

Syllabus of Subject Awareness for M.Sc. (Applied Chemistry)
Entrance Examination (GBU-ET 2020)

(a) Inorganic Chemistry

1. **Periodic table:** Periodic classification of elements, long form of periodic table, trends within a group or period, periodicity in properties, Slater's rule.
2. **Chemical bonding:** Types of bonding. VSEPR theory and shapes of molecules. Hybridization, dipole moment. Ionic solids - lattice energy. Structure of diamond and graphite.
3. **Main group elements (s and p blocks):** Properties; structure of electron deficient compounds of main group elements and application of main group elements.
4. **Transition metals (d block):** Characteristics of d-block elements. Coordination compounds of first row transition elements, bonding in coordination compounds – VBT and CFT of tetrahedral and octahedral complexes. Application of CFT to spectral and magnetic properties. Electronic spectra of coordination compounds.
5. **Organometallic compounds:** Organometallic compounds of Li, Be, Mg, B and Al. Concept of hapticity, 18 electron rule. Carbonyl compounds of first row of transition metals.
6. **Non aqueous solvents:** General characteristics, reactions with reference to ammonia and liquid sulphur dioxide.
7. **Acids and Bases:** Lewis and HSAB concepts
8. **Nuclear Chemistry:** Radioactivity, nuclear reactions, applications of isotopes.

(b) Organic Chemistry

1. **Nomenclature of Organic compounds.**
2. **Mechanism of Organic reactions:** Electronic effects in Organic molecules – Inductive effect, polarizability effect, resonance, hyperconjugation. Formal charge, generation, structure and general reactions of reactive intermediates: Carbocation, carbanion, carbon radical.
3. **Stereochemistry:** Types of isomerism. Projection formulae, chirality, assigning stereochemical descriptors to chiral centres and geometric isomers. Optical isomerism in compounds containing one and two asymmetric centers. Conformations of cyclohexanes.
4. **Aromaticity and Huckel's rule:** Mono and bicyclic carbocyclic aromatic hydrocarbons and their electrophilic substitution reactions.
5. **Synthetic chemistry:** Methods of preparation and characteristic reactions of alkanes, alkenes, alkynes (including their cyclic analogues)
Functional group interconversions. Grignard reagents.
6. **Mechanism (with stereochemistry):** Aliphatic nucleophilic substitution, elimination, enolate reactions, Claisen condensation, esterification and ester hydrolysis, Cannizzaro reaction, benzoin

condensation, Perkin reaction, Claisen rearrangement, Beckmann rearrangement, Wagner-Meerwein rearrangement.

7. **Carbohydrates:** Classification, nomenclature. Open and cyclic formulae. Chemistry of glucose.

8. **Amino acids and peptides:** Structure, stereochemistry, and characteristic reactions of amino acids. Structure of peptides.

(c) **Physical chemistry**

1. **Atomic structure:** Fundamental particles. Bohr's theory of hydrogen atom; Wave-particle duality; Uncertainty principles, Schrodinger equation, Quantum numbers, shapes of orbitals; Hund's rule and Pauli's exclusion principle.

2. **Theory of gases:** Kinetic theory of gases. Real and ideal gases, critical phenomenon.

3. **Chemical thermodynamics:** Reversible and irreversible processes. First law and its application to ideal and nonideal gases. Thermochemistry. Second law. Entropy and free energy, Criteria for spontaneity.

4. **Chemical and Phase equilibria:** Law of mass action; K_p , K_c , K_x and K_n ; Effect of temperature on K ; Ionic equilibria in solutions; pH and buffer solutions; Hydrolysis; Solubility product; Phase equilibria—Phase rule and its application to one-component and two-component systems.

5. **Electrochemistry:** Conductance and its applications; Transport number; Galvanic cells; EMF and Free energy. Liquid junction potential and concentration cells. Application of emf measurement for determination of K , ΔG , ΔH , ΔS . Stability of complexes.

6. **Chemical kinetics:** Reactions of various order, Arrhenius equation, Collision theory; Theory of absolute reaction rate; Chain reactions - Normal and branched chain reactions; Enzyme kinetics; Photophysical and photochemical processes; Catalysis.

(d) **Analytical Chemistry**

Classification of analytical methods. Performance characteristics of analytical methods. Errors and their types. Acid-base titrations and acid-base indicators, Redox titrations, Conductometric and Potentiometric titrations

ENGLISH PROFICIENCY

Comprehension, Vocabulary, Basic English Grammar (like usage of correct forms of verbs, prepositions and articles), Word power, Synonyms and Antonyms, Meanings of words and phrases, Technical writing

GENERAL AWARENESS

Current Affairs of National and International Economy, History, Sports News, Science in everyday life, Politics, Geography, Culture, Economics, Trade Awareness, Personalities in News, Indian Constitution