RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR EXAMINATION FOR THE POST OF
SR.TEACHER (GRADE-II),
SECONDARY EDUCATION DEPARTMENT

PAPER - II

-: SCIENCE :-

Part - (i) **180 marks**

(Secondary and Senior Secondary standard)

- Cell structure and functions of cell organelles, Cell inclusions, Nucleic acid (DNA and RNA) Cell cycle (Mitosis, Meiosis), Genetic code, types of RNA and protein synthesis .
- Bio-molecules : organic and inorganic biomolecules.
- Types of plant tissues, internal structure of Dicot monocot root , stem and leaves , Secondary growth in Monocot & Dicot.
- Structure of flower, Types of inflorescence, reproduction in plants, polyembryony, Apomixis, Alternation of generation, Fruits and seeds, Important characters of families (Brassicaceae, Malvaceae, Solonaceae, Liliaceae, Poaceae, and Leguminosae), Floral formula, floral diagram and economic importance.
- Water relations, Osmosis, DPD, Plasmolysis, Water potential Absorption of water, Ascent of sap, Transpiration, Guttation, Stomatal movement.
- Plant nutrition : macro-nutrients, micronutrients and their functions.
- Photosynthesis : types of pigments, light reaction - Cyclic and non-cyclic photo phosphorylation, and dark reaction, C_3 and C_4 cycle, Chemosynthesis, Law of limiting factor, factors affecting photosynthesis, Crassulacean Acid Metabolism chemiosmotic hypothesis, photorespiration.
- Respiration : types of respiration, Glycolysis, Krebs cycle and Oxidative Phosphorylation, Respiratory quotient (R.Q.), Fermentation.
- Enzymes, classification, mechanism of action, factors affecting enzyme activities
- Plant growth and development : Differentiation, Dedifferentiation and redifferentiation. Growth regulation in plants by Auxins, Gibberellins, Cytokinins, ethylene, Abscisic acid. Photoperiodism, Vernalisation and seed dormancy.
- Types of pollution, Global warming, Green house effect, Acid rains, Alnino effect, ozone depletion Biodiversity, Sanctuaries, National parks, Endangered species, Deforestation, Bio communities, Ecosystem, Food chains, ecological pyramids, wild life and its conservation, Biogeochemical cycles.
- Structure and function of animal tissues, Various systems of human, human population and health, immune system, tissue and organ transplantations, Bio-treatment Techniques.
- Regulation in animal : Nervous system, Endocrine system and hormones.
- Human Physiology : Digestion and absorption, Breathing, Circulatory system, Excretory system, locomotion and movement, Neural control and coordination, chemical coordination and integration.
- External and internal structure of Amoeba, Plasmodium, Earthworm, Cockroach and Frog.

- Evolution:Darwinism,NeoDarwinisim,Lamarckism, Natural selection and Adaptation, Concepts of species and speciation. Palentological evidences and morphological evidences of evolution.
- Genetics and heredity : Molecular basis of heredity. Mendelism, Linkage, Crossing over, hybridization, sex determination and sex linked inheritance, Blood groups, Rh factor, Mutation.
- Biotechnology : Genetic engineering Recombinant DNA Technology its Tools and Techniques, Gene Cloning, DNA Amplification by PCR, Tools and Techniques of Gene Transfer.
- Application of Biotechnology in Agriculture, medicine. Transgenic animals and plants. Ethical issues, Biopiracy.
- Taxonomy of animals, Five kingdom system, Characteristics upto class level with suitable example. Symmetry, Coelom, segmentation and embryogenesis.
- Taxonomy of plants: Eukaryota, Prokaryota, Virus, Bacteria Mycoplasma, Lichens and elementary knowledge of *Ulothrix*, *Riccia* and *Pteridium*
- Embryology of animals, Spermatogenesis, Oogenesis, fertilization, Cleavage, Gastrulation, organogenesis and fate of three germinal layers, test tube baby, embroyonic development in human, placenta, specific aspect of development.

- Atomic Structure : Fundamental Particles, Atomic models and their limitations, dual nature of particles, de-broglie equation, uncertainity principle, Modern concept of atomic structure, quantum numbers, Aufbau principle, Pauli's exclusion principle, Hund's rule, (n+l) rule. Electronic configuration of elements. Molecular orbital theory for simple homo-nuclear diatomic molecules. Atomic mass, molecular mass, Equivalent mass, Mole concept, Symbols, ions, radicals, variable valancies, type of formulas – empirical formula, molecular formula, Chemical stoichiometry.
- States of matter : Gaseous state - gas laws, ideal gas equation, Dalton's law of partial pressure, kinetic theory of gases, deviation from ideal behaviour, critical temperature and its importance, liquification of gases. Liquid state - properties of liquid, vapoure pressure, surface tension and viscocity cofficient and its application. Solid state - classification of solids, crystal structure.
- Chemical bonding and molecular structure : Ionic bond, covalent bond, coordinate bond. General properties of ionic and covalent bond. Geometry of molecules, Valence shell electrons pair repulsion theory, polarisation, Fajan's Rule, Valence bond theory, concept of resonance, directional properties of bond, hybridisation.
- Co-ordination Compounds : Ligand and co-ordination number, Werner’s theory, IUPAC nomenclature and formulation of mono nuclear co-ordination compound, Isomerism, valance bond theory, Crystal field theory. Shapes, Colours, Magnetic properties in complexes, stability of co-ordination compounds, metal carbonyl compound (elementary knowledge)
- Classification of elements and periodicity in properties : Mendeleef's periodic law and classification of elements, limitation of Mendeleef's periodic table, Modern concept of periodic table, electronic configuration and nomenclature of elements, types of elements - s, p, d and f block Periodicity in properties - atomic and ionic radii, ionisation enthalpy, electron gain enthalpy, electronegativity and valency.
- Equilibrium : Law of mass action and its application to homogeneous equilibria, Le-chatelier principle and its application to physical and chemical system. Factors affecting chemical equilibria. Ionic equilibria in solutions, Acid-base concept, pH scale, Buffer solution. Dissociation of acid and base, Common ion effect and its importance. Solubility product and its uses.

- Thermodynamics : Concept of system, work, heat, energy, extensive and intensive properties, first law of thermodynamics – internal energy and enthalpy, heat capacity and specific heat, Hess's law and its applications. Enthalpy and Free energy.
- Redox reaction : Concept of redox reactions, Oxidation numbers, balancing and applications of redox reactions.
- Metals, Non-metals and Metallurgy : Minerals and ores, General principles of metallurgy, Metallurgy of Cu, Fe, Al and Zn.
- Non-metals and their compounds - Carbon, Nitrogen, Sulphur, Oxygen, Phosphorous, halogens, Allotropes of C,S and P and their uses. Cement and Plaster of Paris.
- Organic Chemistry - Principles and Techniques : Different methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature. Homolytic and heterolytic bond fission, free radicals, carbocations, carbanions, electrophiles and nucleophiles, type of organic reactions.
- Hydrocarbons : Aliphatic hydrocarbons (Alkane, Alkene and Alkyne); Aromatic hydrocarbon (Benzene), concept of aromaticity, chemical properties, mechanism of electrophilic substitution, directive influence of functional group.
- Polymers, Bio-molecules, Chemistry in Everyday Life and Surface Chemistry.
- Polymers : Natural and synthetic polymers.
- Bio-molecules : Carbohydrates, Proteins, Vitamins, Nucleic Acids
- Chemistry in Everyday Life : Chemical in medicines, Chemicals in food, Cleansing agents.
- Surface Chemistry : Adsorption, homogenous and heterogeneous catalysis, colloids and suspensions.
- Environmental Chemistry : Air, water and soil pollution, affects of depletion of ozone layer, green house effect and global warming, green chemistry, strategy for control of environmental pollution.
- Physical world and measurement - Fundamental and derived units, systems of units, dimensional formula and dimensional equations, Accuracy and error in measurement.
- Description of motion - motion in one dimension, uniformly accelerated motion, motion with uniform velocity/Acceleration in two dimensions, motion of an object in three dimensions, relative velocity.
- Vectors - Scalar and vector quantities, unit vector, addition and multiplication.
- Laws of motion - first, second and third law of motion, impulse, momentum, conservation of linear momentum.
- Friction - Types of friction, laws of friction, lubrication.
- Work, Energy and Power - Work done by a constant / variable force, K.E., P.E., Elastic collision in one and two dimensions, gravitational P.E., P.E. of a spring, conservation of energy, conservative and non-conservative forces, power.
- Rotational motion - Centre of mass, its motion, rotational motion, Torque, angular momentum, centripetal force, circular motion, moment of inertia, theorems of M.I., Rolling motion.
- Oscillatory motion - Periodic motion, S.H.M. its equation, K.E. and P.E., concept of free, forced and damped oscillations, simple pendulum, oscillation of a loaded spring.
- Gravitation - Universal law of gravitation, g, variation of g, orbital and escape velocity, planetary motion, Kepler's law.
- Elasticity - Hook's law, young's modulus, bulk modulus and shear modulus of rigidity. Applications of elastic behaviour of matter.

- Surface tension - Fluid pressure, Pascal's law, Archiemedes principle, molecular theory of surface tension, Excess of pressure inside a drop and soap bubble, angle of contact, Capalarity, Detergents.
- Liquids in motion - Type of flow of liquid, Critical velocity, Coefficient of viscosity, Terminal velocity, Stoke's law, Reynold's number, Bernoulli's theorem - its applications.
- Kinetic theory of gases - Laws for gases, Ideal gas equation, Assumptions of Kinetic theory of gases, Pressure exerted by a gas, Law of equipartition of energy, Degree of freedom, Specific heats of gases and solids, Mean free path.
- Heat and thermodynamics - Concept of Heat and temperature, Temp. Scales, Thermal expansion of solid, liquid and gases, specific heat, change of state, latent heat, Thermal capacity, Zeroth & first law of thermodynamics, thermodynamic process, second law of thermodynamics, carnot engine.
- Radiation - Modes of transmission of heat, thermal conductivity, Thermal radiations, Perfect blackbody, Newton's law of cooling.
- Waves - Type of waves, wave equation, speed of a progressive wave, superposition principle, beats, stationary waves and normal modes, Doppler's effect.
- Ray optics and optical instruments - Laws of reflection, Reflection by plane and curved mirrors, Laws of refraction, total internal refraction - applications, Lenses, Image formation by lenses, Dispersion by prism, Sattering of light, Eye, Defects of vision, Microscopes, Telescopes.
- Electrostatics - Coulomb's law, electric field and potential due to a point charge and Dipole, concept of Dielectic, Gauss theorem - its applications, Electric lines of force, Force and torque experience by a dipole in uniform electric field, potential energy of a system of charges, equipotential surfaces.
- Capacitance - Capacity of an isolated spherical conductor, capacitor - principle, Parallel plate capacitors, effect of dielectric on capacitance, series and parallel combinations of Capacitors, Energy of a Capacitor, van de graff generator.
- Current Electricity - Ohm's Law, Temperature dependence of resistance, colour code of resistors, series and parallel combination of resistors, resistivity, primary and secondary cells and their combination in series and parallel, Kirchoff's laws, wheat stone bridge and potentiometer - their applications, electrical energy and power.
- Magnetism and magnetic effect of current - Natural and man made magnet, magnetic lines of force, Bar magnet, magnetism and gauss law, magnetic moment, Torque on a magnetic dipole, magnetic field, magnetic induction, magnetic intensity, permeability, susceptibility & Intensity of magnetisation - their relations. Curie Law, Hysterisis, B-H curve. Classification of magnetic materials. Magnetic force, motion in the magnetic field, Biot - Savarts law, magnetic field by a straight Conductor & Circular Current Carrying Coil, Ampere's Circuital law, Solenoid, Toroid, Moving Coil Galvanometer, Ammeter, Voltmeter.
- Electromagnetic Induction - Faraday's Law, Lenz's Law, Self Induction, Mutual Induction, Electric Generators.
- Alternating Current - Mean and rms value of A.C., A.C. Circuit Containing resistance, Inductance and Capacitance, Series resonant Circuit, Q factor, Average power in A.C., Wattless Current, L C oscillations, transformer.
- Wave Optics - Huygen's principle - reflection and refraction, Interference of light, young's double slit experiment, Diffraction of light, Single slit diffraction, resolving power of optical instruments, polarisation of light, law of malus. Polarization by reflection and scattering.

- Photoelectric effect and matter waves - Einstein's Photoelectric equation, Photocell, matter waves, Debroglie's hypothesis, Davison and Germer's experiment.
- Nuclear Physics and Radioactivity – Nucleus, size, Mass defect, Binding energy, Nuclear fission and fusion, Nuclear reactor, Radioactivity, laws of disintegration, α,β and γ decays.
- Solids and semi conductor devices - Energy band in solids, Semi conductor, P-N Junction, Diodes, Diode as an rectifier, Special purpose p-n junction diodes, Junction transistor, Logic gates, integrated circuit.
- Electromagnetic Waves and Communication – Displacement current, Electromagnetic Waves-Source, nature. Electromagnetic spectrum, Elements of a communication system, Bandwidth of signals and transmission medium, Sky and space wave propagation, Need for modulation, Production and detection of an AM wave.

Part - (ii) 80 marks

(Graduate standard)

SCIENCE
(Botany,Zoology, Microbiology,Biotechnology, Biochemistry, Chemistry, Physics):

- Role of Micro organisms such as Bacteria, Viruses, Disease & Immunity..
- Algae: General character, classification and Thallus organization.
- Fungi : General character, classification and economic importance.
- Bryophytes and Pteridophytes : General character, classification and Reproduction.
- Cell structure and functions of cell organelles, chromosome organization. DNA structure, replication. Genetic code, Protein synthesis. Cell cycle ; mitosis, meiosis and their significance.
- Characteristics of seed plants, evolution of seed habit. Evolution and diversity of Gymnosperms. Classification and reproduction in Gymnosperms.
- Taxonomy of Angiosperms : Classification of Angiosperms. Diversity of flowering plants. Economic importance of Timber plants, Medicinal plants, fibre yielding plants, condiments and spices.
- Flower structure, Types of Embryos, Double fertilization, polyembryony, Apomixis, Parthenocarpy.
- Histological organization of monocot and dicot root, stem and leaves, Anomalous secondary growth. Apical meristem. Sapwood, heartwood and annual rings.
- Water relations : Osmosis, transport of water, transpiration, mechanism of stomatal movement. Factors affecting transpiration, mechanism of phloem transport.
- Photosynthesis : types of pigments, light and dark reaction, C_3 and C_4 cycle, Organisation of photosystems, Red drop phenomenon, Chemosysnthesis, Bacterial photosysnthesis. Law of limiting factor factors, affecting photosynthesis, Crassulacean Acid Metabolism.
- Respiration : types of respiration, Glycolysis, Krebs cycle and Oxidative phosphorylation, Respiratory quotient (R.Q.), photorespiration, Electron transpsort system.
- Structure and Function of Biological Macromolecules Proteins, Carbohydrates, Lipids,Nucleic Acid and Enzymes.

- Plant Growth and Development: Photoperiodism, vernalization, physiology of flowering, kinetics of growth, seed dormancy, plant growth regulators.

- Ecology types of pollution, Global warming, Green house effect, Acid rains, Alnino effect, ozone depletion Biodiversity, Sanctuaries, National parks, Endangered species, Deforestation, Bio communities, Ecosystem, Food chains, ecological pyramids, wild life and its conservation, Biogeochemical cycles. Environmental laws, Radiation hazards.

- Structure and function of animal tissues, Various systems of human. Regulation in animals (Nervous system, Endocrine system and hormones)

- Life cycle of Plasmodium, Ascaris, Liverfluke, Economic importance of Protozoa and Insects. Social insects. External and internal structure of Amoeba, Plasmodium, Earthworm, Cockroach and Frog ,

- Genetics : Mendelism, Linkage, Crossing over, sex determination and sex linked inheritance, Mutation.

- Evolution : Darwinism, Neo Darwinisim, Lamarckism, Natural selection and Adaptation, Concepts of species and speciation. Palentological evidences and morphological evidences of evolution, Hardy-Winberg law, Origin of life

- Biotechnology : Tools and Technique of recombinant DNA Technology, cloning vectors, regulation of gene expression in prokaryotes and Eukaryotes Gene Amplication, genomic library, Gene mapping, Plant tissue culture,Vectors for gene transfer, vectorless gene transfer, Transgenics. GM Crops, Application of Biotechnology in Agriculture, Medicine, Animals and Plants, DNA Finger Printing.

- Taxonomy of animals, Five kingdom system,Characteristics upto family level with suitable example. Symmetry, Coelom, segmentation and embryogenesis.

- Embryology of animals, Spermatogenesis, Oogenesis, fertilization, Cleavage, Gastrulation, organogenesis and fate of three germinal layers, test tube baby. Embryology of frog

- Zero group elements : Position in periodic table, isolation, compounds of zero group elements.

- d-block elements : Electronic configuration, general characteristics for e.g. colour, oxidation state, tendency to form complexes, magnetic properties, interstitial compound, catalytic properties, alloys.

- f-block elements : Lanthanides and Actinides, Electronic configuration, Lanthanide contraction and its consequences, Super heavy elements.

- Bio-Inorganic Chemistry : Role of bulk and trace metal ions in biological system with special reference to Mg, Ca, Fe and Cu.

- Reaction Mechanism : Inductive, Mesomeric and Hyper - conjugation. Addition and substitution : Electrophilic addition and substitution reaction, Nucleophilic addition and substitution reactions (S_N1 and S_N2), Elimination reactions.

- Spectroscopy Techniques : UV-Visible : Lambert-Beer's law, Auxochrome and Chromophore, various shifts, calculation of λ_{max} values of dienes, polyenes and enone compounds. IR : Molecular vibrations, Hook's law, intensity and position of IR bands, finger print region, characteristic absorption of common functional groups.

- Chemical Kinetics : Order and Molecularity of reactions, first and second order reactions and their rate expressions (no derivation), Zero and Pseudo order reactions, Arrhanius euqtion, Collision theory and activated complex theory.

- Solutions : Osmotic pressure, Lowering of vapour pressure, depression of freezing point and elevation of boiling point. Determination of molecular weight in solution. Association and dissociation of solutes.
- Electrochemistry : Electrochemical cells, electrode potentials, measurement of e.m.f. Conductance : Cell constant, specific and equivalent conductivity, Kohlrausch's Law and its applications, solubility and solubility product, equivalent conductivity at infinite dilution of weak electrolytes, hydrolysis and hydrolysis constant.
- Conservation Laws : Concept of reduced mass, concept of elastic and inelastic collision, analysis of collision in centre of mass frame, Angular momentum of a system of particles, conservation of Angular momentum
- Oscillatory Motion: Damped harmonic oscillators, power dissipation, Quality factor, Driven harmonic oscillator.
- Waves in media: Speed of transverse waves on a uniform string speed of longitudinal waves in a fluid, energy density and energy transmission in waves
- Kinetic theory of gases: distribution law of molecular velocities, most probable, average and rms velocities. Mean free path Thermal conductivity
- Interference of light: Coherence, Analytical treatment of interference.
- Thermal and electrical properties of solids: Classical theory of specific heat or Solids, Band theory of solids, metal insulator and semiconductor. Elementary idea of superconductivity.

Part - (iii) 40 marks

Teaching Methods :

1 Definition and concept of science, place of science in school curriculum, nature of science, scientific attitude, values of science, correlation of science with other school subjects, aims of science teaching in Secondary Schools, Scientific literacy, Scientific method.

2 Principles of developing science curriculum at secondary level, factors affecting the selection and organisation of science curriculum, NPE-1986, POA (1992) and National curriculum fram work - 2005, Unit plan and lesson plan, Taxonomy of educational objectives, writing objectives in behavioural terms. Role of Science teacher.

3 Methods and approaches - Lecture method, demonstration, laboratory method, problem solving, project method, inductive and deductive method, inquiry approach, discovery method, programmed instruction, panel discussion, team teaching, multi sensory teaching aids.

4. Co-curricular activities, Science lab, planning and equipping science lab, Safety precaution for work in science lab, science-club, field trip.

5. Evaluation-Concepts, type and purposes, type of post items, objective type, S.A. and Essay, preparation of blue print, evaluation of practical work in science, comprehensive and continuous evaluation in science.

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For the competitive examination for the post of senior teacher :-

1 The question paper will carry maximum 300 marks.
2 Duration of question paper will be T**wo Hours Thirty Minutes**.
3 The question paper will carry 150 questions of multiple choices.
4 Paper shall include following subjects carrying the number of marks as shown against them :-

(i)	Knowledge of Secondary and Sr. Secondary Standard about relevant subject matter.	180 Marks
(ii)	Knowledge of Graduation Standard about relevant subject matter.	80 Marks
(iii)	Teaching Methods of relevant subject.	40 Marks
	Total	300 Marks

5 All questions carry equal marks.
6 There will be **Negative Marking.**

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