Oxymercuration, Hydroxylation, Hydrohalogenation, Dehydrohalogenation, Hydration, 1,2 and 1,4 additions, Diel's Alder reaction. Metal ammonia reduction, electrophilic and nucleophilic addition reactions of acetylene.**	**5**
3	**Amines:** **Electronic structure of nitro and amino group, preparation of primary, secondary and tertiary amine, and their chemical reactions, diazotization, and their chemical reactions and importance in organic synthesis.**	**5**
4	**Reaction mechanism:** **Homolytic and Heterolytic fission, free radicals, carbonium ions, carbanions, carbenes, arynes and nitrenes. Types of reagents: electrophiles, nucleophiles. Eletromeric, inductive, conjugative effect. (d) Types of reactions: Addition, rearrangements. Substitution nucleophilic reaction (SN^1 & SN2), elimination reaction (E1, E2, a & β), Stereochemistry of elimination reactions, Elimination v/s substitution, Mechanism of substitution in benzene Ring, nitration, sulfonation, halogenation.**	**5**
5	**(A) Name Reaction:** **Reaction mechanism and applications of the following reactions:** **(1) Friedel-Craft reaction (2) Aldol condensation** **(3) Dickmann reaction (4) Michael reaction (5) Wolf-Kishner reduction (6) Mannich Reaction (7) Reimer-Tiemann reaction** **(8) Wittig reaction (9) Perkin reaction (10)Benzoin Condensation (11) Cannizaro's reaction.** **(B) Molecular Rearrangement:**	**5**

	(1) Wagner-Meerwein (2) Pinocol-Pinacolone **(3) Hoffmann, Curtius, and Beckmann rearrangements.**	
6	**Stereocchemistry:** **(a) Isomerism:- Optical activity, Chiral and Achiral molecules, (b) Optical isomerism of tartaric acid, Enantiomers, diastereomers (Threo&Erythro), Meso compounds, Resolution of Racemates, inversion, retention and racemisation. (c) Geometrical Isomerism: Alkene derivative & oximes E & Z system of nomenclature. (d) Relative and absolute configuration, sequence rules. D & L and R & S system of nomenclature.**	**5**
7	**Aromaticity:** **Introduction to Aromaticity, Huckel's Rule, Aromatic Character of Arenes, Definition & Examples of Aromatic, Non-Aromatic, Anti-Aromatic Compounds (Benzenoids and Non-Benzenoids).**	**5**
8	**Drugs:** **Explanation of the following terms: Agonist, Antagonist, Receptors, Pharmacophore, CNS depressants, CNS stimulants, Mode of action, analgesics, antibiotics, antiviral, anti-cancer, NSAIDs, antipyretic. \ Synthetic Dyes:** **Definition and difference between dyes and pigments, classification of dyes, Witt's theory, Uses of Crystal violet, Indigo, Alizarine, Phenolphthalein, Tetrazine, Acriflavine, Malachite green, eriochrome black-T**	**5**
9	**Polymers:** **Synthetic Polymer-Basic concepts, Degree of polymerization, Classification, polymerization methods. Mechanism of Addition or chain growth polymerization, free radical vinyl polymerization and lonic vinyl polymerization, Ziegler-Natta Polymerization and Vinyl polymers, Condensation or step growth Polymerization, Polyesters, Polyamides, Biodegradable polymers**	**5**
10	**(A) Green Chemistry:** **Basic introduction of green chemistry, Definition of green chemistry, Importance and goals of green chemistry, Green solvents. The twelve principles of Green Chemistry, Green methodologies-Microwave, ultrasound, supercritical fluid, ionic liquids and grinding.** **(B) Environmental Pollution** **Classification, causes and effects of: Air Pollution, Water pollution, Soil pollution, Noise pollution, Radiation Pollution. Climate Change and Global Warming, Acid Rain, Ozone Layer depletion; Water quality parameters and standards; pH, suspended solids, Hardness of water, measurement of TDS; Effect of pollution on living systems.**	**5**
11	**Acid-Base Concept:** **Arrhenius theory, Lowry Bronsted theory, Lewis theory, Solvent - Solute concept of acid-base, Soft-Hard acid-base and its application, common ion effect**	**5**
12	**Atomic Structure** **Historical perspective of atomic structure; Rutherford's atomic model, Bohr's theory and its limitation, Spectrum of Hydrogen atom (Lyman, Balmer, Paschen, Brackett & Pfund), Quantum numbers, Aufbau, Hund and Pauli exclusion principles, Penetration and shielding, Effective nuclear charge (Slater rule)**	**5**
13	**Chemical Bonding** **Definition of chemical bonds (covalent, co-ordinate covalent, ionic, metallic, H-bond, Wan der walls forces of attraction), Polarisability (Fajan's rule), Molecular Orbital theory; LCAO method, Bonding molecular orbital, non-bonding molecular orbital, anti-bonding molecular orbital, bond order, magnetic properties and molecular orbital energy level diagram of hetero diatomic**	**5**

	molecule: CO and NO, VSEPR theory. Theory of hydrogen bonding, classification, and importance of hydrogen bonding in ice.	
14	**Periodic properties-I** **Definition of atomic and ionic radii, ionisation energy, electron affinity and electron negativity, types of elements-s, p, d, f blocks, L-S coupling, J-J coupling. Term symbol, Determination of microstate of system, Term symbol, IUPAC nomenclature of elements Z>100**	**5**
15	**Periodic properties-11** **(A) s-Block elements: Comparative study, diagonal relationship, salient features of hydrides.** **(B) d-block elements: Characteristics, properties of the elements of the first transition series and their oxidation states.** **(C) Lanthanide and Actinide Elements: Electronic configuration, oxidation state and magnetic properties, Lanthanide contraction, Use of Lanthanide compounds. Industrial use of Uranium and Plutonium, Mitch metal**	**5**
16	**Coordination Chemistry** **Shape of d-orbitals, CFT - Basic assumption, splitting of d-orbitals in Octahedral, Tetrahedral, Square planer complexes, John Teller Theorem, Distortion in octahedral complexes and magnetic properties for [CoF], [Co(NH3)6], [FeF], [Fe(CN)6], bonding in octahedral complexes.**	**5**
17	**Solid States:** **Definition of space lattice, Unit cell, Difference between crystalline and amorphous state, Steno's law and laws of symmetry, lattice planes, Miller indices, Bravais indices, type of cubic system, diagrammatic representation of cubic system and d100, d110, d111 planes, Bragg's equation (X-ray diffraction), Crystal structure of NaCl, KCl. (Numerical based on Bragg's equation)**	**5**
18	**Conductance And Ionic Equilibrium:** **Electrical conductance, Specific conductance, equivalent conductance, Molar conductance, Effect of dilution on concentration, Cell constant, Determination of Cell constant, Ostwald's dilution law and its limitations, Acid & Basic buffer actions (Henderson-Hasselbach equation), Buffer capacity, Numerical**	**5**
19	**Thermodynamics:** **Laws of thermodynamics, Carnot cycle and its efficiency, Entropy concept, Change of entropy for reversible isothermic, isobaric, isochoric and adiabatic processes. Entropy change for ideal gases (T & V as variables, P & Tas variables), Gibbs free energy(G), Relation of G and equilibrium constant Kp (Vant Hoff isotherm and isochore Derivation of Clapeyron and Clapeyron-Clausius equation, Numericals**	**5**
20	**Chemical kinetics:** **Chemical kinetics and its scope, rate of reaction, factors affecting rate of reaction: temperature, concentration, pressure, solvent, light and catalyst, Order of reaction (first order, second order, third order). Derivation of the Arrhenius equation. Collision theory of reaction rate, Energy of activation, including determination. Effect of catalysis on energy activation**	**5**
21	**Adsorption:** **Adsorption and absorption, Physical adsorption and chemical adsorption. Freundlich's adsorption isotherm, Langmuir's adsorption isotherm. General features of catalysis. Heterogeneous catalysis, Adsorption theory of catalysis.**	**5**
22	**Phase Equilibria** **Degree of freedom, phase rule, phase equilibria of two-component system-KI-Water system, freezing mixtures, ideal liquid mixtures, Raoult's law, non-ideal or real solutions, positive and negative deviations from Raoult's law,**	**5**

	temperature composition curves for ideal and non-ideal binary solutions, azeotropes, partially miscible liquids: Phenol-water systems, immiscible liquids, Numerical.	
23	**Units of Solution and Standard Solution** **Definitions of terms: Solute, Solvent, and Solution. Composition of solution-normal solution, molar solution, molal solution, mole fraction, % solution, saturated, unsaturated and supersaturated solution and solubility. Effect of temp. on various units of concentration. Preparation of solutions of some primary standard substances (e.g. Oxalic acid, succinic acid, KHP, K2Cr2O7, As_2O). Standardisation. Numerical.**	**5**
24	**Spectroscopy:** **(A) UV: Electromagnetic radiation, Lambert-Beer law, types of electronic transitions.** **(B) IR: Characteristic band of functional groups, sample preparation techniques.** **(C) NMR: Chemical Shift, n+1 rule, equivalent and non-equivalent protons, peak area, coupling constant, Signal Interpretation.** **(D) MS: Base peak, M peak, fragment ions, radical cation,**	**5**
25	**Chromatography:** **(A) Paper chromatography:** **Principles of chromatography, Classification, 1D, 2D and radial paper chromatography,** **(B) Liquid Chromatography: Elementary idea about the technique and layout diagrams of the instrument, components of the instrument of the HPLC technique, and an Elementary idea of TLC.**	**5**