SCIENCE (52)

PHYSICS

SCIENCE Paper - 1

Aims:

1. To acquire knowledge and understanding of the terms, facts, concepts, definitions, laws, principles and processes of Physics.
2. To develop skills in practical aspects of handling apparatus, recording observations and in drawing diagrams, graphs, etc.
3. To develop instrumental, communication, deductive and problem-solving skills.
4. To discover that there is a living and growing physics relevant to the modern age in which we live.

CLASS IX

*There will be one paper of two **hours** duration carrying 80 marks and Internal Assessment of practical work carrying 20 marks.*

*The paper will be divided into **two** sections, Section I (40 marks) and Section II (40 marks).*

***Section I** (**compulsory**) will contain short answer questions on the entire syllabus.*

***Section II** will contain six questions. Candidates will be required to answer any **four** of these **six** questions.*

***Note:** Unless otherwise specified, only SI Units are to be used while teaching and learning, as well as for answering questions.*

1. Measurements and Experimentation

(i) International System of Units, **the required SI units with correct symbols are given at the end of this syllabus.** Other commonly used system of units - fps and cgs.

(ii) Measurements using common instruments, Vernier callipers and *micro-metre* screw gauge for length, and simple pendulum for time.

*Measurement of length using, Vernier callipers and micro-metre screw gauge. Decreasing least-count leads to an increase in accuracy; least-count (LC) of Vernier callipers and screw gauge), zero error (basic idea), (**no** numerical problems on callipers and screw gauge), simple pendulum; time period, frequency, graph of length l vs. T^2 only; slope of the graph. Formula $T=2.\pi.\sqrt{l/g}$ [**no** derivation]. Only simple numerical problems.*

2. Motion in One Dimension

Scalar and vector quantities, distance, speed, velocity, acceleration; graphs of distance-time and speed-time; equations of uniformly accelerated motion with derivations.

Examples of Scalar and vector quantities only, rest and motion in one dimension; distance and displacement; speed and velocity; acceleration and retardation; distance-time and velocity-time graphs; meaning of slope of the graphs; [Non-uniform acceleration excluded].

Equations to be derived: $v = u + at$;

*$S = ut + \frac{1}{2}at^2$; $S = \frac{1}{2}(u+v)t$; $v^2 = u^2 + 2aS$. [Equation for S_n^{th} is **not** included].*

Simple numerical problems.

3. Laws of Motion

(i) Contact and non-contact forces; cgs & SI units.

Examples of contact forces (frictional force, normal reaction force, tension force as applied through strings and force exerted during collision) and non-contact forces (gravitational, electric and magnetic). General properties of non-contact forces. cgs and SI units of force and their relation with Gravitational units.

(ii) Newton's First Law of Motion (qualitative discussion) introduction of the idea of inertia, mass and force.

*Newton's first law; statement and qualitative discussion; definitions of inertia and force from first law, examples of inertia as illustration of first law. (Inertial mass **not** included).*

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(iii)Newton's Second Law of Motion (including **F**=ma); weight and mass.

Detailed study of the second law. Linear momentum, p = mv; change in momentum Δp = Δ(mv) = mΔv for mass remaining constant, rate of change of momentum;

$\Delta p/\Delta t = m\Delta v/\Delta t = ma$ *or*

$$\left\{\frac{p_2 - p_1}{t} = \frac{mv - mu}{t} = \frac{m(v-u)}{t} = ma\right\};$$

Simple numerical problems combining

$F = \Delta p/\Delta t = ma$ *and equations of motion. Units of force - only cgs and SI.*

(iv) Newton's Third Law of Motion (qualitative discussion only); simple examples.

Statement with qualitative discussion; examples of action - reaction pairs, (F_{BA} and F_{AB}); action and reaction always act on different bodies.

(v) Gravitation

Universal Law of Gravitation. (Statement and equation) and its importance. Gravity, acceleration due to gravity, free fall. Weight and mass, Weight as force of gravity comparison of mass and weight; gravitational units of force, (*Simple numerical problems), (problems on variation of gravity excluded*)

4. Fluids

(i) Change of pressure with depth (including the formula p=hρg); Transmission of pressure in liquids; atmospheric pressure.

Thrust and Pressure and their units; pressure exerted by a liquid column p = hρg; simple daily life examples, (i) broadness of the base of a dam, (ii) Diver's suit etc. some consequences of p = hρg ; transmission of pressure in liquids; Pascal's law; examples; atmospheric pressure; common manifestation and consequences. Variations of pressure with altitude, (qualitative only); applications such as weather forecasting and altimeter. (Simple numerical problems)

(ii) Buoyancy, Archimedes' Principle;— floatation; relationship with density; relative density; determination of relative density of a solid.

Buoyancy, upthrust (F_B); definition; different cases, F_B>, = or < weight W of the body immersed; characteristic properties of upthrust; Archimedes' principle; explanation of cases where bodies with density ρ >, = or < the density ρ' of the fluid in which it is immersed.

RD and Archimedes' principle. Experimental determination of RD of a solid and liquid denser than water. Floatation: principle of floatation; relation between the density of a floating body, density of the liquid in which it is floating and the fraction of volume of the body immersed; ($\rho_1/\rho_2 = V_2/V_1$); apparent weight of floating object; application to ship, submarine, iceberg, balloons, etc.

Simple numerical problems involving Archimedes' principle, buoyancy and floatation.

5. Heat and Energy

(i) Concepts of heat and temperature.

Heat as energy, SI unit – joule,

1 cal = 4.186 J exactly.

(ii) *Anomalous expansion of water; graphs showing variation of volume and density of water with temperature in the 0 to 10 ^{0}C range. Hope's experiment and consequences of Anomalous expansion.*

(iii)Energy flow and its importance:

Understanding the flow of energy as Linear and linking it with the laws of Thermodynamics- 'Energy is neither created nor destroyed' and 'No Energy transfer is 100% efficient.

(iv) Energy sources.

Solar, wind, water and nuclear energy (only qualitative discussion of steps to produce electricity). Renewable versus non-renewable sources (elementary ideas with example).

Renewable energy: biogas, solar energy, wind energy, energy from falling of water, run-of-the river schemes, energy from waste, tidal energy, etc. Issues of economic viability and ability to meet demands.

Non-renewable energy – coal, oil, natural gas. Inequitable use of energy in urban and rural areas. Use of hydro electrical powers for light and tube wells.

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(v) Global warming and Green House effect:

Meaning, causes and impact on the life on earth. Projections for the future; what needs to be done.

Energy degradation – meaning and examples.

6. Light

(i) Reflection of light; images formed by a pair of parallel and perpendicular plane mirrors; .

Laws of reflection; experimental verification; characteristics of images formed in a pair of mirrors, (a) parallel and (b) perpendicular to each other; uses of plane mirrors.

(ii) Spherical mirrors; characteristics of image formed by these mirrors. Uses of concave and convex mirrors. (Only simple direct ray diagrams are required).

Brief introduction to spherical mirrors - concave and convex mirrors, centre and radius of curvature, pole and principal axis, focus and focal length; location of images from ray diagram for various positions of a small linear object on the principal axis of concave and convex mirrors; characteristics of images.

f = R/2 (without proof); sign convention and direct numerical problems using the mirror formulae are included. (Derivation of formulae not required)

Uses of spherical mirrors.

Scale drawing or graphical representation of ray diagrams not required.

7. Sound

(i) Nature of Sound waves. Requirement of a medium for sound waves to travel; propagation and speed in different media; comparison with speed of light.

Sound propagation, terms – frequency (f), wavelength (λ), velocity (V), relation V = fλ. (Simple numerical problems) effect of different factors on the speed of sound; comparison of speed of sound with speed of light; consequences of the large difference in these speeds in air; thunder and lightning.

(ii) Infrasonic, sonic, ultrasonic f*requencies* and their applications.

Elementary ideas and simple applications only. Difference between ultrasonic and supersonic.

8. Electricity and Magnetism

(i) Simple electric circuit using an electric cell and a bulb to introduce the idea of current (including its relationship to charge); potential difference; insulators and conductors; closed and open circuits; direction of current (electron flow and conventional)

Current Electricity: brief introduction of sources of direct current - cells, accumulators (construction, working and equations excluded); Electric current as the rate of flow of electric charge (direction of current - conventional and electronic), symbols used in circuit diagrams. Detection of current by Galvanometer or ammeter (functioning of the meters not to be introduced). Idea of electric circuit by using cell, key, resistance wire/resistance box/rheostat, qualitatively.; elementary idea about work done in transferring charge through a conductor wire; potential difference V = W/q.

(*No derivation of formula****)*** *simple numerical problems.*

Social initiatives: Improving efficiency of existing technologies and introducing new eco-friendly technologies. Creating awareness and building trends of sensitive use of resources and products, e.g. reduced use of electricity.

(ii) Induced magnetism, Magnetic field of earth. Neutral points in magnetic fields.

Magnetism: magnetism induced by bar magnets on magnetic materials; induction precedes attraction; lines of magnetic field and their properties; evidences of existence of earth's magnetic field, magnetic compass. Uniform magnetic field of earth and non-uniform field of a bar magnet placed along magnetic north-south; neutral point; properties of magnetic field lines.

(iii) Introduction of electromagnet and its uses.

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