Sample Test Papers
For Yearlong Classroom Contact Programs (YCCPs)
of JEE (Main) Division

Practice, Persistence and Performance

For Class - X, XI, XII
## INDEX

**TARGET : JEE MAIN**

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The sample test papers are only for reference and guidance. The sample papers given in the booklet are actually the papers of previous year's ResoNET conducted by Resonance for its various courses.

**Note**: Resonance reserves the right to change the pattern of selection test (ResoNET). Previous year papers do not guarantee that the papers for this year selection test will be on the same pattern. However, the syllabus of the test paper will be equivalent to the syllabus of qualifying school/board examination and as given on page no. 4.

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How to Prepare for the Resonance’s Forward Admission & Scholarship Test (ResoNET) - 2018

- **For Class-X appearing students (Class-X to Class-XI Moving):**

  Study thoroughly the books of Science (Physics & Chemistry) and Maths of Classes IX & X. (NCERT & Respective Board)

- **For Class-XI appearing students (Class-XI to Class-XII Moving):**

  1. Study thoroughly the books of Physics, Chemistry and Maths of Class XI (Respective Board).
  2. Refer to the following books (only Class-XI syllabus) to increase the level of competence:

    - **For Physics**: Concepts of Physics by H.C. Verma Vol. I & II, NCERT Books
    - **For Maths**: Higher Algebra By Hall & Knight; Co-ordinate Geometry By S.L. Loney; Plane Trigonometry By S.L. Loney, Problem book in high school by A.I.Prilepko

- **For Class-XII appearing students (Class-XII to Class-XIII Moving):**

  1. Study thoroughly the books of Physics, Chemistry and Maths of Classes XI & XII (Respective Board).
  2. Refer to the following books (Class-XI & Class-XII syllabus) to increase the level of competence:

    - **For Physics**: Concepts of Physics by H.C. Verma Vol-I & II
    - **For Chemistry**: Physical Chemistry By R.K. Gupta, Organic Chemistry By Morrison & Boyd, Organic Chemistry By I. L. Finar, Inorganic Chemistry By J.D. Lee, Objective Chemistry By Dr. P. Bahadur
    - **For Maths**: Higher Algebra By Hall & Knight; Co-ordinate Geometry By S.L. Loney; Plane Trigonometry By S.L. Loney, Differential Calculus By G.N. Berman
### GENERAL INSTRUCTIONS IN THE EXAMINATION HALL

(Pरीक्षा भवन के लिए सामान्य निर्देश)

1. This booklet is your Question Paper. (यह पुस्तिका आपका प्रश्न-पत्र है)
2. The Question Paper Code is printed on the top right corner of this sheet. (प्रश्न-पत्र कोड इस पृष्ठ के ऊपर दायरे कोने में छा हुआ है)
3. Blank papers, clip boards, log tables, slide rule, calculators, mobile or any other electronic gadgets in any form are not allowed to be used. (खाली कागज, किलप बोर्ड, लघुगणक सारणी, स्लाइड रूल, कैल्कुलेटर, मोबाइल या अन्य किसी इलेक्ट्रॉनिक उपकरण के किसी भी रूप में उपयोग की अनुमति नहीं है)
4. Write your Name & Application Form Number in the space provided in the bottom of this booklet. (इस पृष्ठ के नीचे दिखाए गए रिक्त स्थान में अपना नाम व आवेदन फॉर्म संख्या बताएं)
5. Before answering the paper, fill up the required details in the blank space provided in the Objective Response Sheet (ORS). (प्रश्न-पत्र हल करने से पहले, ORS-शीट में दिखाए गए रिक्त स्थानों में पूरा गये गये विवरण जोड़ें)
6. Do not forget to mention your paper code and Application Form Number neatly and clearly in the blank space provided in the Objective Response Sheet (ORS) / Answer Sheet. (उपर-पुस्तिका में दिखाए गए रिक्त स्थान में अपना प्रश्न-पत्र कोड व अपना आवेदन फॉर्म संख्या प्रश्न-पत्र और ORS-शीट में ही दिखाएं)
7. No rough sheets will be provided by the invigilators. All the rough work is to be done in the blank space provided in the question paper. (निरीक्षक से हालांकि एक शीट नहीं दी जायेगी। एक कार्य प्रश्न-पत्र में दिखाए गए खाली स्थान में ही करना होगा)
8. No query related to question paper of any type is to be put to the invigilator. (निरीक्षक से प्रश्न-पत्र से सम्बन्धित किसी प्रकार का कोई प्रश्न ना करें)

### Question Paper

(P्र न-पत्र)

9. Marks distribution of questions is as follows. (प्रश्नों के प्रश्नांकों का विवरण निम्न प्रकार से है)

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<th>Part - C (Mathematics)</th>
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Name: _________________________________ Application Form Number: __________________
Syllabus of ResoNET-2018

CLASS - X (CHEMISTRY)
Basic : Cooling by evaporation. Absorption of heat. All things occupy space, possess mass. Definition of matter ; Elementary idea about bonding.
Solid, liquid and gas : characteristics-shape, volume, density; change of state - melting, freezing, evaporation, condensation, sublimation.
Elements, compounds and mixtures : Heterogeneous and homogeneous mixtures; Colloids and suspension.
Mole concept : Equivalence - that x grams of A is chemically not equal to x grams of B ; Partical nature, basic units : atoms and molecules ; Law of constant proportions ; Atomic and molecular masses; Relationship of mole to mass of the particles and numbers ; Valency ; Chemical formulae of common compounds.
Atomic structure : Atoms are made up of smaller particles : electrons, protons, and neutrons. These smaller particles are present in all the atoms but their numbers vary in different atoms.
Isotopes and isobars.
Gradations in properties : Mendeleev periodic table.
Acids, bases and salts : General properties, examples and uses.
Types of chemical reactions : Combination, decomposition, displacement, double displacement, precipitation, neutralisation, oxidation and reduction in terms of gain and loss of oxygen and hydrogen.
Extractive metallurgy : Properties of common metals ; Brief discussion of basic metallurgical processes.
Compounds of Carbon : Carbon compounds ; Elementary idea about bonding ; Saturated hydrocarbons, alcohols, carboxylic acids (no preparation, only properties). Soap - cleansing action of soap.

CLASS - X (MATHEMATICS)
Number Systems :
Natural Numbers, Integers, Rational number on the number line. Even - odd integers, prime number, composite numbers, twin primes, divisiblity tests. Co-prime numbers, LCM and HCF of numbers.
Representation of terminating/non-terminating recurring decimals, on the number line through successive magnification. Rational numbers as recurring/terminating decimals. Ratio and proportions.
Polynomial :
Polynomial in one variable and its Degree. Constant, Linear, quadratic, cubic polynomials; monomials, binomials, trinomials, Factors and multiplex. Zeros/roots of a polynomial/equation.
Remainder theorm, Factor Theorem. Factorisation of quadratic and cubic polynomials
Standard form of a quadratic equation ax² + bx + c = 0, (a ≠ 0). Relation between roots and coefficient of quadratic and relation between discriminant and nature of roots.
Linear Equations :
Linear equation in one variable and two variable and their graphs.
Pair of linear equations in two variables and their solution and inconsistency.
Arithmetic Progressions (AP) :
Finding the n term and sum of first n terms.
Trigonometry :
Trigonometric ratios of an acute angle of a right-angled triangle. Relationships between the ratios.
Trigonometric ratios of complementary angles and trigonometric identities. Problems based on heights and distances.
Coordinate Geometry :
The cartesian plane, coordinates of a point, plotting points in the plane, distance between two points and section formula (internal). Area of triangle. Properties of triangle and quadrilateral. (Square, Rectangle rhombus, parallelogram).

CLASS - XI (CHEMISTRY)
Atomic and molecular masses. Mole concept and molar mass; percentage composition and empirical and molecular formula ; chemical reactions, stoichiometry and calculations based on stoichiometry.
SAMPLE TEST PAPER

Structure of Atom: Discovery of electron, proton and neutron; atomic number, isotopes and isobars. Thompson’s model and its limitations, Rutherford’s model and its limitations, concept of shells and sub-shells, dual nature of matter and light, de Brogle’s relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p, and d orbitals, rules for filling electrons in orbitals - Aufbau principle, Pauli exclusion principle and Hund’s rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.

Classification of Elements and Periodicity in Properties: Significance of classification, brief history of the development of periodic table, trends in properties of elements - atomic radii, ionic radii, inert gas radii, ionization enthalpy, electron gain enthalpy, electronegativity, valence.

Chemical Bonding and Molecular Structure: Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only), hydrogen bond.

States of Matter: Gases and Liquids: Three states of matter, intermolecular interactions, type of bonding, melting and boiling points, role of gas laws in elucidating the concept of the molecule, Boyle’s law, Charles’ law, Gay Lussac’s law, Avogadro’s law, ideal behavior, empirical derivation of gas equation, Avogadro’s number ideal gas equation, deviation from ideal behaviour, Liquefaction of gases, critical temperature, critical pressure, Liquid State - Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations)

Thermodynamics: Concepts of system, types of systems, surroundings, work, heat, energy, extensive and intensive properties, state functions. First law of thermodynamics - internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH, Hess’ law of constant heat summation, enthalphy of bond dissociation, combustion, formation, atomization sublimation, phase transition, ionization, and dilution. Introduction of entropy as a state function, free energy change for spontaneous and non-spontaneous process, equilibrium.

Equilibrium: 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 - ionization of acids and bases, strong and weak electrolytes, degree of ionization concept of pH, Hydrolysis of Salts (elementary idea), buffer solutions, solubility product, common ion effect (with illustrative examples).

Redox Reactions: Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, applications of redox reaction.

Hydrogen: Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen; hydrides - ionic, covalent and interstitial; physical and chemical properties of water; heavy water; hydrogen peroxide - preparation, reactions and structure; hydrogen as a fuel.

s-Block Elements (Alkali and Alkaline Earth Metals): Group 1 and Group 2 elements. General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionization radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens; uses.

Preparation and properties of some important compounds: Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogen carbonate CaO, CaCO₃, and industrial use of lime and limestone, Ca.

General Introduction to p-Block Elements: Group 13 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron - physical and chemical properties, some important compounds; borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkenes, aluminum oxide.

Group 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element. Carbon - catenation, allotropes, physical and chemical properties; uses of some important compounds: oxides.

Important compounds of silicon and a few uses: silicon tetrachloride, silicones, silicones and silicates.

Principles of qualitative analysis: Determination of one anion and one cation in a given salt Cations - Pb²⁺, Cu²⁺, As³⁺, Al³⁺, Fe³⁺, Mn²⁺, Ni²⁺, Zn²⁺, Co²⁺, Ca²⁺, Sr²⁺, Ba²⁺, Mg²⁺, NH₄⁺ Anions - CO₃²⁻, S²⁻, SO₄²⁻, SO₃²⁻, NO₃⁻, NO₂⁻, Cl⁻, Br⁻, I⁻, PO₄³⁻, C₂O₄²⁻, CH₃COO⁻ (Note: Insoluble salts excluded)

Organic chemistry - Some Basic Principles and Techniques: General introduction, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds.

Electronic displacements in a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions.

Classification of Hydrocarbons: Alkanes: Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis.

Alkenes: Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov’s addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.

Alkyynes: Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkyynes, addition reaction of - hydrogen, halogens, hydrogen halides and water.

Aromatic hydrocarbons: Introduction, IUPAC nomenclature; Benzene: resonance, aromaticity; chemical properties: mechanism of electrophilic substitution - nitration sulphonation, halogenation, Friedel Craft’s alkylation and acylation; directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

CLASS XI (MATHEMATICS)

Functions: Sets and their representations. Empty, finite and infinite sets, Subsets, Union and intersection of sets, Venn diagrams. Pictorial representation of a function domain, co-domain and range of a function domain and range of constant, identity, polynomial, rational, modulus, signum and greatest integer functions with their graphs. Sum, difference, product and quotients of functions.

Trigonometric Functions: Measuring angles in radians and in degrees and conversion from one measure to another. Signs of trigonometric functions and sketch of their graphs. Addition and subtraction formulas, formulae involving multiple and sub-multiple angles. General solution of trigonometric equations.

Complex Number: Algebra of complex numbers, addition, multiplication, conjugation, polar representation, properties of modulus and principal argument, triangle inequality, cube roots of unity, geometric interpretations.

Quadratic equations: Quadratic equations with real coefficients, formation of quadratic equations with given roots, symmetric functions of roots.
Sequence & Series :
Arithmetic, geometric and harmonic progressions, arithmetic, geometric and harmonic means, sums of finite arithmetic and geometric progressions, infinite geometric series, sums of squares and cubes of the first n natural numbers.

Logarithm & exponents :
Logarithms and exponents and their properties. Exponential and logarithmic series.

Binomial Theorem :
Binomial theorem for a positive integral index, properties of binomial coefficients. Binomial theorem for any index.

Permutations and combinations :
Problem based on fundamental counting principle, Arrangement of alike and different objects, Circular permutation, Combination, formation of groups.

Straight Line :
Cartesian coordinates, distance between two points, section formulae, shift of origin. Equation of a straight line 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, concurrency of lines; Centroid, orthocentre, incentre and circumcentre of a triangle.

Conic Sections :
Equation of a circle in various forms, equations of tangent, normal and chord. Parametric equations of a circle, intersection of a circle with a straight line or a circle, equation of a through the points of intersection of two circles and those of a circle and a straight line. Equations of a parabola, ellipse and hyperbola in standard form, their foci, directrices and eccentricity, parametric equations, equations of tangent and normal locus problems.

Mental Ability :
Problem based on data interpretation, family relations & Logical reasoning.

CLASS - XI (PHYSICS)

General :
Units and dimensions, dimensional analysis; least count, significant figures; Methods of measurement and error analysis for physical quantities pertaining to the following experiments: Experiments based on using Vernier callipers and screw gauge (micrometer). Determination of g using simple pendulum, Young’s modulus by Searle’s method.

Mechanics :
Kinematics in one and two dimensions (Cartesian coordinates only), projectiles; Uniform Circular motion; Relative velocity.

Newton’s laws of motion; Inertial and uniformly accelerated frames of reference; Static and dynamic friction; Kinetic and potential energy; Work and power; Conservation of linear momentum and mechanical energy.

Systems of particles; Centre of mass and its motion; Impulse; Elastic and inelastic collisions.

Law of gravitation; Gravitational potential and field; Acceleration due to gravity; Motion of planets and satellites in circular orbits; Escape velocity.

Rigid body, moment of inertia, parallel and perpendicular axes theorems, moment of inertia of uniform bodies with simple geometrical shapes; Angular momentum; Torque; Conservation of angular momentum; Dynamics of rigid bodies with fixed axis of rotation; Rolling without slipping of rings, cylinders and spheres; Equilibrium of rigid bodies; Collision of point masses with rigid bodies. Linear and angular simple harmonic motions.

Hooke’s law, Young’s modulus.

Pressure in a fluid; Pascal’s law; Buoyancy; Surface energy and surface tension, capillary rise; Viscosity (Poiseuille’s equation excluded), Stoke’s law; Terminal velocity, Streamline flow, equation of continuity, Bernouilli’s theorem and its applications.

Waves :
Wave motion (plane waves only), longitudinal and transverse waves, superposition of waves; Progressive and stationary waves; Vibration of strings and air columns; Resonance; Beats; Speed of sound in gases; Doppler effect (in sound).

Thermal physics :
Thermal expansion of solids, liquids and gases; Calorimetry, latent heat; Heat conduction in one dimension; Elementary concepts of convection and radiation; Newton’s law of cooling; Ideal gas laws; Specific heats (Cv and Cp for monoatomic and diatomic gases); Isothermal and adiabatic processes, bulk modulus of gases; Equivalence of heat and work; First law of thermodynamics and its applications (only for ideal gases); Blackbody radiation: absorptive and emissive powers; Kirchhoff’s law; Wien’s displacement law, Stefan’s law.

CLASS - XII (CHEMISTRY)

Physical Chemistry

General topics :
Concept of atoms and molecules; Dalton’s atomic theory; Mole concept; Chemical formulae: Balanced chemical equations; Calculations (based on mole concept) involving common oxidation-reduction, neutralisation, and displacement reactions; Concentration in terms of molar fraction, molarity and normality.

Gaseous and liquid states :
Absolute scale of temperature, ideal gas equation; Deviation from ideality, van der Waals equation; Kinetic theory of gases, average, root mean square and most probable velocities and their relation with temperature; Law of partial pressures; Vapour pressure; Diffusion of gases.

Atomic structure and chemical bonding :
Bohr model, spectrum of hydrogen atom, quantum numbers; Wave-particle duality, de Broglie hypothesis; Uncertainty principle; Qualitative quantum mechanical picture of hydrogen atom, shapes of s, p and d orbitals; Electronic configurations of elements (up to atomic number 36); Aufbau principle; Pauli’s exclusion principle and Hund’s rule; Orbital overlap and covalent bond; Hybridisation involving s, p and d orbitals only; Orbital energy diagrams for homonuclear diatomic species; Hydrogen bond; Polarity in molecules, dipole moment (qualitative aspects only); VSEPR model and shapes of molecules (linear, angular, triangular, square planar, pyramidal, square pyramidal, trigonal bipyramidal, tetrahedral and octahedral).

Energetics :
First law of thermodynamics; Internal energy, work and heat, pressure-volume work; Enthalpy, Hess’s law; Heat of reaction, fusion and vapourization; Second law of thermodynamics; Entropy; Free energy; Criterion of spontaneity.

Chemical equilibrium :
Law of mass action; Equilibrium constant, Le Chatelier’s principle (effect of concentration, temperature and pressure); Significance of ΔG in chemical equilibrium; Solubility product, common ion effect, pH and buffer solutions; Acids and bases (Bronsted and Lewis concepts); Hydrolysis of salts.

Electrochemistry :
Electrochemical cells and cell reactions; Standard electrode potentials; Nernst equation and its relation to DG; Electrochemical series, emf of galvanic cells; Faraday’s laws of electrolysis; Electrolytic conductance, specific, equivalent and molar conductivity, Kohlrausch’s law; Concentration cells.

Chemical kinetics :
Rates of chemical reactions; Order of reactions; Rate constant; First order reactions; Temperature dependence of rate constant (Arrhenius equation).

Solid state :
Classification of solids, crystalline state, seven crystal systems (cell parameters a, b, c, α, β, γ), close packed structure of solids (cubic), packing in fcc, bcc and hcp lattices; Nearest neighbours, ionic radii, simple ionic compounds, point defects.

Solutions :
Raoult’s law; Molecular weight determination from lowering of vapour pressure, elevation of boiling point and depression of freezing point.

Surface chemistry :
Elementary concepts of adsorption (excluding adsorption isotherms); Colloids; types, methods of preparation and general properties; Elementary ideas of emulsions, surfactants and micelles (only definitions and examples).

Nuclear chemistry :
Radioactivity: isotopes and isobars; Properties of α rays, Kinetics of radioactive decay (decay series excluded), carbon dating; Stability of nuclei with respect to proton-neutron ratio; Brief discussion on fission and fusion reactions.
Inorganic Chemistry

Isolation/preparation and properties of the following non-metals: Boron, silicon, nitrogen, phosphorus, oxygen, sulphur and halogens; Properties of allotropes of carbon (diamond, graphite), hydrogen, noble gases.

Preparation and properties of the following compounds: Oxides, peroxides, hydroxides, carbonates, bicarbonates, chlorides and sulphates of potassium, sodium, magnesium and calcium; Boron: diborane, boric acid and boric acid; Aluminium: alumina, aluminium chloride and alums; Carbon: oxides and oxoacids (carbonic acid); Silicon: silicones, silicon carbide, silicon oxycarboxides and ammonia; Phosphorus: oxides, oxyacids (phosphoric acid, phosphoric acid) and phosphine; Oxygen: ozone and hydrogen peroxide; Sulphur: hydrogen sulphide, oxides, sulphuric acid, sulphurous acid and sodium thiosulphate; Halogens: hydrohalic acids, oxides and oxyacids of chlorine, bleaching powder; Xenon fluorides.

Transition elements (3d series): Definition, general characteristics, oxidation states and their stability, colour (excluding the details of electronic transitions) and calculation of spin (only magnetic moment), Coordination compounds: nomenclature of mononuclear coordination compounds, cis-trans and ionisation isomerism, hybridization and geometries of mononuclear coordination compounds (linear, tetrahedral, square planar and octahedral).

Preparation and properties of the following compounds: Oxides and chlorides of tin and lead; Oxides, chlorides and sulphates of Fe²⁺, Cu²⁺ and Zn²⁺; Potassium permanganate, potassium dichromate, silver oxide, silver nitrate, silver thiourea.

Ores and minerals: Commonly occurring ores and minerals of iron, copper, tin, lead, magnesium, aluminium, zinc and silver.

Extractive metallurgy: Chemical principles and reactions only (industrial details excluded); Carbon reduction method (iron and tin); Self-reduction method (copper and lead); Electrolytic reduction method (magnesium and aluminium); Cyanide process (silver and gold).

Principles of qualitative analysis: Groups I to V (only Ag⁺, Hg⁺, Cu²⁺, Pb²⁺, Bi³⁺, Fe³⁺, Cr³⁺, Al³⁺, Ca²⁺, Ba²⁺, Zn²⁺, Mn²⁺ and Mg²⁺); Nitrate, halides (excluding fluoride), sulphate and sulphide.

Organic Chemistry

Concepts: Hybridisation of carbon; Sigma and pi-bonds; Shapes of simple organic molecules; Structural and geometrical isomerism; Optical isomerism of compounds containing up to two asymmetric centres, (R,S and E,Z nomenclature excluded); IUPAC nomenclature of simple organic compounds (only hydrocarbons, mono-functional and bi-functional compounds); Conformations of ethane and butane (Newman projection); Hyperconjugation; Keto-enol tautomerism; Determination of empirical and molecular formulae of simple compounds (only combustion method); Hydrogen bonds: definition and their effects on physical properties of alcohols and carboxylic acids; Inductive and resonance effects on acidity and basicity of organic acids and bases; Polarity and inductive effects in aliphilic halides; Reactive intermediates produced during homolytic and heterolytic bond cleavage; Formation, structure and stability of carbocations, carbanions and free radicals.

Preparation, properties and reactions of alkanes: Homologous series, physical properties of alkanes (melting points, boiling points and density); Combustion and halogenation of alkanes; Preparation of alkanes by Wurtz reaction and decarboxylation reactions.

Preparation, properties and reactions of alkenes and alkyne: Physical properties of alkenes and alkynes (boiling points, density and dipole moments); Acidity of alkenes; Acid catalysed hydration of alkenes and alkynes (excluding the stereochemistry of addition and elimination); Reactions of alkenes with K₂MnO₄ and ozone; Reduction of alkenes and alkynes; Preparation of alkenes and alkynes by elimination reactions; Electrophilic addition reactions of alkenes with X₂, HX, HOX and H₂O (X=halogen); Addition reactions of alkenes: Metal acetylides. Reactions on alkynes: Structure and homolytic, Electrophilic substitution reactions: halogenation, nitration, sulphonation, Friedel-Crafts alkylation and acylation; Effect of ortho, meta and para directing groups in monosubstituted benzenes.

Phenols: Acidity, electrophilic substitution reactions (halogenation, nitration and sulphonation); Reimer-Tiemann reaction, Kolbe reaction.

Characteristic reactions of the following (including those mentioned above):

Alkenes: rearrangement reactions of alkyl carbocation, Grignard reactions, nucleophilic substitution reactions; Chlorides: esterification, dehydration and oxidation, reaction with sodium, phenols halides, ZnCl₂-concentrated HCl, conversion of aldehydes into alkenes and ketones; Ethers: Preservation by Williamson’s Synthesis; Aldehydes and Ketones: oximation, reduction, oxime and hydrazone formation; aldol condensation, Perkin reaction; Cannizzaro reaction; halofrom reaction and nucleophilic addition reactions (Grignard addition); Carboxylic acids: formation of esters, acid chlorides and amides; ester hydrolysis; Amines: basicity of substituted amines, and amines, preparation from nitro compounds, reaction with nitric acid, aza coupling reaction of diazonium salts of aromatic amines, Sandmeyer and related reactions of diazonium salts; carbylamine reaction; Haloarenes: nucleophilic aromatic and principal haloarenes and substituted haloarenes (excluding Benzyne mechanism and Cine substitution).

Carbohydrates: Classification; mono- and di-saccharides (glucose and sucrose); Oxidation, reduction, glycoside formation and hydrolysis of sucrose.

Amino acids and peptides: General structure (only primary structure for peptides) and physical properties.

Properties and uses of some important polymers: Natural rubber, cellulose, nylon, teflon and PVC.

Practical organic chemistry: Detection of elements (N, S, halogens); Detection and identification of the following functional groups: hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and keto), carboxylic acid, amine and nitrile; Chemical methods of separation of non-functional organic compounds from binary mixtures.

CLASS - XII (MATHEMATICS)

Complex Number and Quadratic equations:

Algebra of complex numbers, addition, multiplication, conjugation, polar representation, properties of modulus and principal argument, triangle inequality, cube roots of unity, geometric interpretations.

Quadratic equations with real coefficients, form, quadratic equations with given roots, symmetric functions of roots.

Sequence & Series:

Arithmetic, geometric and harmonic progressions, arithmetic, geometric and harmonic means, 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. Permutations and combinations. Binomial theorem for a positive integral index, properties of binomial coefficients.

Binomial theorem for any index, exponential and logarithmic series.

Matrices & Determinants:

Matrices as a rectangular array of real numbers, equality of matrices, addition, multiplication by a scalar and product of matrices, transpose of a matrix, determinant of a square matrix of order up to three, inverse of a square matrix of order up to three, properties of these matrix operations, diagonal, symmetric and skew-symmetric matrices and their properties, solutions of simultaneous linear equation in two or three variables.

Probability:

Addition and multiplication rules of probability, conditional probability, baye’s theorem, independence of events, computation of probability of events using permutations and combinations.

Straight Line:

Cartesian coordinates, distance between two points, section formulae, shift of origin. Equation of a straight line 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, concurrency of lines; Centroid, orthocentre, incentre and circumcentre of a triangle.
SAMPLE TEST PAPER

Conic Section:
Equation of a circle in various forms, equations of tangent, normal and chord. Parametric equations of a circle, intersection of a circle with a straight line or a circle, equation of a through the points of intersection of two circles and those of a circle and a straight line.
Equations of a parabola, ellipse and hyperbola in standard form, their foci, directrices and eccentricity, parametric equations, equations of tangent and normal locus problems.

Three dimensions:
Direction cosines and direction ratios, equation of a straight line in space, equation of a plane, distance of a point from a plane.

Vectors:
Addition of vectors, scalar multiplication, dot and cross products, scalar triple products and their geometrical interpretations. Position vector of a point dividing a line segment in a given ratio. Projection of a vector on a line.

Function:
Real valued functions of a real variable, into, onto and one-to-one functions, sum, difference, product and quotient of two functions, composite functions, absolute value, polynomial, rational, trigonometric, exponential and logarithmic functions. Even and odd functions, inverse of a function, composite function.

Limit, Continuity & Derivability:
Limit and continuity of a function, limit and continuity of the sum, difference, product and quotient of two functions, L'Hospital rule of evaluation of limits of functions even and odd functions, inverse of a function, continuity of composite function. Intermediate value property of continuous functions.

Differentiation:
Derivative of a function, derivative of the sum, difference, product and quotient of two functions, chain rule, derivatives of polynomial, rational, trigonometric, inverse trigonometric, exponential and logarithmic functions. Derivatives of implicit functions, derivatives up to order two.

Tangent & Normal:
Geometrical interpretation of the derivative, tangents and normals.

Maxima & Minima:
Increasing and decreasing functions, maximum and minimum values of a function, Rolle’s theorem and Lagrange’s Mean value theorem.

Integral calculus:
Integration as the inverse process of differentiation, indefinite integrals of standard functions, integration by parts, integration by the methods of substitution and partial fractions.

Trigonometry:
Trigonometric functions, their periodicity and graphs addition and subtraction formulae, formulae involving multiple and sub-multiple angles, general solution of trigonometric equations. Relations between sides and angles of a triangle, sine rule, cosine rule, half-angle formula and the area of a triangle, inverse trigonometric functions (principal value only).

CLASS - XII (PHYSICS)

General:
Units and dimensions, dimensional analysis; least count, significant figures; Methods of measurement and error analysis for physical quantities pertaining to the following experiments: Experiments based on using Vernier calipers and screw gauge (micrometer). Determination of g using simple pendulum, Young’s modulus by Searle’s method. Specific heat of a liquid using calorimeter, focal length of a concave mirror and a convex lens using u-v method. Speed of sound using resonance column. Verification of Ohm’s law using voltmeter and ammeter, and specific resistance of the material of a wire using meter bridge and post office box.

Mechanics:
Kinematics in one and two dimensions (Cartesian coordinates only). Projectile Motion; Uniform Circular Motion; Relative Velocity.

Newton’s laws of motion; Inertial and uniformly accelerated frames of reference; Static and dynamic friction; Kinetic and potential energy; Work and power; Conservation of linear momentum and mechanical energy.

Systems of particles; Centre of mass and its motion; Impulse; Elastic and inelastic collisions. Law of gravitation; Gravitational potential and field; Acceleration due to gravity; Motion of planets and satellites in circular orbits; Escape velocity.

Rigid body, moment of inertia, parallel and perpendicular axes theorems, moment of inertia of uniform bodies with simple geometrical shapes; Angular momentum; Torque; Conservation of angular momentum; Dynamics of rigid bodies with fixed axis of rotation; Rolling without slipping of rings, cylinders and spheres; Equilibrium of rigid bodies; Collision of point masses with rigid bodies.

Linear and angular simple harmonic motions.

Hooke’s law, Young’s modulus.

Pressure in a fluid; Pascal’s law; Buoyancy; Surface energy and surface tension; capillary rise and meniscus (Poiseuille equation excluded); Stoke’s law; Terminal velocity, Streamline flow, equation of continuity, Bernoulli’s theorem and its applications.

Waves:
Wave motion (plane waves only), longitudinal and transverse waves, superposition of waves; Progressive and stationary waves; Vibration of strings and column; Resonance; Beats; Speed of sound in gases; Doppler effect (in sound).

Thermal physics:
Thermal expansion of solids, liquids and gases; Calorimetry, latent heat; Heat conduction in one dimension; Elementary concepts of convection and radiation; Newton’s law of cooling; Ideal gas laws; Specific heats (Cv and Cp for monoatomic and diatomic gases); Isothermal and adiabatic processes, bulk modulus of gases; Equivalence of heat and work; First law of thermodynamics and its applications (only for ideal gases); Blackbody radiation: absorptive and emissive powers; Kirchhoff’s law; Wien’s displacement law. Stefan’s law.

Electricity and magnetism:
Coulomb’s law; Electric field and potential; Electrical potential energy of a system of point charges and of electrical dipoles in a uniform electrostatic field; Electric field lines; Flux of electric field; Gauss’s law and its application in simple cases, such as, to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell.

Capacitance; Parallel plate capacitor with and without dielectrics; Capacitors in series and parallel; Energy stored in a capacitor.

Electric current; Ohm’s law; Series and parallel arrangements of resistances and cells; Kirchhoff’s laws and simple applications; Heating effect of current.

Biot–Savart’s law and Ampere’s law; Magnetic field near a current-carrying straight wire, along the axis of a circular coil and inside a long straight solenoid; Force on a moving charge and on a current-carrying wire in a uniform magnetic field.

Magnetic moment of a current loop; Effect of a uniform magnetic field on a current loop; Moving coil galvanometer meter, voltmeter, ammeter and their conversions.

Electromagnetic induction: Faraday’s law, Lenz’s law; Self and mutual inductance; AC, LR and LC circuits with d.c. and a.c. sources.

Optics:
Rectilinear propagation of light; Reflection and refraction at plane and spherical surfaces; Total internal reflection; Deviation and dispersion of light by a prism; Thin lenses; Combinations of mirrors and thin lenses; Magnification.

Wave nature of light: Huygen’s principle, interference limited to Young’s double-slit experiment.

Modern physics:
Atomic nucleus; Alpha, beta and gamma radiations; Law of radioactive decay; Decay constant; Half-life and mean life; Binding energy and its calculation; Fission and fusion processes; Energy calculation in these processes.

Photoelectric effect; Bohr’s theory of hydrogen-like atoms; Characteristic and continuous X-rays, Moseley’s law; de Broglie wavelength of matter waves.
**SAMPLE TEST PAPER**
(For Class-X Appearing / Passed Students)

COURSE : ABHINAV (EA) & ADHAAR (EB)

TARGET : JEE MAIN 2020

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**PART - A (CHEMISTRY) माग - A (रसायन विज्ञान)**

Atomic masses (परमाणु श्रेणी) : [H = 1, D = 2, Li = 7, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24, Al = 27, Si = 28, P = 31, S = 32, Cl = 35.5, K = 39, Ca = 40, Cr = 52, Mn = 55, Fe = 56, Cu = 63.5, Zn = 65, As = 75, Br = 80, Ag = 108, I = 127, Hg = 200, Pb = 207]

**Straight Objective Type**

This section contains 25 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which ONLY ONE is correct.

1. **Boiling point of 5% aqueous solution of common salt at atmospheric pressure is :**
   (1) 100°C
   (2) > 100°C
   (3) < 100°C
   (4) not possible to predict

2. **Which of the following compound has electrovalent linkage?**
   निम्न में से कौनसा यौगिक वैद्युत संयोजी आकार रखता है?
   (1) CH₃Cl
   (2) NaCl
   (3) CH₃OH
   (4) CH₃COOH

3. **The given compound is:**
   CH₃ — CH₂ — CH₂ — CH₂ — CH₂ — CH₃
   (1) Pentane
   (2) Hexane
   (3) Heptane
   (4) Octane

4. **A neutral atom (atomic No. > 1) consists of :**
   (1) Only protons
   (2) Neutrons + protons
   (3) Neutrons + electrons
   (4) Neutrons + electrons + protons

5. **Present unit of atomic mass is :**
   (1) weight of proton.
   (2) weight of one neutron.
   (3) weight of one hydrogen atom/
   (4) 1/12th of the weight of C-12 atom.

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**PART - A (Chemistry)**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>Nature of Questions</th>
<th>Marks to be awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 25</td>
<td>PART-A (Chemistry)</td>
<td>Single Choice Questions (SCQ)</td>
<td>25 Questions, 4 Correct, 1 Wrong, Total 100</td>
</tr>
<tr>
<td>26 to 50</td>
<td>PART-B (Physics)</td>
<td>Single Choice Questions (SCQ)</td>
<td>25 Questions, 4 Correct, 1 Wrong, Total 100</td>
</tr>
<tr>
<td>51 to 90</td>
<td>PART-C (Maths)</td>
<td>Single Choice Questions (SCQ)</td>
<td>40 Questions, 4 Correct, 1 Wrong, Total 160</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>90 Questions, 36 Questions, 1 Wrong, Total 360</td>
</tr>
</tbody>
</table>

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**STP2018EAEB-PAGE #9**
6. Which of the following is not isoelectronic series?
   (1) Cl–, P3–, Ar
   (2) N3–, Ne, Mg2+
   (3) B3+, He, Li+
   (4) N3–, S2–, Cl–

7. Choose the correct statement with regard to redox displacement reactions.
   (1) A less active metal displaces a more active metal.
   (2) A more active non-metal is displaced by a less active non-metal.
   (3) A less active non-metal displaces hydrogen from dilute acids.
   (4) A more active metal displaces hydrogen from dilute acids.

8. Which of the following is incorrectly matched?
   (1) Slaked lime – Ca(OH)2
   (2) Baking soda – Na2SO4·10H2O
   (3) Blue vitriol – CuSO4·5H2O
   (4) Benzene – C6H6

9. Which of the following statements is not correct?
   (1) A solid sol contains solid particles dispersed in solid.
   (2) An emulsion contains liquid dispersed in liquid.
   (3) A colloidal solution is a homogeneous system.
   (4) A colloidal solution exhibits Brownian motion.

10. Which one of the following is not a compound?
    (1) Marble
    (2) Ozone
    (3) Sodium Chloride
    (4) Quicklime

11. The smell of perfume spreads out by a process known as:
    (1) evaporation
    (2) diffusion
    (3) condensation
    (4) fusion

12. Rutherford scattering experiment is related to the size of the:
    (1) nucleons
    (2) electron
    (3) atom
    (4) nucleus

13. Which of the following statements is correct?
    (1) Intermolecular forces of attraction in solids are maximum.
    (2) Intermolecular forces of attraction in gases are minimum.
    (3) Intermolecular spaces in solids are minimum.
    (4) All of the above

14. Which one of the following is not a chemical change?
    (1) Sublimation
    (2) Combustion
    (3) Electrolysis
    (4) Rusting
15. $^{30}\text{Si}$ and $^{31}\text{P}$ are:

(a) isotopes  
(b) isobars  
(c) isomorphs  
(d) isotones

$^{30}\text{Si}$ तथा $^{31}\text{P}$ निम्न हैं:

(a) समसामान्य  
(b) सममान्य  
(c) समप्रभाविक  
(d) समप्रभाविक

16. A piece of sodium weighs 0.023 g. The number of atoms present in it are:

(a) $6.022 \times 10^{20}$  
(b) $6.022 \times 10^{23}$  
(c) $6.022 \times 10^{21}$  
(d) $6.022 \times 10^{19}$

17. Which of the following statements is true with respect to an element having atomic number $Z = 20$:

(a) It belongs to 2nd group and 3rd period of Modern Periodic Table.  
(b) It belongs to d-block of the Modern Periodic Table.  
(c) Oxide of the element will be basic in nature.  
(d) The element has the maximum atomic size among all the elements of its period.

18. In the modern periodic table, metalloids are mostly located in:

(a) s-block  
(b) p-block  
(c) d-block  
(d) f-block

19. Which one of the following is a chemical change:

(a) Heating of a glass utensil softens it  
(b) Disappearance of solid carbon dioxide in air  
(c) Explosion of dynamite  
(d) Dissolution of sugar in water

20. Which of the following gases combines with haemoglobin of blood, thus reducing oxygen carrying capacity of blood and causes death?

(a) $\text{CO}_2$  
(b) $\text{CO}$  
(c) $\text{N}_2$  
(d) $\text{Ar}$

21. Atomic symbol of element with atomic number 12 is:

(a) Ne  
(b) Na  
(c) Mg  
(d) Al

22. Which of the given is an inert gas?

(a) $\text{O}_3$  
(b) $\text{H}_2$  
(c) $\text{N}_2$  
(d) He

23. One gram of H has:

(a) 1 mole neutron  
(b) 2 mole electron  
(c) 2 mole proton  
(d) 1 mole proton

24. Which of the given element in non metal?

(a) Na  
(b) Al  
(c) Cl  
(d) Ba

25. Chemical formula of washing soda is:

(a) $\text{NaCl}$  
(b) $\text{Na}_2\text{SO}_4$  
(c) $\text{NaHCO}_3$  
(d) $\text{Na}_2\text{CO}_3$
26. An object is held at 40 cm from a concave lens of focal length 60 cm. The distance of the image from the lens is : 60 cm तले का दूरी वाले अवलोकन लेने के समय 40 cm दूरी पर एक वस्तु दिखाई पड़ी है। लेंस से प्रतिबिंब की दूरी होगी : (1) 40 cm (2) 60 cm (3) 120 cm (4) 24 cm

27. A current carrying power line carries current from west to east. What will be the direction of magnetic field 1 m above it ? (1) North to south (2) Upward to downward (3) East to west (4) West to east

28. Choose the correct statement : (1) Like magnetic poles attract each other, unlike poles repel (2) Electric generator is a device that converts mechanical energy into electrical energy (3) If we fix a strong magnet at the axis of a coil then current will be induced in the coil. (4) None of these

29. A 2 cm high candle is used as an object. It is placed perpendicular to the principal axis of a convex lens. The distance of the object from the lens is 30 cm. The image achieved on a screen is half the size of object. The power of the lens is : 2 cm ऊंची एक मोमबत्ती को विभिन्न के रूप में प्रस्तुत करते हैं। यह एक उत्तरार्द्ध बल्स के सुंदर आकार के लम्बाई रखता है। विभिन्न की लेंस से 30 cm है। दृश्य पर प्राप्त प्रतिबिंब विभिन्न से आधार उच्चार का है। लेंस की शक्ति है – (1) +0.1 D (2) –0.1 D (3) +10 D (4) –10 D

30. Which of the following is the biggest source of energy used in India? (1) Petroleum (2) Coal (3) Nuclear power plant (4) Hydro power plant

31. Density of water is 1 gm/cm$^3$ mass (m) and volume (v) of the object is given. Which of the following object will sink in water? (1) m = 50 gm, v = 70 cm$^3$ (2) m = 30 gm, v = 20 cm$^3$ (3) Both (1) and (2) will sink (4) Neither (1) nor (2) will sink

32. A proton enters a magnetic field at right angles to it, as shown in figure. The direction of magnetic force acting on the proton will be : (1) to the right (2) to the left (3) out of the page (4) into the page

33. Two positively charged masses are separated by a distance r. Which statement best describes the gravitational and electrostatic forces between the two masses? (1) Both forces are attractive. (2) Both forces are repulsive. (3) The gravitational force is repulsive and the electrostatic force is attractive. (4) The gravitational force is attractive and the electrostatic force is repulsive.
34. The diagram below shows a ray of light passing from air into glass at an angle of incidence of 0°. Which statement best describes the speed and direction of the light ray as it passes from air into the glass?
(1) Only speed changes.
(2) Only direction changes.
(3) Both speed and direction change.
(4) Neither speed nor direction changes.

35. A 50-watt light bulb and a 100-watt light bulb are each rated at 220 volts. Compared to the resistance of the 50-watt bulb, the resistance of the 100-watt bulb is
(1) half
(2) one-fourth
(3) twice
(4) four times

36. Which of the following cannot form virtual image of a virtual object?
(1) concave mirror
(2) convex mirror
(3) plane mirror
(4) diverging lens

37. Which quantity is equivalent to the product of the absolute index of refraction of water and the speed of light in water?
(1) wavelength of light in vacuum
(2) frequency of light in water
(3) sine of the angle of incidence
(4) speed of light in a vacuum

38. If the potential difference applied to a fixed resistance is doubled, the power dissipated by that resistance
(1) remains the same
(2) halves
(3) doubles
(4) quadruples

39. Which pair of quantities can be expressed using the same units?
(1) work and kinetic energy
(2) power and momentum
(3) impulse and potential energy
(4) acceleration and weight

40. Which type of images cannot be projected onto a screen?
(1) real images, only.
(2) virtual images, only
(3) both real and virtual images.
(4) neither real images nor virtual images.

41. In the figure shown a convex mirror of radius of curvature 20 cm is shown. An object O is placed in front of this mirror. Its ray diagram is shown. How many mistakes are there in the ray diagram (AB is its principal axis):
(1) 3
(2) 2
(3) 1
(4) 0
43. Path of a ray of light is shown. Which is correct statement
(1) There must be reflection of light for such path
(2) There must be refraction of light for such path
(3) There may be refraction of light for such path
(4) No reflection or refraction is required for such path

44. Which of the following correctly represents graphical relation between angle of incidence (i) and angle of reflection (r) ?
(1) \( \theta = 30^\circ, V = \frac{3}{2}\sqrt{2} \times 10^8 \text{ m/s} \)
(2) \( \theta = 60^\circ, V = 3\sqrt{2} \times 10^8 \text{ m/s} \)
(3) \( \theta = 30^\circ, V = \frac{3}{2}\sqrt{2} \times 10^8 \text{ m/s} \)
(4) \( \theta = 45^\circ, V = \frac{3}{2}\times 10^8 \text{ m/s} \)

45. Which of the following is a property of a fuse wire?
(1) Large area
(2) Low melting point
(3) High melting point
(4) Very high resistance

46. Find current passing through point A if potential difference V is applied between A and B?
A सिंदूर से प्रभावित चाला का मान ज्ञात कीजिये ताकि यदि A व B के बीच विभाजन \( V \) है?

47. The magnetic lines of force inside a bar magnet:
(1) are from north-pole to south-pole of the magnet
(2) do not exist
(3) depend upon the area of cross-section of the bar magnet
(4) are from south-pole to north-pole of the magnet

48. A light ray incident on a surface of quartz from air with angle of incidence 45º . What is the angle of refraction and velocity of light in quartz? (Refractive index of quartz = \( \sqrt{2} \), speed of light in air = \( 3 \times 10^8 \) m/s) क्वार्ट्स की सतह पर वायु से 45º के कोण पर प्रकाश किरण आपूर्तित है। अपर्याप्त कोण तथा प्रकाश का वेग होगा: (क्वार्ट्स का अपर्याप्तांक = \( \sqrt{2} \) ), तब में प्रकाश की चाल = \( 3 \times 10^8 \) m/s)

49. A plane mirror moves with a speed of 5 m/sec and image of an object moves with 2 m/sec as shown in figure, then speed of the object is:
(1) 12 m/sec. towards mirror
(2) 7 m/sec. away from mirror
(3) 12 m/sec. away from mirror
(4) 2 m/sec. towards mirror
50. In the nuclear reaction 
\[ ^{92}_{235}U + _0^1n \rightarrow ^{56}_{141}Ba + ^{36}_{92}Kr + 3X + 200 \text{ MeV} \]
Where \( X \) represents :
(1) Proton
(2) Neutron
(3) Electron
(4) Alpha particle

PART - C (MATHEMATICS) मान - C (गणित)

Straight Objective Type
This section contains 40 questions. Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which ONLY ONE is correct.

51. If all the sides of a parallelogram touch a circle, then parallelogram is a
(1) square (वर्ग)
(2) rhombus (समवर्त्तन)
(3) rectangle (आयत)
(4) none of these (इनमें से कोई नहीं)

52. The shaded region in the diagram CANNOT represents
(where \( A' \) represents the complementary set of \( A \))

53. What is the volume of a cube whose diagonal is \( 8 \sqrt{3} \) cm long.

54. The weights of 60 boys are given in the following distribution table:

<table>
<thead>
<tr>
<th>Weight(kg)</th>
<th>37</th>
<th>39</th>
<th>41</th>
<th>43</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of boys</td>
<td>10</td>
<td>14</td>
<td>18</td>
<td>12</td>
<td>6</td>
</tr>
</tbody>
</table>

(1) Median of the above data is \( \frac{122}{3} \)
(2) Mean of the above data is 42
(3) Median of the above data is 41
(4) Mean of the above data is 41

55. Inside a triangular garden there is a flower bed in the form of a similar triangle. Around the flower bed runs a uniform path of such a width that the sides of the garden are double of the corresponding sides of the flower bed. The areas of the path and the flower bed are in the ratio:

56. If two circles touch each other internally then the distance between their centres is equal to

(1) Sum of their radii
(2) Difference of their radii
(3) Product of their radii
(4) Larger of the two radii
57. A running track is the ring formed by two concentric circles. It is 10 m wide. The circumferences of the two circles differ by about
(1) 10 m (app.)  (2) 30 m (app.)
(3) 60 m (app.)  (4) 100 m (app.)

58. The ratio in which the line segment joining (3, 4) and (–2, –1) is divided by the x-axis is
(1) 3 : 2  (2) 4 : 1
(3) 4 : 3  (4) None of these

59. A cube is coloured red on two opposite faces, blue on two adjacent faces and yellow on two remaining faces. It is then cut into two halves along the plane parallel to the red faces. One piece is then cut into four equal cubes and the other one into 32 equal cubes. How many cubes do not have any red face?
(1) 162 cubic units  (2) 162 sq. units
(3) 81 cubic units  (4) 81 sq. units

60. If \((2^2 + 2^3 + 2^4 + \ldots + 2^{10}) = 385\), then the value of \((2^{10} + 3^2 + 6^2 + \ldots + 20^2)\) is
(1) 770  (2) 1155
(3) 1540  (4) \(385 \times 385\)

61. If \((1^2 + 2^2 + 3^2 + \ldots + 10^2) = 385\), then find the value of \((2^2 + 4^2 + 6^2 + \ldots + 20^2)\) (1 + 2)
(1) 15  (2) 20
(3) 35  (4) 40

62. If \((1^2 + 2^2 + 3^2 + \ldots + 10^2) = 385\), then the value of \((2^2 + 4^2 + 6^2 + \ldots + 20^2)\) is
(1) 770  (2) 1155
(3) 1540  (4) \(385 \times 385\)

63. Each side of a cube is 3 units. It is cut into cubes each of side 1 unit. The sum of total surface area of all the smaller cubes thus obtained is
(1) 162 sq. units  (2) 27 sq. units
(3) 61 sq. units  (4) 108 sq. units

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(1) 770  (2) 1155
(3) 1540  (4) \(385 \times 385\)

67. The co-ordinates of one end of a diameter of a circle are \((5, -7)\). If the co-ordinates of the centre be \((7, 3)\), the co-ordinates of the other end of the diameter are:
(1) \((6, -2)\)  (2) \((9, 13)\)
(3) \((-2, 6)\)  (4) \((13, 9)\)

68. The co-ordinates of one end of a diameter of a circle are \((5, -7)\). If the co-ordinates of the centre be \((7, 3)\), the co-ordinates of the other end of the diameter are:
(1) \((6, -2)\)  (2) \((9, 13)\)
(3) \((-2, 6)\)  (4) \((13, 9)\)

69. The co-ordinates of one end of a diameter of a circle are \((5, -7)\). If the co-ordinates of the centre be \((7, 3)\), the co-ordinates of the other end of the diameter are:
(1) \((6, -2)\)  (2) \((9, 13)\)
(3) \((-2, 6)\)  (4) \((13, 9)\)

70. The co-ordinates of one end of a diameter of a circle are \((5, -7)\). If the co-ordinates of the centre be \((7, 3)\), the co-ordinates of the other end of the diameter are:
(1) \((6, -2)\)  (2) \((9, 13)\)
(3) \((-2, 6)\)  (4) \((13, 9)\)
69. A man covers \( \frac{1}{3} \) of his journey by train at 60 km/hr, next \( \frac{1}{3} \) by bus at 30 km/hr and the rest by cycle at 10 km/hr. His average speed during whole journey is:

(1) 40 km/hr.  
(2) 33 \( \frac{1}{3} \) km/hr.  
(3) 20 km/hr.  
(4) 50 km/hr.

70. In a school 437 boys and 342 girls have been divided into classes, so that each class has the same number of students and no class has boys and girls mixed. What is the least number of classes needed?

(1) 20  
(2) 43  
(3) 41  
(4) 49

71. If \( a = \frac{1}{3 - 2\sqrt{2}} \) and \( b = \frac{1}{3 + 2\sqrt{2}} \) then the value of \( a^2 + b^3 \) is

(1) 193  
(2) 194  
(3) 195  
(4) 198

72. If \( a^2 + 2b = 7, b^2 + 4c = -7 \) and \( c^2 + 6a = -14 \), then the value of \( (a^2 + b^2 + c^2) \) is

(1) 14  
(2) 25  
(3) 36  
(4) 47

73. If \( \tan \alpha + \cot \alpha = a \) then the value of \( \tan^2 \alpha + \cot^2 \alpha \) is

(1) \( a^2 + 4a^2 + 2 \)  
(2) \( a^2 - 4a^2 + 2 \)  
(3) \( a^2 - 4a^2 - 2 \)  
(4) None of these

74. If \( (a^2 + b^3)^2 = (a^3 + b^2)^2 \) then value of \( \frac{a+b}{b-a} \) is

(1) 2  
(2) 3  
(3) \( \frac{1}{3} \)  
(4) \( \frac{1}{2} \)

75. If a selling price of Rs. 24 results in a 20% discount of the list price, the selling price that would result in a 30% discount of the list price is

(1) Rs. 9  
(2) Rs. 27  
(3) Rs. 14  
(4) Rs. 21

76. If a, b and c are positive integers less than 10, then \( (10a + b)(10a + c) = 100a(a + 1) + bc \) if:

(1) 10a + b = 100a(a + 1) + bc  
(2) a + b + c = 100a(a + 1) + bc  
(3) a + b = 10  
(4) a = b

77. In the given figure, find the radius of the inner circle if other circums are of radius 'a'.

(1) \( \sqrt{2} \) a  
(2) \( \sqrt{2} - 1 \) a  
(3) \( \frac{1}{\sqrt{2}} \) a  
(4) \( \frac{2}{\sqrt{2} + 1} \) a

78. \( \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6 + \ldots}}} = ?} \)

(1) 3  
(2) 6  
(3) 9  
(4) \( \infty \)

79. In the diagram \( AB = AC \) and \( \angle BAC = 40^\circ \). The sum of the angle ADC and angle DAC.

(1) 55^\circ  
(2) 65^\circ  
(3) 70^\circ  
(4) 60^\circ
80. A cylinder of radius 2 and height 7 is melt and a cone is formed whose radius is equal to radius of cylinder then find height of cone.

81. In a detective agency 23rd June 1987 is coded as HGJDIABC then the decoding of JHHJJIF is

Rehrman buys few apples at 15 for a rupee and the same number of apples at 20 for a rupee. He mixes the two lots and sell them at 35 for 2 rupees. What is his gain or loss percentage?

82. The number of distinct real values of ‘x’ which satisfy the equation

83. Number of solutions of the equation

84. If \( x = 7 + 4\sqrt{3} \) then the value of \( \sqrt{x + \frac{1}{x}} \) is

85. If \( x = 7 + 4\sqrt{3} \) then the value of \( \sqrt{x + \frac{1}{x}} \) is
SAMPLE TEST PAPER
(For Class-XI Appearing / Passed Students)
COURSE : AKHIL (EF)
TARGET : JEE MAIN 2019

PART - A (CHEMISTRY) मान - A (रसायन विज्ञान)

Atomic masses (रसायन वजन) : [H = 1, D = 2, Li = 7, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24, Al = 27, Si = 28, P = 31, S = 32, Cl = 35.5, K = 39, Ca = 40, Cr = 52, Mn = 55, Fe = 56, Cu = 63.5, Zn = 65, As = 75, Br = 80, Ag = 108, I = 127, Ba = 137, Hg = 200, Pb = 207]

Straight Objective Type
This section contains 25 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which ONLY ONE is correct.

1. Which has highest number of atoms
(1) 8 gram Oxygen
(2) 16 gram Sulphur
(3) 14 gram Nitrogen
(4) 2 gram Hydrogen

2. The number of moles of oxygen obtained by the electrolytic decomposition of 108 g water is 108 g
108 g जल के धार्मिक विपरीतीय विपर्यंत्र से प्राप्त ऑक्सीजन के प्रकार नकाशा निजी है :
(1) 2.5
(3) 5
(4) 7.5

3. On the basis of structure, the two sulphur atoms in Na₂S₂O₃ have :
(1) + 2 and + 4 oxidation states
(2) – 2 and + 6 oxidation states
(3) + 4 and + 6 oxidation states
(4) same oxidation state of two sulphur atoms

4. Which of the following is incorrect for critical temperature ?
(1) It is the highest temperature at which liquid and vapour can coexist
(2) Beyond the critical temperature, there is no distinction between the two phases and a gas cannot be liquefied by compression
(3) At critical temperature (T_c) the surface tension of the system is zero
(4) At critical temperature the gas and the liquid phases have different critical densities
5. When heat (q) is lost by the system, the value of $\Delta H$ is ______ & the process is ______.
   (1) positive, exothermic  (2) negative, exothermic
   (3) negative, endothermic  (4) positive, endothermic
   जब तनाव द्वारा उम्मीद (q) का घायल होता है, तो $\Delta H$ का मान ______ व प्रक्रम ______ है।
   (1) धातुता, उष्मावशीय  (2) अणुत्रांक, उष्मावशीय
   (3) अणुत्रांक, उष्मावशीय  (4) धातुता, उष्मावशीय

6. Which electronic level would allow the hydrogen atom to absorb a photon but not to emit a photon?
   कौन सा इलेक्ट्रॉनिक स्तर हाइड्रोजन मौल द्वारा फोटोन अवशोषण करने देगा किन्तु फोटोन का उत्सर्जन नहीं?
   (1) 3s  (2) 2p
   (3) 2s  (4) 1s

7. The molar volume of helium is 44.8 L at (assuming ideal behaviour)
   (1) 100°C and 1 atm  (2) 0°C and 1 atm
   (3) 0°C and 0.5 atm  (4) 100°C and 0.5 atm
   निम्न में से किस परिस्थिति पर हिलियम का मोलर आयाम 44.8 L है। (आवश्यक तथ्यावधार मानते हुए)
   (1) 100°C तथा 1 atm  (2) 0°C तथा 1 atm
   (3) 0°C तथा 0.5 atm  (4) 100°C तथा 0.5 atm

8. Elements in which 4f orbitals are progressively filled are called as
   (1) Transition elements  (2) Lanthanides
   (3) Actinides  (4) Inert gases
   वे तत्वों में 4f कक्ष अनुक्रमिक में भरे होते हैं, कहलाते हैं।
   (1) संक्रमण तत्व  (2) लांथानाइड
   (3) एक्टिनाइड  (4) अक्षर गैस

9. The correct order of bond angles is :
   वैकोणों का सही क्रम निम्न है :
   (1) NO$_2$ > NO$_4^+$ > NO$_2^-$ > NO$_2^-$
   (2) NO$_4^+$ > NO$_2^+$ > NO$_2^+$
   (3) NO$_4^+$ > NO$_2^+$ > NO$_2^+$
   (4) NO$_2^+$ > NO$_2^+$ > NO$_2^+$

10. Which one of the following ions has the highest value of ionic radius?
    निम्न अणुपत्रों में से किसी अणुपत्र के विवेकसाधन है?
    (1) Li$^+$  (2) B$^{3+}$
    (3) O$^{2-}$  (4) F$^{-}$

11. Which one of the following orders presents the correct sequence of the increasing basic nature of the given oxides?
    निम्नलिखित में से किस और स्रोत दिये गये ऑक्साइडों के क्रमांक को प्राप्त करना है?
    (1) Al$_2$O$_3$ < MgO < Na$_2$O < K$_2$O
    (2) MgO < K$_2$O < Al$_2$O$_3$ < Na$_2$O
    (3) Na$_2$O < K$_2$O < MgO < Al$_2$O$_3$
    (4) K$_2$O < Na$_2$O < Al$_2$O$_3$ < MgO

12. The correct order towards bond angle is :
    (1) Bond angle does not depend on hybridisation.
    (2) sp < sp$^2$ < sp$^3$
    (3) sp$^2$ < sp < sp$^3$
    (4) sp$^3$ < sp$^2$ < sp
    तंत्र कोण का सही क्रम है :  
    (1) तंत्र कोण संयंत्र पर निर्भर नहीं करता है।
    (2) sp < sp$^2$ < sp$^3$
    (3) sp$^2$ < sp < sp$^3$
    (4) sp$^3$ < sp$^2$ < sp

13. Sodium metal can be stored under :
    (1) benzene  (2) kerosene
    (3) alcohol  (4) water
    सोडियम में रखा जा सकता है :
    (1) बेंजेन  (2) केरोसीन
    (3) अल्कोहॉल  (4) जल में

14. A gas absorbs 100 J of heat and is simultaneously compressed by a constant external pressure of 1.50 atm from 8.00 to 2.00 L in volume. What is $\Delta E$ in joules for the gas?
    एक गैस 100 J गर्मी अवशोषण करती है तथा साथ ही एक निरिक्षित बाहरी ताप 1.50 atm द्वारा आयाम 8.00 से 2.00 L तक संपन्न हो जाती है तथा गैस के लिए जूल में $\Delta E$ क्या है?
    (1) –812  (2) +812
    (3) –912  (4) 1012

15. Cl–P–Cl bond angles PCl$_5$ molecule are :
    (1) 120° and 90°
    (2) 60° and 90°
    (3) 60° and 120°
    (4) 120° and 30°
    PCl$_5$ में Cl–P–Cl वैंच कोण निम्न है :
    (1) 120° तथा 90°
    (2) 60° तथा 90°
    (3) 60° तथा 120°
    (4) 120° तथा 30°
16. The first ionization energy of nitrogen is more than that of oxygen because
(1) Nitrogen has half filled p-orbitals
(2) Nitrogen is left to the oxygen in the same period of the periodic table
(3) Nitrogen contains less number of electrons
(4) Nitrogen is less electronegative

17. The compound having only primary hydrogen atoms is:
(1) Isobutane
(2) 2, 3-Dimethyl-2-butene
(3) Cyclohexane
(4) Propene

18. The ratio of the kinetic energy of an electron in 2nd excited state of He+ ion to the kinetic energy of an electron in 3rd state of H-atom.
He+ ion has the following orbitals: 1s*, 2s, 2p1, 2p3, 3s, 3p1, 3p3, 3p5.

19. 1-Butanol and 2-Methyl-2-butanol can be distinguished by:
(1) Br2-H2O test
(2) Na metal test
(3) Lucas test
(4) Tollens test

20. Molecular mass of a volatile organic solid can be determined by:
(1) Silver chloride method
(2) Platinic chloride method
(3) Victor Mayer’s method
(4) Kjeldahl’s method

21. What is the common name of CH3–CN:
(1) Ethyl cyanide
(2) Methyl isonitrile
(3) Acetonitrile
(4) Methyl nitrile

CH3–CN has the following names:
(1) Ethyl cyanide
(2) Methyl isonitrile
(3) Acetonitrile
(4) Methyl nitrile

22. The IUPAC name of the following compound is:

23. Only two isomeric monochloro derivatives are possible for:
(1) n-Pentane
(2) 2,4-Dimethyl pentane
(3) Toluene
(4) 2,3-Dimethyl butane

24. Which has only one non zero valency

25. CH3–CH2–O–CH2–CH3 and CH3–CH2–CH2–O–CH3 are:
(1) Chain isomers
(2) Functional isomers
(3) Positional isomers
(4) Metamers

CH3–CH2–O–CH2–CH3 and CH3–CH2–CH2–O–CH3 are
(1) Chain isomers
(2) Functional isomers
(3) Positional isomers
(4) Metamers
PART- B (PHYSICS) भाग - B (भौतिक विज्ञान)

Straight Objective Type

This section contains 25 questions. Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which ONLY ONE is correct.

26. A rigid body moves a distance of 10 m along a straight line under the action of a force of 5 N. If the work done by this force on the body is 25 joules, the angle which the force makes with the direction of motion of the body is:

(1) 0°
(2) 30°
(3) 60°
(4) 90°

27. Velocity of a stone projected, 2 second before it reaches the maximum height, makes angle 53° with the horizontal then the velocity at highest point will be:

(1) 20 m/s
(2) 15 m/s
(3) 25 m/s
(4) 80/3 m/s

28. In Diagram-I spring is in natural length. In Diagram-II spring is in equilibrium under shown forces. What is the spring constant 'k' for the spring shown:

(1) 0
(2) 1/3 m²/s²
(3) 1/12 m²/s²
(4) 1/24 m²/s²

29. A thin rod of length ℓ and mass m is bend at the middle point O as shown in figure. Consider an axis passing through two middle point O and perpendicular to the bent rod. Then moment of inertia about this axis is:

(1) 2/3 m²
(2) 1/3 m²
(3) 1/12 m²
(4) 1/24 m²

30. Two masses m₁ and m₂ are attached to the ends of a massless string which passes over a frictionless pulley attached to the top of an inclined plane. The angle of inclination of the plane in θ. Take g = 10 ms⁻² m₁, m₂ को द्रव्यांकन एक द्रव्यांकनात्मक रस्ते के रिसीवर से जुड़े हुए है जो एक न्यूटन तल के साथ ध्वनी पर धनात्मक प्रवाही निर्देशी से विद्युत गुंडा है। न्यूटन तल का झुकाव कोण θ है तथा g = 10 ms⁻²।

If m₁ = 10kg, m₂ = 5kg, θ = 30°, what is the acceleration of mass m₂?

(1) zero शून्य
(2) (2/3) ms⁻²
(3) 5 ms⁻²
(4) 10/3 ms⁻²

31. A moving car possess average velocities of 5 m/s, 10 m/s and 15 m/s in the first,second and the third seconds respectively. What is the total distance covered by the car in these 3 sec.

(1) 30 m
(2) 55 m
(3) 15 m
(4) 40 m

32. A train is standing on a platform , a man inside a compartment of a train drops a stone . At the same instant train starts to move with constant acceleration . The path of the particle as seen by the person who drops the stone is :

(1) parabola
(2) straight line for sometime & parabola for the remaining time
(3) straight line
(4) variable path that cannot be defined
33. The equation of state for 5g of oxygen at a pressure P and temperature T, when occupying a volume V, will be (R is the gas constant)

\[ P V = n R T \]

(1) \( P V = 5 RT \)
(2) \( P V = \frac{(5/2)RT}{2} \)
(3) \( P V = \frac{(5/16)RT}{2} \)
(4) \( P V = \frac{(5/32)RT}{2} \)

34. A U-tube of base length \( \ell \) filled with same volume of two liquids of densities \( \rho \) and \( 2\rho \) is moving with an acceleration \( a \) on the horizontal plane. If the height difference between the two surfaces (open to atmosphere) becomes zero, then the height \( h \) is given by:

\[ h = \frac{\ell}{2g} \]

(1) \( \frac{\ell}{g} \)
(2) \( \frac{\ell}{g^2} \)
(3) \( \frac{\ell}{a} \)
(4) \( \frac{\ell}{a^2} \)

35. Position of a particle at any instant is given by \( x = 3t^2 + 1 \), where \( x \) is in m and \( t \) in sec. Its average velocity in the time interval \( t = 2 \) sec to \( t = 3 \) sec will be:

\[ \bar{v} = \frac{\Delta x}{\Delta t} = \frac{3(3)^2 + 1 - 3(2)^2 - 1}{3 - 2} \]

(1) 15 m/s
(2) 12 m/s
(3) 18 m/s
(4) 6 m/s

36. A girl walks along an east-west street, and a graph of her displacement from home is shown in fig. Her average velocity for the whole time interval is:

\[ \bar{v} = \frac{\Delta x}{\Delta t} \]

(1) Zero
(2) 6 m/min
(3) 11 m/min
(4) 15 m/min

37. Displacement-time curve of a particle moving along a straight line is shown. Tangents at A and B make angles 45° and 135° with positive x-axis respectively. The average acceleration of the particle during \( t = 1 \), \( t = 2 \) second is:

\[ \bar{a} = \frac{\Delta v}{\Delta t} \]

(1) \( -2 \) m/s²
(2) 1 m/s²
(3) \( -1 \) m/s²
(4) Zero

38. The force \( F \) acting on a particle moving in a straight line is shown in figure. What is the work done by the force on the particle in the 1st meter of the trajectory:

\[ W = \int F \, dx \]

(1) 5 J
(2) 10 J
(3) 15 J
(4) 2.5 J

39. A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is:

\[ F = \mu mg \]

(1) 2 N
(2) 20 N
(3) 50 N
(4) 100 N
40. A car moves around a curve at a constant speed. When the car goes around the arc subtending 60° at the centre, then the ratio of magnitude of instantaneous acceleration to average acceleration over the 60° arc is:

\[ \frac{a_i}{a_d} \]

(1) \( \frac{\pi}{3} \)  
(2) \( \frac{\pi}{6} \)  
(3) \( \frac{2\pi}{3} \)  
(4) \( \frac{5\pi}{3} \)

41. Angle made by vector \( \sqrt{3} \mathbf{i} + \sqrt{2} \mathbf{j} - 2 \mathbf{k} \) with -ve y-axis is:

\[ \cos^{-1} \left( \frac{\sqrt{2}}{3} \right) \]

(1) \( \cos^{-1} \left( \frac{\sqrt{2}}{3} \right) \)  
(2) \( \cos \left( \frac{\sqrt{2}}{3} \right) \)  
(3) \( \pi - \cos^{-1} \left( \frac{\sqrt{2}}{3} \right) \)  
(4) \( \pi - \cos^{-1} \left( -\frac{\sqrt{2}}{3} \right) \)

42. A circular curve of a highway is designed for traffic moving at 72 km/h. If the radius of the curved path is 100 m, the correct angle of banking of the road should be given by:

\[ \tan^{-1} \left( \frac{2}{3} \right) \]

(1) \( \tan^{-1} \left( \frac{2}{3} \right) \)  
(2) \( \tan^{-1} \left( \frac{3}{5} \right) \)  
(3) \( \tan^{-1} \left( \frac{2}{5} \right) \)  
(4) \( \tan^{-1} \left( \frac{1}{4} \right) \)

43. A vessel contains oil (density = 0.8 gm/cm\(^3\)) over mercury (density = 13.6 gm/cm\(^3\)). A uniform sphere floats with half its volume immersed in mercury and the other half in oil. The density of the material of sphere in gm/cm\(^3\) is:

\[ \frac{4M}{\pi L^3} \]

(1) 3.3  
(2) 6.4  
(3) 7.2  
(4) 12.8

44. A bullet moving with a speed of \( \sqrt{3} \) m/s just pierces a fixed plank. The speed of the bullet that would be just stopped by triple the thickness of same type of fixed plank must be (assume that force exerted by plank on the bullet both the cases is same):

\[ \sqrt{3} \]

(1) 3 m/s  
(2) 6 m/s  
(3) 3 \( \sqrt{3} \) m/s  
(4) 9 m/s

45. AB and CD are two identical rods each of length L and mass M joined to form a cross. Find the moment of inertia of the system about a bisector of the angle between the rods (XY).

\[ \frac{ML^2}{12} \]

(1) \( \frac{ML^2}{12} \)  
(2) \( \frac{ML^2}{6} \)  
(3) \( \frac{ML^2}{3} \)  
(4) \( \frac{4ML^2}{3} \)

46. A rod of length L and mass M is bent to form a semi-circular ring as shown in figure. The moment of inertia about XY is:

\[ \frac{ML^2}{2\pi^2} \]

(1) \( \frac{ML^2}{2\pi^2} \)  
(2) \( \frac{ML^2}{\pi^2} \)  
(3) \( \frac{ML^2}{4\pi^2} \)  
(4) \( \frac{2ML^2}{\pi^2} \)
47. Two simple harmonic motions are represented by the equations

\[ y_1 = 0.1 \sin \left( 100\pi t + \frac{\pi}{3} \right) \]

\[ y_2 = 0.1 \cos \pi t \]

The phase difference of the velocity of particle 1 with respect to the velocity of particle 2 at \( t = 0 \) is

\[ \frac{\pi}{3} - \frac{\pi}{6} \]  
\[ \frac{\pi}{6} - \frac{\pi}{3} \]

48. A projectile is thrown with a speed \( v \) at an angle \( \theta \) with the vertical. Its average velocity between the instants it crosses half the maximum height is

(1) \( v \sin \theta \), horizontal and in the plane of projection

(2) \( v \cos \theta \), horizontal and in the plane of projection

(3) \( 2v \sin \theta \), horizontal and perpendicular to the plane of projection

(4) \( 2v \cos \theta \), vertical and in the plane of projection.

50. Shown in the figure are the position time graph for two children going home from the school. Which of the following statements about their relative motion is true after both of them started moving?

Their relative velocity: (consider 1-D motion)

(1) first increases and then decreases

(2) first decreases and then increases

(3) is zero

(4) is non zero constant.

PART - C (MATHEMATICS) भाग - C (गणित)

Straight Objective Type

This section contains 40 questions. Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which ONLY ONE is correct.

51. The 8th term of the sequence is

\[ 2, 5, 8, 5, 2, 5, 8, 5, \ldots \]

52. The vertex of parabola \( x^2 + 2y = 8x - 7 \) is

(1) \( \left( 4, \frac{7}{2} \right) \)

(2) \( \left( 4, \frac{9}{2} \right) \)

(3) \( \left( \frac{9}{2}, 4 \right) \)

(4) \( \left( \frac{7}{2}, 4 \right) \)
53. The greatest coefficient in the expansion of \((5 + 2x)^{10}\) is
\((5 + 2x)^{10}\) के हिसाब से महत्तम गुणक है—
(1) **10C_5 5^5 2^5**
(2) **10C_6 5^6 2^4**
(3) **10C_5 5^5 2^5**
(4) none of these

54. If \((x_1, y_1)\) & \((x_2, y_2)\) are the ends of a diameter of a circle such that \(x_1, x_2\) are the roots of the equation \(ax^2 + bx + c = 0\) and \(y_1, y_2\) are the roots of the equation; \(py^2 + qy + c = 0\). Then the coordinates of the centre of the circle is:

\(y_1\) और \(y_2\) एक यांत्र का सिरे इस प्रकार हैं कि \(x_1\) और \(x_2\) समीकरण \(ax^2 + bx + c = 0\) एवं \(y_1\) और \(y_2\) समीकरण \(py^2 + qy + c = 0\) के मूल हैं तब युग्म के केन्द्र के निर्देशांक हैं—

(1) \(\left( \frac{b}{2a}, \frac{q}{2p} \right)\)
(2) \(\left( -\frac{b}{2a}, -\frac{q}{2p} \right)\)
(3) \(\left( \frac{b}{a}, \frac{q}{p} \right)\)
(4) none of these

55. **\(\log_a (\log_b a)\)** is equal to

\(\log_a (\log_b a)\) बराबर है—

(1) \(-\log_b\)
(2) \(-\log_a\)
(3) \(-1\)
(4) none of these

56. The equation \(x - \frac{8}{|x-3|} = 3 - \frac{8}{|x-3|}\) has

(1) only one solution
(2) infinite solutions
(3) no solution
(4) two solutions

मानक \(x - \frac{8}{|x-3|} = 3 - \frac{8}{|x-3|}\) रहती है—

(1) केवल एक हल
(2) अंतगत हल
(3) कोई हल नहीं
(4) दो हल

57. If \(x^2 - ax - 3 = 0\) and \(x^2 + ax - 15 = 0\) have a common root, then

\(x^2 - ax - 3 = 0\) और \(x^2 + ax - 15 = 0\) का मूल उभयभाषित हो, तो \(a =\)

(1) 2
(2) 3
(3) - 3
(4) none of these

इनमें से कोई नहीं

58. If the sum of first \(n\) positive integers is \(\frac{1}{5}\) times the sum of their squares, then \(n\) equals

\(\text{यदि पहले} \ n \ \text{पॉजिटिव} \ \text{जोड़फल के} \ \text{योग, इनमें} \ \text{योग} \ \text{का} \ \frac{1}{5} \ \text{गुणा हो,} \ \text{तो} \ n \ \text{का मान है}—\)

(1) 5
(2) 6
(3) 7
(4) 8

59. The ratio of the greatest value of \(2 - \cos x + \sin^2x\) to its least value is

\(2 - \cos x + \sin^2x\) के अधिकतम एवं न्यूनतम मानों का अनुपात है—

(1) \(\frac{7}{4}\)
(2) \(\frac{9}{4}\)
(3) \(\frac{13}{4}\)
(4) \(\frac{5}{4}\)

60. The intercepts made by the circle \(x^2 + y^2 - 5x - 13y - 14 = 0\) on the x-axis and y-axis are respectively

\(x^2 + y^2 - 5x - 13y - 14 = 0\) द्वारा x-अक्ष एवं y-अक्ष पर बनाये गये अलग-अलग क्रमांक होंगे—

(1) 9, 13
(2) 5, 13
(3) 9, 15
(4) none of these

इनमें से कोई नहीं

61. The points of contact of the tangents drawn from \(P(−2, 2)\) to the parabola \(y^2 = 16x\) are \(A\) and \(B\). Then \(AB\) is

\(P(−2, 2)\) से पराबोला \(y^2 = 16x\) पर भूली गई स्पर्श रेखा के स्पर्श \(A\) तथा \(B\) है, तब \(AB\) =

(1) \(4\sqrt{17}\)
(2) \(\sqrt{5}\)
(3) \(2\sqrt{17}\)
(4) \(3\sqrt{17}\)

62. The equation of a tangent to the ellipse \(2x^2 + 7y^2 = 14\), drawn from the point \((5, 2)\) is/are

\(2x^2 + 7y^2 = 14\) पर \((5, 2)\) से टिकने \(y^2 = 16x\) पर भूली गई स्पर्श रेखा का समीकरण है—

(1) \(x - 9y + 13 = 0\) केवल
(2) \(x - y - 3 = 0\) केवल
(3) \(x + y - 3 = 0\) केवल
(4) (1) तथा (2) दोनों

63. The eccentricity of the conic represented by the equation \(2x^2 + 2y^2 - 2x + 3y + 2 = 0\) is

\(2x^2 + 2y^2 - 2x + 3y + 2 = 0\) से निर्मित शंकु का उकसाव दूर कहें—

(1) 0
(2) \(\frac{1}{2}\)
(3) \(\frac{1}{\sqrt{2}}\)
(4) \(\sqrt{2}\)

64. The number \(N = \log_7 79. \log_{13} 3 . \log_{8} 1\) lies between two successive integers ‘a’ and ‘b’ where

\(\log_7 79. \log_{13} 3 . \log_{8} 1\) दो क्रमांक दूरान्तों के मध्य \(\text{य सिक्की है, जहाँ—}\)

(1) \(a = 1, b = 2\)
(2) \(a = 2, b = 3\)
(3) \(a = 3, b = 4\)
(4) \(a = 0, b = 1\)
There are some men and 4 women participating in a tournament. Every participant plays four games with every other participant. If the total number of games played between men participants exceeds that played between men and women participants by 380, then the number of men participants is.

If \( \sin \theta = \frac{2}{3} \), then the number of games played between men participants is

\[ 16 \quad 17 \quad 18 \quad 19 \]

(3) 19

(4) 21

If (2, 0) is the vertex & \( y \) – axis the directrix of a parabola, then its focus is:

\[ (3) \quad (2, 0) \quad (2) \quad (2) = 0 \]

(3) 0

(4) –2

If \( a x^2 - 4x + 2 > 0 \) for all \( x \in \mathbb{R} \), then the minimum integral value of \( a \) is

\[ (1) \quad 3 \quad (2) \quad 2 \quad (3) \quad 1 \quad (4) \quad 0 \]

In the figure shown, radius of the semi circle is

\[ (1) \quad 5 \quad 3 \quad (2) \quad 10 \quad 3 \quad (3) \quad 8 \quad 3 \quad (4) \quad 11 \quad 3 \]

If \( x = 16^2 + 17^2 + 18^2 + 19^2 \), then \( x \) divided by 70 leaves a remainder of

\[ (1) \quad 0 \quad (2) \quad 2 \quad (3) \quad 3 \quad (4) \quad 4 \]

The number of distinct real values of \( x \) which satisfy the equation \( (x^2 - 5x + 5)^2 - 9x^2 + 20 = 1 \), is:

\[ (1) \quad 0 \quad (2) \quad 2 \quad (3) \quad 3 \quad (4) \quad 4 \]

The number of values of \( x \) in the interval [0, 3\pi] satisfying the equation \( 2 \sin^2 x + 5 \sin x - 3 = 0 \) is

\[ (1) \quad 6 \quad (2) \quad 1 \quad (3) \quad 2 \quad (4) \quad 4 \]

How many integers greater than 5000 can be formed with the digit 7, 6, 5, 4 and 3, using each digit at most once?

\[ (1) \quad 160 \quad (2) \quad 180 \quad (3) \quad 84 \quad (4) \quad 192 \]

The foci of the ellipse \( \frac{x^2}{16} + \frac{y^2}{25} = 1 \) and the hyperbola \( \frac{x^2}{144} - \frac{y^2}{81} = 1 \) coincide. Then the value of \( b^2 \) is

\[ (1) \quad 5 \quad (2) \quad 1 \quad (3) \quad 7 \quad (4) \quad 9 \]

A, B and C are three points on a circle such that the angles subtended by the chords AB and AC at the centre O are 90° and 110°, respectively. Determine \( \angle BAC \).

If \( (1 - p) \) is a root of quadratic equation \( x^2 + px + (1 - p) = 0 \), then its roots are:

\[ (1) \quad 0, 1 \quad (2) \quad -1, 1 \quad (3) \quad 0, -1 \quad (4) \quad -1, 2 \]
78. The coefficient of \(x^2\) in the expansion of \((1 + x)(1 - x)^n\) is
\[
(1 + x)(1 - x)^n \quad \text{is} \quad \frac{(1 + x)(1 - x)^n}{(n - 1)} \quad \text{is} \quad \frac{(n - 1)^2}{(n - 1)^2}
\]
and \(T_r\) is the \(rth\) term of an AP whose first term is \(a\) and common difference is \(d\). If for some positive integers \(m\) and \(n\), \(m \neq n\), then \(a - d = 0\) if \(n\) is divisible by \(m\).

79. Let \(T_n\) be the \(rth\) term of an AP whose first term is \(a\) and common difference is \(d\). If for some positive integers \(m\) and \(n\), \(m \neq n\), then \(a - d = \frac{1}{m}\) and \(T_n = \frac{1}{n}\) are the terms of the AP.

80. The straight lines, \(x(a + 2b) + y(a + 3b) = a + b\) for different values of \(a\) and \(b\) passes through a fixed point whose coordinates are:
\[
x(a + 2b) + y(a + 3b) = a + b \quad \text{and} \quad b \in R.
\]

81. Let \(\alpha, \beta\) be such that \(\pi < \alpha - \beta < 3\pi\). If \(\sin \alpha + \sin \beta = -\frac{21}{65}\) and \(\cos \alpha + \cos \beta = -\frac{27}{65}\), then the value of \(\cos \left(\frac{\alpha - \beta}{2}\right)\) is
\[
\cos \left(\frac{\alpha - \beta}{2}\right) = -\frac{27}{65}
\]
and \(\cos \alpha + \cos \beta = -\frac{27}{65}\) is the value of \(\cos \left(\frac{\alpha - \beta}{2}\right)\) is
\[
\cos \left(\frac{\alpha - \beta}{2}\right) = -\frac{27}{65}
\]
and \(\cos \alpha + \cos \beta = -\frac{27}{65}\) is the value of \(\cos \left(\frac{\alpha - \beta}{2}\right)\) is
\[
\cos \left(\frac{\alpha - \beta}{2}\right) = -\frac{27}{65}
\]

82. If the coefficients of \((2r + 4)th\), \((r - 2)th\) terms in the expansion of \((1 + x)^{18}\) are equal, then \(r\) is
\[
y \quad (1 + x)^{18} \quad \text{is} \quad \frac{(1 + x)^{18}}{(r - 2)} \quad \text{is} \quad \frac{(r - 2)^2}{(r - 2)^2}
\]
and \(\beta\) is the \(rth\) term of an AP whose first term is \(a\) and common difference is \(d\). If for some positive integers \(m\) and \(n\), \(m \neq n\), then \(a - d = \frac{1}{m}\) and \(T_n = \frac{1}{n}\) are the terms of the AP.

83. Number of integers satisfying the inequation
\[
\frac{(x - 2)^2(x + 1)^3}{x^4(x - 2)} \leq 0
\]
are equal, then \(r\) is
\[
y \quad (1 + x)^{18} \quad \text{is} \quad \frac{(1 + x)^{18}}{(r - 2)} \quad \text{is} \quad \frac{(r - 2)^2}{(r - 2)^2}
\]
and \(\beta\) is the \(rth\) term of an AP whose first term is \(a\) and common difference is \(d\). If for some positive integers \(m\) and \(n\), \(m \neq n\), then \(a - d = \frac{1}{m}\) and \(T_n = \frac{1}{n}\) are the terms of the AP.

84. The length of the chord of contact of the tangents drawn from the point \((-2, 3)\) to the circle, \(x^2 + y^2 - 4x - 6y + 12 = 0\) is
\[
k\quad (x - 2)^2 + (y + 3)^2 = 0
\]
and \(\beta\) is the \(rth\) term of an AP whose first term is \(a\) and common difference is \(d\). If for some positive integers \(m\) and \(n\), \(m \neq n\), then \(a - d = \frac{1}{m}\) and \(T_n = \frac{1}{n}\) are the terms of the AP.

85. Tangents are drawn from the points on the line \(-x - y + 3 = 0\) to parabola \(y^2 = 8x\). Then all the chords of contact passes through a fixed point whose coordinates are:
\[
x - y + 3 = 0 \quad \text{and} \quad b \in R.
\]
and \(\beta\) is the \(rth\) term of an AP whose first term is \(a\) and common difference is \(d\). If for some positive integers \(m\) and \(n\), \(m \neq n\), then \(a - d = \frac{1}{m}\) and \(T_n = \frac{1}{n}\) are the terms of the AP.

86. If the midpoint of a chord of the ellipse \(\frac{x^2}{16} + \frac{y^2}{25} = 1\) is \((0, 3)\), then the length of the chord is-
\[
x - y + 3 = 0 \quad \text{and} \quad b \in R.
\]
and \(\beta\) is the \(rth\) term of an AP whose first term is \(a\) and common difference is \(d\). If for some positive integers \(m\) and \(n\), \(m \neq n\), then \(a - d = \frac{1}{m}\) and \(T_n = \frac{1}{n}\) are the terms of the AP.
87. \[ \sum_{r=1}^{18} |2^r - 2^{10}| = \]

(1) 2^{18} - 2^{11} + 2
(2) 2^{20} - 2^{11} + 2^{10} + 2
(3) 17 \cdot 2^{10} + 2
(4) 2^{19} - 2^{11} + 2

88. The number of solutions of \( \sin 2x + \cos 4x = 2 \) in the interval \((0, 2\pi)\) is

अन्तराल \((0, 2\pi)\) में समीकरण \( \sin 2x + \cos 4x = 2 \) के हलों की संख्या है—
(1) 0
(2) 2
(3) 3
(4) 4

89. If all the letters of the word 'QUEST' are arranged in all possible ways and put in dictionary order, then find the rank of the given word.

यदि शब्द 'QUEST' के सभी अक्षरों को लेकर सभी सम्भव तरीकों से विन्यासित कर समस्त विन्यासों को शब्दकोष के अनुसार रखा जाये तो दिये गये शब्द 'QUEST' का शब्दकोष में क्रम होगा—
(1) 36
(2) 43
(3) 42
(4) 44

90. In the figure, AB is a diameter of the circle. TD is a tangent. If \( \angle AHD = 36^\circ \), \( \angle CDT \) is:

वितर में AB वृत्त का व्यास है। जिसमें TD एक स्पर्शरेखा है यदि \( \angle AHD = 36^\circ \) तो \( \angle CDT \) है—

(1) 120°
(2) 116°
(3) 106°
(4) 126°
PART - A (CHEMISTRY) भाग - A (रसायन विज्ञान)

Atomic masses (परमाणु भार): H = 1, D = 2, Li = 7, C = 12,
N = 14, O = 16, F = 19, Na = 23, Mg = 24,
Al = 27, Si = 28, P = 31, S = 32, Cl = 35.5,
K = 39, Ca = 40, Cr = 52, Mn = 55, Fe = 56, Cu = 63.5,
Zn = 65, As = 75, Br = 80, Ag = 108, I = 127, Ba = 137,
Hg = 200, Pb = 207

Straight Objective Type

This section contains 30 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which ONLY ONE is correct.

1. Aniline is a very weak base. Which of the given aniline solution will have highest degree of dissociation.
   (1) 1M aniline
   (2) 0.1 M aniline
   (3) 0.01 M aniline
   (4) 0.02 M aniline

2. The equilibrium constant Kc of the reaction, $A_2(g) + B_2(g)$
   $\rightleftharpoons 2AB(g)$ is $\frac{4}{3}$. If 1 mol of $A_2$ and
   2 mol of $B_2$ are mixed, the amount $AB$ at equilibrium would be:
   (1) $A_2(g)$ + $B_2(g) \rightleftharpoons 2AB(g)$ के लिए सामायिक
   नियमांक $K_c = \frac{4}{3}$ है। यदि $A_2$ का 1 मोल तथा $B_2$ के 2 मोल
   नियमित है, तब सामायिक पर $AB$ की मात्रा होगी –
   (1) 0.25 mol
   (2) 0.30 mol
   (3) 0.40 mol
   (4) 1.00 mol

3. The magnetic moment of $^{25}Mn$ in ionic state is 4.83 B.M, then Mn is in :
   (1) +2 state
   (2) +3 state
   (3) +4 state
   (4) +5 state

4. Iron (Fe) is reacted with steam to produce $H_2$ gas according to the following reaction,
   $a Fe + b H_2O \rightarrow c Fe_3O_4 + dH_2$. The stoichiometric
   coefficients of the reaction is
   (At. wt., Fe = 56, O = 16, H = 1)
   (1) $4, 3, 1, 4$
   (2) $3, 4, 1, 4$
   (3) $1, 4, 2, 3$
   (4) None of these

5. Iron (Fe) निभन अभिक्रिया के अनुसार जल बायो के साथ क्रिया
   करके $H_2$ गैस मुक्त करता है।
   अभिक्रिया Fe + $b H_2O \rightarrow c Fe_3O_4 + dH_2$ का
   रसायनक्रियानिति गुणांक है।
   (परमाणु भार Fe = 56, O = 16, H = 1)
   (1) $4, 3, 1, 4$
   (2) $3, 4, 1, 4$
   (3) $1, 4, 2, 3$
   (4) इनमें से कोई नहीं
5. The protecting power of lyophilic colloidal sol is expressed in terms of :
   (1) Coagulation value
   (2) Gold number
   (3) Critical miscelle concentration
   (4) Oxidation number

   इसके लिए किस रूप में व्यक्त किया जाता है?
   (1) स्कन्दन मान
   (2) गोल्ड संख्या
   (3) क्राँशिक मिससल संदर्भ
   (4) ऑक्सीजेंशन संख्या

6. Precipitate of PbSO₄ is soluble in :
   (1) ammonium acetate (6M)
   (2) dilute HCl
   (3) dilute H₂SO₄
   (4) none

   \[\text{PbSO}_4\] अबेश उल्लासी छोटा है:
   (1) अम्मनियम एसीटेट (6M)
   (2) तेल ह्यूक में
   (3) तेल \(H_2SO_4\) में
   (4) इनमें से कोई नहीं

7. What is the weight of solute present in 2 liters of 0.6 M \(Na_2CO_3\) ?

   0.6 M \(Na_2CO_3\) के 2 लीटर में उपस्थित विलय का भार क्या है?
   (1) 127.2 g
   (2) 106 g
   (3) 212 g
   (4) 53 g

8. Cyanide process is used for the extraction of :
   (1) barium.
   (2) silver.
   (3) boron.
   (4) zinc.

   सायनाइड विधि को किसके निकारक के लिए प्रयुक्त किया जाता है?
   (1) वेरियम |
   (2) सिस्टर |
   (3) बोरियन |
   (4) जिंक |

9. Atomic number of 15, 33, 51 represents the following family :
   (1) carbon family
   (2) nitrogen family
   (3) oxygen family
   (4) None

   परमाणु संख्या 15, 33, 51 निम्न परिवार से सम्बन्धित है?
   (1) कार्बन परिवार
   (2) नाइट्रोजन परिवार
   (3) ऑक्सीजन परिवार
   (4) कोई नहीं

10. A solution of a salt with concentrated \(H_2SO_4\) acid produces violet colour vapours which turns starch paste blue. The salt may be :
   (1) chloride
   (2) nitrate
   (3) bromide
   (4) iodide

   साइड \(H_2SO_4\) अब्ज़ में कार्बन टिलियन बैरनी रंग का यथार्थ उत्पत्ति करता है जो ढांचे पेट को नीला कर देता है।
   लवण हो सकता है?
   (1) कॉलोइड
   (2) नायड़ेर
   (3) ब्रोमाइड
   (4) आयोडाइड

11. Choose the best response for the following. The ionization energy for the chlorine atom is equal in magnitude to the electron affinity for :
   (1) Cl (g) atom
   (2) \(Cl^-\) (g) ion
   (3) \(Cl^+\) (g) ion
   (4) \(F(g)\) atom

   क्लोरिन अतंत्र के क्षितिज ऊर्जा का माप तरल तरल में बराबर होता है?
   (1) \(Cl\) (g) अनि
   (2) \(Cl^-\) (g) आयन
   (3) \(Cl^+\) (g) आयन
   (4) \(F(g)\) परमाणु

12. Which of the following names and formula of complexes, is not correct :
   (1) Tetramminecopper(II) sulphate \([Cu(NH_3)_4]SO_4\)
   (2) Diamminesilver(I) chloride \([Ag(NH_3)_2]Cl\)
   (3) Tetrapotassium hexacyanidoferrate(II) \(K_4[Fe(CN)_6]\)
   (4) Potassium amminepentachloridoplatinate(IV) \(K[PtCl_6]_2\)

   निम्न में किस संकुच का सूत्र तथा नाम को गुलाब, सही नहीं है?
   (1) टेट्राएमीनकॉपर (II) सल्फेट \([Cu(NH_3)_4]SO_4\)
   (2) डाइएमीनसिल्वर (I) क्लोराइड \([Ag(NH_3)_2]Cl\)
   (3) टेट्रापोट्टसियम हेक्सासियनाइडोफरेट (II) \(K_4[Fe(CN)_6]\)
   (4) पोट्सियम एमीन पेंटासियनाइडोप्लाटाइनेट (IV) \(K[PtCl_6]_2\)

13. When haematite ore is burnt in air with coke along with lime at 200°C, the process not only produces steel but also produces an important compound (1), which is useful in making building materials. The compound (1) is

   जब हेमेटाइट अवस्था का 200°C पर वायु में कोक तथा लाम द्वारा अनिवार्य वस्तु को गूँजाना है?
   (1) \(SiO_2\)
   (2) \(CaSO_3\)
   (3) \(FeO\)
   (4) \(Fe_2O_3\)
14. Total volume of atoms present in face-centred cubic unit cell of a metal is \( r \) (atomic radius).

\[
\begin{align*}
V_{\text{total}} &= \frac{20}{3} \pi r^3 \\
V_{\text{total}} &= \frac{24}{3} \pi r^3 \\
V_{\text{total}} &= \frac{12}{3} \pi r^3 \\
V_{\text{total}} &= \frac{16}{3} \pi r^3
\end{align*}
\]

15. Which of the following species should be aromatic by the Hückel rule?

(1) \( \text{F} \)  
(2) \( \text{Cl} \)  
(3) \( \text{N} \)  
(4) \( \text{O} \)

16. An ore of tin containing Fe\(_3\)O\(_4\) is concentrated by:

(1) magnetic separation  
(2) froth flotation  
(3) leaching method  
(4) gravity separation.

Fe\(_3\)O\(_4\) रंगे वाले टिन के एक अवशेष का सादरण निम्न में से किस विधि द्वारा किया जाता है?

(1) न्यूक्लीय पुष्करण विधि  
(2) ग्रांज पत्तन विधि  
(3) निर्यात विधि  
(4) न्यूक्लीय पुष्करण विधि

17. 16 g of oxygen and 3 g of hydrogen are mixed and kept at 760 mm pressure and 0°C. The total volume occupied by the mixture will be nearly

(1) 22.4 l  
(2) 33.6 l  
(3) 448 litre  
(4) 44800 ml

18. Which of the following have the highest electron affinity?

(1) \( \text{F} \)  
(2) \( \text{Cl} \)  
(3) \( \text{N} \)  
(4) \( \text{O} \)

19. The correct order towards bond angle is:

(1) Bond angle does not depend on hybridisation.  
(2) \( \text{sp} < \text{sp}^2 < \text{sp}^3 \)  
(3) \( \text{sp}^2 < \text{sp} < \text{sp}^3 \)  
(4) \( \text{sp}^3 < \text{sp}^2 < \text{sp} \)

20. Which of the following will not show geometrical isomerism in the following?

(1) \([\text{Cr(NH}_3)_4\text{Cl}_2]Cl\)  
(2) \([\text{Co(en)}_2\text{Cl}_2]Cl\)  
(3) \([\text{Co(NH}_3)_5\text{NO}_2]\text{Cl}_2\)  
(4) \([\text{Pt(NH}_3)_2\text{Cl}_2]\)

21. Which of the following compounds is Oxalic acid?

(1) \( \text{CH}_2\text{–COOH} \)  
(2) \( \text{COOH} \)  
(3) \( \text{H}_2\text{C–COOH} \)  
(4) \( \text{CH}_2\text{–COOH} \)

22. Which of the following is correct IUPAC name of Acrolein?

(1) But-2-enal  
(2) Propenal  
(3) Propanal  
(4) Prop-2-yn-1-al

23. The group reagent for the test of alcohols is:

(1) ceric ammonium nitrate  
(2) Schiff’s reagent  
(3) Molisch’s reagent  
(4) bromine water

एक ऐसी विद्युत प्रेरित जल जिसका सही परीक्षण के लिए निम्न में से किस समूह अभिकर्मक का उपयोग किया जाता है?

(1) सेरिक अभिकर्मक नाइट्रेट  
(2) शिफ्ट अभिकर्मक  
(3) मोलिश अभिकर्मक  
(4) ब्रोमिन जल
24. The IUPAC name of the following is :

\[ \text{CH}_3\text{CH} = \text{CH} - \text{CH}_2 - \text{CH} - \text{CH}_2\text{COOH} \]

(1) 3-Aminohept-5-enoic acid
(2) 5-Aminohex-2-carboxylic acid
(3) 3-Aminohept-4-enoic acid
(4) 5-Aminohex-2-enoic acid

निम्न का IUPAC नाम हैः

\[ \text{CH}_3\text{CH} = \text{CH} - \text{CH}_2 - \text{CH} - \text{CH}_2\text{COOH} \]

(1) 3-एमिनोहेट-5-एनोइड अम्ल
(2) 5-एमिनोहेट-2-एनकाइनिक अम्ल
(3) 3-एमिनोहेट-4-एनोइड अम्ल
(4) 5-एमिनोहेट-2-एनोइड अम्ल

25. The product of following reaction is :

\[ \text{CH}_3\text{CH}_2\text{CH}_2\text{CHCl} \xrightarrow{\text{Benzene}} \xrightarrow{\text{AlCl}_3} (P) \]

(1) Toluene
(2) o-xylene
(3) propylbenzene
(4) cumene (isopropylbenzene)

निम्न अभिक्रिया का उत्तर हैः

\[ \text{CH}_3\text{CH}_2\text{CH}_2\text{CHCl} \xrightarrow{\text{केंजीन}} \xrightarrow{\text{AlCl}_3} (P) \]

(1) टेलर्बुयन
(2) o-जाइलीन
(3) प्रोपिलबेक्जीन
(4) क्षेत्रीय (आइसोप्रोपिलबेक्जीन)

26. Among the following the one that gives positive iodoform test upon reaction with \( \text{I}_2 \) and \( \text{NaOH} \) is

\( \text{I}_2 \) तथा \( \text{NaOH} \) के साथ अभिक्रिया पर निम्न में से कौन सा धनात्मक धारालक आपसीयों में परीक्षण देना?

(1) \( \text{CH}_3\text{CH}_2\text{CH(OH)}\text{CH}_2\text{CH}_3 \)
(2) \( \text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{OH} \)
(3) \( \text{CH}_2 - \text{CH} - \text{CH}_3 \)
(4) \( \text{PhCOCH}_3 \)

27. \( \text{R—COOAg} + \text{Br}_2 \xrightarrow{\text{CCl}_4} \text{R—Br} + \text{CO}_2 + \text{AgBr} \)

Above reaction is known as

(1) Hunsdiecker reaction
(2) Perkin reaction
(3) Cannizzaro's reaction
(4) Clemmensen's reaction

\( \text{R—COOAg} + \text{Br}_2 \xrightarrow{\text{CCl}_4} \text{R—Br} + \text{CO}_2 + \text{AgBr} \)

उपरोक्त अभिक्रिया कहलाती हैः

(1) हूंस्टीकर अभिक्रिया
(2) पर्किन अभिक्रिया
(3) आंसियारो अभिक्रिया
(4) क्लेमसन्स अभिक्रिया

28. Which alkyl bromide produces a single alkene when it reacts with sodium ethoxide and ethanol. This alkene undergoes hydrogenation and produces 2-methylbutane.

(1) 1-Bromo-2-methylbutane
(2) 2-Bromo-3-methylbutane
(3) 1-Bromo-2, 2-dimethylpropane
(4) 2-Bromo-2-methylbutane

कौन सा एमिल ब्रोमाइड नाइट्राइट एथाल्याइड एन्ड ऐथिलीन से क्रिया करने पर कंसल एक ही एल्कीन है तथा यह एल्कीन एक्साइड करके 2-मेथील बुटेन हैः

(1) 1-ब्रोमी-2-मेथिलमेथेन
(2) 2-ब्रोमी-3-मेथिलमेथेन
(3) 1-ब्रोमी-2, 2-डाइमेथिललिपेन
(4) 2-ब्रोमी-2-मेथिलमेथेन

29. Which of the following can be oxidised to ketone?

(1) 1-butyl alcohol
(2) 2-butanol
(3) 1-butanol
(4) 2-Propanol

निम्न में से कौन कॉटोल में ऑक्सीड आये हो सकता हैः

(1) 1-बटील सिक्सोलिन
(2) 2-बटीनल
(3) 1-बटीनल
(4) 2-बोपेनल

30. Which of the following compound having three carbon atoms in its main chain in IUPAC nomenclature?

(1) Lactic acid
(2) Acetic acid
(3) Crotonic acid
(4) Oxalic acid

निम्न में से कौन सा धनात्मक IUPAC नामाकरण में इसकी मुख्य शृंखला में तीन कार्बन प्रमाण रखता हैः

(1) लेटिक्स एम्स्ट्रीक अम्ल
(2) एसीटिक अम्ल
(3) क्रोटोनिक अम्ल
(4) ऑक्सिक अम्ल
31. A prism having an apex angle of 4° and refractive index of 1.50 is located in front of a vertical plane mirror as shown. A horizontal ray of light is incident on the prism. The total angle through which the ray is deviated is:

(1) 4° clockwise
(2) 178° clockwise
(3) 2° clockwise
(4) 8° clockwise

32. Electric potential due to a dipole at a position \( \mathbf{r} \) from its centre is:

\[
\text{where } K = \frac{1}{4\pi \epsilon_0}
\]

\[
\text{A dipole } \mathbf{p} \text{ is located at the centre.}
\]

\[
K = \frac{4\pi \epsilon_0}{r^3}
\]

\[
\mathbf{K} = \frac{\mathbf{K} \cdot \mathbf{p} \cdot \mathbf{r}}{r^3}
\]

\[
\mathbf{K} = \frac{\mathbf{K} \cdot \mathbf{p} \cdot \mathbf{r}}{r^3}
\]

33. A thin equiconvex lens is made up of four different materials. The number of images of the object 'O' lying on the principle axis formed by paraxial rays is /are:

(1) 1
(2) 2
(3) 3
(4) 4

34. In a practical Wheatstone bridge circuit as shown, when one more resistance of 100 \( \Omega \) is connected in parallel with unknown resistance \( 'x' \), then ratio \( \frac{\rho_1 \rho_2}{\rho_1} \) becomes 2. \( \rho_1 \) is balance length. AB is a uniform wire. Then value of \( 'x' \) must be:

(1) 5 m/s
(2) 100 m/s
(3) 200 m/s
(4) 400 m/s

35. A bird is flying up with speed 5 m/s at an angle \( \sin^{-1}(3/5) \) with the horizontal. A fish in a pond looks at that bird when it is vertically above the fish. The speed at which the bird appears to fly (to the fish) is:

(1) 5 m/s
(2) 3\( \sqrt{2} \) m/s
(3) 4\( \sqrt{2} \) m/s
(4) None of these

36. The focal lengths of the objective & the eyepiece of a compound microscope are 1 cm & 5 cm respectively. An object placed at a distance of 1.1 cm from the objective has its final image formed at 25 cm from the eye piece. Find out magnitude of magnified power of compound microscope:

(1) 61
(2) 60
(3) 40
(4) 50

37. The magnetic flux density at a point distant \( d \) from a long straight current carrying conductor is \( B \), then its value at distance \( \frac{d}{2} \) will be:

(1) 4B
(2) 2B
(3) 2
(4) 4
38. The critical angle of light going from medium A to medium B is $\theta$. The speed of light in medium A is v. The speed of light in medium B is:

$$\frac{v}{\sin \theta}$$

39. Two point charges $q_1$ and $q_2$ whose magnitudes are different are positioned at certain distance from each other with $q_1$ at origin, and graph is drawn between electric field strength and distance $x$ from $q_2$. $E$ is taken positive if it is along the line joining from $q_1$ to $q_2$.

- (1) $q_1$ is negative, $q_2$ is positive
- (2) magnitude of $q_1$ is smaller than $q_2$
- (3) magnitude of $q_2$ is smaller than $q_1$
- (4) None of these

40. An unnumbered wall clock shows time 04: 25: 37, where 1st term represents hours, 2nd represents minutes and the last term represents seconds. What time will its image in a plane mirror show.

- (1) 08: 35: 23
- (2) 07: 35: 23
- (3) 03: 34: 23
- (4) None of these

41. A point object is kept in front of a plane mirror. The plane mirror is performing SHM of amplitude 2 cm. The plane mirror moves along the x-axis and x-axis is normal to the mirror. The amplitude of the mirror is such that the object is always infront of the mirror. The amplitude of SHM of the image is:

- (1) zero
- (2) 2 cm
- (3) 4 cm
- (4) 1 cm

42. If the electric potential of the inner shell is 10 volt & that of the outer shell is 5 volt, then the potential at the centre will be:

- (1) 10 volt
- (2) 5 volt
- (3) 15 volt
- (4) 0

43. Potential difference between centre and the surface of sphere of radius R and having uniform volume charge density $\rho$ within it will be:

- (1) $\frac{\rho R^2}{6\varepsilon_0}$
- (2) $\frac{\rho R^2}{4\varepsilon_0}$
- (3) 0
- (4) $\frac{\rho R^2}{2\varepsilon_0}$

44. Four charges (+q and two –q) are placed at the corners of square of edge length ‘a’ as shown in figure. Find the electric potential energy of the system.

$$\text{Potential energy} = \frac{1}{4\varepsilon_0} \frac{kq^2}{a} \left(\sqrt{2} - 4\right)$$

45. A coil of inductance 5.0 mH and negligible resistance is connected to an alternating voltage $V = 10 \sin (100 t)$. The peak current in the circuit will be:

- 5.0 mH
- 10 mH
- 100 mH
- 1000 mH

46. An ideal coil of 10 henry is joined in series with a resistance of 5 ohm and a battery of 5 volt. 2 seconds after joining, the current flowing in amperes in the circuit will be:

- 10 amp
- 20 amp
- 30 amp
- 40 amp

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47. A rectangular loop carrying a current I is situated near a long straight wire such that the wire is parallel to the one of the sides of the loop and is in the plane of the loop. If a steady current I is established in wire as shown in figure, the loop will- 
(1) Rotate about an axis parallel to the wire
(2) Move away from the wire or towards right
(3) Move towards the wire
(4) Remain stationary

48. The peak value of an alternating e.m.f E given by E = E_o cos \(\omega t\) is 10 volt and frequency is 50 Hz. At time t = (1/600) sec, the instantaneous value of e.m.f is : 
(a) 10 volt
(b) 5 \(\sqrt{3}\) volt
(c) 5 volt
(d) 1 volt

49. If the frequency of the source e.m.f. in an AC circuit is n, the power varies with a frequency : 
(1) n
(2) 2 n
(3) n/2
(4) zero

50. A circular current carrying coil has a radius R. The distance from the centre of the coil on the axis where the magnetic induction will be 1/8th to its value at the centre of the coil is -
(1) \(R/\sqrt{3}\)
(2) \(R/\sqrt{3}\)
(3) \(2R/\sqrt{3}\)
(4) \(2R/\sqrt{3}\)

51. The average power delivered to a series AC circuit is given by (symbols have their usual meaning) : 
(1) \(E_m I_m\)
(2) \(E_m I_m \cos \phi\)
(3) \(E_m I_m \sin \phi\)
(4) zero

52. A convex lens forms a real image 9 cm long on a screen. Without altering the position of the object and the screen, the lens is displaced and we get again a real image 4 cm long on the screen. Then the length of the object is- 
(1) 9 cm
(2) 4 cm
(3) 6 cm
(4) 36 cm

53. Energy dissipates in LCR circuit in : 
(1) L only
(2) C only
(3) R only
(4) all of these

54. Potential difference between the points P and Q in the electric circuit shown is -
(a) 4.5 V
(b) 2.4 V
(c) 2.88 V

55. Two similar very small conducting spheres having charges 40 \(\mu\)C and -20 \(\mu\)C are some distance apart. Now they are touched and kept at same distance. The ratio of the initial to the final force between them is : 
(1) 8 : 1
(2) 4 : 1
(3) 1 : 8
(4) 1 : 1

56. A capacitor of 6 \(\mu\)F is charged to such an extent that the potential difference between the plates becomes 50 V. The work done in this process will be 
(1) 7.5 \times 10^{-2} J
(2) 7.5 \times 10^{-3} J
(3) 3 \times 10^{-6} J
(4) 3 \times 10^{-3} J

57. The capacitance of a spherical conductor is proportional to the radius of the charged sphere. The capacitance of the same conductor will be increased if we multiply the radius by : 
(1) \(C \propto R^2\)
(2) \(C \propto R\)
(3) \(C \propto R^0\)
(4) \(C \propto R^{-1}\)
58. Two waves of intensities I and 4I produce interference. Then the intensity act constructive and destructive interference respectively is:
(1) 2I, 8I
(2) I, 3I
(3) 3I, 5I
(4) 9I, I

59. The potential of earth is zero because it is
(1) uncharged
(2) an object of zero capacitance
(3) net charge is very small but radius is very large
(4) having infinite charge

60. A capacitor of capacitance 10μF is charged to a potential of 100 V. Now connecting it in parallel with an uncharged capacitor, the resultant potential difference becomes 40 volt. The capacitance of this capacitor is
10μF
2.5μF
5μF
10μF

62. The 8th term of the sequence is
\[ \frac{2}{\sqrt{5}}, \frac{3}{5}, \frac{4}{5\sqrt{5}}, \frac{5}{25} \]
\[ \text{An} \quad \frac{2}{\sqrt{5}}, \frac{3}{5}, \frac{4}{5\sqrt{5}}, \frac{5}{25} \]
\[ \text{The} \quad \frac{8}{625}, \frac{8}{125\sqrt{5}} \]
\[ \text{Value of } \theta \text{ so that } A = B, \text{ is} \]
\[ \text{Value of } \theta \text{ so that } A = B, \text{ is} \]
\[ (1) 2n\pi + \frac{\pi}{4} \quad (2) 2n\pi - \frac{\pi}{4} \]
\[ (3) (2n + 1) \pi - \frac{\pi}{4} \quad (4) (2n + 1) \pi + \frac{\pi}{4} \]

63. Let \( A = \begin{bmatrix} \sin\theta & 1/\sqrt{2} \\ -1/\sqrt{2} & \cos\theta \end{bmatrix} \) & \( B = \begin{bmatrix} 1/\sqrt{2} & \sin\theta \\ \cos\theta & \cos\theta \end{bmatrix} \). The

\[ \text{Value of } \theta \text{ so that } A = B, \text{ is} \]
\[ \text{Value of } \theta \text{ so that } A = B, \text{ is} \]
\[ (1) 2n\pi + \frac{\pi}{4} \quad (2) 2n\pi - \frac{\pi}{4} \]
\[ (3) (2n + 1) \pi - \frac{\pi}{4} \quad (4) (2n + 1) \pi + \frac{\pi}{4} \]

64. The system of linear equations \( x + y - z = 6, x + 2y - 3z = 14 \) and \( 2x + 5y - \lambda z = 9 (\lambda \in R) \) has a unique solution if \( \lambda \neq 7 \). The solution is
\[ (1) \lambda = 8 \quad (2) \lambda \neq 8 \]
\[ (3) \lambda = 8 \quad (4) \lambda \neq 7 \]

65. The ratio of the greatest value of \( 2 - \cos x + \sin^2 x \) to its least value is
\( 2 - \cos x + \sin^2 x \) to its least value is
\[ \frac{7}{4} \quad \frac{9}{4} \]
\[ \frac{13}{4} \quad \frac{5}{4} \]

66. The set \( A = \{ x : x \in R, x^2 = 16 \text{ and } 2x = 6 \} \) is
\( \{ x : x \in R, x^2 = 16 \text{ and } 2x = 6 \} \)
\[ (1) \text{Null set} \quad (2) \text{Singleton set} \]
\[ (3) \text{Infinite set} \quad (4) \text{None of these} \]
\[ \text{Singleton set} \quad \text{Set of all elements of set } A \text{ satisfying the given condition} \]
\[ (1) \text{Singleton set} \quad (2) \text{A subset of set } A \text{ satisfying the given condition} \]
\[ (3) \text{A subset of set } A \text{ satisfying the given condition} \quad (4) \text{None of these} \]
67. In an upper triangular matrix $A = [a_{ij}]_{n \times n}$, the elements $a_{ij} = 0$ for

(1) $i < j$
(2) $i = j$
(3) $i > j$
(4) $i \leq j$

एक उपरी दीagonal भाग में $A = [a_{ij}]_{n \times n}$, अवयव $a_{ij} = 0$ होता है —

(1) $i < j$ के लिये
(2) $i = j$ के लिये
(3) $i > j$ के लिये
(4) $i \leq j$ के लिये

68. If $\int e^{2x} \cos 4x \, dx = e^{2x} (A \sin 4x + B \cos 4x) + C$ then:

यदि $\int e^{2x} \cos 4x \, dx = e^{2x} (A \sin 4x + B \cos 4x) + C$ हो, तो —

(1) $A = 3B$
(2) $2A = 3B$
(3) $3A = 4B$
(4) $4A + 3B = 2$

69. The order and degree of the differential equation

$$\left(1 + 3 \frac{dy}{dx}\right)^{2/3} = 4 \frac{d^3y}{dx^3}$$

अवकल समीकरण $\left(1 + 3 \frac{dy}{dx}\right)^{2/3} = 4 \frac{d^3y}{dx^3}$ की ओरों पात है —

(1) $\left(1, \frac{2}{3}\right)$
(2) $(3, 1)$
(3) $(3, 3)$
(4) $(1, 2)$

70. $\lim_{x \to \infty} \left(\frac{x-3}{x+2}\right)^x, x \in \mathbb{R}$, is equal to

$\lim_{x \to \infty} \left(\frac{x-3}{x+2}\right)^x$ का मान होगा—

(1) $\infty$
(2) $e$
(3) $e^3$
(4) $e^9$

71. $\int_{0}^{10\pi} |\sin x| \, dx$ is equal to

$\int_{0}^{10\pi} |\sin x| \, dx$ का मान है—

(1) 20
(2) 8
(3) 10
(4) 18

72. If $x^2 = e^x - y$, then $\frac{dy}{dx}$ is—

$$\frac{1 + x}{1 + \log x}$$

(1) $\frac{1 + x}{1 + \log x}$
(2) $\frac{1 - \log x}{1 + \log x}$
(3) not defined
(4) $\frac{\log x}{(1 + \log x)^2}$

यदि $x^2 = e^x - y$ हो तो $\frac{dy}{dx}$ है —

(1) $\frac{1 + x}{1 + \log x}$
(2) $\frac{1 - \log x}{1 + \log x}$
(3) $\frac{\log x}{(1 + \log x)^2}$
(4) $\frac{1 + x}{1 + \log x}$

73. $\int \frac{dx}{x(x^n + 1)}$ is equal to-

(1) $\frac{1}{n} \log \left|\frac{x^n}{x^n + 1}\right| + c$
(2) $\frac{1}{n} \log \left|\frac{x^{n+1}}{x^n + 1}\right| + c$
(3) $\frac{1}{n} \log \left|\frac{x^n + 1}{x^n}\right| + c$
(4) None of these

74. The area bounded by the curve $y = x^3 - 4x$ and x-axis is

(1) 4
(2) 8
(3) 16
(4) none of these

वक्र $y = x^3 - 4x$ तथा x-अक्ष से परिक्रमित क्षेत्रफल है—

(1) 4
(2) 8
(3) 16
(4) none of these

75. If the function $f(x) = 2x^2 - 9ax^2 + 12ax + 1$, where $a > 0$, attains its maximum and minimum at $p$ and $q$ respectively such that $p^2 = q^2$ then $a$ equals

यदि $f(x) = 2x^2 - 9ax^2 + 12ax + 1$, जहाँ $a > 0$ इसके अधिकतम तथा न्यूनतम मान $p$ तथा $q$ पर इस तरह प्रदश्य करता है कि $p^2 = q^2$ तब $a$ बराबर है—

(1) 3
(2) 1
(3) 2
(4) 1/2

76. Let $U = i + j$, $V = i - j$ and $W = i + 2j + 3k$. If $\hat{n}$ is a unit vector such that $U \cdot \hat{n} = 0$ and $V \cdot \hat{n} = 0$, then $W \cdot \hat{n}$ is equal to-

$\hat{n}$ माना $U = i + j$, $V = i - j$ तथा $W = i + 2j + 3k$. यदि $\hat{n}$

एक ईकाई सदिश है तो $\hat{n}$ का प्रकाश है कि $U \cdot \hat{n} = 0$ तथा

(1) 0
(2) 1
(3) 2
(4) 3

$V \cdot \hat{n} = 0$, तो $W \cdot \hat{n}$ बराबर है —

(1) 0
(2) 1
(3) 2
(4) 3
77. In an experiment with 15 observations on $x$, the following results were available: $\Sigma x^2 = 2830$, $\Sigma x = 170$. One observation that was 20 was found to be wrong and was replaced by the correct value 30. Then the corrected variance is calculated. If $x$ has a normal distribution with mean $\mu$ and variance $\sigma^2$, then $\mu = 77$ and $\sigma^2 = 0.07$. None of these are correct. R – {2}

81. The solution of the equation $\frac{d^2y}{dx^2} = e^{-2x}$ is

\[\begin{align*}
(1) & \quad e^{-2x} \\
(2) & \quad \frac{e^{-2x}}{4} + cx + d \\
(3) & \quad \frac{1}{4} e^{-2x} + cx^2 + d \\
(4) & \quad \frac{1}{4} e^{-2x} + c + d
\end{align*}\]

82. The range of the function $f(x) = \frac{2 + x}{2 - x}$, $x \neq 2$ is

\[\begin{align*}
(1) & \quad R \\
(2) & \quad R - \{1\} \\
(3) & \quad R - \{1\} \\
(4) & \quad R - \{2\}
\end{align*}\]

83. The area bounded by the curve $y = 2x - x^2$ and the straight line $y = x$ is given by

\[\begin{align*}
(1) & \quad \frac{9}{2} \text{ sq unit} \\
(2) & \quad \frac{43}{6} \text{ sq unit} \\
(3) & \quad \frac{35}{6} \text{ sq unit} \\
(4) & \quad \text{None of these}
\end{align*}\]
86. If \( z \) and \( \omega \) are two non-zero complex numbers such that 
\[ |z\omega| = 1, \text{ and } \arg(z) - \arg(\omega) = \frac{\pi}{2}, \]
then \( z\omega \) is equal to

(1) \( 1 \)  
(2) \( -1 \)  
(3) \( i \)  
(4) \( -i \)

87. If \( x = e^{y+e^{y+\ldots}} , x > 0 \) then 
\[ \frac{dy}{dx} \]
is 

(1) \( \frac{1}{x} \)  
(2) \( \frac{x}{1+x} \)  
(3) \( \frac{1-x}{x} \)  
(4) \( \frac{1+x}{x} \)

88. The probability that A speaks truth is \( \frac{4}{5} \) while this probability for B is \( \frac{3}{4} \). The probability that they contradict each other when asked to speak on a fact, is

A के सत्य बोलने की प्रायिकता \( \frac{4}{5} \) है जबकि B के सत्य बोलने की प्रायिकता \( \frac{3}{4} \) है तो एक घटना पर उनके परस्पर विरोध की प्रायिकता है—

(1) \( \frac{3}{20} \)  
(2) \( \frac{1}{5} \)  
(3) \( \frac{7}{20} \)  
(4) \( \frac{4}{5} \)

89. Let \( \alpha \) and \( \beta \) be the distinct roots of \( ax^2 + bx + c = 0 \), then

\[ \lim_{x \to \alpha} \frac{1 - \cos(ax^2 + bx + c)}{(x - \alpha)^2} \]
is equal to :

माना \( \alpha \) तथा \( \beta \) समीकरण \( ax^2 + bx + c = 0 \) के भिन्न-भिन्न मूल हैं, तो

\[ \lim_{x \to \alpha} \frac{1 - \cos(ax^2 + bx + c)}{(x - \alpha)^2} \]
का मान है—

(1) \( \frac{1}{2} (\alpha - \beta)^2 \)  
(2) \( -\frac{a^2}{2} (\alpha - \beta)^2 \)  
(3) \( 0 \)  
(4) \( \frac{a^2}{2} (\alpha - \beta)^2 \)

90. For any vector \( \vec{a} \), the value of \( \vec{a} \times \hat{i} + (\vec{a} \times \hat{j})^2 + (\vec{a} \times \hat{k})^2 \)
is equal to—

किसी सदिश \( \vec{a} \) के लिए \( \vec{a} \times \hat{i} + (\vec{a} \times \hat{j})^2 + (\vec{a} \times \hat{k})^2 \) का मान है—

(1) \( 4 \vec{a} \)  
(2) \( 2 \vec{a} \)  
(3) \( \vec{a} \)  
(4) \( 3 \vec{a} \)
Have you appearing in NTSE STAGE-I in 2017

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