Section 1: Subject Knowledge

Please Note: A Total of 40 Questions will be asked, combining the following topics, with the difficulty level commensurate to a Master's Candidate.

Unit I: Catalysis and Green Chemistry

Role of solvents in catalysis, Design of solvent-free processes, Sustainable catalytic processes Case studies of green catalytic processes, Principles of green chemistry, Environmental impact of chemical processes, Techniques for catalyst characterization, and Evaluating catalytic activity.

Unit II: Chemistry in nanoscience and technology

fundamentals of nanomaterials, synthesis methods, characterization techniques, and applications in diverse fields, surface area-to-volume ratio, quantum effects, optical characteristics, scanning electron microscopy, transmission electron microscopy, and atomic force microscopy.

Unit III: Environmental Chemistry

environmental systems, the sources and types of pollutants (such as heavy metals, pesticides, and persistent organic pollutants), and their effects on air, water, and soil quality, biogeochemical cycles of essential elements like carbon, nitrogen, and phosphorus, emphasizing their roles in ecosystems.

Unit IV: Inorganic Chemistry

Atomic Structure, Periodicity of Elements, Chemical Bonding, Metallic bonding and Weak chemical forces, Oxidation-Reduction and general principle of metallurgy, S and P Block Elements, Noble Gases, Inorganic Polymers, Coordination Chemistry, Transition Elements, Lanthanoids and Actinides, Bioinorganic Chemistry, Organometallic Compounds.

Unit V: Organic Chemistry

Organic chemistry and stereochemistry, Aliphatic and aromatic hydrocarbons, halogenated compounds, alcohols, phenols, ethers, epoxides, carbonyl compounds, carboxylic acids, sulfur and nitrogen-containing compounds, Polynuclear hydrocarbons, heterocyclic compounds, alkaloids, terpenes, Organic spectroscopy (UV, IR, NMR, MS).

Unit VI: Physical Chemistry

Gaseous and liquid states, ionic equilibria, solid states, and thermodynamics,Thermochemistry, free energy, partial molar quantities, spectroscopy, photochemistry, chemical kinetics, catalysis, surface chemistry, phase equilibria, quantum chemistry, conductance, and electrochemistry.

Unit VII: Supramolecular chemistry

Molecular recognition and self-assembly. Role of non-covalent interactions (hydrogen bonding, van der Waals forces, π-π stacking). Supramolecular structures (host-guest systems, dendrimers, molecular machines) and their applications in drug delivery, materials science, and nanotechnology.

Section 2: Fundamental Skills

Please Note: A Total of 24 Questions will be asked, combining the following topics, with the difficulty level commensurate to a Master's Candidate.

Unit I: Data Analysis

Unit II: Math and Statistics

Unit III: Lab skills

Unit IV: Reading and Writing

Section 3: Specific Skill Proficiency

This section has more than 30 skills. You can select the ones you are proficient in from the enrollment form. You can choose a maximum of 4 skills. Each skill contains 10 questions.