



AVICENNA INTERNATIONAL COLLEGE

CHEMICAL SCIENCES ACADEMIC CALENDAR

LECTURE SYLLABUS



GENERAL CHEMISTRY

| Session | Topic | Lecturer |
|---------|-------------------------------------------------------------------------------------|----------|
| 1 | Properties of Matter, Atoms, Compounds, Ions | |
| 2 | Atomic theory, Atomic numbers, Isotopes | |
| 3 | The Mole Concept, Types of Chemical Formulae | |
| 4 | Percent Composition of Compounds, Periodic Table | |
| 5 | Electronic Structure | |
| 6 | Quantum Numbers | |
| 7 | Pauli Exclusion Principle (Hund Rule, Aufbau Method) | |
| 8 | Electronic Structure of Atoms and Ions | |
| 9 | Atomic Size, Ionic Size, Ionization Energy | |
| 10 | Electron Affinity, Electronegativity | |
| 11 | Metallic Bond, Ionic Bond, Coulomb Law (Lattice Energy and Factors affecting It) | |
| 12 | Covalent bond, Coordinate Bond | |

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| 13 | Lewis Structure, Octet Rule | |
| 14 | Exceptions to Octet Rule, Resonance, Formal Charge | |
| 15 | Molecular Geometry (VSEPR Theory) | |
| 16 | Polarity of Covalent Bonds and Molecules | |
| 17 | Intermolecular Forces: Dispersion (London) Forces, Dipole-Dipole Forces | |
| 18 | Hydrogen Bond, Ion-Dipole Forces, Relationship between IMF and physical properties | |
| 19 | States of Matter: Gas, Ideal Gas Law, Phase Diagram | |
| 20 | Liquid, Solid, Types of Lattices | |
| 21 | Classification of Solutions, Solubility | |
| 22 | Concentration Units | |
| 23 | Solution Process: NaCl in Water, Sugar in Water | |
| 24 | Gas in Water, Nonpolar Solutes in Nonpolar Solvents | |
| 25 | Gas Solutions, Raoult Law (Air as a Gas Solution) | |
| 26 | Factors Affecting Solubility | |
| 27 | Colligative Properties, Types of Solutes | |
| 28 | Vapor Pressure Lowering | |

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|---------|----------------------------------------------------------------------------------------|----------|
| 29 | Boiling Point Elevation, Freezing Point Depression | |
| 30 | Osmosis, Osmotic Pressure | |
| 31 | Chemical Kinetics, Rate Constant | |
| 32 | Rate Laws, Factors Affecting Reaction Rate | |
| 33 | Collision Theory, Transition-State Theory | |
| 34 | Catalysis | |
| 35 | Chemical Equilibrium, Law of Mass Action | |
| 36 | Gas and Heterogeneous Equilibria (Ammonia Synthesis) | |
| 37 | Law of Mass Action for Self-Ionization of Water, Weak Acid Dissociation, Precipitation | |
| 38 | Le Chatelier Principle | |
| 39 | Acid-Base Theories, Common Types of Acids | |
| 40 | Acidity and Molecular Structure | |
| 41 | Ionization of Strong Electrolytes in Water | |
| 42 | Ionization of Weak Electrolytes in Water, Degree of Ionization and its pH Dependence | |
| 43 | pH, pOH and their Calculation | |
| 44 | Neutralization | |

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| 45 | pH of Salt Solutions, Ion Hydrolysis (Acidic Salts, Basic Salts, Neutral Salts) | |
| 46 | Buffer Components, Buffer Capacity | |
| 47 | Henderson-Hasselbach Equation, Choosing the Best Buffer | |
| 48 | Physiological Buffers | |
| 49 | Thermochemistry Concepts, Types of Energy, System and Surroundings | |
| 50 | Enthalpy, Hess Law, Enthalpy of Formation | |
| 51 | Energy Input and Output, Endothermic/Exothermic, Endergonic/Exergonic, Spontaneity | |
| 52 | Specific Heat, Heat Capacity | |
| 53 | First Law of Thermodynamics, Law of Conservation of Energy and Mass | |
| 54 | Entropy, Gibbs Free Energy, Second and Third Laws of Thermodynamics | |
| 55 | Definition of Oxidation/Reduction, Oxidation Numbers | |
| 56 | Galvanic Cells, Electrolysis | |

ORGANIC CHEMISTRY & BIOCHEMISTRY

| Session | Topic | Lecturer |
|---------|------------------------------------------------------------------------------------------------------------------------------------|----------|
| 57 | Characteristics of Organic Molecules, Wöhler Experiment (Role of Carbon, Excitation and Hybridization of Carbon) | |
| 58 | List of Organic Functional Groups | |
| 59 | Saturated Hydrocarbons (Physical and Chemical Properties, Combustion, Radical Substitution) | |
| 60 | Unsaturated Hydrocarbons (Physical and Chemical Properties, Addition, Markovnikov Rule) | |
| 61 | Aromatic Hydrocarbons, Halogenated Hydrocarbons (Physical and Chemical Properties, Nucleophilic and Electrophilic Substitution) | |
| 62 | Naming of Hydrocarbons | |
| 63 | Isomerism: Constitutional Isomers (Branch, Position, Functional Group) | |
| 64 | Configurational Isomers | |
| 65 | Alcohols (Physical and Chemical Properties, Elimination) | |
| 66 | Ethers, Phenols, Thiols (Physical and Chemical Properties, Ether Formation, Phenol Acid Dissociation, Thiol Oxidation) | |
| 67 | Aldehydes, Ketones (Physical and Chemical Properties) | |
| 68 | Redox Reactions of Alcohols/Aldehydes/Ketones, Hemiacetal/Acetal and Hemiketal/Ketal Formation | |
| 69 | Carboxylic acids (Physical and Chemical Properties, Acid Dissociation) | |
| 70 | Reaction of Carboxylic acids, Esters (Condensation, Acyl Halide Reactions) | |
| 71 | Amines (Physical and Chemical Properties, Base Dissociation) | |
| 72 | Amides, Amide formation | |

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|----------------|-----------------------------------------------------------------------------|-----------------|
| 73 | Types and Importance of Carbohydrates, Types of Monosaccharides | |
| 74 | Structure and Properties of Monosaccharides | |
| 75 | Isomerism of Monosaccharides | |
| 76 | Structure and Properties of Disaccharides and Polysaccharides | |
| 77 | Types and Importance of Lipids, Fatty Acids | |
| 78 | Structure and Properties of Triglycerides and Phospholipids | |
| 79 | Structure and Importance of Amino Acids | |
| 80 | List of Amino Acids | |
| 81 | Peptide Formation | |
| 82 | Protein Structures and Biological Importance, Denaturation, Enzyme Function | |
| 83 | Structure and Importance of Nucleotides | |
| 84 | Types of Nucleic Acids and Biological Importance | |
| 85 | Types of Metabolic Pathways and their Energetics | |
| 86 | Heterotroph/Autotroph Organisms, Photosynthesis, Energy Producing Pathways | |
| 87 | Glycolysis, Fermentation, Citric Acid Cycle | |
| 88 | Cellular Respiration | |