

ITEM NO.1 OF PROGRAMME NO.15/2009

CATEGORY NO.236/2007

DETAILED TOPICS

Part I - CHEMISTRY

1. THEORIES OF BONDING

VBT, MOT and their comparison based on H₂ molecule Resonance theory. Hybrid orbital-expression for hybrid orbitals, in terms of wave functions of S and P-orbitals. Lattice Energy-Born Haber Cycle. Metallic bonding and Hydrogen bonding

2. SOLUTION, GASES AND LIQUIDS

Raoult's law, types of binary solutions-theory of distillation-azeotropes Molecular mass determination, Transition temperature, van't Hoff factor, abnormal molecular mass, osmotic pressure. Distribution of molecular velocities, Maxwell equation, liquid crystals, theory of liquid crystals.

3. SPECTROSCOPY

Beer Lambert's Law, Born-Oppenheimer approximation, Microwave Spectroscopy, IR Spectroscopy-Fundamentals Overtones, Determination of Force Constants, Finger print region, FTIR, Raman Spectroscopy, Raman Scattering, Polarizability, Comparison of Raman Spectra with IR. Electronic Spectra, NMR Spectra, 2D, 3D NMR, Spin-spin Mossbauer Spectroscopy, Doppler effect, Instrumentation for AAS, Application of AAS. Elucidation of Molecular structure using spectroscopic data.

4. REACTION MECHANISM

Rearrangement reactions, Wagner Meerwein, Pinacol, Hoffmann, Curtius, Schmidt, Bechmann, Wolf, Fries, Arylazo, Fischer, Hoffmann, Martius, Orton, Bamberger, Benzidine, Stevens, Wittig, Sommelet-Hauser, Baeyer Villiger reactions.

5. BIOMOLECULES

Cholesterol, Testosterone, Andosterone, Estrone, Progesterone, B-Carotene, Ascorbic Acid Reserpine.

6. CHEMISTRY IN EVERYDAY LIFE

Dyes, food Additives, Artificial sweetening agents, Pesticides, Fertilisers, Water purification.

7. THERMODYNAMICS

Intensive and extensive properties, Thermodynamic equation of state, Joule Thomson effect, I law of thermodynamics, 2nd law of thermodynamics, 3rd law of thermodynamics and Zero'th law of thermodynamics particle properties, chemical potential, fugacity and activity.

8. ELECTROCHEMISTRY

Electro chemical cells, concentration cells, liquid junction potential, electrical double layer, hydrogen over voltage, oxygen over voltage, Nernst equation, fuel cells, Faraday, free energy and emf, eq.constant and emf.

9. ELECTROANALYTICAL TECHNIQUES

Potentiometric method of measurement of pH, Electrogravimetry, Conductometry, Coulometry, Voltametry, cyclic voltametry, stripping voltametry, amperometry, polarography, principle of electron microscope, SEM, Scanning tunnelling Microscopy, (GC,GC-MS, HPLC, LC-MS

Part II - BIOCHEMISTRY

1. STRUCTURE OF MACROMOLECULES

Macromolecules and their building blocks in biological system. Proteins- Functional diversity of proteins. Methods for purification and characterisation of proteins and study of protein structure. Structural organisation of proteins. Structure of DNA and RNA.

2. BIOORGANIC AND BIOPHYSICAL CHEMISTRY

Acids, bases and buffers. Chemistry **of bio molecules**. Chemistry of Carbohydrates, Lipids, Amino **acids**, Vitamins, Nitrogenous bases and Nucleosides. Colorimetry, Spectrophotometry, Flame Photometry and Radioactivity.

3. ENZYMES

Enzymes-Isolation and characterisation. Industrial and clinical application of enzymes. Enzyme engineering. Designer enzymes —Abzymes, Ribozymes.

4. IMMUNOCHEMISTRY

Immune system. Measurement of antigen-antibody interaction. Diseases related to immune function. Vaccination and Immunization. Blood group antigens. Bone marrow and kidney transplantation. Cancer immunology. Immunological methods —Elisa and RIA

5. MOLECULAR ENDOCRINOLOGY

Mammalian endocrine system, Chemical nature of mammalian hormones. Biosynthesis and transport of steroid, peptide and amino acid derived hormones. Regulation of endocrine function. Biochemical effect of individual hormones, molecular mechanisms. Clinical evaluation of endocrine function.

6. MOLECULAR BIOLOGY

Nucleic acids as genetic information carriers. DNA as genetic material. DNA replication, repair and synthesis. DNA polymerises, cellular control of DNA synthesis, biosynthesis of RNA and rRNA polymerises. Mechanism of transcription and its regulation. Reverse transcriptase. Role of histones in gene expression. Types of RNA. Genetic code, Translation, Regulation of gene expression

7. TECHNIQUES IN BIOCHEMISTRY, MOLECULAR BIOLOGY AND IMMUNOLOGY

Biochemical separation techniques-Chromatography, Electrophoresis, Dialysis, Ultracentrifugation. Antigen-Antibody reaction, Production of antibodies. Common Immunological techniques. Isolation of nucleic acids. Electrophoretic separation of nucleic acids. Southern and Northern blot

Part III - FORENSIC SCIENCE

1. FORENSIC SEROLOGY

Forensic examination of blood stains and other body fluids. Detection of bloodstains, identification of bloodstains, identification of species origin, diffusion techniques, electrophoresis technique, blood groups, Rh typing, Bombay groups, absorption inhibition technique, mixed agglutination technique, absorption elution technique. Identification of seminal stains, Acid phosphatase test, Florence test, Berberios test, Morphology of Spermatozoa, Microscopic detection of spermatozoa, Secretors and non secretors status, blood group examination in seminal stain, Identification of saliva stains, species, origin and blood group, urine and faecal stains

2. TOXICOLOGY

Schematic analysis of viscera, vegetable poisons, volatile poisons, Poisoning by carbon monoxide and detection of carboxyl haemoglobin in blood, corrosives, metallic poisons, Alkaloid poisons, Insecticide poisons, ethyl alcohol and methyl alcohol, blood alcohol level

3. NARCOTICS

Classification of narcotics, Ganja, opium, Haroine, cocaine, LSD, Amphetamine, Tranquillisers

4. EXPLOSIVES

Classification of Explosives, Composition of gun powder, fire works, RDX, TND, PETN, Gun cotton, Detonator

5. INSTRUMENTAL METHOD OF ANALYSIS

Ultraviolet Spectroscopy, Infra red Spectroscopy, Gas Chromatography, High pressure liquid Chromatography, Atomic absorption spectroscopy

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.