B. Tech./B. Pharm.		
	Duration	No. of Question
A Physics & Chemistry	60 minutes	40
B Mathematics/Biology	60 minutes	40
C Logical Reasoning	30 minutes	20

Note : Each question is of one mark. Wrong answers carry negative marks (-¼ for every wrong answer)

Part A : Physics & Chemistry

Physics

1. **Units and Measurement** : Units (Different systems of units, SI units, fundamental and derived units), Dimensional analysis and its applications, Least count, Accuracy and Precision, Significant figures, Errors in measurement, Vernier calipers, Screw gauge, Physical balance, Spherometer etc.

2. **Kinematics** : Vectors, Properties of vectors, Position, Velocity and Acceleration vectors, Vector addition and subtraction, Resolution of vectors, products of vector, motion in a straight line, Uniform accelerated motion.

3. **Laws of Motion** : Newton's laws, Momentum, Impulse, Conservation of momentum and its applications, Equilibrium of concurrent forces, Circular motion, Projectile motion, Static and Kinetic friction, Rolling friction.

4. **Work, Energy and Power** : Work done by a constant and variable force, kinetic and potential energies, work-energy theorem, power, Potential energy of a spring, conservation of mechanical energy, conservative and non-conservative forces, Elastic and inelastic collisions in one and two dimensions.

5. **Rotational Motion** : Centre of mass, motion of center of mass, Rigid body, Rotational motion, moment of a force, torque, angular momentum, conservation of angular momentum and its applications, moment of inertia and radius of gyration, Values of moments of inertia for simple geometrical objects, parallel and perpendicular axes theorems and their applications, Rigid body rotation.

6. **Gravitation and Satellite** : The universal law of gravitation, Kepler's laws of planetary motion, Gravitational potential energy, gravitational potential, Escape velocity, Orbital velocity of a satellite, Geo-stationary and Polar satellites.

7. **Mechanics of Solids and Fluids** : Elasticity, Hooke's Law, Young's modulus, bulk modulus, modulus of rigidity, Poission's ratio, Pressure due to a fluid column, Pascal's law and its applications, Pressure, Density, Viscosity, Stokes' law, Bernoulli's principle and its applications, Surface Tension, angle of contact, application of surface tension - drops, bubbles and capillary rise.

8. **Oscillations and Waves** : Simple Harmonic Motion, Loaded spring, Simple and Compound Pendulum, Longitudinal and Transverse waves, Stationary waves, Superposition of waves, Beats, Doppler's effect for sound and light waves, Lissajous figures.

9. **Heat and Thermodynamics** : Black body, Kirchhoff's law, prevost's theory of heat exchange, statement of Stefan's law, Newton's law of cooling, verification of Newton's law of cooling, Kinetic theory of gases, rms speed, Average kinetic energy of gases, Concept and scale of Temperature, Specific Heat, Work, heat and first law of Thermodynamics, work done in isobaric, isothermal, isometric and adiabatic process, Second law, Carnot engines.

10. **Electrostatics** : Fundamental forces of nature, conservation and quantization of charge, Coulomb's law, Intensity of electric field, electric flux, Electric field (discrete and continuous charge distributions), Electrostatic potential and Electrostatic potential energy, Gauss' law and its applications, Electric dipole, Electrical capacitance, principle of a capacitor, parallel plate capacitor with dielectric, combinations of capacitors.

11. **Current Electricity** : Electric current, Ohm's law, series and parallel connection of resistances, Effect of temperature on resistance, Kirchhoff's laws, Wheat stone bridge and meter bridge, Potentiometer and its applications.

12. **Heating and Magnetic Effect of Current** : Heating effect of electric current, Joule's law, Bio-Savart's law and its applications, Ampere's law and its applications, moving coil galvanometer, ammeter, voltmeter and tangent galvanometer, Galvanometer and its conversion to voltmeter and ammeter, Lorentz force, force on current carrying conductors in a magnetic field, Magnetic moment of a current loop, torque on a current loop, elements of earth's magnetism, diamagnetic, paramagnetic and ferromagnetic substances and their properties, magnetic permeability, magnetic susceptibility and intensity of magnetization, Hysteresis curve.

13. **Electromagnetic Induction and Alternating Currents** : Faraday's laws, Lenz's law, Induced emf, Self and mutual induction, A.C and D.C generator, D.C. motor, Transformer, Alternating current- instantaneous, average and root mean square values, R.C, L.R and L.C.R. A.C. circuits, choke coil.

14. **Optics** : Laws of reflection and refraction, Corpuscular theory of light, wave theory of light, Dispersion, Fraunhoffer lines, Interference, Coherence, Young's double slit experiment, Freshel's Bipresim, Michelson's interferometer, Diffraction, Fresnel's half period zones, Idea of polarization with the help of light vector, double refraction, Nicol prism, Polaroid.

15. **Atomic and nuclear Physics** : Dual nature of radiation, Photoelectric effect, De Broglie hypothesis, Davisson-Germer experiment.

    Bohr's theory of hydrogen spectrum, x-rays, Radioactivity, Mass defect and nuclear binding energy, nuclear fission and fusion, Nuclear Reactor.

16. **Semiconductor Physics** : Insulator, conductors and semi conductor, intrinsic and extrinsic semi conductors (N and P type) and basic semiconductor devices.

Chemistry :

1. **State of Matter** : Gaseous State: Measurable properties of gases; Gas laws , Dalton's law of partial pressure; Concept of Absolute scale of temperature; Ideal gas equation, Kinetic theory of gases (only postulates);

   Liquid State: Properties of liquids - vapour pressure, viscosity and surface tension and

effect of temperature on them (qualitative treatment only).

Solid State : Classification of solids (elementary idea), Unit cell and lattices, packing in solids (fcc, bcc and hcp lattices), voids, calculations involving unit cell parameters, imperfection in solids; Electrical, magnetic and dielectric properties, liquid crystals and unusual properties of water.

2. **Atomic Structure :** Bohr model of hydrogen atom - its postulates, derivation of the relations for energy of the electron and radii of the different orbits, limitations of Bohr's model; Dual nature of matter, de-Broglie's relationship, Heisenberg uncertainty principle. Various quantum numbers (principal, angular momentum and magnetic quantum numbers) and their significance; shapes of s, p and d - orbitals, electron spin and spin quantum number; Rules for filling electrons in orbitals – aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of elements, extra stability of half-filled and completely filled orbitals.

3. **Chemical Bonding and Molecular Structure :** Ionic Bonding: Formation of ionic bonds, factors affecting the formation of ionic bonds; covalent Bonding: Concept of electronegativity, Fajan's rule, dipole moment; Valence Shell Electron Pair Repulsion (VSEPR) theory and shapes of simple molecules.

Valence bond theory - Its important features, concept of hybridization involving s, p and d orbitals; Resonance. Molecular Orbital Theory - Its important features, LCAOs, types of molecular orbitals (bonding, antibonding), sigma and pi-bonds, molecular orbital electronic configurations of homonuclear diatomic molecules, concept of bond order, bond length and bond energy. Elementary idea of metallic bonding. Hydrogen bonding and its applications.

4. **Chemical Thermodynamics :** Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, types of processes.

First law of thermodynamics - Concept of work, heat internal energy and enthalpy, heat capacity, molar heat capacity; Hess's law of constant heat summation; Enthalpies of bond dissociation, combustion, formation, atomization, sublimation, phase transition, hydration, ionization and solution.

5. **Solutions :** Different methods for expressing concentration of solution - molality, molarity, mole fraction, percentage (by volume and mass both), vapour pressure of solutions and Raoult's Law - Ideal and non-ideal solutions, vapour pressure - composition, plots for ideal and non-ideal solutions; Colligative properties of dilute solutions - relative lowering of vapour pressure, depression of freezing point, elevation of boiling point and osmotic pressure; Determination of molecular mass using colligative properties; Abnormal value of molar mass, van't Hoff factor and its significance.

6. **Equillibrium :** Law of chemical equilibrium, equilibrium constants (Kp and Kc) and their significance, factors affecting equilibrium concentration, pressure, temperature, effect of catalyst; Le Chatelier's principle.

Ionic equilibrium: Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius, Bronsted - Lowry and Lewis) and their ionization, acid base equilibria and ionization constants, ionization of water, pH scale, common ion effect,

hydrolysis of salts and pH of their solutions, solubility of sparingly soluble salts and solubility products, buffer solutions.

7. **Redox Reactions and Electrochemistry :** Electronic concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number, balancing of redox reactions.

8. **Chemical Kinetics :** Rate of a chemical reaction, factors affecting the rate of reactions: concentration, temperature, pressure and catalyst; elementary and complex reactions, order and molecularity of reactions, rate law, rate constant and its units, differential and integral forms of zero and first order reactions, their characteristics and half - lives, effect of temperature on rate of reactions - Arrhenius theory, activation energy and its calculation, collision theory of bimolecular gaseous reactions (no derivation).

   Catalysis - Homogeneous and heterogeneous, activity and selectivity of solid catalysts, enzyme catalysis and its mechanism.

9. **Classification of Elements and Periodicity in Properties :** Modern periodic law and present form of the periodic table, s, p, d and f block elements, periodic trends in properties of elements, atomic and ionic radii, ionization enthalpy, electron gain enthalpy, valency, oxidation states and chemical reactivity.

10. **s-Block Elements (Group-1 and 2 Elements) :** General introduction, electronic configuration and general trends in physical and chemical properties of elements, anomalous properties of the first element of each group, diagonal relationships.

11. **p-Block Elements (Group - 13 to Group 18 Elements) :** General Introduction, Electronic configuration, diagonal relationships and general trends in physical and chemical properties of elements across the periods and down the groups; unique behaviour of the first element in each group.

12. **d- and f- Block Elements :** Transition Elements: General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first row transition elements - physical properties, ionization enthalpy, oxidation states, atomic radii, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation; Inner Transition Elements: Lanthanides-Electronic configuration, oxidation states, chemical reactivity and lanthanide contraction.

13. **Co-ordination Compounds :** Introduction to co-ordination compounds, Werner's theory; ligands, co-ordination number, denticity, chelation; IUPAC nomenclature of mononuclear co-ordination compounds, isomerism.

14. **Nomenclature :** Trivial and IUPAC Nomenclature of organic compounds.

15. **Basic Principles of Organic Chemistry :** Covalent bond fission - Homolytic and heterolytic: free radicals, carbocations and carbanions; stability of carbocations and free radicals, electrophiles and nucleophiles. Electronic displacement in a covalent bond Inductive effect, electromeric effect, resonance and hyperconjugation.

   Common types of organic reactions - Substitution, addition, elimination and rearrangement.

16. **Hydrocarbons :** Classification, isomerism, IUPAC nomenclature, general methods of

preparation, properties and reactions, Alkanes - Conformations: Sawhorse and Newman projections (of ethane); Mechanism of halogenation of alkanes. Alkenes - Geometrical isomerism; Mechanism of electrophilic addition: (Markownikoff's and peroxide effect); Ozonolysis, oxidation, and polymerization. Alkynes - Acidic character; Addition of hydrogen, halogens, water and hydrogen halides; Polymerization. Aromatic hydrocarbons - Nomenclature, benzene - structure and aromaticity; Mechanism of electrophilic substitution: halogenation, nitration, Friedel – Craft's alkylation and acylation, directive influence of functional group in mono-substituted benzene.

17. **Organic Compounds Containing Halogens :** General methods of preparation, properties and reactions; Nature of C-X bond; Mechanisms of substitution reactions.

18. **Organic Compounds Containing Oxygen :** General methods of preparation, properties, reactions and uses of Alcohols, Phenols, Ethers, Aldehyde and Ketones. Carboxylic Acids : Acidic strength and factors affecting it.

19. **Organic Compounds Containing Nitrogen :** General methods of preparation, properties, reactions of Amines, Diazonium Salts.

20. **Stereochemistry :** Geometrical isomerism and conformations, optical activity, specific rotation, chirality – chiral objects, chiral molecules, compounds containing one chiral centre, enantiomers, D-L and R-S nomenclature, racemic forms, racemisation. Compounds containing two chiral centers, diastereoisomers, mesoform.

21. **Bio-molecules :** Carbohydrates- aldoses and ketoses; monosaccharides (glucose and fructose), constituent monosaccharides of oligosacchorides (sucrose, lactose, maltose) and polysaccharides (starch, cellulose, glycogen). Proteins- Elementary Idea of amino acids, peptide bond, polypeptides; Proteins: primary, secondary, tertiary and quaternary structure (qualitative idea only), denaturation of proteins, enzymes.Vitamins- Classification and functions. Nucleic Acids-Chemical constitution of DNA and RNA. Biological functions of nucleic acids.

22. **Polymers :** Natural and synthetic rubber and vulcanization; some important polymers with emphasis on their monomers and uses - polythene, nylon, polyester and bakelite.

Part B : Mathematics/Biology

Mathematics

1. **Algebra :** Complex numbers, addition, multiplication, conjugation, polar representation, properties of modulus and principal argument, triangle inequality, roots of complex numbers, geometric interpretations; Theory of Quadratic equations, quadratic equations in real and complex number system and their solutions, relation between roots and coefficients, nature of roots, equations reducible to quadratic equations; Arithmetic, geometric and harmonic progressions, arithmetic, geometric and harmonic means, arithmetico-geometric series, sums of finite arithmetic and geometric progressions, infinite geometric series, sums of squares and cubes of the first n natural numbers; Logarithms and their properties; Exponential series, Permutations and combinations, Permutations as an arrangement and combination as selection, simple applications; Binomial theorem for a positive integral index, properties of binomial coefficients.

2. **Matrices and Determinants** of order two or three, properties and evaluation of determinants, addition and multiplication of matrices, adjoint and inverse of matrices, Solutions of simultaneous linear equations in two or three variables; Sets, Relations and Functions, algebra of sets applications, equivalence relations, mappings, one-one, into and onto mappings, composition of mappings; Mathematical Induction, Linear Inequalities, solution of linear inequalities in one and two variables.

3. **Trigonometry :** Trigonometric ratios, functions and identities, Solution of trigonometric equations; Properties of triangles and solutions of triangles; Inverse trigonometric functions; Heights and distances.

4. **Two-dimensional Coordinate Geometry :** Cartesian coordinates, distance between two points, section formulae, shift of origin; Straight lines and pair of straight lines: Equation of straight lines in various forms, angle between two lines, distance of a point from a line, lines through the point of intersection of two given lines, equation of the bisector of the angle between two lines, concurrent lines; Circles and family of circles : Equation of circle in various form, equation of tangent, normal & chords, parametric equations of a circle , intersection of a circle with a straight line or a circle, equation of circle through point of intersection of two circles, conditions for two intersecting circles to be orthogonal; Conic sections : parabola, ellipse and hyperbola, their eccentricity, directrices & foci, parametric forms, equations of tangent & normal, conditions for $y=mx+c$ to be a tangent and point of tangency.

5. **Three dimensional Coordinate Geometry :** Direction cosines and direction ratios, equation of a straight line in space and skew lines;Angle between two lines whose direction ratios are given; Equation of a plane, distance of a point from a plane, condition for coplanarity of three lines.

6. **Vectors :** Addition of vectors, scalar multiplication; Dot and cross products of two vectors; Scalar triple products and their geometrical interpretations

7. **Differential calculus :** Domain and range of a real valued function, Limits and Continuity of the sum, difference, product and quotient of two functions, Differentiability; Derivative of different types of functions (polynomial, rational, trigonometric, inverse trigonometric, exponential; logarithmic, implicit functions), derivative of the sum, difference, product and quotient of two functions, chain rule;Geometric interpretation of derivative, Tangents and Normals; Increasing and decreasing functions, Maxima and minima of a function; Rolle's Theorem, Mean Value Theorem and Intermediate Value Theorem.

8. **Integral calculus :** Integration as the inverse process of differentiation, indefinite integrals of standard functions; Methods of integration: Integration by substitution, Integration by parts, integration by partial fractions, and integration by trigonometric identities; Definite integrals and their properties, Fundamental Theorem of Integral Calculus and its applications; Application of definite integrals to the determination of areas of regions bounded by simple curves.

9. **Ordinary Differential Equations :** Variables separable method; Solution of homogeneous differential equations; Linear first order differential equations

10. **Probability :** Addition and multiplication rules of probability; Conditional probability; Independent events, Discrete random variables and distributions

11. **Statistics :** Measures of dispersion; Measures of skewness and Central Tendency

12. **Linear Programming :** Formulation of linear Programming; Solution of linear Programming using graphical method.

Biology :

1. **Living World & Diversity of life :** Historical breakthroughs; scope of Biology and branches, Characters of living organisms. Origin of life; evidences in favour of organic evolution; sources of variations; speciation and isolation (geographical and reproductive).Types of classifications; biosystematics; binomial nomenclature; botanical gardens and herbaria; zoological parks and museums.

2. **Cell and Cell Division :** Cell as a basic unit of life – discovery of cell, unicellular and multicellular organisms; tools and techniques (compound microscope, electron microscope and cell fractionation); Ultrastructure of prokaryotic and eukaryotic cell; cellular movements (exocytosis, endocytosis); cell organelles and their functions. Water, salt, mineral ions, carbohydrates, lipids, amino acids, proteins, nucleotides, Enzymes (properties, chemical nature and mechanism of action); vitamins, hormones and steroids. Cell cycle: significance of cell division; amitosis, mitosis and meiosis; karyotype analysis.

3. **Genetics :** Mendel's laws of inheritance; Qualitative and quantitative inheritance; Heredity and variation; linkage and crossing over; sex determination; sex linked inheritance; mutation and chromosomal aberrations; Human genetics – methods of study, genetic disorders. DNA as a genetic material; its structure and replication; structure of RNA and its role in protein synthesis; regulation of gene expression, oncogenes. Basics of Recombinant DNA technology; cloning; gene bank; genomics – principles and applications, transgenic plants, animals and microbes.

4. **Morphology of Plants and Animals :** Morphology - root, stem and leaf, their structure and modification; inflorescence, flower, fruit, seed and their types; Salient features of various plant groups, algae, fungi, bryophyte, pteridophyte & gymnosperm; classification of angiosperms up to order level (Bentham and Hooker's system), Description of *Poaceae, Liliaceae, Fabaceae, Solanaceae, Brassicaceae* and *Asteraceae*. Internal structure of plants – Tissues (meristematic and permanent); tissue systems; anatomy of root, stem and leaf of monocot and dicot; secondary growth. Salient features of non-chordates up to phylum level and chordates up to class level. Morphology of Animals – Salient features of earthworm, cockroach and rat; tissue systems, structure and function of tissues – epithelial, connective, muscular and nervous.

5. **Physiology of Plants :** Cell as a physiological unit; water relations – absorption and movement; theories of water translocation; transpiration; mechanism of stomatal opening and closing. Mineral nutrition – functions of minerals, essential major elements and trace elements; deficiency symptoms of elements; translocation of solutes. Photosynthesis; photorespiration; mode of nutrition (autotrophic, heterotrophic –saprophytic, parasitic and insectivorous plants), chemosynthesis. Mechanism of respiration –aerobic and anaerobic respiration.

6. **Physiology of Animals :** Nutrition and its types; Intracellular and extracellular digestion in animals; role of enzymes and hormones in digestion; disorders related to nutrition. Respiratory organs; mechanism of breathing, gaseous exchange and transport in animals; regulation of respiration; common respiratory disorders. Circulation of body fluids – open and closed system, composition of blood, structure of human heart; pulmonary and systemic circulation; heart beat; blood related disorders; ECG; pacemaker; lymphatic system, immunity and immune system; Various kinds of nitrogenous waste elimination; physiology of excretion; composition and formation of urine; osmoregulation. Locomotion and movements; human skeleton- axial and appendicular including cranium and rib cage bones; Joints and their types; bone, cartilage and their disorders (arthritis, osteoporosis); mechanism of muscle contraction. Nervous coordination in cockroach and humans; structure and function of brain and spinal cord, transmission of never impulse; reflex action; sensory receptors; structure and function of sense organs – eye, ear. Endocrine glands and their functions, hormonal imbalance; hypothalamo – hypophysial axis; feedback controls.

7. **Reproduction, Growth and Development :** Modes of reproduction in flowering plants- vegetative propagation; micropropagation; sexual reproduction- development of male and female gametophytes; pollination; double fertilization, incompatibility, embryo development, parthenogenesis and parthenocarpy. Characteristics of plant growth; growth regulators (phytohormones)- Auxins, gibberellins, cytokinins, ethylene, ABA; seed dormancy; senescence; abscission; stress factors (salt and water) and growth; plant movement- geotropism, phototropism, turgor growth movements, process of flowering- photoperiodism, vernalisation. Types of reproduction-asexual and sexual; anatomy of reproductive system; reproductive cycles, gametogenesis; Fertilization- physical and chemical events; development of zygote up to 3 germinal layers and their derivatives; extra- embryonic membranes; general aspects of placenta. Cellular growth – growth rate and growth curve; hormonal control of growth; mechanism and types of regeneration; ageing-cellular and extracellular changes; theories of ageing.

8. **Ecology and Environment :** Ecology: definition, components of ecosystem. Levels of organization, energy flow Ecological succession major ecosystem of the world, study of local ecosystem, pyramids of mass, number and energy. Global environment changes, green house effect. Global warming. Conservation of natural resources. National & international efforts, environmental ethics & legislation.

9. **Biology in Human Welfare :** Food production, breeding, improved varieties, biofertilizers, plant tissue culture and its applications; biopesticides; biopatent. Recent advances in vaccines; Elementary knowledge of hemoglobin estimation and estimation of sugar and urea in blood, TLC, DLC, ESR, AIDS, STD, cancer.

Part C : Logical Reasoning

1. Verbal Reasoning: Analogy, classification, series completion, Logical deduction, Chart logic.

2. Non-verbal Reasoning : Pattern Recognition, Analysis, Rule detection.

Sample Questions

Part A : Physics & Chemistry

1. A Particle moving along a circle with a constant speed has :

   (A) Constant Velocity   (B) Constant Acceleration

   (C) Radically inward acceleration   (D) Radically outward acceleration

   एक कण, एकसमान चाल से वृत्ताकार गति कर रहा है, उसके लिए :

   (अ) एकसमान वेग।   (ब) एकसमान त्वरण।

   (स) त्रिज्यीय अन्दर की तरफ त्वरण।   (द) त्रिज्यीय बाहर की तरफ त्वरण।   [ ]

2. Which of the following correct representations the relation between P and T for a adiabatic process :

   (A) $P^{1-\gamma}T^{\gamma}$ = Constant   (B) $P^{\gamma}T^{1-\gamma}$ = Constant

   (C) $PT^{1-\gamma}$ = Constant   (D) $P^{1-\gamma}T$ = Constant

   रूद्धोष्म प्रकरण के लिए निम्न में से कौनसा P तथा T में सम्बन्ध सत्यरूप है :

   (अ) $P^{1-\gamma}T^{\gamma}$ = नियतांक   (ब) $P^{\gamma}T^{1-\gamma}$ = नियतांक

   (स) $PT^{1-\gamma}$ = नियतांक   (द) $P^{1-\gamma}T$ = नियतांक   [ ]

3. If surface tension of a liquid is 5×10^{-2} N/m and weight of the liquid column is 6.28×10^{-4} Kg. Find out the radius of the capillary tube?

   (A) 2×10^{-3} m   (B) 2.5×10^{-3} m

   (C) 2×10^{-4} m   (D) 4×10^{-3} m

   यदि एक द्रव का पृष्ठ तनाव 5×10^{-2} न्यू०/मी० है तथा द्रव स्तम्भ का भार 6.28×10^{-4} किग्रा है तो केशिका नली की त्रिज्या क्या होगी ?

   (अ) 2×10^{-3} मी०   (ब) 2.5×10^{-3} मी०

   (स) 2×10^{-4} मी०   (द) 4×10^{-3} मी०   [ ]

4. Charge q enclosed in closed surface then flux is equal to how many times of charge :

   (A) ε_0 (B) $1/\varepsilon_0$

   (C) $1/4\pi\varepsilon_0$ (D) $4\pi\varepsilon_0$

   आवेश q एक बन्द सतह में है तब फ्लक्स का मान आवेश के गुणक में क्या होगा ?

   (अ) ε_0 (ब) $1/\varepsilon_0$

   (स) $1/4\pi\varepsilon_0$ (द) $4\pi\varepsilon_0$ [ ]

5. If a particle moves as $x = at^2$, $y = bt^2$, its velocity at time t:

   (A) $2t(a^2+b^2)^{1/2}$ (B) $t(a^2+b^2)^{1/2}$

   (C) $[t(a^2+b^2)^{1/2}]/2$ (D) None of the above

   अगर एक कण की गति $x = at^2$, $y = bt^2$ समीकरणों से दी जाती है तो समय t पर इसका वेग क्या होगा :

   (अ) $2t(a^2+b^2)^{1/2}$ (ब) $t(a^2+b^2)^{1/2}$

   (स) $[t(a^2+b^2)^{1/2}]/2$ (द) उपरोक्त में से कोई नहीं।   [ ]

6. A mass m is raised from a distance $2R_e$ from surface of earth to $3R_e$, work done to do so against gravity will be:

   (A) $mgR_e/10$ (B) $mgR_e/11$

   (C) $mgR_e/12$ (D) $mgR_e/14$

   एक द्रव्यमान m को दूरी $2R_e$ से $3R_e$ तक उठाने में, गुरूत्व बल के विरूद्ध किया गया कार्य :

   (अ) $mgR_e/10$ (ब) $mgR_e/11$

   (स) $mgR_e/12$ (द) $mgR_e/14$ [　]

7. β^- particle is emitted when:

   (A) Neutron is converted into proton   (B) electron is emitted from inner shells

   (C) proton is converted into neutron   (D) electron is emitted from outermost shell

   β^- कणों का उत्सर्जन होता है जब :

   (अ) न्यूट्रॉन, प्रोटॉन में बदलता है   (ब) आन्तरिक कोषों से इलेक्ट्रॉन उत्सर्जन

   (स) प्रोटॉन, न्यूट्रॉन में बदलता है   (द) बाह्य कोषों से इलेक्ट्रॉन उत्सर्जन   [　]

8. Two plane mirrors are inclined at 60 degree to each other. The number of images formed by them will be :

   (A) 5   (B) 6

   (C) 8   (D) 7

   दो समतल दर्पण एक दूसरे से 60^0 के कोण पर झुके हुए हैं। उनके द्वारा बनाये गये प्रतिबिम्बों की संख्या होगी :

   (अ) 5   (ब) 6

   (स) 8   (द) 7   [　]

9. Which of the following is nearest to a blackbody :

   (A) Carbon black   (B) An enclosure with a small hole

   (C) Asbestos   (D) none of the above

   इनमें से कौनसा निकटतम कृष्णिका है :

   (अ) कार्बन काला   (स) एक आवरण जिसमें एक छोटा छिद्र हो

   (स) एस्बेस्टॉस   (द) उपरोक्त में से कोई नहीं।   [　]

10. Which of the following is not having Electromagnetic wave nature :

   (A) X-rays   (B) Ultraviolet rays

   (C) β-rays   (D) Microwave

   निम्न में से कौनसा विद्युत चुम्बकीय तरंग प्रकृति नहीं दिखाता है।

   (अ) एक्स किरणें।   (ब) पराबैंगनी किरणें।

   (स) बीटा –किरणें।   (द) सूक्ष्म तरंगे।   [　]

Chemistry :

1. The correct order of first ionization energy is:

    (A) C > B > Be > Li   (B) C > Be > B > Li

    (C) B > C > Be > Li   (D) Be > Li > B > C

    प्रथम आयनन ऊर्जा का सही क्रम है :

    (अ) C > B > Be > Li   (ब) C > Be > B > Li

    (स) B > C > Be > Li   (द) Be > Li > B > C

2. Which of the following has permanent dipole moment?

    (A) CF_4 (B) SF_4 (C) XeF_4 (D) BF_3

    निम्न में से किसमें स्थायी द्विध्रुव अघूर्ण होता है ?

    (अ) CF_4 (ब) SF_4 (स) XeF_4 (द) BF_3

3. Which one molecule has 3 centre-2 electron (3c-2e) type bonds ?

    (A) B_2H_6 (B) XeF_2 (C) PCl_5 (D) SO_3

    निम्न में से किस एक अणु में 3c-2e प्रकार का बन्ध पाया जाता है ?

    (अ) B_2H_6 (ब) XeF_2 (स) PCl_5 (द) SO_3

4. Correct relation for B_2 is:

    (A) Bond order = 1.0, Diamagnetic.   (B) Bond order = 1.0, Paramgnetic.

    (C) Bond order = 1.5, Diamagnetic.   (D) Bond order = 1.5, Paramgnetic.
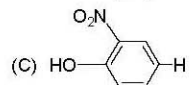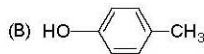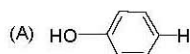
    बोरॉन के लिए सही सम्बन्ध है ?

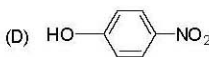   (अ) बन्ध-क्रम = 1.0, प्रतिचुम्बकीय   (ब) बन्ध-क्रम = 1.0, अनुचुम्बकीय
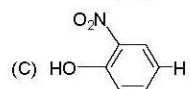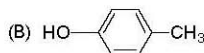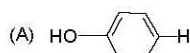
    (स) बन्ध-क्रम = 1.5, प्रतिचुम्बकीय   (द) बन्ध-क्रम = 1.5, अनुचुम्बकीय

5. Which one is strongest acid?
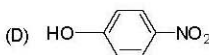
    निम्न में से कोनसा प्रबलतम अम्ल है ?

6. Correct order of stability of carbocations is:

    (A) 3° > 2° > 1°   (B) 3° > 1° > 2°   (C) 1° > 2° > 3°   (D) 2° > 3° > 1°

    कार्बधनायनो के स्थायित्व का सही क्रम है :

    (अ) 3° > 2° > 1° (ब) 3° > 1° > 2°   (स) 1° > 2° > 3°   (द) 2° > 3° > 1°

7. What is the correct order of reactivity for S_N1 reaction?

(A) $CH_3X < R\text{-}CH_2X < R_2CHX < R_3CX$ (B) $R_3CX < R_2CHX < R\text{-}CH_2X < CH_3X$

(C) $CH_3X < R_2CHX < R\text{-}CH_2X < R_3CX$ (D) $R_3CX < R\text{-}CH_2X < R_2CHX < CH_3X$

S_N1 अभिक्रिया के लिए क्रियाशीलता का सही क्रम क्या है ?

(अ) $CH_3X < R\text{-}CH_2X < R_2CHX < R_3CX$ (ब) $R_3CX < R_2CHX < R\text{-}CH_2X < CH_3X$

(स) $CH_3X < R_2CHX < R\text{-}CH_2X < R_3CX$ (द) $R_3CX < R\text{-}CH_2X < R_2CHX < CH_3X$

8. What will be the pH of 10^{-8} M HCl?

(A) 6.9   (B) 8.0   (C) 7.1   (D) 7.0

10^{-8} M HCl का pH क्या होगा ?

(अ) 6.9   (ब) 8.0   (स) 7.1   (द) 7.0

9. What will be consequence on density in Frankel defect?

(A) Decrease   (B) Increase

(C) Same   (D) First decrease than increase

फ्रेनकल त्रुटि में घनत्व पर क्या असर पडता है ?

(अ) घटता है   (ब) बढता है

(स) वही रहता है   (द) पहले घटता है फिर बढता है

10. Calculate the rate constant for first order reaction, the initial concentration of reactant is M/10 and after 8 minute 20 second the concentration of reactant is M/100.

(A) 4.606×10^{-3} sec.$^{-1}$ (B) 8.212×10^{-3} sec.$^{-1}$

(C) 2.303×10^{-3} sec.$^{-1}$ (D) 1.154×10^{-3} sec.$^{-1}$

$f'(e) = f(e) = f(1) = 1$

प्रथम कोटि की अभिक्रिया का वेग स्थिरांक की गणना करिए, जब अभिकारक की प्रारम्भिक सान्द्रता M/10 और 8 मिनिट 20 सैकण्ड के बाद अभिकारक की सान्द्रता M/100 रह जाती है ?

(अ) 4.606×10^{-3} सैकण्ड$^{-1}$ (ब) 8.212×10^{-3} सैकण्ड$^{-1}$

(स) 2.303×10^{-3} सैकण्ड$^{-1}$ (द) 1.154×10^{-3} सैकण्ड$^{-1}$

Part B : Mathematics/Biology :

1. Suppose f, f', f'' are continuous on [0, e] & that and

$$\int_1^e \left(\frac{f(x)}{x^2}\right)dx = 1/2,$$ then the value of $\int_1^e f''(x)\, ln\, x\, dx$ equals

(a) $\dfrac{5}{2} - \dfrac{1}{e}$ (b) $\dfrac{3}{2} - \dfrac{1}{e}$ (c) $\dfrac{1}{2} - \dfrac{1}{e}$ (d) $1 - \dfrac{1}{e}$

माना कि f, f', f'' अन्तराल [0, e] में संतत है एवं तथा

$$\int_1^e \left(\frac{f(x)}{x^2}\right)dx = 1/2,$$ तब $\int_1^e f''(x)\, ln\, x\, dx$ का मान होगा :

अ) $\dfrac{5}{2} - \dfrac{1}{e}$ ब) $\dfrac{3}{2} - \dfrac{1}{e}$ स) $\dfrac{1}{2} - \dfrac{1}{e}$ द) $1 - \dfrac{1}{e}$

2. Through the focus of parabola $y^2=2px$ $(p>0)$, a line is drawn which intersects the curve at A (x_1, y_1) and B (x_2, y_2). The ratio $\dfrac{y_1 y_2}{x_1 x_2}$ equals

   (a) 2   (b) -1   (c) -4   (d) some function of p

   परवलय $y^2=2px$ $(p>0)$, की नाभि से एक सरल रेखा इस प्रकार खींची गई है कि यह परवलय को दो बिंदुओं A (x_1, y_1) एवं B(x_2, y_2) पर काटती है, तब अनुपात $\dfrac{y_1 y_2}{x_1 x_2}$ का मान होगा :-

   अ) 2   ब) −1   स) −4   द) p का कोई फलन

3. $\displaystyle\sum_{r=1}^{n} T_r = \dfrac{n(n+1)(n+2)}{3}$ $than$ $\displaystyle\lim_{n\to\infty}\sum_{r=1}^{n}\dfrac{2008}{T_r} =$

   (a) 2008   (b) 8002   (c) 2080   (d) 2000

   यदि $\displaystyle\sum_{r=1}^{n} T_r = \dfrac{n(n+1)(n+2)}{3}$ तब $\displaystyle\lim_{n\to\infty}\sum_{r=1}^{n}\dfrac{2008}{T_r} =$

   अ) 2008   ब) 8002   स) 2080   द) 2000

4. In order to get at least once a head with the probability ≤ 0.9, the number of times, a coin needs to be tossed is

   (a) 3   (b) 4   (c) 5   (d) none of these

   यदि कम से कम एक बार चित आने की प्रायिकता 0.9 के बराबर या उससे अधिक हो, तो एक सिक्के को कितनी बार उछालना पड़ेगा ?

   अ) 3   ब) 4   स) 5   द) उपरोक्त में से कोई नहीं

5. Let $f(x) = \left[\sqrt{2}\,Cos\left(x+\dfrac{\pi}{4}\right)\right], 0 \leq x \leq 2\pi,$ (where [x] denotes greatest integer less than equal to x). The number of points of discontinuity of $f(x)$ are

   (a) 5   (b) 6   (c) 4   (d) 3

   यदि $f(x) = \left[\sqrt{2}\,Cos\left(x+\dfrac{\pi}{4}\right)\right], 0 \leq x \leq 2\pi,$ (जहां [x] महत्तम पूर्णांक फलन है) तब $f(x)$ असांत्यता के कितने बिंदु होंगें ?

   अ) 5   ब) 6   स) 4   द) 3

6. The function $f(x) = \dfrac{\ell n(\pi+x)}{\ell n(e+x)}$ is

   (a) increasing on $[0, \infty)$

   (b) decreasing on $[0, \infty)$

(c) increasing on $[0, \frac{\pi}{e})$ and decreasing on

(d) decreasing on   and increasing on

फलन   है तो

अ. अन्तराल $[0, \infty)$ में वृद्धिमान

ब. अन्तराल $[0, \infty)$ में ह्रासमान

स. अन्तराल $[0, \frac{\pi}{e})$ में वृद्धिमान एवं   ह्रासमान

द. अन्तराल $[0, \frac{\pi}{e})$ में ह्रासमान एवं   में वृद्धिमान

7.   Let α, β be the real roots of the equation $x^2+(a-4)x+(a^2-3a+3) = 0$.
       If $\alpha^2+\beta^2 =6$, then a =

(a)   (b) $1-\sqrt{5}$ (c) $-1+\sqrt{5}$ (d) $1+\sqrt{5}$

माना कि α, β समी. $x^2+(a-4)x+(a^2-3a+3) = 0$.
के वास्तविक मूल हैं। यदि $\alpha^2+\beta^2 =6$, तब a =

अ. $-1-\sqrt{5}$ ब. $1-\sqrt{5}$ स. $-1+\sqrt{5}$ द. $1+\sqrt{5}$

8.   If $0 < a < b$, be integers such that $a^2+b^2 = (1^2+2^2)(3^2+4^2)(5^2+7^2)$, then the sum of all the
       values of a is

(a) 120   (b) 124   (c) 156   (d) 168

यदि $0 < a < b$, दो पूर्णांक इस प्रकार से हैं कि $a^2+b^2 = (1^2+2^2)(3^2+4^2)(5^2+7^2)$, तब a के सभी मानों का योग
क्या होगा

अ. 120   ब. 124   स. 156   द. 168

9.   A and B be two fixed points whose coordinates are (3, 2) and (5, 4) respectively. The
       coordinates of a point P in APB in an equilateral triangle, are

(a) $(4-\sqrt{3}, 3+\sqrt{3})$ (b) $(4+\sqrt{3}, 3-\sqrt{3})$ (c) $(3-\sqrt{3}, 4+\sqrt{3})$ (d) $(3+\sqrt{3}, 4-\sqrt{3})$

A एवं B दो स्थिर बिन्दु है जिनके निर्देशांक क्रमशः (3, 2)एवं (5, 4) है, तब बिन्दु P के निर्देशांक क्या होगें
यदि त्रिभुज APB एक समबाहु त्रिभुज है।

अ. $(4-\sqrt{3}, 3+\sqrt{3})$ ब. $(4+\sqrt{3}, 3-\sqrt{3})$ स. $(3-\sqrt{3}, 4+\sqrt{3})$ द. $(3+\sqrt{3}, 4-\sqrt{3})$

10.   The equation of the straight line passing through the point (4,3) and making intercepts on
       the coordinate axes whose sum is -1 is

(a) $\frac{x}{2} + \frac{y}{3} = 1$ (b) $\frac{x}{2} + \frac{y}{1} = 1$ (c) $\frac{x}{2} + \frac{y}{3} = -1$ (d) $\frac{x}{-2} + \frac{y}{1} = 1$

उस सरल रेखा का समीकरण क्या होगा जो बिन्दु (4,3) से गुजरती है एवं उसके द्वारा अक्षों पर काटे गये अंत: खण्डों का योग −1 है।

अ) $\qquad$ ब) $\dfrac{x}{2} + \dfrac{y}{1} = 1$ स) $\dfrac{x}{2} + \dfrac{y}{3} = -1$ द) $\dfrac{x}{-2} + \dfrac{y}{1} = 1$

Biology :

1. Inheritance of acquired characters is called_____.

(a) Lamarckism (b) Neo-Lamarckism (c) Mutational theory (d) None of these

उपार्जित लक्षणों की वशांगति को...........................कहते है।

(अ) लैमार्कवाद (ब) नवलैमार्कवाद (स) उत्परिवर्तन सिद्धान्त (द) इनमें से कोई नही। [ ]

2. In which sub-stage of Prophase-I of Meiosis does synapsis occur ?

(a) Leptonema (b) Zygonema (c) Pachynema (d) Diplonema

अर्धसूत्री विभाजन की प्रथम प्रोफेज की किस प्रावस्था में साईनैप्सिस, होता है ?

(अ) लैप्टोनीमा (ब) जाईगोनीमा (स) पैकीनीमा (द) डिप्लोनीमा। [ ]

3. Vivipary is characteristic of –

(a) Xerophytes (b) Halophytes (c) Hydrophytes (d) None

पितृस्थउद्भेदन विशेषता है :–

(अ) मरूद्भिद (ब) लवणोद्भिद (स) जल्नोद्भिद (द) कोई नही। [ ]

4. If chromosome number in gynoecium is 12 then the number in endosperm will be –

(a) 18 (b) 36 (c) 12 (d) 6

यदि जायांग में गुणसूत्रों की संख्या 12 है तो भ्रूणपोष में संख्या कितनी होगी ?

(अ) 18 (ब) 36 (स) 12 (द) 6 [ ]

5. Restriction enzyme is used for cutting –

(a) Proteins (b) RNA (c) DNA (d) Fats

रिस्ट्रिक्शन एन्जाइम से काटा जा सकता है :–

(अ) प्रोटीन को (ब) आर. एन. ए. को (स) डी. एन. ए. को (द) वसा को। [ ]

6. Which of the following bacteria does not cause disease in humans ?

(a) *Vibrio cholerae* (b) *Salmenella typhii*

(c) *Clostridium titani* (d) *Azobacter*

वह जीवाणु जो मनुष्यों में रोग उत्पन्न नहीं करता है, वह है :–

(अ) विब्रियो कॉलेरी (ब) सॉल्मोनेला टाइफी (स) क्लोस्ट्रीडियम टिटेनी (द) एजोबैक्टर। [ ]

7. Which one of the following is the biggest gland in human body ?

(a) Pancreas (b) Thyroid (c) Pituitary (d) Liver

मानव शरीर में सबसे बडी ग्रन्थि कौन सी है :-

(अ) अग्नाशय   (ब) थाइराइड   (स) पिच्यूटरी   (द) यकृत।   [ ]

8. The number of characters studied in garden pea by Mendel were –

(a) Five   (b) Three   (c) Six   (d) Seven

मेंडल द्वारा मटर के पौधे मे अध्ययन किये गये लक्षणों की गिनती थी :-

(अ) 5   (ब) 3   (स) 6   (द) 7   [ ]

9. Duckbill platypus is –

(a) Flying bird   (b) Ratite bird   (c) Egg-laying Mammal   (d) Reptile

डक-बिल प्लैटिपस् होता है :-

(अ) उडने वाला पक्षी (ब) न उडने वाला पक्षी (स) अण्डा देने वाला मैमल (द) सरीसृप   [ ]

10. In a grassland ecosystem, pyramid of numbers is

(a) Upright   (b) Inverted   (c) Any of the two   (d) None of the above

घास मैदान के पारिस्थितिकी तन्त्र मे जीव संख्या का पिरेमिड होता है :-

(अ) सीधा   (ब) उल्टा

(स) दोनो में से कोई भी   (द) उपरोक्त मे से कोई नही।   [ ]

PART C : LOGICAL REASONING

1. Sheela told Reena: "The girl I met yesterday at the hospital was the youngest daughter of the brother-in-law of my friend's brother." How is the girl related to Sheela's friend?

(A) Friend   (B) Cousin   (C) Daughter   (D) Niece

शीला ने रीना से कहा "कल मैं मेरी सहेली के भाई के जीजा की सबसे छोटी बेटी से मिलने अस्पताल गई" उस लड़की का शीला की सहेली से क्या सम्बन्ध है ?

(अ) मित्र   (ब) चचेरी बहिन   (स) बेटी   (द) भतीजी   [ ]

2. A man brought some watermelons to town and sold them. He sold 1/2 more than 1/2 of what he brought and he was left with one melon. How many melons did he bring to town?

(A) 1   (B) 2   (C) 3   (D) 4

एक आदमी बेचने के लिये कुछ तरबूज शहर लाया। उसने आधे और आधे के आधे से अधिक बेच दिये और इसके बाद उसके पास एक तरबूज बचा। वो कुल कितने तरबूज लाया था।

(अ) एक   (ब) दो   (स) तीन   (द) चार   [ ]

3. Find the odd one out

(A) RST   (B) FGH   (C) VXY   (D) DEF

विषम बताइये।

(अ) RST   (ब) FGH   (स) VXY   (द) DEF   [ ]

4. When you reverse the digits of age of father you will get the age of son. One year ago the age of father was twice that of son's age. What are the current ages of father and son ?

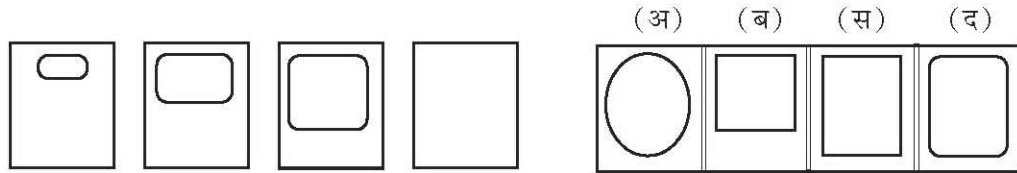(A) 73 and 37   (B) 24 and 42   (C) 31 and 13   (D) 45 and 54

यदि पिता की आयु के अंक पलटने पर पुत्र की आयु मिलती है। एक वर्ष पहले पिता की आयु पुत्र की आयु से दुगनी थी। पिता और पुत्र की वर्तमान आयु बताइये।

(अ) 73 एवं 37   (ब) 24 और 42   (स) 31 एवं 13   (द) 45 एवं 54   [   ]

5. In the four boxes on the left you can see that there is a box that is blank. Work out which of the four boxes on the right contains the missing shape or object so that there is a sequence.

(A)   (B)   (C)   (D)
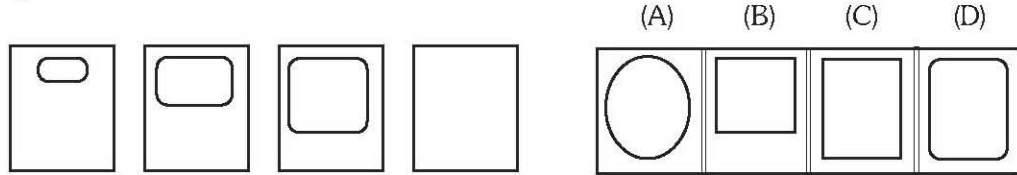
बायीं ओर के चार खानों में से एक खाना खाली है। दायीं ओर दी गई चार आकृतियों में से कौन सी आकृति उपयुक्त होगी ?

(अ)   (ब)   (स)   (द)

[   ]

Answers :