CAREERS 360

PREPARATION Series

JEE Main 2025

Chemistry Syllabus

(As Per the Latest NTA Syllabus)

Powered by: AMITY UNIVERSITY – NOIDA (DELHI NCR) –

Contents

A Note to students

Dear JEE Main Aspirants, It is a known fact that JEE Main is the best entrance examination for admission to top engineering institutes in India. All the aspirants who aim to qualify for JEE Main have to make a perfect exam strategy to stand out of the crowd and ace the exam. With this comes lots of queries and confusion regarding the preparation strategy regarding what to study, where to study from and much more. It is very important for the aspirants to fully understand the exam pattern and syllabus of JEE Main Chemistry to clear all their queries.This eBook contains an analysis of the new topics that have been added and the topics that have been removed in the revised JEE Main Chemistry syllabus in comparison to the previous year's syllabus.

The Chemistry section is divided into three parts: Physical Chemistry, Organic Chemistry, and Inorganic Chemistry.

1. PHYSICAL CHEMISTRY

In Physical Chemistry, chapters such as "States of Matter" and "Surface Chemistry" have been completely removed. Additionally, certain topics from other chapters have been omitted.

2. INORGANIC CHEMISTRY

In Inorganic Chemistry, chapters such as "General Principles and Processes of Isolation of Metals,"Hydrogen," "S-Block Elements (Alkali and Alkaline Earth Metals)," and "Environmental Chemistry" have been entirely removed. Additionally, certain topics from the "p-block elements" chapter have been omitted.

3. ORGANIC CHEMISTRY

Organic Chemistry has seen the removal of chapters like "Polymers" and "Chemistry in Everyday Life." In Organic Chemistry, chapters such as "Polymers" and "Chemistry in Everyday Life." have been entirely removed.
By conducting a thorough analysis of the new topics added and the topics removed in the revised JEE Main Chemistry syllabus in comparison to the previous year's syllabus, as provided in this eBook, you will be better prepared for your JEE Main exam.

Good luck, and may your hard work and determination pave the way for your success in the JEE Main

Warm Regards
Team Careers360

JEE Mains Chemistry Syllabus

PHYSICAL CHEMISTRY

UNIT I: SOME BASIC CONCEPTS IN CHEMISTRY

Matter and its nature, Dalton's atomic theory, Concept of atom, molecule, element and compound, Laws of chemical combination, Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae, Chemical equations and stoichiometry.

UNIT 2: ATOMIC STRUCTURE

Nature of electromagnetic radiation, photoelectric effect, spectrum of the hydrogen atom, 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, Heisenberg uncertainty principle, elementary ideas of quantum mechanics, the quantum mechanical model of the atom and its important features, concept of atomic orbitals as one-electron wave functions, variation of chi and Chi square 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, 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.

UNIT 3: CHEMICAL BONDING AND MOLECULAR STRUCTURE

Kossel-Lewis approach to chemical bond formation, the concept of ionic and covalent bonds.
Ionic Bonding: Formation of ionic bonds, factors affecting the formation of ionic bonds; calculation of lattice enthalpy.
Covalent Bonding: Concept of electronegativity, Fajan's rule, dipole moment, Valence Shell Electron Pair Repulsion (VSEPR) theory and shapes of simple molecules.
Quantum mechanical approach to covalent bonding: Valence bond theory - its important features, the concept of hybridization involving s, p and d orbitals, resonance.
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.
Elementary idea of metallic bonding, hydrogen bonding and its applications.

UNIT 4: CHEMICAL THERMODYNAMICS

Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, 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, ionization and solution.

The second law of thermodynamics - Spontaneity of processes, Δ S of the universe and Δ G of the system as criteria for spontaneity. ΔG°(Standard Gibbs energy change) and equilibrium constant.

UNIT 5: SOLUTIONS

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, vapour pressure - composition, plots for ideal and non- ideal solutions, Colligative properties of dilute solutions - a relative lowering of vapour pressure, depression of freezing point, the elevation of boiling point and osmotic pressure, determination of molecular mass using colligative properties, abnormal value of molar mass, van't Hoff factor and its significance.

UNIT 6: EQUILIBRIUM

Meaning of equilibrium is the concept of dynamic equilibrium.
Equilibria involving physical processes: Solid-liquid, liquid-gas, gas-gas and solid-gas equilibria, Henry's law. General characteristics of equilibrium involving physical processes.
Equilibrium involving chemical processes: Law of chemical equilibrium, equilibrium constants (Kp and Kc) and their significance, the significance of Δ G and Δ G ° in chemical equilibrium, factors affecting equilibrium concentration, pressure, temperature, the effect of catalyst, Le Chatelier's principle.
Ionic equilibrium: Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius, Bronsted - Lowry and Lewis) and their ionization, acid-base equilibria (including multistage ionization) and ionization constants, ionization of water, pH scale, common ion effect, hydrolysis of salts and pH of their solutions, the solubility of sparingly soluble salts, solubility products and buffer solutions.

UNIT 7: REDOX REACTIONS AND ELECTROCHEMISTRY

Electronic concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number and balancing of redox reactions.
Electrolytic and metallic conduction, conductance in electrolytic solutions, molar conductivities and their variation with concentration, Kohlrausch's law and its applications.
Electrochemical cells - Electrolytic and Galvanic cells, different types of electrodes, electrode potentials including standard electrode potential, half-cell and cell reactions, emf of a Galvanic cell and its measurement, Nernst equation and its applications, relationship between cell potential and Gibbs' energy change, dry cell and lead accumulator, fuel cells.

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, rate constant and its units, differential and integral forms of zero and first-order reactions, their characteristics and half-lives, the effect of temperature on the rate of reactions, Arrhenius theory, activation energy and its calculation, collision theory of bi-molecular gaseous reactions (no derivation).

INORGANIC CHEMISTRY

UNIT 9: CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Modern 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, ionization 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, ionization enthalpy, oxidation states, atomic radii, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation, preparation, properties and uses of K 2 Cr 2 O 7 and KMnO 4 .
Inner Transition Elements
Lanthanoids - Electronic configuration, oxidation states and Lanthanoid contraction.Actinoids - Electronic configuration and oxidation states.

UNIT 12: COORDINATION COMPOUNDS

Introduction to coordination compounds. Werner's theory, ligands, coordination number, denticity, chelation, IUPAC nomenclature of mononuclear co-ordination compounds, isomerism, Bonding: Valence bond approach and basic ideas of Crystal field theory, colour and magnetic properties, importance of coordination compounds (in qualitative analysis, extraction of metals and in biological systems).

ORGANIC CHEMISTRY

UNIT 13: PURIFICATION AND CHARACTERISATION OF ORGANIC COMPOUNDS

Purification - Crystallization, 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, nitrogen, halogens, sulphur and phosphorus.
Calculations of empirical formulae and molecular formulae, numerical problems in organic quantitative analysis,

UNIT 14: SOME BASIC PRINCIPLES OF ORGANIC CHEMISTRY

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, homologous series: Isomerism - structural and stereoisomerism.
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 - Inductive effect, electromeric effect, resonance and hyperconjugation.
Common types of organic reactions- Substitution, addition, elimination and rearrangement.

UNITS 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 - Geometrical isomerism, mechanism of electrophilic addition, addition of hydrogen, halogens, water, hydrogen halides (Markownikoffs and peroxide effect), Ozonolysis and polymerization.
Alkynes - Acidic character, addition of hydrogen, halogens, water and hydrogen halides, polymerization.
Aromatic hydrocarbons - Nomenclature, benzene - structure and aromaticity, mechanism of electrophilic substitution, halogenation, nitration.
Friedel-Craft's alkylation and acylation, directive influence of the functional group in mono- substituted Benzene.

UNIT 16: ORGANIC COMPOUNDS CONTAINING HALOGENS

General methods of preparation, properties and reactions, nature of C-X bond, mechanisms of substitution reactions. Uses, environmental effects of chloroform, iodoform, freons and DDT.

UNIT 17: ORGANIC COMPOUNDS CONTAINING OXYGEN

General methods of preparation, properties, reactions and uses.

ALCOHOLS, PHENOLS AND ETHERS

Alcohols: Identification of primary, secondary and tertiary alcohols, mechanism of dehydration.
Phenols: Acidic nature, electrophilic substitution reactions, halogenation, nitration and sulphonation, Reimer - Tiemann reaction.
Ethers: Structure.
Aldehyde and Ketones: Nature of carbonyl group, nucleophilic addition to >C=O group, relative reactivities of aldehydes and ketones, important reactions such as - Nucleophilic addition reactions (addition of HCN, NH 3 and its derivatives), Grignard reagent, oxidation, reduction (Wolf Kishner and Clemmensen), the acidity of alpha-hydrogen. Aldol condensation, Cannizzaro reaction, Haloform reaction, chemical tests to distinguish between aldehydes and ketones.
Carboxylic Acids: Acidic strength and factors affecting it.

UNIT 18: ORGANIC COMPOUNDS CONTAINING NITROGEN

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.

Diazonium Salts: Importance in synthetic organic chemistry.

UNIT 19: BIOMOLECULES

General introduction and importance of biomolecules.
CARBOHYDRATES – Classification, aldoses and ketoses, monosaccharides (glucose and fructose) and constituent monosaccharides of oligosaccharides (sucrose, lactose and maltose).
PROTEINS - Elementary idea of alpha -amino acids, peptide bond, 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. Hormones (General introduction)

UNIT 20: PRINCIPLES RELATED TO PRACTICAL CHEMISTRY

Detection of extra elements (Nitrogen, sulphur, halogens) in organic compounds, detection of the following functional groups, hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketones) carboxyl and amino groups in organic compounds.
The chemistry involved in the preparation of the following:
Inorganic compounds, Mohr's salt, potash alum.
Organic compounds: Acetanilide, p-nitro acetanilide, aniline yellow, iodoform.
The chemistry involved in the titrimetric exercises – acids, bases and the use of indicators, oxalic-acid vs KMnO4, Mohr's salt vs KMnO4
Chemical principles involved in the qualitative salt analysis:
Cations – Pb 2+, Cu 2+, Al 3+ , Fe 3+ , Zn 2+ , Ni 2+ , Ca 2+ , Ba 2+ , Mg 2+ , NH 4+
Anions- CO 32− , S 2- , SO 42− , NO 3- , NO 2- , Cl - , Br - , I - (Insoluble salts excluded).
Chemical principles involved in the following experiments:
1. Enthalpy of solution of CuSO 4
2. Enthalpy of neutralization of strong acid and strong base.
3. Preparation of lyophilic and lyophobic sols.
4. Kinetic study of the reaction of iodide ions with hydrogen peroxide at room temperature.

How to Prepare For JEE Main Chemistry

Securing a strong score in JEE Main Chemistry requires a mix of conceptual understanding, memorization, and consistent practice. Here's a targeted approach to prepare effectively for Chemistry:
Thorough Knowledge of Syllabus and Exam Pattern: Familiarize yourself with the JEE Main Chemistry syllabus and exam structure. Divide topics into Physical, Organic, and Inorganic Chemistry to organize study sessions effectively.

- **Foundational Study Using NCERT Textbooks:** Begin with NCERT textbooks for Grades 11 and 12, as they cover the fundamental concepts and factual details that are frequently tested in JEE Main Chemistry.
- **Conceptual Mastery in Physical Chemistry:** Focus on understanding the core concepts in Physical Chemistry, such as thermodynamics, chemical kinetics, and electrochemistry. Practice calculations extensively to improve accuracy in problem-solving.
- **Memorization and Regular Review in Inorganic Chemistry:** Inorganic Chemistry requires strong memorization skills. Regularly revise periodic trends, reactions, and exceptions, and use mnemonics or notes to aid memory retention.
- **Mechanisms and Reactions in Organic Chemistry:** In Organic Chemistry, understand reaction mechanisms and practice converting between compounds. Pay special attention to named reactions, reagents, and functional group transformations.
- **Frequent Revision of Key Concepts:** Set aside time to revisit and reinforce important concepts, formulas, and reactions. Regular review is crucial for retaining information across all three branches of Chemistry.
- **Mock Tests and Practice Questions:** Solve mock tests and previous years' papers to gain familiarity with question types and improve time management. After each test, review errors to adjust your approach and focus on weaker areas.

Other Useful Resources

Are you preparing for the JEE Main exam, a crucial stepping stone towards your dream engineering college? Success in this competitive exam requires dedication, hard work, and access to high-quality study materials. To help you excel in the JEE Main exam, we have provided below some essential eBooks. Let's explore those ebooks.

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Thank You