

Revised Syllabus For The session 2020-21

CHEMISTRY

for 1st year Science

Unit I: Some Basic Concepts of Chemistry

Atomic and molecular masses and equivalent mass of elements, acid, base, and salt, oxidants, reductants, and mole concept and molar mass, percentage composition, empirical and molecular formula, chemical reactions, stoichiometry and calculations based on stoichiometry, expression of concentration of solutions.

Unit II: Structure of Atom

Atomic number, isotopes, isobars, Rutherford's model and its limitations, Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals – Aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of atoms, stability of half filled and fully filled orbitals.

Unit III: Classification of Elements and Periodicity in Properties

Modern periodic law and the present form of periodic table, periodic trends in properties of elements - atomic radii, ionic radii, inert gas radii, ionization enthalpy, electron gain enthalpy, electronegativity, valency and oxidation state. Nomenclature of elements with atomic number greater than 100.

Unit IV : Chemical Bonding and Molecular Structure

Valence electrons, ionic bond, covalent bond; bond parameters, Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization, involving s, p and d orbitals and shapes of some molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only), hydrogen bond.

Unit V : States of Matter : Gases and Liquids

Role of gas laws in elucidating the concept of the molecule, Boyle's law, Charles law, Gay Lussac's law, Avogadro's law, ideal behaviour, empirical derivation of gas equation, Avogadro's number, ideal gas equation. Deviation from ideal behaviour, liquefaction of gases, critical temperature, kinetic energy and molecular speeds (elementary idea).

Unit VI : Chemical Thermodynamics

Concepts of System and surroundings and types of system, surroundings, work, heat, energy, extensive and intensive properties, state functions.

First law of thermodynamics - Internal energy and enthalpy. Hess's law of constant heat summation, enthalpy of bond dissociation, combustion, formation, neutralization, atomization, sublimation, phase transition, ionization, solution and dilution, Second law of

Thermodynamics (brief introduction). Introduction of entropy as a state function, Gibb's energy change for spontaneous and non-spontaneous processes, criteria for equilibrium.

Third law of thermodynamics (Statement only).

Unit VII : Equilibrium

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant (K_c , K_p and K_x and their relationship), factors affecting equilibrium, Le- Chatelier's principle, ionic equilibrium, ionization of acids and bases, strong and weak electrolytes, degree of ionization, concept of pH , hydrolysis of salts (elementary idea), buffer solution, Henderson Equation, solubility, product, common ion effect (with illustrative examples) numerical problems.

Unit VIII : Redox Reaction

Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, in terms of loss and gain of electrons and change in oxidation number.

Unit IX : Hydrogen

Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen, hydrides-ionic, covalent and interstitial; physical and chemical properties of water, heavy water and use of hydrogen as a fuel.

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 and halogens, uses.

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 - physical and chemical properties.

Group 14 Elements : General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first elements. Carbon-catenation, allotropic forms, physical and chemical properties; uses of some important compounds: oxides. Important compounds of Silicon, Silicones, Zeolites and their uses.

Unit XII : Organic Chemistry - Some Basic Principles and Technique

General introduction, classification and IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond, inductive effect, electromeric effect, resonance and hyperconjugation. Homolytic and heterolytic fission of a covalent bond free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions.

Unit XIII : Hydrocarbons

Classification of Hydrocarbons

Aliphatic Hydrocarbons :

Alkanes - Nomenclature, isomerism, conformation (ethane only), methods of preparation from unsaturated hydrocarbons, alkyl halides, carboxylic acids (Decarboxylation and Kolbes electrolytic method), physical properties, chemical reactions: including free radical mechanism of halogenation, combustion, controlled oxidation, isomerisation, aromatisation, with steam and pyrolysis.

Alkenes - Nomenclature, structure of double bond (ethene), geometrical isomerism, methods of preparation from alkynes, alkyl halides, vicinal dihalides, alcohols, physical properties, chemical reactions: addition of hydrogen, halogen, water, hydrogen halides, sulphuric acid (Markownikoff's addition and peroxide effect), ozonolysis, oxidation, polymerisation and mechanism of electrophilic addition reaction.

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

Aromatic Hydrocarbons : Introduction, IUPAC nomenclature, benzene : resonance, aromaticity, preparation of benzene from acetylene, phenol and aromatic acids, chemical properties: mechanism of electrophilic substitution, nitration, sulphonation, halogenation, Friedel Craft's alkylation and acylation, addition of hydrogen, addition of chlorine, combustion.

CHEMISTRY (PRACTICAL)

+2, 1st Year Science

(Detailed syllabus)

Experiments :

1. Basic Laboratory Techniques : (Non-evaluative)

- a) Bunsen burner (different parts and their functions)
- b) Chemical balance - weighing with chemical balance by equal oscillation method.
- c) Cutting and bending of glass tube, drawing jet and boring a cork.

2. Crystallisation :

Preparation of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ crystal from CuCO_3 .

3. Qualitative Analysis :

- a) Identification of acid radicals :

Radicals : CO_3^{2-} , SO_3^{2-} , S^{2-} , NO_2^- , Cl^- , Br^- , I^- , NO_3^- , SO_4^{2-} & PO_4^{3-} .

- b) Identification of Basic Radicals :

Radicals : Ag^+ , Pb^{2+} , Hg_2^{2+} , Cu^{2+} , Hg^{2+} , Bi^{3+} , As^{3+} , Sb^{3+} , Sn^{2+} , Al^{3+} , Fe^{3+} , Cr^{3+} , Co^{2+} , Ni^{2+} , Zn^{2+} , Mn^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , NH_4^+ , Mg^{2+} , K^+ and Na^+ (Dry Tests only).

4. Volumetric Analysis :

Single titration of acids and bases (three experiments to be done; one on direct determination of

normality of one of the solutions from that of the other and the other two, involving numerical calculations)

QUESTION PATTERN AND DISTRIBUTION OF MARKS

CHEMISTRY (PRACTICAL)

+2, 1st year Science

Full Mark : 30 Time : 3 Hrs

1. Salt analysis (Acid radical) - - 10 marks

Dry Test - 04 mark

Wet Test - 06 mark

2. Crystallisation / Single titration –10 marks

3. Viva-Voce - - 06 marks

4. Record - - 04 marks

CHEMISTRY

for 2nd year Science

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.

Unit II: Solutions

Types of solutions, 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 colligative properties (Preliminary idea only).

Unit III: Electrochemistry

Electrolytes and non-electrolyte conductor, 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, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, Relation between Gibbs energy change and emf of a cell.

Unit IV: Chemical Kinetics

Rate of a reaction (Average and instantaneous), factors affecting rate 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, catalysts, colloidal state distinction between true solutions, colloids and suspension; lyophilic, lyophobic, multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation, emulsion - 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.

Unit VII: p - Block Elements

Group 15 Elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen preparation properties & uses; compounds of nitrogen, preparation and properties of ammonia, oxides of nitrogen (Structure only); Phosphorus – allotropic forms.

Group 16 Elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties, dioxygen: Preparation, Properties and uses, classification of oxides, Ozone, Sulphur allotropic forms; compounds of sulphur: Preparation properties and uses of sulphur dioxide, sulphuric acid, properties and uses; oxoacids 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 (structure 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, occurrence and 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.

Unit IX: Coordination Compounds

Coordination compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's theory, VBT and CFT.

Unit X: Haloalkanes and Haloarenes

Haloalkanes: Nomenclature, nature of C-X bond, preparation from alcohols, halogenations of alkanes, alkenes, Sandmeyer's reaction, halogen exchange reaction, physical properties and chemical properties, nucleophilic substitution reactions (unimolecular and bimolecular), stereochemical effect of substitution reaction, elimination reaction, Electrophilic substitution reactions (halogenations, nitration, sulphonation), Friedel-Crafts reaction, reaction with metals (Wurtz Fittig and Fittig reaction), optical rotation.

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

Unit XI: Alcohols, Phenols and Ethers

Alcohols: Nomenclature, methods of preparation, from alkenes, carbonyl compounds, Grignard reagent, physical properties and chemical properties (of primary alcohols only), esterification, reaction with (hydrogen halide, phosphorus trihalide Oxidation (identification of primary, secondary and tertiary alcohols mechanism of dehydration).

Phenols: Nomenclature, methods of preparation from haloarenes, benzene sulphonic acid, diazonium salt, cumene, physical properties and chemical properties, acidic nature of phenol, esterification, Electrophilic aromatic substitution (halogenations, nitration) Reimer-Tiemann reaction, reaction with Zn dust, oxidation.

Ethers : Nomenclature, methods of preparation dehydration of alcohols, Williamson synthesis, physical properties and chemical properties, formation of alcohols, Electrophilic substitution (halogenations, nitration, Friedel-Craft reaction).

Unit XII : Aldehydes, Ketones and Carboxylic Acids

Aldehydes and Ketones : Nomenclature nature of carbonyl group methods of preparation, from alcohols (oxidation and dehydrogenation), ozonolysis of alkenes, hydration of alkynes, preparation of ketones from acyl chlorides and nitriles, preparation of acetone by Friedel-Craft acylation reaction, physical properties and chemical properties, nucleophilic addition reaction with hydrogen cyanide, sodium hydrogen sulphite, reaction with NH_3 and $\text{NH}_2\text{-G}$ compounds (Hydrazine, hydroxyl amine, semicarbazide, phenyl hydrazine, 2,4-dinitro phenylhydrazine), alcohol, Grignard reagent, Clemmensen reaction, Wolff-Kishner reduction, Fehling's Test, Tollen's Test, haloform reaction, Aldol condensation, Cannizzaro's reaction, special reaction of (formaldehyde with ammonia and acetone with concentrated sulphuric acid), Electrophilic substitution reactions of aromatic aldehydes and ketones.

Carboxylic Acids : Nomenclature, acidic nature, methods of preparation, from primary alcohols, aldehydes, anhydrides, esters, nitriles and Grignard reagent, preparation of benzoic acid from toluene and benzanilide, physical properties, chemical properties, reaction with (metals, alkalis, PCl_3 , PCl_5 , SOCl_2 , NH_3), formation of anhydride, esterification, reduction, decarboxylation, Hell-Volhard-Zelinsky reaction. Substitution reaction of benzoic acid (nitration, bromination) uses.

Unit XIII : Organic compounds containing Nitrogen

Amines : Nomenclature classification, structure, methods of preparation, reduction of (nitrocompounds, nitriles, amides) amonolysis of alkyl halides, Hoffmann bromamide degradation, Gabriel phthalamide synthesis. Physical properties and chemical properties, basic character of amines, alkylation, acylation, carbylamines reaction, identification of primary, secondary and tertiary amines (reaction with nitrous acid and arylsulphonyl chloride). Electrophilic substitution reactions of aniline (nitration, sulphonation, bromination). Cyanide and Isocyanides-will be mentioned at relevant places in context.

Unit XV: Polymers

Classification-Natural and synthetic methods of polymerization(addition and condensation)co polymerization, some important polymers, natural and synthetic like polythene, nylon, polyester, bakelite, rubber, Biodegradable and non-biodegradable polymers.

Unit XVI : Chemistry in Everyday life

Chemical in Medicines- Analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifungal, drugs, antibiotics, antacids, antihistamines.

Cleansing agents – Soap & detergents, cleansing action

CHEMISTRY (PRACTICAL)

+2, 2nd Year Science

(Detailed syllabus)

1. Crystallisation

a) Preparation of Mohr's Salt ($\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$) crystal

b) Preparation of potash alum [$\text{K}_2\text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$] crystal

2. Quantitative Analysis :

Double titration : Two experiments to be done - i) one acid two alkalis double titration and ii) two acids one alkali double titration.

3. Qualitative Inorganic Analysis :

Wet tests for basic radicals : Wet tests for the following basic radicals be done.

Group-I basic radicals : Ag^+ , Pb^{2+} , Hg_2^{2+}

Group-II basic radicals : Hg^{2+} , Cu^{2+} , Bi^{3+} , As^{3+} , Sb^{3+} , Sn^{2+} & Sn^{4+}

Group-IIIa basic radicals : Fe^{3+} , Al^{3+} & Cr^{3+}

Group-IIIb basic radicals : Co^{2+} , Ni^{2+} , Zn^{2+} & Mn^{2+} .

Group-IV basic radicals : Ba^{2+} , Ca^{2+} & Sr^{2+} .

Group-V basic radicals : NH_4^+ , Mg^{2+} , K^+ , Na^+ .

Identification of unknown basic radicals.

[For Identification of unknown basic radicals both dry and wet tests are to be performed]

QUESTION PATTERN AND MARKS DISTRIBUTION

CHEMISTRY (PRACTICAL)

+2, 2nd year Science

Full Mark : 30 Time : 3 Hrs

1. Salt analysis (Identification of basic radical only) 10 marks

Dry Test -- 04 mark

Wet Test -- 06 mark

2. Crystallisation / Double Titration -- 10 marks

3. Viva-Voce - - 06 marks

4. Record - - 04 marks