

Structure of atom- Development of classical model of an atom- (i) Bohr's model of atom: Calculation of radius of Bohr's orbit and energy of an electron, (ii) Dual nature of matter and radiation- quantization of electronic energy levels, spectral evidence for quantization, (iii) Sommerfield's extension (no mathematical treatment), (iv) De-Broglie's relationship, (v) Uncertainty principle, (vi) Orbitals and quantum numbers- shapes of orbitals, spatial distribution of atomic orbitals, (vii) Distribution of extra nuclear electrons, Aufbau principle, Pauli's exclusion principle, Hund's rule, n+l Rule, variation in relative energies of orbitals with increase in atomic number, electronic configuration of elements (S, P, D, F, block elements). Stability of half-filled and completely filled orbitals.

Periodic table and periodicity in properties- (i) Electronic configuration and periodic table- the log form of periodic table and S, P, D, F, block elements and advantages over Mendeleev's periodic table, (ii) Electronic configuration and periodicity in properties, periodic perspectives, (iii) Detailed study of periodicity in physical and chemical properties with special reference to- density, melting and boiling points of elements. Atomic and ionic radii, ionization potential, electron affinity. Electro negativity, variation of effective nuclear charge in a period, metallic character, diagonal relationship.

Chemical bonding and molecular structure- (i) Lewis structure- Octet rule and its limitations, (ii) ionic bond- characteristics of ionic compounds, solubility of ionic compounds, (iii) Covalent bond, introductory concept of over-lapping of orbitals and bonds, valence bond theory- Characteristics of covalent compounds. Coordinate bond, partial covalent character in ionic bond, partial ionic character in covalent bond. Fajan's rule, polarities of covalent molecules, (iv) Bond length, bond angle and bond-energy general consideration, (v) Hybridization of orbitals illustrated with example of compounds of first and second row elements in periodic table- shapes of common molecules- VSEPR Theory, (vi) Hydrogen bond, (vii) Vander Waals forces of attraction.

Redox reaction- (i) Concept of formal charge on ions, (ii) Oxidation number, (iii) Oxidation reduction electron transfer concept with examples, (iv) Redox reaction- examples, (v) Balancing of equations by ion-electron method.

Equilibrium

Chemical equilibrium- (i) Concept of reversibility equilibrium constant, (ii) Law of mass action generalized expression, (iii) Experimental method for verification of law of mass action. factors affecting equilibrium (concentration, pressure, temperature), (iv) Application to systems such as $N_2 + 3H_2 \leftrightarrow 2NH_3$, $PCl_5 \leftrightarrow PCl_3 + Cl_2$, $N_2 + O_2 \leftrightarrow 2NO$ (v) Le Chatelier's principle-Application. **Ionic equilibrium-** (i) Electrolytes and non-electrolytes, (ii) Arrhenius theory- Evidence in favour of dissociation theory, (iii) Ionic product of water, (iv)Hydrolysis, degree of hydrolysis, hydrolysis constant, (v) Relation between hydrolysis constant, ionic product of water and dissociation constant, (vi) Common ion effect, (vii) Solubility product and its application to qualitative analysis.

Unit-B

(10 questions)

Chemical kinetics- (i) Rate of a reaction, (ii) Instantaneous rate of a reaction and order of reaction (Zero and I order), (iii) Factors affecting the rate of reaction, concentration of reactant molecule, effect of temperature on the reaction rate, concept of activation energy, catalysis, (iv) Effect of light on rate of reaction, (v) How fast are chemical reactions?

Chemical thermodynamics

Thermodynamics and chemical energy science- Basic concepts of thermodynamics, types process, first law of thermodynamics, complete heat, heat capacity, entropy heat of fusion, heat of vaporization, heat of sublimation. Exothermic and endothermic reactions. Adsorption- Definition, type (physical and chemical) and factors affecting adsorption.

Acids and bases- (i) Hydrogen and hydroxyl ion in aqueous solution, (ii) Bronsted-Lowry concept of acids and bases, (iii) Lewis concept (iv) Dissociation of acids, (v) pH value, (vi) Buffer solutions, (vii) Theory of indicators of acid-alkali titrations, (viii) Choice of indicators.

Colloidal state of matter- (i) Crystalloid and colloids, (ii) Classification of colloids -Emulsion, preparation of colloids, lyophilic and lyophobic colloids, (iii) Properties- electrophoresis, dialysis, Tyndall phenomenon, Brownian movement, Coagulation-Hardy and Schulze's law, peptisation, absorption, applications.

Metals- (i) Nature of metallic state- structural packing of atom in metals. Metallic bond- valence bond concept, (ii) Occurrence of metals in nature, (iii) General principles of metallurgy- activity series of metals, standard electrode potential, metallurgical processes, (iv) Extraction of metals- copper, silver, aluminum and iron.

S-Block elements- (i) General characteristics, (ii) Trends in variation of properties in periodic table of alkali and alkaline earth metals, (iii) General principles of extraction of the elements, (iv) General chemistry of their compounds.

D-Block elements- (i) General characteristics, (ii) Elementary idea about para magnetism and diamagnetism, (iii) Different oxidation states, (iv) Chemistry of transition elements as illustrated by different oxidation states of the following metals- Silver, gold, chromium, manganese and iron.

Unit- C

(10 questions)

Agricultural chemistry

Soil-Soil, minerals, rocks and its weathering, definition, functions of soil and characteristics soil is a natural body; soil is a medium for plant growth, soil composition, soil profile, earth, rocks and type of minerals, weathering of rocks and soil formation, factors of soil formation. **Soil organic matter and soil**

microorganism- Definition, source, composition, decomposition, factors affecting the decomposition of organic matter, humus, definition, properties and formation, effect of organic matter on soil properties and fertility, soil microorganism, C:N ratio and nitrogen cycle, symbiotic and non-symbiotic nitrogen fixation.

Soil colloids- Definition, types and importance, properties and classification, major lay minerals present in soil, importance of lay in soil. **Ion exchange-** Importance, mechanism of cation exchange, kinds of

exchange enable cations, cation exchange capacity- Definition, importance and factors effecting, percent base, saturation, cation and nutrition of plant. **Soil reaction-** (P^H , P^H - scale, changes in P^H , relationship of soil P^H with availability of nutrient, effect of soil P^H soil microorganism, plant growth and disease, buffering capacity. **Acidic and saline soil-** Definition, characteristics, reason for formation of acidic soil,

effect of acidic on plant and chemical amelioration, classification of salt affected soils, definition, reason for formation of saline and sodic soil and formation, effect of soil sodicity and salinity on plants, diagnosis of saline and sodic soil and its reclamation, properties of irrigation water and treatment of saline water and management. **Essential nutrients of plants-** Classification, sources of plant nutrients in soil,

mechanism of absorption of nutrients by plant, factors affecting the availability of nutrients, specific function of nutrients and deficiency symptoms. **Reaction of different fertilizers in soil & effects on crops-** Definition of fertilizer and classification properties, composition and effect on soil and crop of

urea, calcium ammonium nitrate (CAN), ammonium sulphate, diammonium phosphate (DAP), single super phosphate, muriate of potash, potassium chloride and potassium sulphate. **Agrochemicals and environmental pollution-** Definition, types, importance, definition of environment and environmental

pollution, types of environmental pollution its harmful effect and control measures, effect of uncontrol application of agrochemicals on environmental pollution (soil, water, air) and its control. **Biochemistry-** Preservatives- definition, types, uses and characteristics.

Edible colour- Definition, types, characteristic and its effect on health, definition, importance and major sources for availability of carbohydrate, protein, fat, vitamin and enzymes. **Organic manures and bio**

fertilizers- Definition, classification of organic manures, effect of organic manures on physical, chemical

and biological properties, formation method, importance and effect on soil for farm yard manure, vermicompost, Nadep compost, green manure cakes and its importance in soil, bio fertilizer- Definition, classification, importance and benefits, method of application, deference between organic manure and fertilizer. **Dairy chemistry-** Milk and colostrum- Definition, chemical composition, nutritive value, factors effecting composition. Nutritive value and chemical composition of milk products (dahi, butter, ghee, cream, chhana) applied material for milk adulteration and its test. Milk processing method, clean and preservative, milk production, market milk and its types.

Unit-D.

(10 questions)

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.

Valency of carbon and hybridisation- (i) Tetra-valency of carbon atom, Kekule, Vant-Hoff and Le-Bell theories, (ii) Orbital representation of covalent bond, multiple bonding (sigma bond: Pi bond), (iii) Hybridization (sp, sp², sp³ hybridization), (iv) Orbital structure of acetylene, ethylene and methane, (v) Concept of bond length, bond strength and bond angle, (vi) Electronegetivity inductive effect, polarity of covalent bond, formal charge, polarity of carbon, Halogen bond.

Saturated hydrocarbons (upto 5 carbon atoms)- (i) Nomenclature and isomerism, (ii) General methods of preparation of alkanes, (iii) General properties and uses of alkanes, (iv) Individual members propane, butane, pentane, (v) Inter conversions of alkanes.

Unsaturated hydrocarbons- (i) Nomenclature and isomerism, (ii) General methods of preparation of alkenes and alkynes, (iii) General properties and uses of alkenes and alkynes with reaction mechanism, (iv) Individual members, propene, butene, propyne and butyne.

Organic chemistry based on functional groups a- (i) Halides, nomenclature and isomerism, general methods of preparation of mono alkyl halides- general properties of mono alkyl halides with reaction mechanism. Preparations and properties of dihalogen derivatives, synthetic uses of alkyl halides, (ii) Hydroxy compounds- nomenclature and isomerism, classification of monohydric alcohols, general methods of preparation of monohydric alcohols, general properties and uses of monohydric alcohols, hydrogen bonding in alcohol and its effect on boiling point and solubility, test for alcoholic groups, Inter conversion of methanol and ethanol.

Organic chemistry based on functional groups b- (i) **Carbonyl groups-** nomenclature and isomerism of aldehydes and ketones, general preparations of aldehydes and ketones, general properties and uses of aldehydes and ketones with reaction mechanism, polarity of carbon-oxygen double bond; test for aldehydes and ketones, (ii) **Carboxylic group-** Nomenclature and isomerism. General preparations of monocarboxylic acids, general properties and uses of carboxylic acid, hydrogen bonding in carboxylic acids, resonance.

Synthetic and natural polymers- (i) Classification of polymers, (ii) Some important natural and synthetic polymers with their general methods of preparation.

Chemistry in action- (i) Dyes, (ii) Chemicals in medicines, (iii) Fertility contraceptives, material schemo- sterilints.

MATHEMATICS

Unit-A: Sets and functions

(5 questions)

Sets-Sets and their representations. Different type of set. Empty set. Finite and Infinite sets. Equal sets. Subsets. Subsets of a set of real numbers especially intervals (with notations). Power set. Universal set.