JEE Main Chemistry Syllabus

Candidates can check the chemistry syllabus of JEE Main here in the table below.

| ***Physical Chemistry*** | | |
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| **Unit Number** | **Chapter** | **Topics** |
| Unit I | Some Basic Concepts In Chemistry | Matter and its nature, Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae, Laws of chemical combination; Chemical equations and stoichiometry, Dalton's atomic theory: Concept of atom, molecule, element, and compound |
| Unit 2 | Atomic Structure | Concept of atomic orbitals as one-electron wave functions: Rules for filling electrons in orbitals – Aufbau principle. Pauli's exclusion principle and Hund's rule, electronic configuration of elements, and extra stability of half-filled and completely filled orbitals, Variation of and 2 with r for 1s and 2s orbitals; various quantum numbers (principal, angular momentum, and magnetic quantum numbers) and their significance; shapes of s, p, and d - orbitals, electron spin, and spin quantum number:  Nature of electromagnetic radiation, photoelectric effect; Heisenberg uncertainty principle, Elementary ideas of quantum mechanics, quantum mechanics, the quantum mechanical model of the atom, and its important features. Bohr model of a hydrogen atom - its postulates, derivation of the relations for the energy of the electron and radii of the different orbits, limitations of Bohr's model; Dual nature of matter, de Broglie's relationship. Spectrum of the hydrogen atom. |
| Unit 3 | Chemical Bonding And Molecular Structure | Kossel-Lewis approach to chemical bond formation, the concept of ionic and covalent bonds  Molecular Orbital Theory:  Its important features. LCAOs, types of molecular orbitals (bonding, antibonding), sigma and pi-bonds, molecular orbital electronic configurations of homonuclear diatomic molecules, the concept of bond order, bond length, and bond energy  Valence Shell Electron Pair Repulsion (VSEPR ) theory and shapes of simple molecules, Covalent Bonding: Concept of electronegativity. dipole moment: Fajan’s rule,  Ionic Bonding: Formation of ionic bonds, factors affecting the formation of ionic bonds; calculation of lattice enthalpy  Valence bond theory - its important features, the concept of hybridization involving s, p, and d orbitals; Resonance, Quantum mechanical approach to covalent bonding:  Hydrogen bonding and its applications, Elementary idea of metallic bonding. |
| Unit 4 | Chemical Thermodynamics | Fundamentals of thermodynamics: state functions, extensive and intensive properties, System and surroundings, Entropy, types of processes.  The first law of thermodynamics:  Concept of work, heat internal energy and enthalpy, heat capacity, molar heat capacity; Hess’s law of constant heat summation; Enthalpies of bond dissociation, combustion, formation, atomization, sublimation, phase transition, hydration, ionisation, and solution  The second law of thermodynamics:  Spontaneity of processes; S of the universe and G of the system as criteria for spontaneity. G (Standard Gibbs energy change) and equilibrium constant |
| Unit 5 | Solutions | Colligative properties of dilute solutions - a relative lowering of vapour pressure, depression of freezing point, vapour pressure - composition, plots for ideal and nonideal solutions; the elevation of boiling point and osmotic pressure; Determination of molecular mass using colligative properties; Different methods for expressing the concentration of solution - molality, molarity, mole fraction, percentage (by volume and mass both), the vapour pressure of solutions and Raoult's Law - Ideal and non-ideal solutions, Abnormal value of molar mass, Van’t Hoff factor and its significance |
| Unit 6 | Equilibrium | Meaning of equilibrium is the concept of dynamic equilibrium.  Ionic equilibrium:  Weak and strong electrolytes, acid-base equilibria (including multistage ionisation) and ionisation constants, ionisation of electrolytes, various concepts of acids and bases (Arrhenius. Bronsted - Lowry and Lewis) and their ionisation, , ionisation of water. pH scale, common ion effect, hydrolysis of salts and pH of their solutions, the solubility of sparingly soluble salts and solubility products, and buffer solutions  Equilibria involving physical processes:  General characteristics of equilibrium involving physical processes, Solid-liquid, liquid-gas - gas and solid-gas equilibria, ,Henry's law. |
| Unit 7 | Redox Reactions And Electrochemistry | Electronic concepts of oxidation and reduction, rules for assigning oxidation number, and balancing of redox reactions, oxidation number, redox reactions  EMF of a Galvanic cell and its measurement: Relationship between cell potential and Gibbs' energy change: Dry cell and lead accumulator; Fuel cells. Nernst equation and its applications, Electrochemical cells - Electrolytic and Galvanic cells, different types of electrodes, electrode potentials including standard electrode potential, half-cell and cell reactions,  Electrolytic and metallic conduction, conductance in electrolytic solutions, molar conductivities and their variation with concentration: Kohlrausch’s law and its applications. |
| Unit 8 | Chemical Kinetics | Rate of a chemical reaction, factors affecting the rate of reactions: concentration, temperature, pressure, and catalyst; elementary and complex reactions, order and molecularity of reactions, rate law, collision theory of bimolecular gaseous reactions (no derivation), differential and integral forms of zero and first-order reactions, rate constant and its units, the effect of temperature on the rate of reactions, Arrhenius theory, their characteristics and half-lives, activation energy and its calculation, |
| ***Inorganic Chemistry*** | | |
| **Unit Number** | **Chapter** | **Topics** |
| Unit 9 | Classification Of Elements And Periodicity In Properties | Modem periodic law and present form of the periodic table, s, p. d and f block elements, periodic trends in properties of elements atomic and ionic radii, ionisation enthalpy, electron gain enthalpy, valence, oxidation states, and chemical reactivity |
| Unit 10 | P- Block Elements | Group -13 to Group 18 Elements  General Introduction: Electronic configuration and general trends in physical and chemical properties of elements across the periods and down the groups; unique behaviour of the first element in each group |
| Unit 11 | d - and f- Block Elements | Transition Elements  General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first-row transition elements - physical properties, atomic radii, alloy formation, ionisation enthalpy, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, oxidation states  Inner Transition Elements  Lanthanoids - Electronic configuration, lanthanide contraction and oxidation states. Actinides - Electronic configuration and oxidation states. |
| Unit 12 | Coordination Compounds | Importance of coordination compounds (in qualitative analysis, extraction of metals, and in biological systems). Werner's theory; ligands, coordination number, denticity. chelation; isomerism; IUPAC nomenclature of mononuclear coordination compounds, Bonding-Valence bond approach and basic ideas of Crystal field theory, colour and magnetic properties; Introduction to coordination compounds. |
| ***Organic Chemistry*** | | |
| **Unit Number** | **Chapters** | **Topics** |
| Unit 13 | Purification And Characterisation Of Organic Compounds | Purification - Crystallisation, sublimation, distillation, differential extraction, and chromatography - principles and their applications.  Qualitative analysis - Detection of nitrogen, sulphur, phosphorus, and halogens.   Quantitative analysis (basic principles only) - Estimation of carbon, hydrogen, sulphur, halogens, nitrogen, and phosphorus.  Calculations of empirical formulae and molecular formulae: Numerical problems in organic quantitative analysis, |
| Unit 14 | Some Basic Principles Of Organic Chemistry | Homologous series: Isomerism - structural and stereoisomerism. Tetravalency of carbon: Shapes of simple molecules - hybridization (s and p): Classification of organic compounds based on functional groups: and those containing halogens, oxygen, nitrogen, and sulphur;  Common types of organic reactions - Substitution, addition, elimination, and rearrangement.  Nomenclature (Trivial and IUPAC) Covalent bond fission - Homolytic and heterolytic: free radicals, carbocations, and carbanions; stability of carbocations and free radicals, electrophiles, and nucleophiles.  Electronic displacement in a covalent bond - electromeric effect, Inductive effect, resonance, and hyperconjugation. |
| Unit 15 | Hydrocarbons | Classification, isomerism, IUPAC nomenclature, general methods of preparation, properties, and reactions  Alkanes - Conformations: Sawhorse and Newman projections (of ethane): Mechanism of halogenation of alkanes.  Alkenes - Ozonolysis and polymerisation, Geometrical isomerism: Mechanism of electrophilic addition: addition of hydrogen, halogens, water, hydrogen halides (Markownikoffs and peroxide effect):  Alkynes - Polymerisation, Acidic character: Addition of hydrogen, halogens, water, and hydrogen halides:  Mechanism of electrophilic substitution: halogenation, nitration, Aromatic hydrocarbons - Nomenclature, benzene - structure and aromaticity:  Friedel-Crafts alkylation and acylation, directive influence of the functional group in monosubstituted benzene. |
| Unit 16 | Organic Compounds Containing Halogens | General methods of preparation, Mechanisms of substitution reactions, properties, and reactions; Nature of C-X bond  Uses; Environmental effects of chloroform, iodoform freons, and DDT |
| Unit 17 | Organic Compounds Containing Oxygen | General methods of preparation, properties, reactions, and uses.  Alcohols: Identification of primary, secondary, and tertiary alcohols: mechanism of dehydration.  Phenols: Acidic nature, nitration and sulphonation. Reimer - Tiemann reaction, electrophilic substitution reactions: halogenation  Ethers: Structure  Aldehyde and Ketones: Nature of carbonyl group; Nucleophilic addition to >C=O group, Grignard reagent; oxidation: reduction (Wolf Kishner and Clemmensen), relative reactivities of aldehydes and ketones; the acidity of -hydrogen. aldol condensation, Cannizzaro reaction. Haloform reaction, Chemical tests to distinguish between aldehydes and Ketones. Important reactions such as - Nucleophilic addition reactions (addition of HCN. NH3, and its derivatives),  Carboxylic Acids |
| Unit 18 | Organic Compounds Containing Nitrogen | Diazonium Salts: Importance in synthetic organic chemistry  General methods of preparation. Properties, reactions, and uses  Amines: Nomenclature, classification structure, basic character, and identification of primary, secondary, and tertiary amines and their basic character |
| Unit 19 | Biomolecules | Proteins - Elementary Idea of -amino acids, peptide bonds, polypeptides. Proteins: primary, secondary, tertiary, and quaternary structure (qualitative idea only), denaturation of proteins, enzymes  Vitamins – Classification and functions  Nucleic Acids – Chemical constitution of DNA and RNA  Biological functions of nucleic acids.  Carbohydrates - Classification; aldoses and ketoses: monosaccharides (glucose and fructose) and constituent monosaccharides of oligosaccharides (sucrose, lactose, and maltose).  Hormones (General introduction) |
| Unit 20 | Principles Related To Practical Chemistry |  |