

INDIAN INSTITUTE OF TECHNOLOGY MADRAS, CHENNAI-600036.

Advertisement No. IITM/R/2/2024 dated 02.03.2024

Syllabus & Scheme of Examination

Post: Junior Technician

Stream: Chemistry

LEVEL-1 Multiple Choice Question Test

(100 Marks)

PART – A

(30 Marks)

1. **Quantitative aptitude:** Number systems, simplification, decimals, fractions, LCM, HCF, ratio & proportion, percentage, log and trigonometric functions, solutions of simple equations (linear and quadratic), basic statistics – mean and standard deviation, profit & loss, discount, simple & compound interest, mensuration, time & work, time & distance, tables & graphs.
2. **Logical reasoning aptitude:** Analogies, similarities, differences, space visualization, analysis, judgment, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification
3. **Computer-related aptitude:** Hardware, software, operating systems, basic operations in MS Office® - Word, Excel, Powerpoint
4. **Language aptitude:** Comprehension, vocabulary, basic grammar in English.
5. **General awareness aptitude:** Current events, general knowledge, Indian history, Indian constitution, basic geography.

PART – B

(70 Marks)

1. Solids, liquids, and gases Classification of solids based on different binding forces:

Molecular, ionic, covalent and metallic solids. Crystal system — unit cell and voids. Surface tension effect of temperature on surface tension; Viscosity -effect of temperature, effect of pressure; Solutions -concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions; Colligative properties-relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure. Raoult's law-binary liquid mixtures, ideal solutions, deviations from ideal behaviour, vapour pressure, composition and vapour pressure, temperature curves and azeotropic distillation.

Kinetic theory of molecular gases; transport properties — viscosity, thermal conductivity, diffusion, Maxwell's distribution of molecular velocities

2. Thermochemistry, chemical kinetics, and electrochemistry

Thermodynamics: Bond Energy, Bond dissociation energy, calculation from thermochemical data variation of heat of reaction with temperature Kirchoff's equation.

Chemical kinetics: Definition of order and molecularity -methods to determine the rate of reactions - derivation of rate constants for I, II, III and Zero order reactions -derivation for time for half change - methods to determine the order of reactions -effect of temperature on the rate of reactions -Arrhenius equation and concept of energy of activation.

Electrochemistry: Redox reactions and their standard electrode potential; Relation between Gibbs energy and emf of the cell; Galvanic cells -standard cell-emf and its measurement; Specific and molar conductivity -variation of conductivity with concentration; Electrorefining of copper and molten aluminium production by smelting.

3. Organic chemistry

Concepts and Characteristic reactions< Hybridisation of carbon; σ and π -bonds; Shapes of simple organic molecules; Structural and geometrical isomerism; Optical isomerism of compounds containing up to two asymmetric centres; IUPAC nomenclature of simple organic compounds (simple hydrocarbons, mono-functional and bi-functional compounds); Conformations of ethane and butane (Newman projections); Resonance and hyperconjugation; Keto-enol tautomerism; Hydrogen bonds: definition and their effects on physical properties of alcohols and carboxylic acids; Inductive and resonance effects on acidity and basicity of organic acids and bases; Polarity and inductive effects in alkyl halides; Reactive intermediates (carbocations, carbanions and free radicals) — formation, structure and stability; Aliphatic nucleophilic substitution reactions — SN1 and SN2; Elimination reactions — E1 and E2 mechanisms; Electrophilic addition reactions of alkenes with X₂, HX, HOX and H₂O (X = halogen); Addition reactions of alkynes; Aromaticity, Electrophilic substitution reactions Effect of *o*-, *m*-and *p*-directing groups in monosubstituted benzenes; simple functional group interconversions pertaining to alkenes, alkynes, carbonyl compounds, haloalkanes and arenes, hydroxyl compounds, amines.

Laboratory techniques

Separation techniques -chromatography, distillation, extraction; Purification techniques — crystallization, recrystallization, sublimation; Quantitative estimation — acid/base, iodo/iodimetry, potentiometric and conductometric titrations, and gravimetry; Qualitative analysis -detection of nitrogen, sulphur, halogen in organic compounds; determination of anions and cations.

4. Polymers and biomolecules

Free radical, cationic, anionic, addition and condensation polymerization, polymers: natural rubber, nylon, teflon and PVC; Amino acids, peptides, proteins (primary, secondary, tertiary and quaternary structures); DNA and RNA; Carbohydrates (glucose, fructose, sucrose and starch).

5. Chemistry of s-and p-block elements

Alkali and alkaline earth metals —electronic configuration, structure, study of oxides, hydrides, halides, hydroxides, carbonates and sulfates; Electronic configuration, structure, oxidation states, oxides and oxoacids of N, P, S and halogens, their preparation and properties.

6. d-block elements

Electronic configuration, oxidation states; coordination compounds — ligands, coordination number, colour, magnetic properties and shape. Crystal field stabilization theory.

7. Mathematics for chemists

Linear equations; polynomials; logarithmic and exponential relations; calculus (Functions of single variable, limit, continuity and differentiability); first order differential equations; probability and statistics (Definitions of probability and sampling theorems, conditional probability, mean, median, mode and standard deviation, random variables, Poisson, Normal and Binomial distributions, Linear regression analysis).

LEVEL – 2 Trade Test

- **Trade Test** - Syllabus as above under Part-B for Level-1 Multiple Choice Question Test.

Scheme of Examination:

Level	Type of Test	Time	No. of Questions – Max. Marks	Weightage for the final result
Level -1	Multiple Choice Question Test	Time: 120 Minutes	100 Objective Questions – 100 Marks	70 %
Level-2	Trade Test	Time: 90 minutes approximately	Practical Trade Test	30 %

- A minimum of 5X candidates shall be shortlisted (for X number of posts advertised) for the Level-2 Trade Test, based on their performance in the Level-1 Multiple Choice Question Test.

NOTE:

- a) The medium of examination will be ENGLISH
 - b) The questions will generally be on the minimum qualification level i.e. Graduation.
 - c) There shall be no negative marking for wrong answers.
 - d) **The Level-1 Multiple Choice Question Test is tentatively scheduled to be held on 06th February 2025 at TCS iON Centres in Chennai.**
-