

deficiency. **Diseases of Kharif crops-** Downy mildew and green ear of pearl millet, cotton wilt, tikka disease of groundnut, peanut clump virus, bacterial blight of cotton, yellow vein mosaic of okra, early blight and leaf curl of tomato. **Diseases of Rabi crops-** Wheat rust disease, white rust of mustard, loose smut and covered smut, little leaf of brinjal, blight and powdery mildew of cumin. **Diseases of Fruit crops in Rajasthan-** Citrus canker, powdery mildew of ber, guava wilt. Disease management method- Chemical, biological and mechanical.

Section – II Zoology

(15 Questions)

Unit-A

Animal Kingdom- salient features and classification of non-chordates animals up to phyla level and chordates up to class level. **Taxonomy and classification of animals-** Different steps of classification, system of bio-scientific classification. Peculiar characteristic of kingdom animalia. **Body organization and animal tissue-** Epithelial tissue, connective tissue, blood lymph, supporting tissues, bone, cartilage, muscular tissues, nervous. **External and internal morphology and internal structure of animals-** Amoeba, earthworm, cockroach in brief.

Unit-B

Invertebrates

(1) Animals and their economic importance with special reference to Agriculture;

(i) **Protozoa-** Amoeba, (ii) **Helminthes-** Soil Nematode and disease caused by nematode (molya, ear cockle, tundu of wheat, root knot, (iii) **Annelida-** Earthworm, (iv) **Mollusca-** Snail & slug, (v) **Arthropoda** (various classes)- (a) Arachnida- Mites (b) Crustacea- Prawns, lobsters, (c) Diplopoda- Millipede (d) Chilopoda- Centipedes, (e) Insecta- Cockroach

(2) Important insect-pests of crops and storage (general introduction, importance, host plants, losses, life cycle and their control)- (i) Red hairy caterpillar, (ii) White grub, (iii) Termites, (iv) Grass hopper, (v) Pod borers, (vi) Khapra beetle

Honey bee: Bee Keeping and its importance in agriculture.

(3) **Methods of insect control** (insect control: general introduction): (i) Physical and mechanical control (ii) Cultural control, (iii) Chemical control (pesticides, insecticide formulation, classification of insecticides, miticides, nematicides, rodenticides) and safe use of chemicals, (iv) Bio-control-predators and parasitoids, pheromone traps, *Trichoderma*, NPV, botanical insecticides. (v) Integrated pest management (vi) Sprayers and dusters.

Unit-C

Vertebrates

(i) **Nutrition in animals**– Nutritive elements of food, energy yielding chemicals, minerals and vitamins, balance diet. (ii) **Respiration in animals** – Gaseous exchange. (iii) **Circulation in animals**– Blood– Composition, blood groups, Rh-factor, blood coagulation. (iv) **Reproductive system** – Male and female reproductive system. (v) **Reproduction & development:** (a) Asexual & sexual reproduction in animals (b) Gametogenesis, spermatogenesis, structure of sperm, oogenesis and type of ovum, female reproductive cycle (c) Fertilization- external and internal fertilization. (d) Mechanism of fertilization.

CHEMISTRY

Unit–A

(10 Questions)

Basic concept of chemistry- Importance and scope of chemistry in daily life and agriculture. Measurements in chemistry- Significant figures and international units of measurement. Laws of chemical combination. Dalton's atomic theory- initial concept of elements, atoms and

molecules. Avogadro hypothesis and its uses. Mole concept and Avogadro number. Initial concept of atomic weight, equivalent weight and molecular weight. Percentage composition, empirical formula and molecular formula. Stoichiometry of chemical reaction and calculation, limiting reagent.

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, $n+1$ 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 long 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 clay minerals present in soil, importance of clay in soil. **Ion exchange-** Importance, mechanism of cation exchange, kinds of exchangeable cations, cation exchange capacity-

Definition, importance and factors affecting, percent base, saturation, cation and nutrition of plant. **Soil reaction-** (pH, p^H- scale, changes in pH, relationship of soil pH with availability of nutrient, effect of soil pH soil microorganism, plant growth and disease, buffering capacity.

Acidic and saline soil- Definition, characteristics, reason for formation of acidic soil, effect of acidity 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 uncontrolled 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, Nadeb 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 hybridization- (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) Electronegativity 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. Venn diagrams. Union and Intersection of sets. Difference of sets. Complement of a set. Properties of Complement. Operation of set. Primary operation of sets represented by Venn diagrams. **Relations & functions**- Open sentence, ordered pairs. Cartesian product of two sets. Relation as a set of ordered points, Invers relation, Identity relation, Kinds of relation. Number of elements in the Cartesian product of two finite sets. Cartesian product of the set of reals with itself (upto $R \times R \times R$). Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Junctions, Function as a set of ordered pairs, function as a special type of relation. Pictorial representation of a function, domain, co-domain and range of a function. Real valued functions, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum, exponential, logarithmic and greatest integer functions, with their graphs. Sum, difference, product and quotients of functions. Types of relations: reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function. Binary operations.

Unit-B: Algebra

(5 Questions)

Principle of mathematical induction-Process of the proof by induction, motivating the application of the method by looking at natural numbers as the least inductive subset of real numbers. The principle of mathematical induction and simple applications. **Complex numbers and quadratic equations** -Set of complex numbers, theorems on complex numbers, basic operations of set of complex numbers, some properties of conjugate complex numbers, Need for complex numbers, especially $\sqrt{-1}$, to be motivated by inability to solve some of the quadratic equations. Algebraic properties of complex numbers. Argand plane and polar Representation of complex numbers. Statement of Fundamental Theorem of Algebra, solution of quadratic equations (with real coefficients) in the complex number system. Square root of a complex number, cube root of unit, quadratic equation. **Linear inequalities**- Linear inequalities. Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Graphical method of finding a solution of system of linear inequalities in two variables. **Permutations and combinations** -Fundamental principle of counting (multiplication & Addition). Factorial n . $(n!)$ Permutations and combinations, Permutations of those objects in which not all distinct, Circular permutations, difference between clockwise and anticlockwise permutations. Derivation of formulae for and their connections, simple applications. **Binomial theorem**-History, statement and proof of the binomial theorem for positive integral indices.

Sequence progression and series - Sequence and Series. Arithmetic Progression (A. P.), Properties of A.P., Arithmetic Mean (A.M.) Geometric Progression (G.P.), general term of a G.P. and A.P., sum of n terms of a G.P., infinite G.P. and its sum, geometric mean (G.M.), relation between A.M. and G.M. Sum of an infinite of G.P. Arithmetic Geometric series, sum to n terms of series of natural numbers, their squares and cubes, sum of series by difference method, Harmonic progression (H.P.) Harmonic mean (H.M.), relation between A.M., G.M. and H.M. **Logarithm**-Logarithm, fundamental laws and systems of logarithm, relation between Napierian & common logarithm, Characteristics and mantissa of the logarithm, Introduction and method to find antilogarithm.