

LONG FORM OF

- Alkali Metals
- Alkaline Earth Metals
- Transition Metals
- Non-Metals

d-BLOCK (TRANSITION ELEMENTS)
 $[(n-1)d^{1-10} ns^1]$

s-BLOCK ($ns^{1,2}$)

- 1
(1s)
- 2
(2s 2p)
- 3
(3s 3p)
- 4
(4s 3d 4p)
- 5
(5s 4d 5p)
- 6
(6s (4f) 5d 6p)
- 7
(7s (5f) 6d 7p)

s-BLOCK ($ns^{1,2}$)		d-BLOCK (TRANSITION ELEMENTS) $[(n-1)d^{1-10} ns^1]$					
1 H $1s^1$ Hydrogen	2 He $1s^2$ Helium						
3 Li $2s^1$ Lithium	4 Be $2s^2$ Beryllium						
11 Na $3s^1$ Sodium	12 Mg $3s^2$ Magnesium						
19 K $4s^1$ Potassium	20 Ca $4s^2$ Calcium	21 Sc $3d^1 4s^2$ Scandium	22 Ti $3d^2 4s^2$ Titanium	23 V $3d^3 4s^2$ Vanadium	24 Cr $3d^5 4s^1$ Chromium	25 Mn $3d^5 4s^2$ Manganese	26 Fe $3d^6 4s^2$ Iron
37 Rb $5s^1$ Rubidium	38 Sr $5s^2$ Strontium	39 Y $4d^1 5s^2$ Yttrium	40 Zr $4d^2 5s^2$ Zirconium	41 Nb $4d^4 5s^1$ Niobium	42 Mo $4d^5 5s^1$ Molybdenum	43 Tc $4d^5 5s^2$ Technetium	44 Ru $4d^7 5s^1$ Ruthenium
55 Cs $6s^1$ Cesium	56 Ba $6s^2$ Barium	57 La* $d^1 6s^2$ Lanthanum	72 Hf $4f^{14} 5d^2 6s^2$ Hafnium	73 Ta $5d^3 6s^2$ Tantalum	74 W $5d^4 6s^2$ Tungsten	75 Re $5d^5 6s^2$ Rhenium	76 Os $5d^6 6s^2$ Osmium
87 Fr $7s^1$ Francium	88 Ra $7s^2$ Radium	89 Ac** $f^1 7s^2$ Actinium	104 Rf $5f^{14} 6d^2 7s^2$ Rutherfordium	105 Db $6d^3 7s^2$ Dubnium	106 Sg $6d^4 7s^2$ Seaborgium	107 Bh $6d^5 7s^2$ Bohrium	108 Hs $6d^6 7s^2$ Hassium

Horizontal rows or periods



Vertical rows or groups



*Lanthanoids

**Actinoids

58 Ce $4f^1 5d^1 6s^2$ Cerium	59 Pr $4f^3 5d^0 6s^2$ Praseodymium	60 Nd $4f^4 5d^0 6s^2$ Neodymium	61 Pm $4f^5 5d^0 6s^2$ Promethium	62 Sm $4f^6 5d^0 6s^2$ Samarium
90 Th $5f^0 6d^2 7s^2$ Thorium	91 Pa $5f^2 6d^1 7s^2$ Protactinium	92 U $5f^3 6d^1 6s^2$ Uranium	93 Np $5f^4 6d^1 7s^2$ Neptunium	94 Pu $5f^6 6d^0 7s^2$ Plutonium

THE PERIODIC TABLE

p-BLOCK ($ns^2 p^{1-6}$)

 Noble Gases

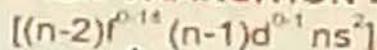
 Other Metals

 Lanthanoids

 Actinoids

				13	14	15	16	17
				5 B $2s^2 2p^1$ Boron	6 C $2s^2 2p^2$ Carbon	7 N $2s^2 2p^3$ Nitrogen	8 O $2s^2 2p^4$ Oxygen	9 F $2s^2 2p^5$ Fluorine
				13 Al $3s^2 3p^1$ Aluminium	14 Si $3s^2 3p^2$ Silicon	15 P $3s^2 3p^3$ Phosphorus	16 S $3s^2 3p^4$ Sulphur	17 Cl $3s^2 3p^5$ Chlorine
9	10	11	12	31 Ga $4s^2 4p^1$ Gallium	32 Ge $4s^2 4p^2$ Germanium	33 As $4s^2 4p^3$ Arsenic	34 Se $4s^2 4p^4$ Selenium	35 Br $4s^2 4p^5$ Bromine
27 Co $3d^7 4s^2$ Cobalt	28 Ni $3d^8 4s^2$ Nickel	29 Cu $3d^{10} 4s^1$ Copper	30 Zn $3d^{10} 4s^2$ Zinc	49 In $5s^2 5p^1$ Indium	50 Sn $5s^2 5p^2$ Tin	51 Sb $5s^2 5p^3$ Antimony	52 Te $5s^2 5p^4$ Tellurium	53 I $5s^2 5p^5$ Iodine
45 Rh $4d^8 5s^1$ Rhodium	46 Pd $4d^{10} 5s^0$ Palladium	47 Ag $4d^{10} 5s^1$ Silver	48 Cd $4d^{10} 5s^2$ Cadmium	81 Tl $6s^2 6p^1$ Thallium	82 Pb $6s^2 6p^2$ Lead	83 Bi $6s^2 6p^3$ Bismuth	84 Po $6s^2 6p^4$ Polonium	85 At $6s^2 6p^5$ Astatine
77 Ir $5d^7 6s^2$ Iridium	78 Pt $5d^9 6s^1$ Platinum	79 Au $5d^{10} 6s^1$ Gold	80 Hg $5d^{10} 6s^2$ Mercury	113 Uut $7s^2 7p^1$ Ununtrium	114 Uuq $7s^2 7p^2$ Ununquadium	115 Uup $7s^2 7p^3$ Ununpentium	116 Uuh $7s^2 7p^4$ Ununhexium	117 Uus $7s^2 7p^5$ Ununseptium
109 Mt $6d^7 7s^2$ Meitnerium	110 Ds $6d^8 7s^2$ Darmstadtium	111 Rg $6d^{10} 7s^1$ Roentgenium	112 Uub $6d^{10} 7s^2$ Ununbium					

f-BLOCK (INNER-TRANSITION ELEMENTS)



63 Eu $4f^7 5d^0 6s^2$ Europium	64 Gd $4f^7 5d^1 6s^2$ Gadolinium	65 Tb $4f^9 5d^0 6s^2$ Terbium	66 Dy $4f^{10} 5d^0 6s^2$ Dysprosium	67 Ho $4f^{11} 5d^0 6s^2$ Holmium	68 Er $4f^{12} 5d^0 6s^2$ Erbium	69 Tm $4f^{13} 5d^0 6s^2$ Thulium	70 Yb $4f^{14} 5d^0 6s^2$ Ytterbium	71 Lu $4f^{14} 5d^1 6s^2$ Lutetium
95 Am $5f^7 6d^0 7s^2$ Americium	96 Cm $5f^7 6d^1 7s^2$ Curium	97 Bk $5f^9 6d^0 7s^2$ Berkelium	98 Cf $5f^{10} 6d^0 7s^2$ Californium	99 Es $5f^{11} 6d^0 7s^2$ Einsteinium	100 Fm $5f^{12} 6d^0 7s^2$ Fermium	101 Md $5f^{13} 6d^0 7s^2$ Mendelevium	102 No $5f^{14} 6d^0 7s^2$ Nobelium	103 Lr $5f^{14} 6d^1 7s^2$ Lawrencium



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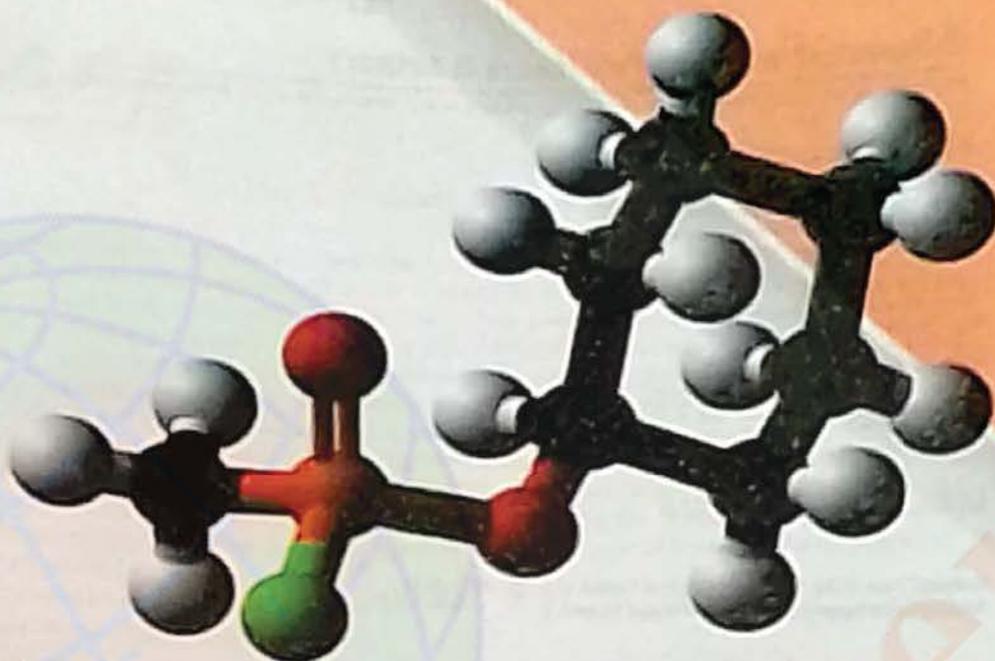
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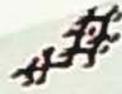
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PREFACE

To the One Hundred Fifteenth Edition

Encouraged by the tremendous response to the previous editions of this book we have ventured to bring out the One Hundred Fifteenth thoroughly revised edition in a span of around 20 years. The book has been extensively revised. The review given at the start of each chapter has been made so comprehensive and exhaustive that the students need not have to consult any other book or text-book for the study material. A section containing questions for JEE Advanced has been specially introduced so as to make the book equally useful for our engineering aspirants. A large no. of NEW and TYPICAL questions have also been added in the basic portion as well as at the end of each chapter in the form of Ultimate Preparatory Package. Moreover almost all the questions have been solved and extra pain has been taken to make the book an error free.

Keeping in view the inconvenience of the students in carrying this book, this edition is being released in three easy to carry volumes plus the one containing Solved Previous Years' Papers of various Entrance Tests.

Some Salient Features of this book are:

- ⇒ Covers New CBSE Syllabus
- ⇒ 39,000 plus
- ⇒ Hints/Explanations to almost all the questions.
- ⇒ Complete Study Material at the start of each chapter
- ⇒ Some Note worthy points—new and selected points not easily available in the other books.
- ⇒ Red Alert - some key points which need student's attention
- ⇒ Useful A-level Information containing advanced and most typical material for competitive exams.
- ⇒ Some Pitfalls - crucial errors and misconcepts which students tend to ignore.
- ⇒ A revision exercise which is a collection of questions from previous 22 years competitive exams (including 2012 exams.)
- ⇒ Selected Straight Objective Type MCQs (For JEE Advanced, JEE Main, NEET & others)
- ⇒ Linked Comprehension Type MCQs (For JEE Advanced)
- ⇒ Matrix Match Type MCQs (For JEE Advanced)
- ⇒ Unit Test at the end of each unit.
- ⇒ Reason-Assertion Type Questions for JEE (Advanced) and A.I.I.M.S. aspirants.
- ⇒ Ultimate Preparatory Package containing selected and most important challenging typical questions
- ⇒ Some challenging and selective questions covering key/choosy points of the whole unit are given at the end of every unit in the form of Brain Teasers.
- ⇒ Various Model Papers according to the style of different competitive examinations, including new style NEET and JEE (Main) model papers for 2013 and 2014 examinations.
- ⇒ Different papers of 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011 and 2012 examinations have been appended at the end of the book.

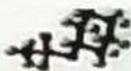
We are thankful to the various teachers, especially, Mr. Radha Krishnan, Thrissur; Mr. S. Narayanan, Thrissur; Mr. T.N.G. Nair, Thiruvanthapuram; Mr. O.P. Singh, Varanasi. Special thanks are also due to our energetic and enlightened publishers **Sh. S.P. Jain (B.E.)**, **Sh. Dinesh K. Jain (B.E.)** and **Sh. Vinesh Jain (B.Com.)** for bringing out this book in time and in the proper form. Suggestions for the further improvement of the book will be thankfully acknowledged.

Authors

SYLLABUS for NEET(UG)

Chemistry Class 11th

- UNIT-I: Some Basic Concepts of Chemistry**
 General introduction, importance and scope of chemistry, Laws of chemical combination, Dalton's atomic theory; concept of elements, atoms and molecules, Atomic and molecular masses, Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions, stoichiometry and calculations based on stoichiometry.
- UNIT-II: Structure of Atom**
 Atomic number, isotopes and isobars, Concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbital, quantum numbers, shapes of *s*, *p* and *d* orbitals, rules for filling electrons in orbitals- Aufbau principle, Pauli exclusion principles and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.
- UNIT-III: Classification of Elements and Periodicity in Properties**
 Modern periodic law and long form of periodic table, periodic trends in properties of elements- atomic radii, ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, valence.
- UNIT-IV: Chemical Bonding and Molecular Structure**
 Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory, concept of hybridization involving *s*, *p* and *d* orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only). Hydrogen bond.
- UNIT-V: States of Matter: Gases and Liquids**
 Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws of elucidating the concept of the molecule, Boyle's law, Charles's law, Gay Lussac's law, Avogadro's law, ideal behaviour of gases, empirical derivation of gas equation, Avogadro number, ideal gas equation, Kinetic energy and molecular speeds (elementary idea), deviation from ideal behaviour, liquefaction of gases, critical temperature.
 Liquid State- Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).
- UNIT-VI: Thermodynamics**
 First law of thermodynamics-Internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH , Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution.
 Introduction of entropy as state function, Second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium and spontaneity.
 Third law of thermodynamics- Brief introduction.
- UNIT-VII: Equilibrium**
 Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of chemical equilibrium, equilibrium constant, factors affecting equilibrium- Le Chatelier's principle; ionic equilibrium- ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of polybasic acids, acid strength, concept of pH , Hydrolysis of salts (elementary idea), buffer solutions, Henderson equation, solubility product, common ion effect (with illustrative examples).
- UNIT-VIII: Redox Reactions**
 Concept of oxidation and reduction, redox reactions oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers.
- UNIT-IX: Hydrogen**
 Occurrence, isotopes, preparation, properties and uses of hydrogen; hydrides-ionic, covalent and interstitial; physical and chemical properties of water, heavy water; hydrogen peroxide-preparation, reactions, uses and structure;



UNIT - X: s-Block Elements (Alkali and Alkaline earth metals)

Group 1 and group 2 elements:

General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens, uses.

Preparation and Properties of Some Important Compounds

Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogencarbonate, biological importance of sodium and potassium.

Industrial use of lime and limestone, biological importance of Mg and Ca.

UNIT - XI: Some p-Block Elements

General Introduction to p-Block Elements

Group 13 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group, Boron, some important compounds: borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalis.

General 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element. Carbon, allotropic forms, physical and chemical properties: uses of some important compounds: oxides.

Important compounds of silicon and a few uses: silicon tetrachloride, silicones, silicates and zeolites, their uses.

UNIT - XII: Organic Chemistry- Some Basic Principles and Techniques

General introduction, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds.

Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation.

Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions.

UNIT - XIII: Hydrocarbons

Alkanes-Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis.

Alkenes-Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.

Alkynes-Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of- hydrogen, halogens, hydrogen halides and water.

Aromatic hydrocarbons- Introduction, IUPAC nomenclature; Benzene; resonance, aromaticity; chemical properties: mechanism of electrophilic substitution- Nitration, sulphonation, halogenation, Friedel Craft's alkylation and acylation; directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

UNIT - XIV: Environmental Chemistry

Environmental pollution: Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

Chemistry Class 12th

- UNIT-I: Solid State**
 Classification of solids based on different binding forces, molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea), unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties, Band theory of metals, conductors, semiconductors and insulators.
- UNIT-II: Solutions**
 Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties- relative lowering of vapour pressure, Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties abnormal molecular mass, Van Hoff factor.
- UNIT-III: Electrochemistry**
 Redox reactions, conductance in electrolytic solutions, specific and molar conductivity variation of conductivity with concentration, Kohlrausch's Law, electrolysis and Laws of electrolysis (elementary idea), dry cell- electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.
- UNIT-IV: Chemical Kinetics**
 Rate of a reaction (average and instantaneous), factors affecting rates of reaction; concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenius equation.
- UNIT-V: Surface Chemistry**
 Adsorption- physisorption and chemisorption; factors affecting adsorption of gases on solids, catalysis homogeneous and heterogeneous, activity and selectivity; enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophilic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation, emulsions- types of emulsions.
- UNIT-VI: General Principles and Processes of Isolation of Elements**
 Principles and methods of extraction- concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.
- UNIT-VII: p-Block Elements**
Group 15 elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties, preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous- allotropic forms: compounds of phosphorous: preparation and properties of phosphine, halides (PCl_3 , PCL_5) and oxoacids (elementary idea only).
Group 16 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties, dioxygen: preparation, properties and uses; classification of sulphur dioxide; sulphur - allotropic forms: compounds of sulphur: preparation, properties and uses of sulphur (structures only).
Group 17 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties, compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only).
Group 18 elements: General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.
- UNIT-VIII: d and f-Block Elements**
 General introduction, electronic configuration, characteristics of transition metals, general trends in properties of the first row transition metals- metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation, Preparation and properties of $K_2Cr_2O_7$ and $KMnO_4$.
 Lanthanoids- electronic configuration, oxidation states, chemical reactivity, and lanthanoid contraction and its consequences.



Actinoids: Electronic configuration, oxidation states and comparison with lanthanoids.

UNIT - IX: Coordination Compounds

Coordination compounds: Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, isomerism (structural and stereo) bonding, Werner's theory VBT, CFT, importance of coordination compounds (in qualitative analysis, biological systems)

UNIT - X: Haloalkanes and Haloarenes

Haloalkanes: Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions. Optical rotation.

Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only).

Uses and environment effects of - dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

UNIT - XI: Alcohols, Phenols and Ethers

Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses with special reference to methanol and ethanol.

Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.

Ethers: Nomenclature, methods of preparation, physical and chemical properties uses.

UNIT - XII: Aldehydes, Ketones and Carboxylic Acids

Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties; and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

UNIT - XIII: Organic Compounds Containing Nitrogen

Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary secondary and tertiary amines.

Cyanides and Isocyanides - will be mentioned at relevant places.

Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

UNIT - XIV: Biomolecules

Carbohydrates- Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D.L. configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); importance.

Proteins- Elementary idea of - amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.

Hormones- Elementary idea (excluding structure).

Vitamins- Classification and function.

Nucleic Acids: DNA and RNA

UNIT - XV: Polymers

Classification- Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polyesters, bakelite; rubber. Biodegradable and non-biodegradable polymers.

UNIT - XVI: Chemistry in Everyday Life

Chemicals in medicines- analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

Chemicals in food- preservatives, artificial sweetening agents, elementary idea of antioxidants.

Cleansing agents- soaps and detergents, cleansing action.

SYLLABUS FOR JEE (Main)

Section-A (Physical Chemistry)

Unit-1: Some Basic Concepts in Chemistry

Matter and its nature, Dalton's atomic theory, Concept of atom, molecule, element and compound; Physical quantities and their measurements in Chemistry, precision and accuracy, significant figures, S.I. units; dimensional analysis; Laws of chemical combination; Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae; Chemical equations and stoichiometry.

Unit-2: States of Matter

Classification of matter into solid, liquid and gaseous states.

Gaseous State: Measurable properties of gases; Gas laws—Boyle's law, Charles's law, Graham's law of diffusion, Avogadro's law, Dalton's law of partial pressure, Concept of absolute scale of temperature; Ideal gas equation, Kinetic theory of gases (only postulates); Concept of average, root mean square and most probable velocities; Real gases, deviation from ideal behaviour, compressibility factor, van der Waals equation.

Liquid State: Properties of liquids—vapour pressure, viscosity and surface tension and effect of temperature on them (qualitative treatment only).

Solid State: Classification of solids: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea); Bragg's Law and its applications, Unit cell and lattices, packing in solids (fcc, bcc and hcp lattices), voids, calculations involving unit cell parameters, Imperfection in solids; electrical and magnetic properties.

Unit-3: Atomic Structure

Thomson and Rutherford atomic models and their limitations; Nature of electromagnetic radiation, photoelectric effect, spectrum of hydrogen atom, Bohr model of hydrogen atom—its postulates, derivation of the relations for energy of the electron and radii of the different orbits, limitations of Bohr's model, dual nature of matter, de-Bruglie's relationship, Heisenberg uncertainty principle, Elementary ideas of quantum mechanics, quantum mechanical model of atom, its important features, ψ and ψ^2 , concept of atomic orbitals as one electron wave functions; Variation of ψ and ψ^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; rules for filling electrons in orbitals—Aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of elements, extra stability of half-filled and completely filled orbitals.

Unit-4: Chemical Bonding and Molecular Structure

Kossel-Lewis approach to chemical bond formation, 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, 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, concept of bond order, bond length and bond energy.

Elementary idea of metallic bonding, Hydrogen bonding and its applications.

Unit-5: Chemical Thermodynamics

Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, types of processes.

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.

Second law of thermodynamics: Spontaneity of processes; ΔS of the universe and ΔG of the system as criteria for spontaneity, ΔG° (Standard Gibbs energy change) and equilibrium constant.

Unit-6: Solutions

Different methods for expressing concentration of solution—molarity, molar mass, mole fraction, percentage (by volume and mass both), 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—relative lowering of vapour pressure, depression of freezing point, 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 - 7: Equilibrium**

Meaning of equilibrium, concept of dynamic equilibrium.
 Equilibria involving physical processes: Solid-liquid, liquid-gas and solid-gas equilibria, Henry's law, general characteristics of equilibrium involving physical processes.
 Equilibria involving chemical processes: Law of chemical equilibrium, equilibrium constants (K_c and K_p) and their significance, significance of ΔG and ΔG° in chemical equilibria, factors affecting equilibrium concentration, pressure, temperature, 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, solubility products, buffer solutions.

Unit - 8: Redox Reactions and Electrochemistry

Electronic concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number, balancing of redox reactions.

Electrolytic and metallic conduction, conductance in electrolytic solutions, specific and 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 - 9: 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, effect of temperature on rate of reactions—Arrhenius theory, activation energy and its calculation, collision theory of bimolecular gaseous reactions (no derivation).

Unit - 10: Surface Chemistry

Adsorption: Physisorption and chemisorption and their characteristics, factors affecting adsorption of gases on solids—Freundlich and Langmuir adsorption isotherms, adsorption from solutions.

Catalysis: Homogeneous and heterogeneous, activity and selectivity of solid catalysts, enzyme catalysis and its mechanism.
Colloidal State: Distinction among true solutions, colloids and suspensions, classification of colloids—hydrophilic, hydrophobic; multi molecular, macromolecular and associated colloids (micelles), preparation and properties of colloids—Tyndall effect, Brownian movement, electrophoresis, dialysis, coagulation and flocculation; Emulsions and their characteristics.

Section-B (Inorganic Chemistry)**Unit - 11: 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 - 12: General Principles and Processes of Isolation of Metals

Modes of occurrence of elements in nature, minerals, ores; steps involved in the extraction of metals—concentration, reduction (chemical and electrolytic methods) and refining with special reference to the extraction of Al, Cu, Zn and Fe; Thermodynamic and electrochemical principles involved in the extraction of metals.

Unit - 13: Hydrogen

Position of hydrogen in periodic table, isotopes, preparation, properties and uses of hydrogen; physical and chemical properties of water and heavy water; Structure, preparation, reactions and uses of hydrogen peroxide; Classification of hydrides—ionic, covalent and interstitial; Hydrogen as a fuel.

Unit - 14: s-Block Elements (Alkali and Alkaline Earth Metals)**Group-1 and 2 Elements**

General Introduction: electronic configuration and general trends in physical and chemical properties of elements, anomalous properties of the first element of each group, diagonal relationships.

Preparation and properties of some important compounds—sodium carbonate, sodium hydroxide and sodium hydrogen carbonate; Industrial uses of lime, limestone, Plaster of Paris and cement; Biological significance of Na, K, Mg and Ca.

Unit - 15: p-Block Elements

Group-13 to Group 18 Elements: 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.

Groupwise study of the p-block elements

Group-13: Preparation, properties and uses of boron and aluminium; structure, properties and uses of borax, boric acid, diborane, boron trifluoride, aluminium chloride and alums.

Group-14: Tendency for catenation; Structure, properties and uses of allotropes and oxides of carbon, silicon tetrachloride, silicates, zeolites and silicones.

Group-15: Properties and uses of nitrogen and phosphorus; Allotropic forms of phosphorus; Preparation, properties,



Structure and use of aromatic rings with phenyl and benzyl groups (PCL, PCL) Structure of oxides and oxoacids of nitrogen and phosphorus

Group 16: Preparation, properties, structures and uses of oxides, chlorides, forms of sulphur, Preparation, properties, structures of sulphur compounds and uses of sulphur and bisulphides with bonds to the weak nature of hydrogen halides

Group 17: Preparation, properties and uses of chlorine and bromine with bonds to the weak nature of hydrogen halides

Group 18: Occurrence and uses of noble gases, formation of fluorides and oxides of noble gases

2021-22: Transition Elements

General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first row transition elements, physical properties, oxidation states, complex formation, coordination number, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation, Preparation, properties and uses of hydrogen halides

2021-22: Inner Transition Elements

Lanthanoids, electronic configuration, occurrence and characteristics, general trends in properties of the first row lanthanoids, physical properties, oxidation states, complex formation, coordination number, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation, Preparation, properties and uses of hydrogen halides

2021-22: Actinoids

Introduction to actinoids, configuration, occurrence and characteristics, general trends in properties of the first row actinoids, physical properties, oxidation states, complex formation, coordination number, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation, Preparation, properties and uses of hydrogen halides

2021-22: Environmental Chemistry

Atmospheric Pollution: Air pollution, water and soil

Atmospheric pollutants: Tropospheric and stratospheric

Stratospheric pollutants: Gaseous pollutants: Check of carbon, nitrogen and sulphur, hydrocarbons, their sources, harmful effects and prevention. Green house effect and Global warming, Acid rain.

Particulate pollutants: Smog, dust, smog, Soot, etc. their sources, harmful effects and prevention.

Stratospheric pollutants: Formation and breakdown of ozone, depletion of ozone layer, its mechanism and effects

Water pollutants: Major pollutants such as pesticides, insecticides, herbicides and fungicides, their harmful effects and prevention

Soil pollutants: Major pollutants such as pesticides, insecticides, herbicides and fungicides, their harmful effects and prevention

Strategies to control environmental pollution

Section-C (Organic Chemistry)

2021-22: 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, nitrogen, halogens, sulphur, phosphorus, Calcium and organic formulae and molecular formulae. Functional groups in organic quantitative analysis

2021-22: Stereoisomerism (Organic Chemistry)

Isomerism: Stereoisomerism: Geometric isomerism, optical isomerism (1 and 2). Classification of organic compounds based on functional groups and those containing halogens, oxygen, nitrogen and sulphur. Homologous series, isomerism—structural and stereoisomerism

Nomenclature (IUPAC and EIPAC)

Conformations, Newman projections and staggered conformations, 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

2021-22: 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 (Markovnikov's 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 functional group in mono-substituted benzene

Syllabus for JEE (Advanced)

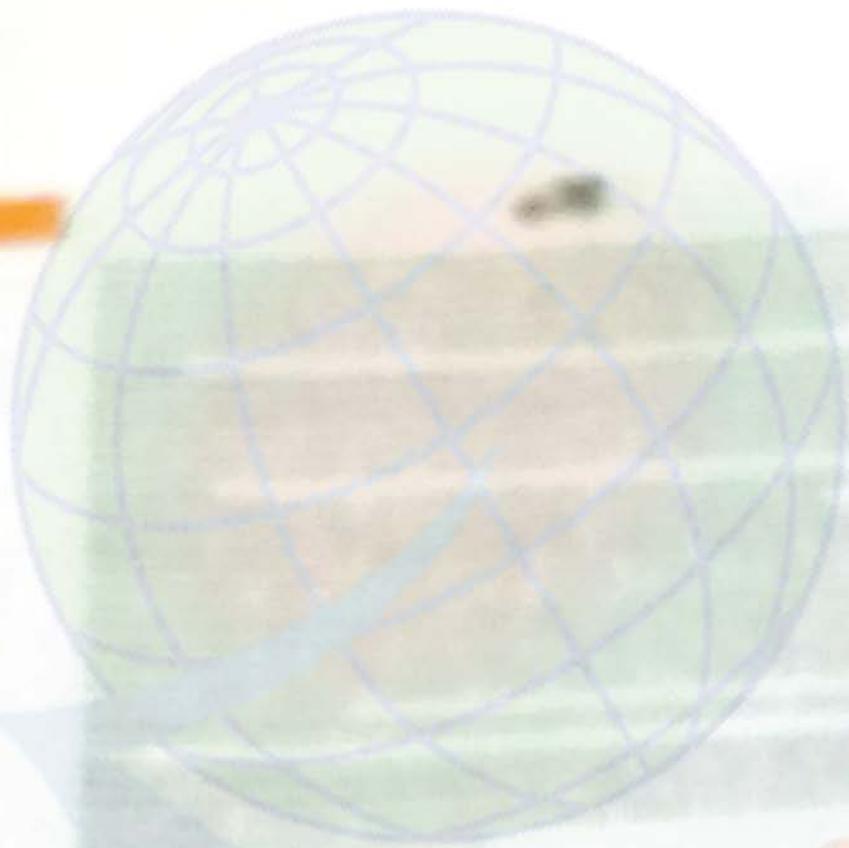
The syllabus for JEE (Advanced) is divided into two parts: Part I and Part II. Part I covers the following topics:

- Atomic Structure
- Chemical Bonding
- States of Matter
- Thermodynamics
- Equilibrium
- Redox Reaction
- Electrochemistry
- Chemical Kinetics
- Surface Chemistry

Part II covers the following topics:

- Organic Chemistry
- Inorganic Chemistry

The syllabus is designed to test the candidate's understanding of the concepts and their ability to apply them in solving problems. The questions are of a high standard and require a deep understanding of the subject.



GradeSetter



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UNIT - III

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1.133. Basics	P.1481-P.1490
1.134. Basics	P.1491-P.1500
1.135. Basics	P.1501-P.1510
1.136. Basics	P.1511-P.1520
1.137. Basics	P.1521-P.1530
1.138. Basics	P.1531-P.1540
1.139. Basics	P.1541-P.1550
1.140. Basics	P.1551-P.1560
1.141. Basics	P.1561-P.1570
1.142. Basics	P.1571-P.1580
1.143. Basics	P.1581-P.1590
1.144. Basics	P.1591-P.1600
1.145. Basics	P.1601-P.1610
1.146. Basics	P.1611-P.1620
1.147. Basics	P.1621-P.1630
1.148. Basics	P.1631-P.1640
1.149. Basics	P.1641-P.1650
1.150. Basics	P.1651-P.1660
1.151. Basics	P.1661-P.1670
1.152. Basics	P.1671-P.1680
1.153. Basics	P.1681-P.1690
1.154. Basics	P.1691-P.1700
1.155. Basics	P.1701-P.1710
1.156. Basics	P.1711-P.1720
1.157. Basics	P.1721-P.1730
1.158. Basics	P.1731-P.1740
1.159. Basics	P.1741-P.1750
1.160. Basics	P.1751-P.1760
1.161. Basics	P.1761-P.1770
1.162. Basics	P.1771-P.1780
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1.164. Basics	P.1791-P.1800
1.165. Basics	P.1801-P.1810
1.166. Basics	P.1811-P.1820
1.167. Basics	P.1821-P.1830
1.168. Basics	P.1831-P.1840
1.169. Basics	P.1841-P.1850
1.170. Basics	P.1851-P.1860
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Unit-1

[Faint, illegible text from a textbook page, likely containing a lesson plan or introduction for Unit 1.]

Some Note Worthy Points

- When a number ends in zeros that are not to the right of decimal point, the zeros are not necessarily significant e.g., 180 has two or three significant figures. 18600 has three, four or five significant figures. This ambiguity can be removed by expressing the value in terms of Exponential notations also called Scientific notations. For example, a mass of 18600 g can be written in exponential notations showing three, four or five significant figures as
 1.86×10^4 - three significant figures
 1.860×10^4 - four significant figures
 1.8600×10^4 - five significant figures
 In this notation, every number is written as $N \times 10^n$, where N = a number with simple not-zero digit to the left of the decimal point and n = an integer.
 All significant figures come before the exponent, the exponential term does not add to the number of significant figures.
 (i) 0.000054 is expressed as 5.4×10^{-5} - two significant figures
 (ii) Avogadro's number is 6.022×10^{23} - four significant figures.
 (iii) Planck's constant is 6.626×10^{-34} J s - four significant figures.
- The exponential notations are used in expressing very small and very large numbers.
- There is always some uncertainty in results obtained from experimental measurements. However, there is no such problem in counting of the number. The results are accurate. As such no rules are needed.
- Exact integral numbers, such as the number of objects in a dozen or number of grams in a kilogram do not have any uncertainty associated with them and as such these numbers have infinite number of significant figures. This applies to many definitions between the units e.g., a foot has 12 inches, the number 12 is exact, and we need not worry about the number of significant figures in it.

Red Alert

If more than one digit is to be rounded off from a particular number, they are dropped one by one in steps. For example, if the number 3.124556 is to be reported upto three decimal places the digits 5 and 6 are dropped in two steps as follows.
 1st step. 3.12456 is rounded off to 3.1246 (last digit to be dropped is greater than 5).
 2nd step. 3.1246 is rounded off to 3.125 (last digit to be dropped is greater than 5).
 Note. If the problem involves more than one step, the rounding off is carried out only in the final answer.

SI UNITS. Seven Basic SI units for physical quantities are as follows :

Length	Mass	Time	Temperature	Electric Current	Luminous Intensity	Amount of Substance
metre (m)	kilogram (kg)	second (s)	kelvin (K)	Ampere (A)	Candela (Cd)	Mole (mol)

- Some derived units. Volume = Length \times Breadth \times Height = $m \times m \times m = m^3$
 Velocity = Distance/Time = $m s^{-1}$
 Acceleration = $\frac{\text{Change in velocity}}{\text{Time}} = \frac{m s^{-1}}{s} = m s^{-2}$
 Force = Mass \times Acceleration = $kg m s^{-2} = \text{newton (N)}$
 Pressure = $\frac{\text{Force}}{\text{Area}} = \frac{kg m s^{-2}}{m^2} = kg m^{-1} s^{-2} = \text{pascal (Pa)}$

Some Basic Concepts of Chemistry

$$\text{Energy} = \text{Force} \times \text{Distance} = \text{kg m s}^{-2} \times \text{m} \\ = \text{kg m}^2 \text{s}^{-2} = \text{joule (J)}$$

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}} = \frac{\text{kg}}{\text{m}^3} = \text{kg m}^{-3}$$

$$\text{Concentration} = \frac{\text{Mass of solute}}{\text{Volume of solution}} = \text{mol m}^{-3} = \text{mol l}^{-1}$$

- Some prefixes used for subsidiary units.

Sub-multiples : deci (d) = 10^{-1} , centi (c) = 10^{-2} , milli (m) = 10^{-3} , micro (μ) = 10^{-6} ,
nano (n) = 10^{-9} , pico (p) = 10^{-12} , femto (f) = 10^{-15} , atto (a) = 10^{-18}

Multiples : deca (da) = 10^1 , hecto (h) = 10^2 , kilo (k) = 10^3 , mega (M) = 10^6 ,
giga (G) = 10^9 , tera (T) = 10^{12} , penta (P) = 10^{15} , exa (E) = 10^{18}

- Some useful conversion factors. One set of units can be converted into another with the help of conversion factors such that the common units are cancelled. Some important conversion factors are
 $1 \text{ \AA} = 10^{-10} \text{ m}$, $1 \text{ nm} = 10^{-9} \text{ m}$, $1 \text{ pm} = 10^{-12} \text{ m}$, $1 \text{ L} = 10^{-3} \text{ m}^3 = 1 \text{ dm}^3$, $1 \text{ atm} = 760 \text{ mm Hg}$
 $1 \text{ torr} = 101325 \text{ Pa or N m}^{-2}$, $1 \text{ bar} = 10^5 \text{ N m}^{-2} = 10^5 \text{ Pa}$, $1 \text{ calorie} = 4.184 \text{ J}$
 $1 \text{ electron volt (eV)} = 1.6022 \times 10^{-19} \text{ J}$

MATTER

Matter is defined as anything which occupies space, possesses mass and can be judged by one or more of our senses. The matter may be classified as under :

- Physical classification.** Depending upon the rigidity, volume and shape, *i.e.*, physical nature, matter may be classified into three states—solids, liquids and gases.
- Chemical classification.** Depending upon the chemical composition of the substance, matter may be classified into (a) pure substances *i.e.*, elements and compounds (homogeneous) (b) mixtures which may be homogeneous (solutions) or heterogeneous.

ELEMENTS, COMPOUNDS AND MIXTURES

- An **element** is a pure substance which can neither be broken nor built from two or more simple substances by any known physical or chemical methods. The elements are building block of matter *i.e.* any matter is made up of one or more types of elements. Substances built of only one kind of atoms are called elements.

On the basis of characteristic properties, the elements are further classified into metals, non-metals and metalloids.

- Compound** is a pure substance which contains two or more than two elements combined together in some fixed proportion by weight and which can be decomposed into two or more elements by a suitable method. It is always homogeneous.
- Mixture** is a material obtained by mixing two or more substances (elements or compounds) in any proportion. In it, the properties of the constituents remain unchanged. It may be homogeneous or heterogeneous.

- Separation of components of the mixture** depends upon (i) the physical state of the substance in the mixture (*i.e.*, solid, liquid, gases or in solution) (ii) physical properties (*i.e.*, melting point, boiling point, solubility) of each component. The choice of the method used depends on (a) the type of the mixture to be separated. (b) the nature of each component to be separated.
- Types of mixtures.** Common types of mixtures are (i) solid-solid mixture (ii) solid-liquid mixture (iii) liquid-liquid mixture (iv) gas-liquid mixture (v) gas-gas mixture (vi) gas-solid mixture.
- Common methods of separation of mixture**

- Filtration.** The insoluble solid present in a liquid is separated by filtration *e.g.*, BaSO_4 present in aqueous solution.
- Crystallisation.** A dissolved crystalline substance from a solution is separated by crystallisation. *e.g.*, copper sulphate crystals from aqueous solution.

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