

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)

Biology :

1. Cell structure and functions of cell organelles, Cell inclusions, Nucleic acid (DNA and RNA) Cell division (Mitosis, Meiosis), Genetic code, types of RNA and protein synthesis
2. Types of plant tissues, internal structure of root , stem and leaves , Secondary growth
3. 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.
4. Water relations, Osmosis, DPD, Plasmolysis, Water potential Absorption of water, Ascent of sap, Transpiration, Guttation, Stomatal movement
5. Photosynthesis, types of pigments, light and dark reaction, C₄ cycle, Chemosynthesis Law of limiting factor, factors affecting photosynthesis, Crassulacean Acid Metabolism
6. Respiration, types of respiration , Glycolysis , Krebs cycle and Oxidative phosphorylation , Respiratory quotient (R..Q.)
7. Enzymes, classification, mechanism of action, factors affecting enzyme activities
8. Regulation in animals (Nervous system, Endocrine system and hormones), regulation in plants by hormones Auxin, Gibberellins, Cytokinins, Ethylene, Abscisic acid, application of plant hormones in agriculture and horticulture, Photoperiodism , Vernalisation and seed dormancy.
9. Types of pollution, Global warming, Green house effect, Acid rains, Alnino effect, ozone depletion Biodiversity, Sancturies, National parks, Endangered species, Deforestation, Bio communities, Ecosystem, Food chains, ecological pyramids, wild life and its conservation , Biogeochemical cycles.
10. Structure and function of animal tissues, Various systems of human, human population and health, immune system, tissue and organ transplantations, Bio-treatment Techniques.
11. External and internal structure of Amoeba, Plasmodium, Earthworm, Cockroach and Frog.
12. Heredity and Evolution, Darwinism, Neo Darwinisim, Lamarckism, Natural selection and Adaptation, Concepts of species and speciation. Palentological evidences and morphological evidences of evolution
13. Genetics and heredity : Mendelism, Linkage, Crossing over, hybridization, sex determination and sex linked inheritance, Blood groups, Rh factor, Mutation, gene mapping and human genome project, Genetic engineering, clones, techniques of gene transfer, applications of biotechnology, Tot potency Tissue culture and its applications, transgenic animals, bioinformatics, gene library and cDNA library.

14. Taxonomy of animals, Five kingdom system, Characteristics upto class level with suitable example. Symmetry, Coelom, segmentation and embryogenesis.
15. Taxonomy of plants: Eukaryota, Prokaryota, Virus, Prion, Mycoplasma, Lichens and elementary knowledge of Ulothrix, Riccia and Pteridium
16. Embryology of animals, Spermatogenesis, Oogenesis, fertilization, Cleavage, Gastrulation, organogenesis and fate of three germinal layers, test tube baby, embryonic development in human, placenta, specific aspect of development.

Chemistry :

- 1 Atomic Structure : Fundamental Particles, Atomic models and their limitations, dual nature of particles, de-broglie equation, uncertainty 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 weight, molecular weight, Equivalent weight, Mole concept, Chemical stoichiometry.
- 2 **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, vapour pressure, surface tension and viscosity coefficient and its application. Solid state - classification of solids, crystal structure.
- 3 **Chemical bonding and molecular structure** - Symbols, ions, radicals, variable valencies, types of formulas - empirical formula, molecular formula, Ionisation potential, Electronegativity, electron-affinity.
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.
- 4 **Co-ordination Compounds** : Ligand and co-ordination number, IUPAC nomenclature and formulation of mono nuclear co-ordination compound, Isomerism, Stereoisomerism, Crystal field theory. Shapes, Colours, Magnetic properties in complexes, stability of co-ordination compounds, Organometallic compound (elementary knowledge)
- 5 **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, types of elements - s, p, d and f block periodicity in properties - atomic and ionic radii, ionisation potential, electron affinity, electronegativity and valency.
- 6 **Chemical Equilibria** : 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.
- 7 **Ionic 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.
- 8 **Oxidation - Reduction reaction** : Redox reactions, Oxidation numbers.
- 9 **Metals, Non-metals and Metallurgy** : Minerals and ores, General metallurgy, Metallurgy of Cu, Fe, Al and Zn. Use of important compounds of metals and non-metals in daily life.
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.
- 10 **Purification & characterisation of organic compounds** - Different methods of purification, qualitative & quantitative analysis, Tetravalency of carbon, overlapping of orbitals, sigma and pi-bond, shape of methane, ethane and ethyne molecules, effect of hybridisation on bond length and bond energy,

functional groups, homologous series, classification of organic compounds, Nomenclature of organic compounds, Isomerism.

- 11 **Hydrocarbons** : Aliphatic hydrocarbons (Alkane, Alkene and Alkyne); Aromatic hydrocarbon (Benzene), concept of aromaticity, petroleum and petrochemicals.
- 12 Polymers, Bio-molecules, Chemistry in everyday life and surface chemistry.
- 13 Environmental Chemistry.

Physics :

- 1 **Physical world and measurement** - Need, fundamental and derived units, systems of units.
- 2 **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.
- 3 **Vectors** - Scalar and vector quantities, unit vector, addition and multiplication.
- 4 **Laws of motion** - first, second and third law of motion, impulse, momentum, conservation of linear momentum.
- 5 **Friction** - Types of friction, laws of friction, lubrication.
- 6 **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.
- 7 **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.
- 8 **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.
- 9 **Gravitation** - Universal law of gravitation, g , variation of g , orbital and escape velocity, planetary motion, kepler's law.
- 10 **Elasticity** - Hook's law, young's modulus, bulk modulus and shear modulus of rigidity. P.E. in a stretched wire.
- 11 **Surface tension** - Fluid pressure, Pascal's law, Archimedes principle, molecular theory of surface tension, Excess of pressure inside a drop and soap bubble, Capilarity, Detergents.
- 12 **Liquids in motion** - Type of flow of liquid, critical velocity, Newton's formula, Coefficient of viscosity, Terminal velocity, Stoke's law, Energy of a liquid, Bernoulli's theorem - its applications.
- 13 **Kinetic theory of gases** - Laws for gases, Ideal gas equation, assumptions of Kinetic theory of gases, Kelvin scale of temp, Pressure exerted by a gas, Law of equipartition of energy, Degree of freedom.
- 14 **Heat and thermodynamics** - Concept of Heat and temperature, Temp. Scales, Thermal expansion of solid, liquid and gases, specific heat, Law of mixture, latent heat, Thermal capacity, Zeroth & first law of thermodynamics.
- 15 **Radiation** - Modes of transmission of heat, thermal conductivity, Thermal radiations, perfect blackbody, Wein's displacement law, Stefan's law, Kirchoff's law, Newton's law of cooling.
- 16 **Waves** - Type of waves, wave equation, superposition principle, Interference, beats, stationary waves, resonance tube, sonometer. Melde's experiment, Doppler's effect in sound and light.

17. **Ray optics and optical instruments** - Laws of reflection, Reflection by plane and curved mirrors, Laws of refraction, total internal refraction - applications, Diffraction, Lenses, Image formation by lenses, Scattering of light, Eye, Defects of vision, Microscopes, Astronomical telescopes.
18. **Electrostatics** - Coulomb's law, electric field and potential due to a point charge, Dipole, concept of Dielectric, Gauss theorem - its applications, Electric lines of force, Force and torque experienced by a dipole in uniform electric field.
19. **Capacitance** - Capacity of an isolated spherical conductor, capacitor - principle, Types of Capacitors, series and parallel combinations of Capacitors, Energy of a Capacitor.
20. **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, Wheatstone bridge and potentiometer - their applications.
21. **Thermal and Chemical effect of current** - Electric power, Joule's law, Chemical effect of current, Faraday's law of electrolysis, Thermoconductivity, Seebeck effect, Peltier and Thomson effect.
22. **Magnetism and magnetic effect of current** - Natural and man made magnet, magnetic lines of force, Coulomb's law, magnetic moment, Torque on a magnetic dipole, magnetic field, magnetic induction, magnetic intensity, permeability, susceptibility & Intensity of magnetisation - their relations. Curie Law, Hysteresis, B-H curve. Classification of magnetic materials. Oersted's experiment, Biot - Savart's law, magnetic field by a straight Conductor & Circular Current Carrying Coil, Ampere's Circuital law, Solenoid, Toroid, Cyclotron, Moving Coil, Galvanometer, Ammeter, Voltmeter and Tangent Galvanometer.
23. **Electromagnetic Induction** - Faraday's Law, Lenz's Law, Self Induction, Mutual Induction, Electric Generators, Motor, Transformers.
24. **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, Choke Coil.
25. **Wave Optics** - Huygen's principle - reflection and refraction, Interference of light, Young's double slit experiment, Fresnel's Bi-prism, Diffraction of light, Fresnel's HPZ, Fraunhofer's diffraction, polarisation of light, law of Malus, Nicol prism, Polaroids.
26. **Atomic physics** - Electric conduction in gases, Cathode rays, Thomson experiment, Millikan's oil drop method, Alpha particle scattering experiment, Thomson, Rutherford, Bohr and Sommerfeld's model of Atom, Hydrogen spectrum, X-rays, Spectrum of X-rays.
27. **Photoelectric effect and matter waves** - Einstein's Photoelectric equation, Photocell, matter waves, De Broglie's hypothesis.
28. **Nuclear Physics and Radioactivity** - Nucleus, Mass defect, Binding energy, Nuclear reactions, Nuclear fission and fusion, Nuclear reactor, Radioactivity, laws of disintegration, α , β and γ rays, radioactive isotopes - uses, Radio Carbon dating.
29. **Solids and semi conductor devices** - Energy band in solids, Semi conductor, P-N Junction, Diodes, Diode as a rectifier, Junction transistor.
30. **Electromagnetic Waves and Communication** - Electromagnetic Waves- Properties, Electromagnetic spectrum, propagation of radio waves, Satellite Communication.

Part - (ii)**80 marks****(Graduate standard)****Biology :**

1. **Cell structure and functions** of cell organelles, Cell inclusions, Nucleic acid (DNA and RNA) Cell division (Mitosis , Meiosis), Genetic code, types of RNA and protein synthesis, Duplication of DNA , Watson Crick model , B-DNA , Z-DNA
2. **Types of plant tissues**, internal structure of root, stem and leaves, Secondary growth, Anomalous secondary growth, Annual rings, heartwood and sap wood, tyloses
3. **Structure of flower**, Types of inflorescence, reproduction in plants, Double fertilisation, types of embryosacs polyembryony, Apomixis, Parthenocarpy Alternation of generation, Economic botany: Timber plants, Medicinal plants Fibre yielding plants, Condiments and spices
4. **Water relations**, Osmosis, DPD, Plasmolysis, Water potential Absorption of water, Ascent of sap, Transpiration, Guttation, Stomatal movement, Antitranspirants
5. **Photosynthesis**, types of pigments, light and dark reaction, C₄ cycle, Organisation of Photosystems, Red drop phenomenon, Chemosynthesis, Bacterial photosynthesis

Law of limiting factor, factors affecting photosynthesis, Crassulacean Acid Metabolism
6. **Respiration**, types of respiration, Glycolysis, Krebs cycle and Oxidative phosphorylation, Respiratory quotient (R..Q.), Photorespiration, Electron transport system
7. **Enzymes**, classification, mechanism of action, factors affecting enzyme activities, Isoenzymes, Regulation of enzyme activity
8. **Regulation in animals** (Nervous system, Endocrine system and hormones), regulation in plants by hormones Auxin, Gibberellins, Cytokinins, Ethylene, Abscisic acid, application of plant hormones in agriculture and horticulture, Photoperiodism, Vernalisation and seed dormancy, Avena culture test, Bioassay of hormones, Richmond -Lang effect, Plant movements.
9. **Ecology** Types of pollution, Global warming, Green house effect, Acid rains, Alnino effect, ozone depletion Biodiversity, Sancturies, National parks, Endangered species, Deforestation, Bio communities , Ecosystem , Food chains, ecological pyramids, wild life and its conservation, Biogeochemical cycles.Environmental laws, Radiation hazards
10. **Structure and function of animal tissues**, Various systems of human
11. **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 ,
12. **Heredity and 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

13. **Genetics and genetic engineering** : Mendelism, Linkage, Crossing over, hybridization, sex determination and sex linked inheritance, Blood groups, Rh factor, Mutation, gene mapping and human genome project, Genetic engineering, clones, techniques of gene transfer, applications of biotechnology, Totipotency Tissue culture and its applications, transgenic animals, bioinformatics, gene library and cDNA library, Linkage and crossing over, One gene one enzyme hypothesis, Operon model of gene. Mutation, Polyploidy
14. **Taxonomy of animals**, Five kingdom system, Characteristics upto family level with suitable example. Symmetry, Coelom, segmentation and embryogenesis.
15. **Taxonomy of plants**: Eukaryota, Prokaryota, Virus, Prion, Mycoplasma, Lichens and elementary knowledge of Ulothrix, Riccia and Pteridium, Selaginella, Pinus, Cycas and Ephedra. Economic importance of Gymnosperms.
16. **Embryology of animals**, Spermatogenesis, Oogenesis, fertilization, Cleavage, Gastrulation, organogenesis and fate of three germinal layers, test tube baby. Embryology of frog

Chemistry :

- 1 **Zero group elements** : Position in periodic table, isolation, compounds of zero group elements.
- 2 **d-block elements** : Electronic configuration, general characteristics for e.g. colour, oxidation state, tendency to form complexes, magnetic properties, interstitial compound, catalytic properties, alloys.
- 3 **f-block elements** : Lanthanides and Actinides, Electronic configuration, Lanthanide contraction and its consequences, Super heavy elements.
- 4 **Bio-Inorganic Chemistry** : Role of bulk and trace metal ions in biological system with special reference to Mg, Ca, Fe and Cu.
- 5 **Reaction Mechanism** : Inductive, Mesomeric and Hyper-conjugation. Addition and substitution : Electrophyls and Nucleophyls. Electrophilic addition and substitution reaction, Nucleophilic substitution reactions (SN_1 and SN_2), Elimination reactions.
- 6 **Chemical Kinetics** : Order and Molecularity of reactions, first and second order reactions and their rate expressions (no derivation), Zero and Pseudo order reactions, Collision theory and activated complex theory.
- 7 **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.
- 8 **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.

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 framework - 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 **Two 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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