

**SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF
HIGH SCHOOL TEACHER (SCIENCE) UNDER SCHOOL EDUCATION
DEPARTMENT, GOVERNMENT OF MIZORAM, 2017**

SUBJECTS

- (a) General English (Conventional / Objective Type) 100 Marks
- (b) Technical Paper - I (MCQ/Objective Type)..... 150 Marks
- (c) Technical Paper - II (MCQ/Objective Type)..... 150 Marks

GENERAL ENGLISH

(Full Marks : 100)

- (a) Essay Writing (Conventional)..... 20 Marks
- (b) Idioms & Phrases (Objective Type)..... 16 Marks
- (c) Comprehension of given passages (Objective Type)..... 16 Marks
- (d) Grammar (Objective Type) 16 Marks
Parts of Speech : Nouns, Adjective, Verb, Adverb, Preposition, etc.
- (e) Composition (Objective Type)..... 16 Marks
 - i) Analysis of complex and compound sentences
 - ii) Transformation of sentences
 - iii) Synthesis of sentences
- (f) Correct usage and vocabularies (Objective Type) 16 Marks

TECHNICAL PAPER – I(150 MARKS)

Unit – I Physics	.....	76 Marks
Unit– II Chemistry	.....	74 Marks

TECHNICAL PAPER – II (150 MARKS)

Unit – I Botany	.....	66 Marks
Unit- II Zoology	.....	64 Marks
Unit- III Aptitude Test	.....	20 Marks

TECHNICAL PAPER – I

Unit – I : Physics (76 Marks)

Part I : General Physics, Heat and Thermodynamics

(36 Marks)

1. Laws of Motion; Newton's laws of motion and their applications. Equilibrium of concurrent forces. Static and kinetic friction, laws of friction, rolling friction, lubrication. Dynamics of uniform circular motion: Centripetal force and examples of circular motion. Work done by a force; kinetic energy and potential energy, work-energy theorem, power. Conservative forces and non-conservative forces; elastic and inelastic collisions in one and two dimensions.
2. Centre of mass of a two-particle system, a rigid body and uniform rod with momentum conservations. Equilibrium of rigid bodies, rigid body rotation and equation of rotational motion, comparison of linear and rotational motions; moment of inertia, radius of gyration. Kepler's laws of planetary motion. The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Gravitational potential energy; Escape velocity, orbital velocity of a satellite. Geostationary satellites.
3. Properties of Matter; Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus-, shear, modulus of rigidity, poisson's ratio; elastic energy. Pressure due to a fluid column; Pascal's law and its applications Effect of gravity on fluid pressure. Viscosity, Stokes' law, terminal velocity, Reynolds's number, streamline and turbulent flow. Critical velocity, Bernoulli's theorem and its applications.
4. Heat, temperature, thermal expansion; thermal expansion of solids, liquids, and gases. Anomalous expansion. Specific heat capacity: C_p , C_v — calorimetry; change of state — latent heat. Heat transfer-conduction and thermal conductivity, convection and radiation. Qualitative ideas of Black Body Radiation, Wein's displacement law, and Green House effect.
5. Laws of thermodynamics and subsequent related topics; Equation of state of a perfect gas; work done on compressing a gas. Kinetic theory of gases; assumptions, concept of pressure. Kinetic energy and temperature; rms speed of gas molecules; degrees of freedom, law of equipartition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path, Avogadro's number.

Part II: Electricity & Magnetism, Optics**(24 Marks)**

6. Electric charges and their conservation. Coulomb's law and its applications, electric field, electric flux, Gauss's theorem and electric potential. Conductors and insulators, Dielectrics and properties. Electric current, Ohm's law, Kirchhoff -'s laws and simple applications. Wheatstone bridges, metre bridge. Potentiometer
7. Biot - Savart law and its application, Ampere's law and its applications, Cyclotron, moving coil galvanometer. Para-, dia-, and ferro- magnetic substances, with examples. Electromagnets and factors affecting their strengths. Permanent magnets. Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, Eddy currents. Self - and mutual inductance. Alternating currents, peak and rms value of alternating current/voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, wattless current.
8. Reflection, refraction and scattering of light; laws and formulae derivations, with reference to mirror, lenses prisms. Myopia and hypermetropia. Wavefront and Huygens' principle, reflection and refraction of plane wave at a plane surface using wavefronts. Interference, Young's double hole experiment and expression for fringe width, coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum. Resolving power of microscopes and astronomical telescopes. Polarisation, plane polarised light; Brewster's law, uses of plane polarised light and Polaroids.

**Part III: Atomic, Nuclear Physics & Electronics
Marks)****(16**

9. Einstein's photoelectric equation –particle nature of light. Matter waves; wave nature of particles, de Broglie relation. Davisson-Germer experiment. Alpha - particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity — alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission and fusion.
10. Energy bands in solids; conductors, insulators and semiconductors; semiconductor diode V-I characteristics in forward and reverse bias, diode as a rectifier; *I-V* characteristics of LED, photodiode, solar cell, and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier and oscillator, transistor as a switch. Logic gates (OR, AND, NOT, NAND and NOR).

UNIT- II : Chemistry (75 Marks)

Part I: Inorganic Chemistry

(24 Marks)

1. Atomic Structure and Periodic property: Atomic model; Thomson's, Rutherford's Bohr's models and their limitations, concept of shells and sub-shells, dual-nature of matter and light, de Broglie's relationship, Uncertainty principle, atomic-orbitals (*s*, *p* and *d*-orbitals); Aufbau principle; Pauli's exclusion principle; Hund's rule; Effective nuclear charge, shielding or screening effect. Concept of hybridization; VSEPR; hydrogen bonding. MOT for homonuclear & heteronuclear species; VBT; CFT (octahedral, tetrahedral & square planar), CFSE in weak and strong ligands. Ionic bond, Covalent bond, Coordinate bond, Metallic bond, Hydrogen bond, Structures of solids- Types of crystals, Packing, Radius ratio, Crystal structures, Lattice energy, Lattice defects.
2. *s* & *p* block properties: Properties of *s* & *p*-block elements with reference to electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties, trends in chemical reactivity. Preparation and Properties of Some Important elements and Compounds like Boron, Aluminium, Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogencarbonate, their uses.
3. Equilibrium & redox reactions: Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium —Le Chatelier's principle; ionic equilibrium, strong and weak electrolytes, degree of ionization, ionization of polybasic acids, acid strength, concept of pH., Hydrolysis of salts, buffer solutions, Henderson equation, solubility product, common ion effect. Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers, applications of redox reactions.

Part II: Organic Chemistry

(30 Marks)

4. Basic Principles and Techniques: methods of purification, qualitative and quantitative, analysis, classification and IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions.
5. Hydrocarbons: Classification, Aliphatic and Aromatic hydrocarbons with reference to Nomenclature, conformations, geometrical isomerism, physical & chemical properties, methods of preparation; chemical reactions. Haloalkanes and Haloarenes; Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions. Uses and environmental effects of - dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT. Alcohols, Phenols, Ethers, Aldehydes, Ketones and Carboxylic Acids; Nomenclature, methods of preparation, physical and chemical properties, their uses.
6. Biomolecules and Polymers: Carbohydrates; Classification, monosaccharide, oligosaccharides and polysaccharides. importance. Proteins; Elementary idea of a

amino acids, peptide bond, polypeptides, proteins, structures, denaturation of proteins, enzymes. Hormones; Elementary ideas. Vitamins; Classification and functions. Nucleic Acids; DNA and RNA. Polymers; Classification of Polymers, methods of polymerization, copolymerization, natural and synthetic polymers, biodegradable and non-biodegradable polymers.

7. Environment Chemistry & Health : Environmental pollution; Air, water and soil pollution, effects of depletion of ozone layer, greenhouse effect and global warming, green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution. Chemicals and medicines; analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

Part III: Physical Chemistry

(20 Marks)

8. States of Matter: Three states of matter, intermolecular interactions, role of gas laws in elucidating the concept of the molecule, Boyle's law, Charles's law, Gay Lussac's law, Avogadro's law, ideal behaviour, empirical derivation of gas equation, Avogadro number, ideal gas equation. Kinetic energy and molecular speeds, deviation from ideal behaviour, liquefaction of gases, critical temperature. Liquid State; vapour pressure, viscosity and surface tension. Solid; Classification of solids based on different binding forces, amorphous and crystalline solids, unit cell in two dimensional and three dimensional lattices
9. Electrochemistry: Conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, laws of electrolysis, dry cell; electrolytic cells and Galvanic cells; lead accumulator, 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, fuel cells; corrosion.
10. Chemical Kinetics: Rate of a reaction, factors affecting rates of reaction, order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life, concept of collision theory. Activation energy, Arrhenius equation.

TECHNICAL PAPER – II

Unit – I Botany

(66 Marks)

1. Binomial Nomenclature of Plants: Biodiversity; Need for classification; Three domains of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy. Five kingdom classification; Salient features and classification of Monera; Protista and Fungi into major groups; Lichens. Salient features and classification of plants into major groups- Algae, Bryophytes, Pteridophytes, Gymnosperm and Angiosperm.
2. Cell structure of plants and function of cell organelles: Structure of prokaryotic and eukaryotic cell; Cell envelope, cell membrane, cell wall; Cell organelles; structure and function, Endomembrane system- endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids; Nucleus—nuclear membrane, chromatin, nucleolus.
3. Plant tissues, its structure and function: Anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence- cymose and racemose, flower, fruit and seed. Transport in plants: Movement of water, gases and nutrients; Cell to cell transport, Diffusion, facilitated diffusion, active transport; Plant-water relations; Imbibition, water potential, osmosis, plasmolysis; Long distance transport of water; Absorption, apoplast, symplast, transpiration pull, root pressure and guttation;
4. Transpiration-Opening and closing of stomata; Uptake and translocation of mineral nutrients—Transport of food, phloem transport, Mass flow hypothesis; Diffusion of gases (brief mention). Mineral nutrition: Essential minerals, macro and micronutrients and their role; Deficiency symptoms; Mineral toxicity; Elementary idea of Hydroponics as method to study mineral nutrition; Nitrogen metabolism- Nitrogen cycle, biological nitrogen fixation.
5. Photosynthesis: Photosynthesis as a means of Autotrophic nutrition; Where does photosynthesis take place; How many pigments are involved in Photosynthesis (Elementary idea) Photochemical and biosynthetic phases of photosynthesis; Cyclic and non cyclic photophosphorylation; Chemiosmotic hypothesis; Photorespiration; C₃ and C₄ pathways, Factors affecting photosynthesis.
6. Respiration: Exchange of gases; Cellular respiration— glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations, - Number of ATP molecules generated; Amphibolic pathways; Respiratory quotient. Plant growth and development: Seed germination; Phases of plant growth and plant growth rate; Conditions of growth; Differentiation, dedifferentiation and redifferentiation; Sequence of developmental process in a plant cell; Growth regulators.
7. Reproduction in plants: Asexual and sexual reproduction; Asexual reproduction; Modes- Binary fission, sporulation, budding, gemmule, fragmentation; vegetative propagation in plants. Sexual reproduction in flowering plants: Flower structure; Development of male and female gametophytes; Pollination-types, agencies and examples; Outbreedings devices; Pollen-Pistil interaction; Double fertilization; Post

fertilization events— Development of endosperm and embryo, Development of seed and formation of fruit; Special modes - apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation.

8. Environmental pollution and their control: Air pollution and its control; Water pollution and its control; Agrochemicals and their effects; Solid waste management; Radioactive waste management; Greenhouse effect and global warming, Ozone depletion, Deforestation

Unit- II Zoology

(64 Marks)

1. Classification of animals upto class level: Salient features and classification of animals- non chordate up to phyla level and chordate up to classes level with examples. Structure and function of Bio-molecules: structure and function of proteins, carbohydrates, lipid, nucleic acids; Enzymes—types, properties, enzyme action. Mechanism of cell division, replication, transcription and translation in prokaryotes and eukaryotes, Cell cycle, mitosis meiosis and their significance.
2. Human Reproduction: Male and female reproductive systems, Microscopic anatomy of testis and ovary; Gametogenesis- spermatogenesis & oogenesis; Menstrual cycle; Fertilisation, embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation , Parturition; Lactation.
3. Genetics: Mendel's law of hereditary, Deviations from Mendelism— Incomplete dominance, Co-dominance; Multiple alleles and Inheritance of blood groups, Pleiotropy; Elementary idea of polygenic inheritance; Chromosome theory of inheritance; Chromosome and genes, Sex determination in humans, birds, honey bee; Linkage and crossing over; Sex linked inheritance, Chromosomal disorders in humans, Molecular Basis of Inheritance: Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; Transcription, genetic code, translation; Gene expression and regulation— Lac Operon; Genome and human genome project; DNA finger printing.
4. Evolution: Origin of life; Biological evolution and evidences for biological evolution; Paleontological, comparative anatomy, embryology and molecular evidence; Darwin's contribution, Modern Synthetic theory of Evolution; Mechanism of evolution—Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection; Gene flow and genetic drift; Hardy- Weinberg's principle; Adaptive Radiation; Human evolution.
5. Human diseases, causative agents, symptoms, prevention and their control: Pathogens; parasites causing human diseases (Malaria, Filariasis, Ascariasis, Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts or immunology— vaccines; Cancer; HIV and AIDS; Adolescence, drug and alcohol abuse. Improvement in food production: Plant breeding, tissue culture, single cell protein, Biofortification; Apiculture and Animal husbandry. Microbes in human welfare: In household food processing, industrial production, sewage treatment, energy generation and as biocontrol agents and biofertilizers.

6. Biotechnology and Its Applications: Principles and process of Biotechnology; Genetic engineering (Recombinant DNA technology). Application of Biotechnology in health and agriculture: Human insulin and vaccine production, gene therapy; Genetically modified organisms- Bt crops; Transgenic Animals; Biosafety issues— Biopiracy and patents.
7. Ecology and environment: Organisms and environment: Habitat and niche; Population and ecological adaptations; Population interactions mutualism, competition, predation, parasitism; Population attributes—growth, birth rate and death rate, age distribution. Ecosystems: Patterns, components; productivity and decomposition; Energy flow; Pyramids of number, biomass, energy; Nutrient cycling(carbon and phosphorous); Ecological succession; Ecological Services— Carbon fixation, pollination, oxygen release.
8. Biodiversity and its conservation: Concept of Biodiversity; Patterns of Biodiversity; Importance of Biodiversity; Loss of Biodiversity; Biodiversity conservation; Hotspots, endangered organism, extinction, Red Data Book, biosphere reserves, National parks and sanctuaries.

UNIT– III Aptitude Test

(20 Marks)

a) Numerical and Figure work Test: (4 marks)

These tests are reflections of fluency with numbers and calculations. It shows how easily a person can think with numbers. The subject will be given a series of numbers. His /Her task is to see how the numbers go together to form a relationship with each other. He /She has to choose a number which would go next in the series.

b) Verbal Analysis and Vocabulary Tests (6 marks)

These tests measure the degree of comfort and fluency with the English language. These tests will measure how a person will reason with words. The subject will be given questions with alternative answers that will reflect his /her command of the rule and use of English language

c) Visual and Spatial/ 3-D Ability Tests (4 marks)

These tests are used to measure perceptual speed and acuity. The subject will be shown pictures where he/she is asked to identify the odd one out; or which comes next in the sequence or explores how easily he/she can see and turn around objects in space

d) Abstract and Reasoning Test: (6 marks)

This test measures the ability to analyze information and solve problems on a complex, thought based level. It measures a person's ability to quickly identify patterns, logical rules and trends in new data, integrate this information, and apply it to solve problems