Shiv Chhatrapati Shikshan Sanstha's

# RAJARSHI SHAHU MAHAVIDYALAYA

## LATUR ( JUNIOR SCIENCE )

# Rajarshi Shahu Screening Test

# परिशिष्ट 'ब'

# SYLLABUS - PCM GROUP

# EXAM DATE

# 23 MARCH, 2025

# Mathematics

1. **Number Theory :** Real Numbers, Prime numbers, co-prime, relatively prime numbers, H. C. F. and L. C. M

2. **Linear Equations :** One variable linear equation, Two variable linear equation and geometrical interpretation.

3. **Polynomials :** Zeros and roots of polynomial, geometrical meaning of roots, Remainder theorem, Factor theorem, Division of polynomial, Factorisation

4. **Expansion formulae :** Algebric identities $(x \pm y)^2 = x^2 \pm 2xy + y^2$

   $(x+y+z)^2 = x^2 + y^2+z^2+2xy+2yz+2zx$ $\quad$ $(x \pm y)^3 = x^3 \pm y^3 \pm 3xy\,(x \pm y)$

   $x^3 \pm y^3 = (x \pm y)(x^2 \mp xy + y^2)$ $\quad$ $x^3 + y^3 + z^3 - 3xyz = (x + y + z)\,(x^2 + y^2 + z^2 - xy - yz - zx)$

5. **Quadratic Equations :** Nature of Roots, Solution of Equations, Solution by factorisation, Relation between roots & coefficients of the equation, Cubic equations and its roots.

6. **Rationalization and Simplification** of the type

   $\frac{1}{a+b\sqrt{x}}$ and $\frac{1}{\sqrt{x}+\sqrt{y}}$, $\sqrt{x+\sqrt{ax-b}}, \sqrt{x-\sqrt{ax-b}}$

7. **Exponents & Powers :** Square & Square root, Cube & cube roots, Indices & Surds

   $a^m \times a^m = a^{m+n}$, $a^m \div a^n = a^{m-n}$, $(a^m)^n = a^{mn}$ etc.

8. **Ratio & Proportion :** Properties of ratio, Proportionality. Componendo, dividendo, alternendo, invertendo, properties and their combination.

9. **Arithmetic progression :** Progression, $n^{th}$ term of A.P. , Sum of $n^{th}$ term of an A.P., Geometric progression (G.P.) $n^{th}$ term of G.P. & sum of $n^{th}$ term of G.P., Harmonic progression & its $n^{th}$ term.

10. **Plane Geometry :** Lines and Angles, Polygons, Triangles, congruency of triangles (SSS, SAS, AAS and RHS), similarity of triangles (SSS, SAS, AA). Mid-point theorem and its converse, equal intercept theroem, Pythagoras theorem. Apollonius theorem.

    - Quadrilaterals - Its types, cyclic quadrilaterals and its properties,

    - Parallel lines - Perpendicular lines, Intersecting lines & properties.

    - Circles - Definition of circle in terms of locus. Its angle/arc properties, chord properties, cyclic properties, tangent, normal & secant properties.

11. **Trigonometry :** Trigonometric ratios, Values of trigonometric ratio, Trigonometric identities, Complimentary and Supplimentry angles, Heights & Distances.

12. **Mensuration** : Area & perimeter of triangle (Heron's formula), area and circumference of circle, area of sector of circle.

    Area (Surface area & total surface and curved surface area) Volume of 3D solids and figures - Cube, Cuboids, right circular Cylinder, right circular Cone, Sphere.

13. **Coordinate Geometry :** Distance Formula, Section formula, Area of triangle & collinearity , - Slope/ Gradient / tan $\theta$ of line, where $\theta$ is angle made by line with positive x-axis.

- Equation of line. Slope - Intercept form y = mx + c. Two point form $(y-y_1) = m(x-x_1)$.

- Geometric understanding of x-intercept & y-intercept and gradients.

- Conditions for two lines to be parallel or perpendicular.

14. **Probability :** Random experiments, sample space, events, Classical definition of probability, Problems on dice, coin and playing card etc.

15. **Statistics :** Types of data set , random, grouped and ungrouped data.

- Measure of central tendency, Mean, Mode, Median, Emperical relation between mean, median, mode

16. **Discount & commission :** Profit & loss, Simple interest, Compound interest, Percentage calculation.

17. **Logarithmic and exponential function** : Defination, relation between logarithm and exponential function. Properties of logarithm.

18. **Basic curves** - of polynomials - linear, quadratic expression, logarithmic and exponetial function.

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## BASIC MATHEMATICS AND QUANTITATIVE APTITUDE AND REASONING

1. Number system, HCF and LCM, Square and Square root, Cube and Cube root, Average, Ratios and Proportion, Partnership.
2. Algebric Identities : Expansion of $(A+B)^2$, $(A-B)^2$, $(A+B)^3$, $(A-B)^3$, $A^3-B^3$, $A^3+B^3$ & $(A+B+C)^2$
3. Discount and percentage : Profit & Loss ( Percentage based )
4. Logarithms : Defination, Properties of logarithms.
5. Time & Work, Time, Speed and Distance, Problems on trains, Boats and Streams.
6. Arithmetic Progression and geomatric progression.
7. Mensuration Surface areas & volumes.
8. Trigonometric ratios of standard angles, its application.
9. Plane geometry : ( Concept of line & angle, triangle, quadrilaterals and circle )
10. Co-ordinate geometry : Graph of line ( co-ordinate system) , Collinear points.
11. Probability, Permutation and combination.
12. S.I.Units & symbols.
13. Basic knowledge of vector : Vector quantities, Direction of vector, type of vector.

### REASONING

1. Syllogism reasoning.
2. Data sufficiency - Blood relation, Order and Ranking, Clock, Calender, Direction sence test, Distance, Coding Decoding, Seating arrangement.
3. Counting figure, Cube and Dice.
4. Venn diagram reasoning.

# Physics

1. **Motion in One Dimension :** Motion of an Object, Displacement & Distance, Speed & Velocity, Uniform & Non-uniform Linear motion, Acceleration (+ ve, - ve & Zero acceleration), Effects of speed & direction on Velocity due to acceleration, Distance-Time graph (Uniform & Non-uniform motion), VelocityTime graph (Uniform Motion & Uniformly Accelerated Motion). Equation of motion using graphical method, Kinematical Equations , Free fall.
2. **Laws of Motion :** Contact & Non contact forces, Balanced & unbalanced forces , Newton's First, Second & Third law of motion & their applications, Momentum & Law of Conservation of Momentum. Pressure - atmospheric pressure ( **NCERT 8th** )
3. **Work, Energy & Power :** Work done by constant force, Mechanical Energy (Kinetic energy & its expression, Potential energy & its expression & their Applications), Law of conservation of energy, Power.
4. **Gravitation:** Newton's universal law of gravitation, Acceleration due to gravity, Variation of acceleration due to gravity with height from surface of earth.
5. **Fluid Mechanics:** Pressure on solids & Liquids, Buoyancy, Archimedes Principle, Flotation.
6. **Sound:** Production of sound, Propagation of sound in medium, Frequency of sound waves, Velocity of sounds in different media, Reflection of sound, Applications of reflection of sounds (SONAR, Sound Board), Ultrasound & it's Application for detecting defects.
7. **Heat : ( State Board 8th, 10th )** Heat & Temperature, Thermometer, Specific heat & calorimeter, effects of heat (Expansion of solids, Liquids & Gases- General Idea Only), Latent heat, Anomalous behavior of water, Heat Capacity & Specific heat capacity.
8. **Current Electricity :** Current electricity, Electric cells , Combination of cells, Potential & potential difference, Free electron & Electric current, Resistance & Ohm's law, Graphs of Current V/s Voltage, Resistivity, Conductors & Insulators, Electric symbols, Resistor in series & parallel, Current Null Point , Electric Circuits, Electric Power
9. **Effects of Electric Current:** Magnetic effect of electric current & their activities( straight conductor, circular loop, solenoid), Force on current carrying conductor due to Magnetic Field, Heating Effects of Electric current.
10. **Light :** Mirrors (Reflection): Laws of Reflection & Their Activities, Regular & irregular reflection, Multiple reflections, Mirror & types of mirror, Spherical mirrors & images formed by them, Magnification due to spherical mirrors.
11. **Lens (Refraction) :** Refraction of light, Laws of refraction, Refractive index, Dispersion of light, Lenses, Ray diagram of refracted light, Sign convention, Working of human eye & lens, Defects of vision and their correction, use of lens.
12. Units and Physical quantities , conversion of units

# Chemistry

1. **Inside the atom :** Charged particle in matter , Types of substances, Dalton's atomic theory, Thomson's Plum pudding model of atom, Rutherford's nuclear model of atom and scatterring experiment, Bhor's atomic model, Drawbacks of Dalton's atomic theory, Thomson's Plum pudding model, Rutherford's Nuclear model, Subatomic particles (electron, proton, neutron), Atomic numeber, mass number, isotopes and isobars, valency , Electronic configuration of elements, Nuclear reactor.

2. **Composition of Matter :** Characteristics of states of matter, evaporation, Types of elements, types of compounds, solution and concentration of solution, types of mixture, true and colloidal solution molecular formula and valency, dot and cross formula for writing chemical formula.

3. **Metals and Nonmetals :** Physical properties of metals and non metals , chemical properties of metals and non metals , Uses of metals and non metals

4. **Pollution :** Pollutants, Air Pollution, Green house effect, Acid rains, Water pollution, Prevention and control of pollution, soil pollution.

5. **Acids bases and salts :** Introduction, Indicator, Effects of acid and bases on litmus paper, properties of acids and bases and neutratization.

   Arrhenius theory of acids and bases, Concept of Bronsted acid and base, Lewis acids and bases, classification of acids and bases, concentration of acids and bases, pH of solution, universal indicator, Reaction of acids and bases with metals metal oxides, Carbonates and bicarbonates, Types of Salts, Crystallisation of water, Electrical conductivity of ionic compounds Electrolysis of water.

6. **Chemical Change and Chemical bond :** Introduction, Natural and manmade chemical changes, Ionic bond, Covalent bond, Co-ordinate bond , valency and lone pair of electron.

7. **Substances in common use :** Importance of salts in daily life, NaCl, $NaHCO_3$, $Na_2CO_3$, $CaOCl_2$, $Na_2CO_3$, POP ( their preparation and reaction )

   Nature of radioactive radiation, Characteristics of $\alpha$, $\beta$, $\gamma$ rays. , Uses of radioactive isotopes, Some chemical substances in day to day life., Food colours and essences, Dye, Artifical Colours, Deodrant, Teflon, Powder Coating, Anodizing, Ceramic and Porcelain.

8. **Chemical Reaction and equations :** Chemical reaction, Combination, Decomposition, Displacement, Double Displacement, Chemical Equation and balancing of chemical equation, Types of Chemical reactions, Exothermic and endothermic reactions, Factors affecting the rate of chemical reactions, Oxidation and reduction, Oxidation number, oxidising agent and reducing agent, Corrosion and Rancidity.

9. **Metallurgy :** Reactivity series of metals, Ionic Compounds and Properties of ionic compounds , Basic Principles of Metallurgy, Conc of Ores, Gravitation Method, Magnetic Separation Method, Froth Floatation Method, Leaching. Roasting and calcination.

   Extraction of reactive Metals, Moderately Reactive metals, Extraction of less reactive Metals, Extraction of Aluminium , Refining of Metals, Corrosion and Preventions of Corrosion. Different ores of iron , copper and aluminium.

10. **Periodic Classification of elements :** Classification elements, Dobereiner's Triads, Newland's Law of Octaves, Mendeleev's Periodic table, Merits and demerits, Modern Periodic table and its structure, Groups, Periods and electronic configurations, Periodic trends in the modern periodic table, Valency, Atomic size, Ionic size, Metallic and Non metallic nature, Ionisation energy, Electronegativity.

11. **Study of Gas Laws :** Properties Of Gases, Liquids And Solids, Boyle'S Law, Charle'S Law, Gas Equation, Absolute Zero Temperature, Standard Temperature, Pressure, N.T.P. And S.T.P. Dalton's law of partial pressure, Diffusion and Effusion of gases, Comparision study of ideal gas and real gas.

12. **Measurement of Matter ( Mole Concept ) :** Laws Of Chemical Combination, Law of conservation of mass, Atom - Shape, Mass, Valency, Molecular Mass, Atomic Mass, Formula Mass, Radicals, Ions, Mole Concept - Avogadro's Number, Calculation Of Moles, Mass, Atoms, No. Of Particles, Relation of mole with mass, number & volume.

13. **Carbon Compounds** : Valency, Catenation Of Carbon, Formation Of Double And Triple Bond, Isomerism Including Single, Homologous Series of Alkane, Alkene, Alkyne And Relation With Molecular Mass, Types of carbon and hydrogen (In terms of primary, secondary, tertiary and quaternary).

    Nomenclature Of Simple Compounds Having Functional Groups Including Double Bond And Triple Bond, Alcohol, Aldehyde and acid, Bond line representation of organic compound.

    Hydrocarbon, Method Of Preparation Of Alkane, Alkene And Alkyne And Chemical Properties And Uses Also, Combustion, addition, oxidation, substitution reactions.

    Preparation Properties ( Physical And Chemical Both ) Of Alcohol ( Ethanol) And Carboxylic Acid ( Acetic Acid ) Uses Of Alcohol And Acetic Acid. Soaps and detergents Method of cleaning action of soap.

    Occurance of carbon, allotropes, Carbondioxide and Methane : Occurance, Properties and Uses.

14. **Synthetic Fibres and Plastics :** Natural and artifical fibres ( Synthetic )

    Types of synthetic fibres, Characetrstics of synthetic fibres.

    Plastics and its characteristics.

    Plastic and environment. (Biodegradable, Non Biodegradable)

15. **Coal and Petroleum ( 8th NCERT ) :** Natural resources, (Exhaustible and Inexhaustible ) Coal

    Petrolium : Refining , Natural gas, Limited natural sources, Introduction of Octane number and Cetane number.

    Combustion and flame : Combustion and its types, flame, structure of flame , fuel and fuel efficiency and harmful product.