

Physical Chemistry I	
Basic Concept of Chemistry (DVD -1)	<p>Chemistry, Matter, Atom, Molecule, Avogadro's Law, To find the relationship between molecular mass and vapour density of a gas, Proof of Atomicity of Gases, Atomic mass, Atomic mass unit, Average atomic mass Calculation of Average Atomic Mass, Other Frequently Encounter Terms.</p> <p>The Mole Concept, Definition Mole, To find the relationship between mass and volume of a gas, Principal Of Atomic Conservation (POAC).</p> <p>Stoichiometry, Definition of stoichiometry Coefficients, Definition of Limiting Reagent, Definition of Significance of Equivalent Weight, In acid-base neutralization reactions, Law of Chemical Equivalence, Redox Reaction - Oxidation number Method, The oxidation number concept, Equivalent Weight Calculation, Equivalent in Precipitate Reaction, Electrolytes,, In general, Some Formulae of Equivalent.</p> <p>Eudiometry, Reaction in solutions, Mass percentage or volume percentage, Volume of percentage, Parts per million, Molarity of a Solution, Mole fraction, Normality, Dulong – Petits law, Ionic Strength(μ).</p>
Properties Of Gases (DVD -1)	<p>States of matter, Measurement of pressure, Measuring Devices, Definition Standard Atmospheric pressure, Various units of pressure, Gas Laws, Boyle's Law, Isotherm, Altitude Sickness.</p> <p>Charles' Law, Straight Line, Alternative from of charles' law, Isobar, Effect of Pressure, Gay Lussac's Law, Avogadro's Law, Ideal Gas Equation, Numerical Value of R.</p> <p>Dalton's Law of partial Pressure, Graham's Law of Diffusion/Effusion, Kinetic Molecular Theory of Gases, Kinetic Gas Equation, Derivation of Gas Laws, Kinetic Energy and Temperature.</p> <p>Maxwell Distribution of molecular speeds, Effect of Temperature, Collision Parameters, Ideal Gases, Real Gases, Effect of Temperature on Deviations, Boyle Temperature, Reasons For Deviation, Corrections : Van der waals, Significance of Van der Waals Constants, Vander Waals Equations, Boyle Temperature in terms of Vander Waals Constant.</p> <p>Liquefaction of gases, Critical Temperature (T_c), Critical Pressure (P_c), Critical Volume (V_c), Critical constant of some gases, Critical constants in terms of Van der Walls constants, Andrews Experiment.</p>
Thermodynamics (DVD -2)	<p>Thermodynamics, System and Surroundings, Types of System, Macroscopic Properties of the System, Types of Processes, Internal Energy.</p> <p>Work, Heat, According to IUPAC Conventions, First Law of Thermodynamics, Observations in Support of First Law, Alternative Statements of First Law of Thermodynamics, Mathematical Formulation of the First Law of Thermodynamics, Enthalpy Change, Enthalpy of the System, Internal Energy Change.</p> <p>Heat Capacity, Moral Heat Capacity, Relationship Between C_p and C_v for Ideal Gas.</p>

	<p>Joule-Thomson Expansion, Thermo Chemistry, Important Points Regarding a Thermochemical Reaction, Heat of Reaction, Factors Affecting Heat of Reaction, Kirchhoff's Equation, Standard Enthalpy, Enthalpy of Formation, Standard Enthalpy of Formation.</p> <p>Enthalpy of Neutralization, Enthalpy Change During Phase Transitions, Hess's Law of Constant Heat Summation, Application of Hess Law, Determination of Enthalpy Change of Slow Reactions, Lattice Enthalpy, Important Consequences of Lattice Enthalpies, Heat of Solution, Bond Energies, Application of Bond Energies, Limitations of First Law.</p> <p>Spontaneous Processes, Entropy, Entropy Change, Spontaneity in terms of entropy change, Entropy Change, Isothermal Process, Second Law of Thermodynamics, Spontaneity Criteria in Terms of Gibbs Free Energy, Effect of Sign of ΔH and Temperature on the Spontaneity of a Process, Third Law of Thermodynamics.</p>
Redox Reactions & Electromotive Force (DVD -2)	<p>Photosynthesis, Production of heat from fuels, Oxidation & Reduction, Classical Concept, Reduction, Electronic Concept, Oxidation Number Method, Ion- electron Method.</p> <p>Electromotive Force, Electrode potential, Redox couple, Electrochemical Cell, Salt bridge and its function, Representation of electrochemical cell, More about Electrode Potentials, Electrochemical series (Activity series), Nernst Equation, Thermodynamics of Cells.</p>
Structure Of Atom (DVD -2)	<p>Dalton's Atomic Theory, Thomson's Model of Atom, Rutherford's Scattering Experiment, Rutherford's Nuclear Model of Atom, Concept of the Atomic Number, Mass Number and Discovery of Neutron, Wave Nature of Light, Characteristics of Wave Motion {1870, James Clark Maxwell}, Characteristics of Electromagnetic Radiations, Particle Nature of Light : {Processes not explained by wave nature}, Observation.</p> <p>Quantum theory of radiation, Spectrum, Limitations of Rutherford Model of Atom, Bohr's Model of the Atoms, Explanation of Atomic Spectrum of hydrogen atom, Principal quantum number.</p> <p>De-Broglie Hypothesis, Heisenberg's Uncertainty Principle, Quantum mechanical model, Salient features of Quantum mechanical model, Principal Quantum Number (n), Angular momentum quantum number (l), Magnetic Quantum Number (m_l), Spin Quantum Number, Pauli Exclusion Principle, Shape of Atomic Orbitals, Concept of nodes, Number of radial nodes = $n - l - 1$, Angular Nodes, Number of angular nodes = l.</p>
Solid States (DVD -2)	<p>Characteristic properties of solids are, Crystalline solids, Amorphous solids, The solid state, Molecular solids, Ionic Solids, Metallic Solids, Electron and sea model, Exceptional behaviour of Graphite, Covalent or Network Crystals, Diamond, Graphite, Crystal Lattice, Unit cell, Types of unit cells, Calculation of no. atoms per unit cell, Calculations of atoms per unit cell, Relationship between the neighbour distance(d) and radius of atom(r) ($r=d/2$ for crystals of pure elements)</p>

and the edge of unit cell (a).

Close Packing, Packing Efficiency, Location of void in unit cell.

Size of voids, Relationship between radius of octahedral void and radius of atoms in the close packing, Relationship between radius of the tetrahedral void and radius of atoms in close packing, Density of unit cell, X-ray Diffraction From a Crystal Lattice, Bragg's Equation, Imperfections of Solids, Electronic Imperfection, Point Defects, Defect in Stoichiometric crystals, Conditions causing Schottky defects, Conditions causing Frenkel defects, Point Defects in Non-Stoichiometric Crystals, Consequences of Metal Excess Defects, Metal Deficient Defects, Impurity Defects.

Physical Chemistry II	
Chemical Kinetic (DVD -1)	<p>Chemical Kinetics, Classification of reactions, Rate of Reaction, Law of Mass Action (Guldberg and Waage, 1864), Rate Law Expression, Rate Constant or Velocity Constant, Order of Reaction, Integration of rate Expressions, Zero – order Reaction, Half life Period, First – Order Reactions, $t_{1/2}$ for a First – Order Reaction. Integration of Rate Expressions for Second Order Reaction, Case I:- When the Reactant are Different, Case II:- When Both the Reactants are the Same, Integration of Rate Expression for Third – Oder Reaction, Mechanism of Reaction, Molecularity, Elementary Reactions, Complex Reactions.</p> <p>Collision Theory, Energy Barrier, Maxwell’s Distribution of Energies, Activation Energy, Activated complex theory, Factors Affecting Rate of Reaction, Arrhenius Equation, Methods for Determination of Order of a Reaction.</p> <p>Parallel Path Reactions, Consecutive Reactions.</p>
Chemical Equilibrium (DVD -1)	<p>Chemical Equilibrium, Type of Reaction, Chemical Equilibrium, Heterogeneous Reaction, Homogeneous Reaction, Physical Equilibrium, Henry’s Law, Assertion and Reason, Passage.</p> <p>Law of Mass Action, Heterogonous Equilibrium, Equilibrium Constant, The mode of representation of the reaction, Stoichimetric representation of the chemical reaction, Use of partial pressure instead of concentration, Temperature, Reaction Quotient, Degree of Dissociation.</p> <p>Free energy and Equilibrium constant, Le Chateller’s Principle, Reversible Reaction.</p>
Ionic Equilibrium (DVD -1)	<p>Electrolytes, Ostwald’s Dilution Law, Common Ion Effect, Classical Concept of Acids and Bases, Acid, Base, Arrhenius Concept of Acids and Base, Limitations, Bronsted-Lowry Concept of Acid and Base, Influence of Solvent on Acid Strength, Dissociation in liquid ammonia, Dissociation in hydrogen fluoride, Limitations of Bronsted-Lowry concept, Lewis Concept, Types of Lewis Bases, Types of Lewis Acids.</p> <p>Dissociation of a Weak Acid, Relative Strengths of Weak Acids, Dissociation Constant of Polybasic Acids, Dissociation of Weak Base, Dissociation of Water, pH Scale, pH Decreases With Temperature, Relationship Between pH and pOH, Relationship Between K_a and K_b or pK_a and pK_b values.</p> <p>Acid-Base Neutralisation-Salts, Hydrolysis of Salts, Salt of a strong acid and a weak Base, Relation Between Hydrolysis Constant and Degree of Hydrolysis, pH of Hydrolysed Salt Solution, Salt of a Weak Acid and a Strong Base, Relation Between Hydrolysis Constant and Degree of Hydrolysis, pH of Hydrolysed Salt Solution, Salt of Weak Acid and Weak Base, Salt of a Strong Acid and a Strong Base.</p> <p>Buffer Solution, Calculation of pH of acidic Buffer, Basic Buffer, Addition of Acid, Addition of Base, Calculation of pH of Basic Buffers, B. Buffer Mixture of a Weak Base and its Salt, Solubility Product, Relationship Between Solubility and Solubility Product, Effect of common ions on solubility, Calculation of remaining concentration after precipitation, Simultaneous Solubility.</p>
Electrolysis	Electrical Conductors, Electrolysis, Faraday’s Laws, Faraday’s First Law of

<p>and Electrolytic Conductance (DVD -2)</p>	<p>Electrolysis, Electrochemical equivalent, Faraday's Second Law of Electrolysis, Quantitative aspects of Electrolysis, Transport number or Transference number, Electroplating.</p> <p>Conductance of Electrolytic Solutions, Factors affecting electrolytic conduction, Electrical Resistance and Conductivity, Resistivity and Conductivity, Cell Constant and K cell, Equivalent Conductance, Molar Conductance, Effect of Dilution on, Variation of Molar Conductivity with Concentration, Kohlrausch's Law, Ionic Mobility.</p>
<p>Ideal Solutions (DVD -2)</p>	<p>Ideal Solution, Constituents, Binary Solution, Types of Solution, Concentration Units, Methods of Expressing the Concentration of a Solution, Solutions of Gases in Liquids, Factors affecting solubility of gas in liquid, Exception, Values of Henry's Law Constant (KH) for Some Common Gases in Water, Limitation of Henry's Law.</p> <p>Solutions of Liquids in Liquids, Ideal Solution, Vapour Pressure, Raoult's Law, Composition of Vapour Phase, Ideal Solution.</p> <p>Non-Ideal Solutions, Types of Non-Ideal Solutions, Azeotropes, Azeotropes, Some Azeotropic Mixtures, Colligative Properties of Dilute Solutions, Measurement of Relative Lowering of Vapour Pressure, Calculation of Molal Elevation, passage.</p> <p>Depression in Freezing Point, Calculation of Molal Depression, Calculation of Molecular mass of the solute, Osmosis and Osmotic Pressure, Difference Between Osmosis and Diffusion, Determination of Osmotic Pressure: Berkeley and Hartley's Method, Expression for the osmotic pressure, Isotonic Solution, Van't Hoff Theory of Dilute Solutions, Reverse Osmosis, Abnormal Colligative Properties, Van't Hoff Factor, Calculation of degree of ionization, Calculation of degree of association, passage.</p>
<p>Surface Chemistry (DVD -2)</p>	<p>Surface Chemistry, Terms, Free Energy Change During Adsorption, Adsorption-an Exothermic Process, Entropy Change During Adsorption and Adsorption Equilibrium, Factors Affecting Adsorption of Gases by Solids, Types of Adsorption, Mechanism of Chemisorption, Adsorption of nitrogen on Iron, Freundlich Adsorption Isotherm, Limitation of Freundlich adsorption isotherm, Adsorption from solutions, Langmuir Adsorption Isotherm, Adsorption Isobars, Application of Adsorption.</p> <p>Catalysis, Positive and Negative Catalysis, Promoters and Poisons, Types of Catalysis, Theory of Homogeneous Catalysis, Heterogeneous Catalysis, Theory of Heterogeneous Catalysis, Some Important Features of Solid Catalysts (or Heterogeneous Catalysis), Zeolites as Shape-Selective Catalysts, Enzymes as Catalysts, Characteristics of Enzyme Catalysis, Mechanism of enzyme catalysis, passage.</p> <p>Colloidal State of Matter, Characteristics of true solutions, colloidal solutions and suspensions, Terms, Classification of Colloids, Types of Colloidal systems (or colloidal dispersions), Points of difference between lyophilic and lyophobic sols, Mechanism of micelle formation, Preparation of Colloidal Solutions, Electro-dispersion (Bredig's arc method), Ultrasonic Dispersion, Dispersion or Disintegration methods, Condensation or Aggregation methods, Purification of colloidal Solutions, Properties of Colloidal Solutions, Visibility, Filtrability, Surface tension and viscosity, Colligative properties, Tyndall effect, Charge on particles of some common sols, Electrokinetic or zeta</p>

	<p>potential, Electrophoresis or cataphoresis, Coagulation or Flocculation or Precipitation, Hardy Schulze Law, Isoelectric point of a colloid, Protective Action of Lyophilic Colloids and Gold Number, Congo Rubin Number, Emulsions, Method of Preparation, Types of Emulsions, Properties of emulsion, Gels, Applications of Colloids, Natural Applications, Technical Applications</p> <p>Additional Topic, Theory of Indicators, Theory of acid-base indicators, Ostwald's theory, Phenolphthalein, Methyl orange, Quinonoid theory, Selection of suitable indicator or choice of indicator, Titration of soluble carbonate with strong acid, Advance level</p> <p>Include Objective, Subjective, passage, reasoning type questions.</p>
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Organic Chemistry Part II

Basic Organic Chemistry (DVD -1)	<p>Introduction To Organic Chemistry, Acyclic or open chain compounds, Modern Definition of Organic Chemistry, Reasons for Large Number of Organic Compounds, Condensed and Bond-line Structural Formulas, Classification of Organic Compounds, Alicyclic or Closed Chain or Ring Compounds, Heterocyclic, Aromatic compounds, Benzenoid aromatic compounds, Homologous Series,</p> <p>Nomenclature, Root ward, Primary suffix, Secondary Suffix, Primary Prefix, Secondary prefix, Nomenclature Rules – Saturated and Branched Chain, Unsaturated and Functional Groups,</p> <p>Cyclic Compounds, Aromatic Compounds are Cyclic,</p> <p>Isomerism, Structural Isomerism, Chain Isomerism, Functional Isomerism, Positional Isomers, Metamers, Tautomerism,</p> <p>Stereo Isomerism, Wedge and Dash, Fisher Projection, Sawhorse projections, Newman Projections, Conformers of Butane C_4H_{10}, Cyclo Hexane, Geometrical Isomerism.</p> <p>Optical Isomerism, Discovery of Optical Isomerism, Measuring Optical Activity, Number of Optical Isomers of an Compound, Importance of Optical Compounds</p> <p>In Biochemistry, Nomenclature of Geometric Isomers (E and Z) in Case More Than Two Different Groups are Present and Optical Isomers (R and S), Isotopes, Double and Triple Bonds, Double bonds: E/Z, Chiral Carbons:- R/S, Assigning Stereocentres Using Fischer Projections,</p> <p>Purification and Elemental Analysis Methods of Purification of Organic Compounds, Sublimation, Crystallisation, Distillation, Fractional Distillation, Distillation Under Reduced Pressure, Steam Distillation, Differential Extraction, Chromatography, Qualitative Analysis of Organic Compounds, Detection of Carbon and Hydrogen, Detection of other Elements, Test for Nitrogen, Quantitative Analysis, Carbon and Hydrogen,</p> <p>Nitrogen, Halogens Carius Method, Sulphur, Phosphorus, Oxygen, Empirical Formula and Molecular Formula, Determination of Molecular Mass, Duma's Method, Chemical Method,</p>
Reaction Mechanism (DVD -1)	<p>Reaction Mechanism, Introduction, Carbocations, Carbanions, Nucleophiles and Electrophiles, Electron Displacement in Substance, Strength of Various Atom and Groups, Resonance.</p> <p>Conditions For Resonance, Resonance Effect or Mesomeric Effect, Hyperconjugation, Electromeric Effect (E-Effect), Classification of Reactions, Strength of Acid (in General org. chemistry),</p> <p>Reaction Mechanism of Different Types, Electrophilic Addition Reactions, Addition of HX to Alkene, Markownikoff's Rule, Nucleophilic Addition Reaction, Stereochemistry of Addition Nucleophilic, Anti-Markownikoff's Rule (Kharash Peroxide Effect), Chain-Initiating Step, Chain-Propagation Step, Chain-terminating Step, Free Radical Addition Reaction.(Is Shown Only By Hbr), Substitution Reactions,</p> <p>Free Radical Reactions in Cyclic Compounds, Stereochemistry of Radical Substitution</p>

	<p>Reaction, Electrophilic Substitution Reaction (SE), Substitution Electrophilic and Addition Electrophilic, Nucleophilic Substitution Reactions, S_N1 Reaction, S_N2 Reaction,</p> <p>Elimination Reactions, E1 (Elimination) Reaction, E1-CB (Elimination) Reaction, E2 (Elimination) Reaction,</p>
Hydrocarbon (DVD -2)	<p>Hydrocarbon (Alkanes/Alkanes/Alkanes) Introduction, Classification, Physical Properties, Alkanes Preparation Natural Source – Petroleum & Natural Gas, General Oxidation/Reduction,</p> <p>Chemical Properties, In case of Bromination, Oxidation, Decomposition, Isomerization, Aromatisation, Reaction With Steam, Alkenes, Isomers, Physical State, Preparation of Alkenes Dehydrohalogenation of Alkyl Halides, Hindered Base Given Hoffman Product as Major Isomers, Dehydration of Alcohols, Dehalogenation, Reduction of Alkynes,</p> <p>Chemical Properties of Alkenes Addition of Hydrogen, Addition of Halogens, Addition of Halogen Acid/Hydrogen Halide, Addition of Water (H₂O) (Hydration), Hydroxylation (Glycol Formation), Ozonolysis,</p> <p>Alkynes, Alkynes, Chemical Properties of Alkynes, Aromatic Hydrocarbon, Structure of Benzene, Complete Delocalization, Properties of Benzene, Dipole Moment, Electrophilic (Aromatic) Substitution Reactions,</p>
Halogen Compounds (DVD -2)	<p>Introduction, Classification, Nomenclature.</p> <p>Chemical Properties, Elimination, C – (I) → Sub Nucleophilic, Electron with Drawing Group,</p>
Alcohols, Phenols and Ethers (DVD -2)	<p>Alcohols, Phenols and Ethers, Mono, Di, tri or Polyhydric Compounds, Allylic Alcohols, Ethers, Nomenclature, Preparation of Alcohol (A) Hydration of Alkenes, Reduction by catalytic Hydrogen, Hydrolysis of Esters, From Acid and Acid Derivatives.</p> <p>Chemical Properties, Distinguish between 1° 2° and 3° Alcohols, Williamson Ether Synthesis, Oxymercuration/Demercuration in Presence of Alcohol, Auto Oxidation, Phenol Preparation, Physical Properties, Chemical Properties.</p>
Ketones and Aldehydes (DVD -2)	<p>Ketones and Aldehydes Carbonyl Compounds, Structure of the Carbonyl Group, Nomenclature of ketones and Aldehydes,</p> <p>Preparation of Aldehyde and Ketone, Hydroboration Oxidation, Decarboxylation of Calcium Salts of Carboxylic Acids, OXO Process, Wacker Process, Ozonolysis, Chemical Properties, Reduction of Carbonyls,</p> <p>Addition Reaction (Nucleophilic), Cannizzaro Reaction, Aldol Condensation, Crossed Aldol Condensation, Claisen Condensation, Aromatic Aldehyde and Ketone, Chemical Properties, Claisen Schmitt Condensation, Knoevenagel Cond, Reformatsky Reaction,</p>
Carboxylic Acid (DVD -3)	<p>Introduction, Classification, Nomenclature, IUPAC Names, Nomenclature of Dicarboxylic Acids, IUPAC Names of Dicarboxylic Acids, Structure and Physical Properties of Carboxylic Acids, Acidity of Carboxylic Acids Measurement of Acidity, Common Reducing Agents and Their Reactions, Some Common Reactions of Acid</p>

	salts, Carboxylic Acid Derivatives Introduction, Structure and Nomenclature of Acid Derivatives Ester of Carboxylic Acids, Amides, Nitriles, Hydrolysis to an Acid, Synthesis from an Acid, Acids Halides, Acid Anhydrides, Boiling Points and Melting Points, Physical Properties, Chemical Properties.
Nitrogen Compounds (DVD -3)	Nitrogen Compounds, UREA, Preparation, Properties Physical, Chemical, Amines Introduction, Classification, Nomenclature, Preparation Primary Amines, Secondary Amines, Tertiary Amine, Hoffman's Method, Physical Properties, Chemical Property, Aromatic Amine, Used in Separation of Amines, Reactions given only by 1 ⁰ Amine, Reactions shown only by 2 ⁰ Amines, Reactions Shown Only by 3 ⁰ Amines, Aniline Preparation, Chemical Properties, Substitution Electrophilic, Benzene Diazonium Chloride-Reaction of Diazanium Salt, Cyanides and Isocyanides, Isocyanides Preparation, Nitro Compounds, Halogenation,
Biomolecules (DVD -3)	Introduction, Classification of Carbohydrates, Another Classification, Glucose, Fructose, Glycosidic Linkage, Disaccharides, Polysaccharides, Proteins, Amino Acids, Isoelectric Point, Structure of Proteins, Classification of Proteins, Denaturation of Proteins, Enzymes, Vitamins, Nucleic Acids, Basic Structure of Nucleic Acid, H-bonds between the nitrogenous bases in DNA, Different Types of RNA Formed in the Cell, H-bonds between the nitrogenous bases in RNA, Replication of two DNA.
Polymers (DVD -3)	Introduction, Classification of Polymers,
Chemistry in Everyday Life (DVD -3)	Introduction, Drugs, Different Medicines Antacids, Antihistamines, Neurologically Active Drugs, Antimicrobials, Chemicals in Food, Cleaning Agents,

Organic Chemistry Part I (only one DVD)	
Classification and representation of organic molecules	Representation and Nomenclature of organic molecules, What is an organic molecule?, How organic molecules are represented?, Representation of molecular structure, Can structural diagrams on a two dimensional page show three dimensional information?, Three dimensional representation, Fisher projection, Fisher projection with more than one asymmetric carbon atom, Newman projection, Sawhorse representation, Flying wedge representation, Translation of Fisher projection to Newman and Sawhorse, Why translation is required?, Advantage of Fisher projection, Advantage of Newman and Sawhorse projection, Method of Translation, Fisher projection, Eclipsed Newman projection, Eclipsed Sawhorse projection, Staggered Newman projection, Staggered Sawhorse projection.
Nomenclature of organic molecules	Nomenclature of organic molecules, How an organic molecule is named?, IUPAC Rules for Alkenes, Some of the acceptable branched alkyl groups name used in IUPAC nomenclature are, Name the compounds, Translate the following into bond – line formula, Nomenclature of unsaturated and functionalized acyclic hydrocarbon, Rules of Naming, Here sum of the numbers matters, Poly Functional Hydrocarbons, Cyclic compounds, Aromatic compounds, Polycyclic compounds, Spiro compounds, Name the compounds, Translate the following.
Determination of molecular formula	Determination of molecular formula of an organic compound, Calculation of empirical formula, Estimation of carbon and hydrogen, Estimation of Nitrogen, Estimation of halogen, Estimation of Sulphur, Estimation of Oxygen, Determination of empirical formula, Determination of molecular weight, Gram – molecular weight, Gram – molecular volume, Victor Meyers method, This is a physical method, Cryoscopic or depression of freezing point method, Silver salt method, Volumetric methods, Calculation of molecular formula.
General concepts of chemical bonding	Concepts of chemical bonding, Covalent bond, Ionic bond, Dative covalent bond, Chemical bonding in organic molecules, Sigma (σ) and Pi (π) bonding, Linear overlapping of atomic orbitals, Lateral overlapping of atomic orbitals, Relative strength of σ and π bond, Bond strength and bond order relation, Bond length and bond order relation
Hybrid orbitals and geometry of molecules	Hybridization, Sp ³ Hybrid orbitals, sp ² Hybrid orbitals, sp Hybrid orbitals, Hybrid orbitals of nitrogen, Hybrid orbitals of oxygen, Molecular shape, Modified hybrid orbitals, Valence shell electron pair repulsion (VSEPR), To find the molecular shape of a molecule X Y m.
Bonding weaker than covalent bonding	Bonding weaker than covalent bonding (intermolecular forces), London (Van der Waals) forces, Effect of Van der Waals force on physical properties of compounds, Dipole – dipole interaction, Effect of dipole – dipole interaction in physical properties of compounds, Hydrogen bonding, Condition of Hydrogen Bonding, Types of hydrogen bonding, Intermolecular hydrogen bonding, Intramolecular hydrogen bonding, Effect of Hydrogen bonding on some physical properties of compounds, This unusual property of water is due to intermolecular hydrogen

	bonding, Effect of hydrogen bonding on the physical properties of alcohols, Effect of hydrogen bonding on hydrogen halides, Effect of hydrogen bonding on amine, Effect of hydrogen bonding in acid base strength, Conjugate acid of the base.
Factors affecting the nature of covalent bonding	Factors affecting the nature of covalent bond, Inductive effect, Salient features of inductive effect, Field effects, Inductomeric effect, Inductive / field effect and physical and chemical properties of molecules, Mesomeric or resonance or conjugative effect, Mechanism of electron shift, Rules of resonance, Effect of Resonance, Electromeric effect, Resonance and electromeric effect on physico-chemical properties of molecule, Difference between inductive and mesomeric effects, Hyper conjugative effect, Baker and Nathan effect, Effects of hyper conjugation, Steric crowding to resonance.
Aromaticity 1 (aromaticity of annulenes)	Aromaticity-1, The concept of aromaticity, Valence bond theory of aromaticity of benzene, According to this theory benzene is a hybrid form of I and II, Molecular orbital theory of aromaticity of benzene, Aromaticity in molecules other than benzene, Nuclear magnetic resonance study to determine aromaticity, Predicting aromatic, antiaromatic or nonaromatic in terms of energy or stability, Huck le's rule ($4n + 2$) of aromaticity, Annulenes, [4] Annulenes, [6] Annulene, [8] Annulene, Plan ar '8' electron system is anti aromaticity, [10] Annulenes, Aromatic 10 electron systems, [12] Annulene, [14] Annulene, [16] Annulene.
Aromaticity 2 (aromaticity of other compounds)	AROMATICITY 2, Charged cyclic polyenes, Cyclopropenyl cation, Cyclopropenyl carbanion, Cyclobutadiene dication and dianion, Cyclopentadiene carbanion and cation, Cycloheptatriene carbocation and anion, Cyclooctatetraene dication and dianion, Polycyclic compounds, The most contributing resonance structures of azulenes are the following, Heterocyclic compounds, Fulvenes and metallocenes, Fullerenes, Mesionic compounds.
Isomerism (constitutional)	Isomerism, Constitutional isomers, Structural or constitutional isomerism, Skeletal or chain isomerism, Position isomerism, Ring – chain isomerism, Functional isomerism, Metamerism, Valence isomers, Tautomerism, Dyad system, Triad system, Different types of triad system tautomerism, Keto-enol tautomerism, Acid catalyzed tautomerism (Keto-enol), Base catalyzed tautomerism (Keto-enol), Phenol-Keto tautomerism, Nitroso-oxime tautomerism, Nitro - aci tautomerism, Imine-enamine tautomerism, Valence tautomerism, Comparison of tautomerism, isomerism and molecular rearrangement and resonance.

Inorganic Chemistry I (only one DVD)	
Basic concept of periodic table	<p>Periodic Table, Classification of Element and Periodicity in Properties, Periodic Table, Periodicity of Properties, Cause of Periodicity, Electronic Configuration of alkali Metals, Electronic Configuration of Halogens, IUPAC Nomenclature Elements with at Number > 100.</p> <p>Main Characteristics of Periodic Table, Periods, Groups, Division of Elements into s, p, d, and f block elements, s – block elements, General Properties, p – block elements, General Character, General Properties, f – block elements, General Properties.</p> <p>Periodic Properties, Atomic Radius, Covalent Radius, Vander walls Radius, Metallic Radius, Generally, Along the period, Reason, Along the group, Isoelectronic Ions, Ionization Enthalpy/Energy, Unit, Successive Ionization Enthalpy, Factors Affected Ionization Energy, First ionization enthalpies of some elements (KJ mol^{-1}).</p> <p>Electron Gain Enthalpy $\Delta_{\text{eg}} H$, Characteristics, Reason for Positive e^- Gain Enthalpy, Factors which affect $\Delta_{\text{eg}} H$, Electron gain enthalpies of some elements in (KJ mol^{-1}), Variation With in a Group, Important Point, Variation in a Period, Electro negativity, Electronegativities of representative elements (on the Pauling scale), Summary of Periodic Properties, Anomalous properties of second period element, Diagonal Relationship.</p>
Metallurgy	<p>Ores and minerals, Important, Principal Minerals/Ores of some important metals, Extractive Metallurgy, Concentration of ore, Hydraulic washing / Levigation / Gravity Saperation, Electromagnetic Saperation, Froth Floatation Method, Principle, Working, Leaching/Hydrometallurgy.</p> <p>Conversion of ore into their oxides, Calcination, Benefits of Calcination, Roasting, Important Term, Flux, Reduction of Metallic Oxide into Crude Metal, Ellingham diagram, Application of Ellingham Diagram, Reduction of Metallic oxides, eq. Reduction of Cr_2O_3 to Cr metal by Al powder, Thermite welding process, Self reduction Method, Electrolytic Reduction Method, Continenence from Carnelite, Hydrometallurgy, Cyanide Process (Oxidation Reduction Method).</p> <p>Refining, Zone. Refining, Vapour – Phase Refining, Conditions, Chromatographic Method.</p> <p>Metallurgy of Iron, Wrought Iron, Metallurgy of Copper, Extraction of copper from cuprous oxide, Bessemer Convertor.</p> <p>Metallurgy of Pb, Metallurgy of Zinc, Metallurgy of Tin (Sn), Metallurgy of Mg.</p>
s-block elements	<p>1st group \Rightarrow Alkali metals, Chemical Properties, Reactivity and electrode potential, Reason, Reactivity with water, Reactivity towards oxygen, Alkali metals get tarnished when exposed to air & moisture, Reactivity with H_2, Reactivity with halogens, Solubility in liquid Ammonia, Oxides & hydroxides, Anomalous behaviour of Li, Similarities, Imp. Points.</p> <p>Extraction of Sodium, Down's process, Extraction of Potassium, Sodium carbonate [washing soda] $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$. [Solvay Process], Function of NH_3, Properties of</p>

$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, Compounds of Sodium, Sodium Hydroxide, Properties by Castner & Kellner's cell, Properties, Compounds of Sodium, Sodium Hydroxide, Sodium oxide (Na_2O), Sodium peroxide (Na_2O_2), Sodium Sulphate $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ (Glauber's salt), Microcosmic Salt [$\text{Na}(\text{NH}_4)\text{HPO}_4$].

Oxides of Potassium, KO_2 , Preparation, Properties, Potassium Sesquioxide (K_2O_3), Potassium Hydroxide (KOH), Potassium Carbonate (Potash/Pearl ash), Preparation (Leblanc process), Potassium Sulphate (K_2SO_4), Sodium bicarbonate NaHCO_3 , Biological importance of Sodium and Potassium.

Alkaline Earth Metal, Atomic and Physical Properties of the Alkaline Earth Metals, Ionization Enthalpies, Hydration Enthalpy $\text{Be}^{2+} > \text{Mg}^{2+} > \text{Ca}^{2+} > \text{Sr}^{2+} > \text{Ba}^{2+}$, Density, Flame Colouration, Chemical Reactivity, Reactivity Towards air & H_2O , Reactivity towards halogens, Reactivity towards hydrogen, Reactivity towards acid, General Characteristics of the compound of the alkaline Earth metal, Halides, Carbonates of group Element, Sulphates, Nitrates, Anomalous Behavior of Be, Diagonal Behavior of Be and Al.

Compounds of Mg, Magnesium Oxide MgO (Magnesia), Properties, $\text{Mg}(\text{OH})_2$, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, Preparation, CaCO_3 , Preparation, Magnesium Chloride ($\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$), Preparation, Compounds of Calcium, Correct Increasing Order Of Some Properties With Their Hints / Explanation.

Inorganic Chemistry II

p – Block Elements (DVD -1)

p – block elements, Group – 13 Elements, Some Atomic and Physical Properties of Group 13 Elements, Atomic radii / Ionic radii, Ionization Enthalpy, Electronegativity, Electropositive / metallic character, Density, Melting Point, Chemical Properties, Oxidation state and trends in chemical reactivity, Inert pair effect, Trends in chemical reactivity, AlCl_3 exist as dimer while BCl_3 not, Reactivity towards air, Reactivity towards Acid & Alkalies, Reactivity with Halogens.

Important Trends and Anomalous Properties of Boron, Boron, Ore, Extraction of Boron, Properties, Compounds of Boron, B_2O_3 , Preparation, Orthoboric Acid H_3BO_3 or $\text{B}(\text{OH})_3$, Preparation, Properties, Test for Borate radical, Borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$), Preparation, Borax Bead Test, With NaOH , Useful primary standard for titrating against acids, Boron Hydrides, Diborane (B_2H_6), Industrial method, Special Molecule, Hydrolysis of Borazine.

Aluminum, Compounds of Aluminum, Al_2O_3 (Al oxide), Aluminum Chloride ($\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$), Alums.

Group 14 Elements Carbon Family, Electronic Configuration of Elements of Group 14, Some Atomic and Physical of Group 14 Elements, Chemical Properties, Oxidation State, Reactivity with oxygen, Reactivity towards halogens, Anomalous Behavior of Carbon in Family, Main point of difference, Allotropic Forms of Carbon, Properties of Carbon, Oxides of Carbon, CO_2 , Preparation (Industrial), Carbon Monoxide (CO), Carbides.

Silicones, Compounds of Silicon, Silicates, Ortho silicates, Pyro silicates, Cyclic silicate, Chain Silicate.

Compound of Tin, SnO , Stannous Chloride ($\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$), SnCl_4 , Compounds of Lead, Litharge – PbO , Lead Oxide PbO_2 , Red lead Pb_3O_4 , Lead Chloride PbCl_2 .

p – block (Nitrogen Family Group 15), p – block (Nitrogen Family), Atomic and Physical properties, Chemical Properties, Anomalous Behavior of Nitrogen, Reactivity Towards Hydrogen, Basicity, Stability, Reducing Character, Properties of Hydrides of Group 15 Elements, Reactivity Towards Oxygen E_2O_3 and E_2O_5 , Reactivity Towards Halogens EX_3 and EX_5 , Reactivity Towards Metals.

Dinitrogen N_2 , Lab Method, Common Method, Oxidation of Nitrogen, Structures of Oxides of Nitrogen, Point to Remember, Reducing Agent, Oxidizing Agent, Ammonia NH_3 , Lab method for preparation, Haber's Process, Test for ammonium salt, Properties of Hydrazine, Uses of NH_3 , Nitric Acid (HNO_3), Brown ring test (in test Fe^{2+} , NO_3^-).

Phosphorus, Act as a reducing agent, Compounds of P, Phosphine (PH_3), Phosphorus Halides, PCl_5 , Oxoacids of P, H_3PO_4 Orthophosphoric acid, Oxides of phosphorous, P_2O_3 , P_2O_5 , Important Questions.

Group – 16, Oxygen family, Occurrence : Oxygen, Sulphur, Combined sulphur, Selenium, Tellurium, Polonium, Electronic Configuration of Elements of Group 16, Some Physical Properties of Group 16 Elements, General electronic configuration –

	<p>ns₂np₄, Electron gain enthalpy, Electronegative, Physical Properties, Elemental State, S₈, Anomalous behavior of oxygen, Photosensitive elements.</p> <p>Compounds of Oxygen, O₂, Preparation (Lab Method), Brins process (manufacture process), Chemical Properties, Types of Oxides, H₂O₂ Hydrogen Peroxide, Lab method, Industrial Method (Auto oxidation), By electrolysis, Chemical Properties, Acidic nature, As oxidizing agent, H₂O₂ as reducing agent, Test for H₂O₂, Ozone (O₃), Chemical Properties, Oxidizing agent, Test for Ozone.</p> <p>Sulphur, Compounds of Sulphur, SO₂, SO₃, Acidic Nature, Oxidizing nature, Oxoacids of Sulphur, Structure, Sulphur acid Structure, Manufacturing, H₂S, Sodium thiosulphate (Na₂S₂ O₃.5H₂O) or hypo, As Reaction agent.</p> <p>Group – 17 Elements (Halogen Family), Bond Dissociation Enthalpy, Chemical Properties, SRP (Standard Reduction Potential), Hydration energy of X⁻, Anomalous behavior of F, Reactivity With Hydrogen.</p> <p>F₂, Preparation, Electrolytic method, Electrolytic, Anode, Cathode, Wessel, On electrolysis, Chemical method, Oxidising character:, Reaction with NaOH solution, Reaction with SiO₂, Reaction with SO₃, Cl₂, Common method (Cl₂, Br₂, I₂), Only for Cl₂, Manufacture of chlorine, Reaction with NH₃ (common for Cl₂ & Br₂), Reaction with NaOH, Bromine (Br₂), Common method, From Sea – water, Iodine (I₂), Common method, From Caliche or Crude chile salt petre, Reaction with KClO₃ or KBrO₃, Hydrogen Halide HX, Enthalpy of dissociation in kJ/mol, Dichlorine monoxide (Cl₂O), Chlorine dioxide (ClO₂), Laboratory method, Dichlorine hexoxide (Cl₂O₆), Dichlorine heptoxide Cl₂O₇, Bromine dioxide (BrO₂), Oxides of iodine, Hypohalous acid (HOX), Halous acid (HXO₂), Halic acid (HXO₃), Important Points, Bleaching Powder (CaOCl₂. H₂O), Some important order, Pseudo Halogens & Pseudo Halides, Interhalogen Compounds, From lower interhalogens.</p> <p>Group – 18 Elements (The Zero Group Family), Occurrence, Atomic radii, Electron gain enthalpy, Chemical Properties, Physical compound → possess no proper bonding, Clathrate Compound, True chemical compound (with proper bonding), Compounds of Xenon, XeF₄, Xenon hexafluoride XeF₆, Some Important Points, Xenon Oxygen Compounds.</p>
<p>d – Block Elements (DVD -2)</p>	<p>d – Block Elements, Electronic Configurations of Transition Metals, First (3d) Transition Series (Sc – Zn), Second (4d) Transition Series (Y – Cd), Third (5d) Transition Series (La – Hg), Fourth (6d) Transition Series, Trends in Properties, Atomic Radii, Atomic radii of d – block elements in pm, Lanthanoid Contraction, Metallic Character, Lattice Structure of Transition Metals, Density, Ionisation Enthalpies, Oxidation States, Generally shown oxidation states of transition metals, Oxides of metals of first transition series in different oxidation states (*Mixed oxides), Stable halides of 3d series in different oxidation states. (X = F → I. Exceptions are given in brackets), Standard electrode and chemical reactivity, Thermochemical data (KJ mol⁻¹) for First Row Transition Elements, The results lead to the following conclusion, Oxides of</p>

	<p>metals of first transition series in different oxidation states (*Mixed oxides), Formation of Coloured Ion, Magnetic Properties, Formation of Complex, Interstitial Compounds, Alloy Formation, Catalytic Properties, Some Properties of the First Series of Transition Elements, Preparations and properties of some important d – block metal compounds [A] Compounds Of Iron Zinc & Copper Ferrous Sulphate, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ (Green vitriol), Ferric Oxide, Fe_2O_3, Ferric Oxide, FeCl_3, Compounds of Zinc Zinc oxide, ZnO (Chinese white or philosopher's wool), Zinc Sulphate, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ (White vitriol), Zinc Chloride $\text{ZnCl}_2 \cdot 2\text{H}_2\text{O}$, Compounds of Copper Copper Sulphate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (Blue Vitriol), Compounds of Silver Manganese & Chromium Silver Nitrate, AgNO_3 (Lunar caustic), Silver oxide (Ag_2O), Potassium Permanganate (KMnO_4), Potassium Dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$), f-Block Elements, Oxidation State, Atomic Radii, Lanthanoid Contraction, Important Characteristics, Colour, Magnetic Behavior, Reducing Agent, Complex Formation, Chemical Reaction, Actinoids, Comparison of Lanthanoid & Actinoids, Difference between Lanthanoids and Actinoids.</p>
<p>Coordination Compounds (DVD -2)</p>	<p>Co – ordination compounds, Difference between double salts and co – ordination compounds, Definition and Terminology, Central Metal Atom or Ion, Ligands, Co – ordination Number, Co – ordination Sphere, Denticity and Chelation, Importance of Chelates, Types of ligands, Important Ligands Forming Complexes, Oxidation Number/State, Charge on the complex ion, Homonuclear and Polynuclear Complexes. IUPAC Nomenclature of Co – ordination Compounds, Rule for naming of mono – nuclear compounds, Some Common Ligands And Their Names, Neutral Ligands, Positive Ligands, Organic Ligands, Naming of Co – ordination compound containing metal bonding. Isomerism in co – ordination compounds, Structural Isomerism, Ionisation isomerism, Solvate /Hydrate isomerism, Linkage isomerism, Co – ordination isomerism. Stereoisomerism, Geometrical Isomerism, Optical Isomerism, Geometrical Isomerism, Square Planes Complexes (Co – ordination No. 4), Octahedral Complexes (Co – ordination No. 6), Cisform, Trans form, Important, Optical Isomerism, Cis – isomerism of $[\text{Co}(\text{en})_2\text{Cl}_2]^+$, Optically active. Bonding in Co – Ordination Compounds, Main Postulates of Werner's Theory, Limitation of Werner's Theory. Valence Bond Theory (VBT), Main Features, Octahedral complexes (Co – ordination number = 6), Outer Orbital complexes, Inner Orbital Complexes, Predicting the Type of Hybridization From Magnetic Behavior, Tetrahedral Complex (Co – ordination No. = 4), Square Planar Complexes (Co – ordination no. = 4), Complex With Trigonal Bipyramidal Geometry (Co – ordination no. 5), Draw Backs of Valence Bond Theory, Crystal Field Theory (CFT). Crystal Field Theory (CFT), Developed by Hans Bethe (1929) & John Van Vleck</p>

(1932), Crystal Field Theory for Octahedral Complex, d – orbital, Shape of d-orbital, Splitting of d – orbital in an octahedral crystal field, Calculation of CFSE, Calculation of CFSE (Δ_0) values for d4 to d7 configurations, Explanation of properties the complexes by crystal field theory, High spin and low spin state, Magnetism, Color, Crystal field theory for square planar complex, Crystal field theory for tetrahedral complex, Factors affecting the magnitude of orbital splitting energy, Limitation of CFT, Importance and Application coordination complex, Analytical Chemistry, In Metallurgy, In purification of metal ($\text{Ni}(\text{CO})_4$), In Biological system, In industry.
