STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

TNCF 2017 - DRAFT SYLLABUS

Subject : Chemistry **Class :** XI

TOPIC	CONTENT
Unit 1 : Basic concepts of chemistry and chemical calculations	Importance of Chemistry; Classification of matters; Elements and compounds; Atomic and molecular masses; equivalent mass, empirical and molecular formula;mole concept; stoichiometric calculations; Limiting reagents, redox reactions, competitive electron transfer reactions, oxidation number; types of redox reactions and balancing redox reactions
Unit 2 : Quantum mechanical model of atom	Brief introduction to various atom models; Dual behaviour of matter;Debroglie relation, Heisenberg's uncertainty principle; Quantum mechanical model of atom;Schrödinger equation, Quantum numbers; Atomic orbitals – shapes, energy, Aufbauprinciple, Pauli exclusion principle, Hund's rule; Electronic configuration of atoms, stability of completely filled and half-filled orbitals
Unit 3: Elements and periodic classification	Need for classification of elements; Modern periodic law and periodic table; Nomenclature of elements with atomic numbers greater than 100; Classification of elements based on

	electronic configurations;Periodic trends in properties - atomic radius, ionic radius, ionisation enthalpy, electron affinity, electronegativity; Periodic trends in chemical properties, periodicity of valence/oxidation states, Anomalous properties of second period elements, Diagonal relationship
Unit 4: Hydrogen and water	Position of hydrogen in the periodic table,isotopes of hydrogen,ortho and para hydrogen; Preparation of hydrogen:laboratory and commercial production; Physical and chemical properties of hydrogen, uses of hydrogen; Hydrides:classification; Physical and chemicalproperties of water, heavy water; hardness of water and its removal; Hydrogen peroxide: Preparation, structure, physicalandchemical properties, uses.
Unit 5 : Alkaline and alkaline earth metals	Alkali metals: General characteristics, chemical properties and uses; general characteristics; physical, chemical properties and uses; compounds of alkali metals: oxides, hydroxides, halides, salts of oxoacids – general characteristics; Biological importance of sodium and potassium. Alkaline earth metals: general characteristics, physical, chemical properties and uses; compounds of alkaline earth metals: oxides, hydroxides, halides, salts of oxoacids – general characteristics; important compounds of

	calcium: quick lime, slake lime, gypsum and plaster of paris; Biological importance of magnesium and calcium.
Unit 6 : Chemical Bonding	Kossel – Lewis approach to chemical bonding; octet rule, ionic bond, covalent bond, co-ordinate bond; bonding in metals; Bond parameters; resonance; polarity of bonds; Hybridisation – Orbital overlap, σ and π bonds, VSEPR theory, shapes of covalent molecules; Valence bond theory (VBT), Molecular Orbital Theory: Bonding in homo-nuclear diatomic molecules (H_2, Li_2, B_2, C_2, $N_2$and O_2) and hetero-nuclear diatomic molecules (CO and NO); Hydrogen bond – criteria, types, and significance.
Unit 7 : Thermodynamics	Introduction to thermodynamic terms, System and surroundings, types and properties of system: processes : reversible, irreversible, adiabatic, isothermal, isobaric, isochoric and cyclic processes; Internal energy and work; First law of thermodynamics; Enthalpy: relationship between ΔH and ΔU; Thermo-chemical equations; Enthalpy changes for different types of reactions and phase transformations; Measurement of ΔH and ΔU using calorimetry; Hess law of constant heat summation; Lattice enthalpy: Born-Haber cycle; Need for second law of

	thermodynamics; various statements of second law; Meaning and significance of entropy; Gibbs free energy and its significance; criteria for spontaneity of a process; Relationship between ΔG and equilibrium constant; Third law of thermodynamics (statement only)
Unit 8: Gaseous state	Introduction; Gas laws: Boyle's law, Charles law, Gay Lussac's law, Avogadro law; Ideal gas equation and deviation from ideal behaviour; Compressibility factor; Vander-waals equation; critical phenomena; Relation between Vander-waals constants and critical constants; diffusion - Grahams diffusion law; Liquefaction of gases – Joule Thomson effect; isotherms of carbon-dioxide.
Unit 9 : Solutions	Types of solutions; expressing Concentration of solutions – mass percentage, volume percentage, parts per million (ppm), mole fraction, molarity, molality and normality; Henrys law, Vapour pressure of liquid solutions; Raoult's law for volatile solutes and non-volatile solutes; ideal and non-ideal solutes; factors responsible for deviation from Raoults law. Colligative properties; Relative lowering of vapour pressure; depression of freezing point; Elevation of boiling point; Osmosis and

	osmotic pressure; Reverse osmosis and water purification; Abnormal molecular mass: Dissociation and association, Vant Hoff factor.
Unit 10 : Chemical equilibrium	Introduction to physical and chemical equilibria; Law of mass action; Equilibrium constants ($K_p$and K_c); Relation between K_p and K_c; Homogeneous and Heterogeneous equilibrium; Applications of equilibrium constants in predicting the extend and the direction of a reaction; Lechatlier's principle – effect of concentration, pressure, temperature, catalyst and inert gas addition; Vant-Hoff equation
Unit 11 : Organic Chemistry – Basic principles and technique	Introduction, Classification and nomenclature of organic compounds; IUPAC rules for naming organic compounds; structural representation; Isomerism – structural isomerism, stereo isomerism: Geometrical and optical isomerism, Detection and estimation of elements (C, H, N, S, X and P) in organic compounds; Purification of organic compounds – sublimation, crystallisation, distillation (fraction, steam and azeotropic), differential extraction, chromatography (absorption, column, thin layer and partition chromatography)
Unit 12 : Organic reactions and their	Fundamental concepts in organic reaction mechanism; Fission of co-valent bond;

mechanism	Nucleophiles, electrophiles and free radicals; Electron displacements effects in covalent bonds – inductive effect, electrometric effect, resonance effect, hyper conjugation and mesomeric effect; Types of organic reactions: substitution reactions, addition reactions, elimination reactions, oxidation reactions, reduction reactions, molecular rearrangements; Functional group interconversions,
Unit 13 : Hydrocarbons	Introduction, classification of hydro carbons; Preparation and chemical properties of alkanes, alkenes and alkynes; Markovnikov and anti-markovnikov addition reactions and their mechanism; conformers of alkanes; Aromatic hydrocarbons: Aromaticity and Huckel Rule; Structure of benzene; Preparation of benzene; Aromatic electrophilic substitution reactions and mechanism, influence of functional group in mono substituted benzene; toxicity(carcinogenicity)
Unit 14 : Halo-alkanes and halo-arenes	Halo-alkanes; nature of C–X bond, classification and nomenclature; preparation from alkanes, alkenes and alcohols; physical properties; chemical properties – nucleophilic substitution reactions, stereo chemical aspects (S_N1, S_N2); Elimination reactions, E1 and E2 mechanisms; organometallic compounds: Introduction, preparation and

	uses of Grignard reagent; Haloarenes: Preparation of chlorobenzene; Chemical properties of chlorobenzene: nucleophilic and electrophilic substitution reactions, reaction with metals (Wurtz-Fittig and Fittig reactions), Formation of DDT; polyhalogen compounds and uses.
Unit 15 : Environmental chemistry	Environmental pollution; Types – air, water and soil pollution; Particulate pollutants, Greenhouse effect and global warming; Acid rain and its effect; Ozone hole; Strategies to control environmental pollutions; Green chemistry

STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

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Subject : Chemistry **Class :** XII

TOPIC	CONTENT
Unit 1 : Metallurgy	Occurrence of metals; Concentration of ores; Extraction of crude metal; Thermodynamic principle of metallurgy; Electrochemical principle of metallurgy and applications: Electrolytic extraction of Aluminium, electrochemical series; extraction based on oxidation and reduction; application of metals (Al, Zn, Fe, Cu, Au)
Unit 2 : p-Block elements – I	Occurrence, electronic configurations, oxidation states, general trends in physical and chemical properties of the elements in the period and group; Anomalous properties of the first element of each group; Boron and Aluminium: occurrence, preparation, physical and chemical properties and uses; structure, properties and uses of borax, boric acid, boron trifluoride; Reactions with acids and alkalies; Structure, properties and uses of aluminium chloride and alums; Carbon and Silicon: Anomalous behaviour of carbon; Tendency for catenation;

	Structure, properties and uses of allotropes of carbon; Structure, properties and uses of oxides of carbon; Structure, properties and uses of silicon tetrachloride, silicones, silicate and zeolites; Nitrogen and Phosphorus: Occurrence, Properties and uses of Nitrogen; Preparation, properties, structure and uses of ammonia and nitric acid; Structure of oxides and oxoacids of nitrogen; Allotrophic forms of phosphorus; Properties and uses of phosphorus; Preparation, properties, structure and uses of phosphine and phosphorus halides(PCI_3, PCl_5); Structure of oxides and oxoacids of phosphorus.
Unit 3 : P block elements – II	Oxygen and Sulphur :preparation, properties, structure and uses of oxygen and ozone, Allotropic forms of sulphur, preparation, properties, structure and uses of sulphur dioxide and sulphuric acid. halogens :Occurrence, preparation, properties and uses of chlorine and hydrochloric acid; Trends in the physical and chemical properties of hydrogen halides; Structures of inter-halogen compounds, oxides and oxoacids of halogens; Noble gases: Occurrence, trends in physical & chemical properties and uses.
Unit 4: Transition and inner transition metals	Position in the periodic table; Electronic configuration; General trend in properties of 3d series elements; Characteristics of transition metals; Oxides and oxo anions of transition metals; Potassium dichromate& potassium permanganate:

	structure, shape, oxidizing nature in acidic, basic and neutral medium, use in redoxtitration, structure of chromate, dichromate, manganite and permanganate ion; f-block elements: position of f-block elements in periodic table, electronic configuration, atomic and ionic radii, oxidation states: Lanthanide contraction and its consequences; Actinides: oxidation states and comparison with lanthanides
Unit 5 : Co-ordination Compounds	Definition of co-ordination compounds: coordination entity, Central metal atom/ion, Ligands, Coordination number, Coordination sphere, Coordination polyhedron, Oxidation number of central atom, Homoleptic and heteroleptic complexes; Differences with double salt; IUPAC Nomenclature of coordination compounds; Isomerism in co-ordination compounds: structural and stereoisomerism; Theories of co-ordination compounds: Werner's theory, Valence Bond Theory, Crystal field theory; Stability and applications of co-ordination compounds.
Unit 6 : Solid State	Introduction to solid state; Amorphous and crystalline solids; classification of crystalline solids; Unit Cell: Types of unit cell in two dimensions and three dimensions; Calculation of no of atoms per unit cell in a cubic unit cell; Packing and packing efficiency in solids; Packing fraction in sc, fcc and bcc; Voids: types, location and formation; Calculations involving unit cell dimensions; Imperfection in solids – types of point defects; Electrical and magnetic properties

Unit 7: Chemical Kinetics	Introduction of Kinetics; Rate of a reaction; order of a reaction; molecularity of a reaction; factors affecting reaction rate; Integrated rate equations (zero and first order reactions only); half-life of a reactions; pseudo first order reaction; concept of collision theory; Temperature dependence of reaction rate – activation energy and Arrhenius equation.
Unit 8 : Ionic Equilibrium	Acids, bases and salts; Various concepts of acids and base; Arrhenius, Brönsted-Lowry and Lewis theory of acids and bases; Ionisation of water; The P^H scale; Ionisation of week acids- Oswalt dilution law; Common ion effect; Buffer solution; Henderson- Hasselbalch equation; Salt hydrolysis; Solubility and Solubility product;
Unit 9 : Electrochemistry	Introduction; Conductivity of electrolytic solutions;Resistivity, conductivity, equivalent conductivity, molar conductivity; measurement of the conductivity of ionic solutions; Variation of conductivity with concentration; Debye HuckelOnsagar equation;Kohlrausch's law; Electrochemical Cells; IUPAC conventions for electro chemical cells Galvanic Cell; Measurement of Electrode Potential;Nernst Equation; Equilibrium constant from Nernst Equation; Electro-chemical cell and Gibbs Energy of Reaction; Electrolytic cells and electrolysis; Faradays law of electrolysis; Product of electrolysis; Batteries; Primary Batteries; Secondary Batteries; Fuel cells; Corrosion; Control of corrosion;
Unit 10 :	Introduction; absorption and adsorption;

Surface Chemistry	Types of adsorption; Applications of Adsorption;Adsorption isotherms; Catalysis; Characteristics of catalyst; Types of catalyst, theories of catalysis; Enzyme catalysis; Colloids. Classification, Preparation and Purification of colloids; Properties of colloidal solution; Emulsions; Application of colloids and emulsions in day today life;
Unit 11 : Alcohols, phenols and ethers	Alcohols; Introduction; classification; nomenclature; Monohydric alcohols- methods of preparation; Physical and chemical properties, mechanism of dehydration; (Saytzeff's rule), oxidation, acidity of alcohols; Methods of differentiation of primary, secondary and tertiary alcohols; Inter conversions of primary, secondary and tertiary alcohols; Commercially important alcohols; Manufacture of methanol, ethanoland its uses; Dihydric alcohols and Trihydric alcohols; Ethylene glycol – preparation; Physical and chemical properties and uses; Phenols- classification, nomenclature occurrence; Methods of preparation Physical and chemical properties; Distinction test between alcohols and phenols; Uses of phenols; Ether- classification, nomenclature; methods of preparation; physical and chemical properties and uses; Crown ethers.
Unit 12 : Aldehydes, Ketones and Carboxylic acids	Carbonyl compounds; Introduction; structure of carbonyl group; nomenclature; aliphatic aldehydes and ketones; Methods of preparation; physical and chemical properties; order of reactivity of aldehydes and ketones; Nucleophilic addition reaction and mechanism; uses of aliphatic

	aldehydes and ketones; Aromatic aldehydes; Methods of preparation and ; Chemical reactions; carboxylic acids; Introduction; Structure of carboxyl group; nomenclature; Aliphatic and aromatic carboxylic acids; Methods of preparation; Physical and Chemical properties; Acidity of carboxylic acids – effect of substituents (Concept of $K_a$and pK_a); Test for carboxylic acids; uses of carboxylic acids; Acid derivatives; Acid chlorides, esters, acid anhydrides and acid amides: Nomenclature, order of reactivity of acid derivatives; Preparation, properties and uses;
Unit 13 : Organic compounds containing Nitrogen	Nitrocompounds: Nomenclature, isomerism, preparation, chemical reactions and uses; Amines: classification, nomenclature, structure; methods of preparations, physical properties, chemical properties, Basic character of amines (K_b and pK_b); distinction between primary, secondary and tertiary amines; Diazonium salts: structure, preparation, physical and chemical properties ; Cyanides and Isocyanides: nomenclature, preparation, properties and uses
Unit 14 : Biomolecules	Carbohydrates: Monosaccharides; preparation and cyclic structures; disaccharides cyclic structure; polysaccharides; sources and cyclic structures; Importance of carbohydrates; Proteins: amino acids, classification, Zwitter ions, isoelectric point, peptide bond, classification proteins; structure of proteins: denaturation of proteins; Enzymes: mechanism of enzyme action; Lipids: classification and biological

	functions; Vitamins: definition, classification, sources and deficiency diseases; Nucleic acids: definition : DNA & RNA, Nucleoside and nucleotides, ATP and its importance.
Unit 15 : Chemistry in everyday life	Introduction; Medicinal chemistry: classification of drugs, drug target interactions; different classes of drugs; Food chemistry: food additives, artificial sweeteners, food preservatives, anti-oxidants; Cleansing agents: Soaps and detergents – types, cleansing action, Polymer chemistry: classification based on source, structure, molecular forces; Types of polymerisation, addition polymerisation and mechanism; Preparation of addition polymers (polyethene, Teflon, poly acrylonitrile); Condensation polymers: preparation of polyamides (Nylon-6 & Nylon 6,6), polyesters (terelene), Bakelite, melamine, formaldehyde polymer; Co-polymerisation: Rubber: natural rubber, vulcanization of rubber; Biodegradable polymers: PHBV, Nylon-2, Nylon-6; Commercially important polymers