Secondary School Certificate Examination Syllabus

PHYSICS

Class IX examination in 2010 and onwards

Part I (Class IX)

Topics Student Learning Outcomes

1. Physical quantities and Measurement:

1.1 Introduction:

1.1.1 Describe the crucial role of physics in science, technology and Society

1.2 **Physical quantities**

1.2.1 Explain with examples that science is based on physical quantities which consist of Numerical magnitude and a unit

1.3 **International system of units:**

1.3.1 Differentiate between base and derived physical quantities

1.3.2 List the seven units of System International (SI) along with their symbols and Physical quantities; (standard definitions of SI units are not required)

1.4 **Prefixes (multiples and sub-multiples):**

1.4.1 Interconvert the prefixes and their symbols to indicate multiple and sub-multiple for both base and derived units

1.5 **Standard form / scientific notation:**

1.5.1 Write the answer in scientific notation in measurements and calculations

1.6 **Measuring instruments**:

1. Meter rule
2. Vernier calipers
3. Screw gauge
4. Physical balance
5. Stopwatch
6. Measuring cylinder

1.6.2 Identify the measuring instruments such as meter rule, Vernier calipers and screw gauge explain their limitation

1.7 An introduction to significant figures

1.7.1 Discuss the need of using significant figures for recording and stating results in the laboratory

1.7.2 Use significant figures in calculations

2. Kinematics:

2.1 **Rest and motion:**

2.1.1 Describe using examples how objects can be at rest and in motion simultaneously

2.2 Type of motion (Translatory, Rotatory, vibratory):

2.2.1 Describe and identify different types of motion i.e. Translatory, Rotatory and vibratory motion and distinguish them

2.3.1 Define the terms speed, velocity and acceleration and write their formulas;

2.3 Terms associated with motion, (distance and displacement, speed and velocity, Acceleration):

2.3.2 Differentiate between distance and displacement, speed and velocity

2.4 **Scalars and vectors:**

2.4.1 Define scalar and vectors

2.4.2 Differentiate between scalar and vector quantities

2.5 **Graphical analysis of motion:**

2.5.1 Represent vector quantities by drawing

a). Distance time graph

b). Speed time graph

2.5.2 Plot and interpret distance-time graph and speed-time graph

2.5.3 Determine and interpret the slope of distance-time and speed time graph

2.5.4 Determine from the shape of the graph, the state of a body

(i) at rest, (ii) moving with constant speed, (iii) moving with variable speed

2.5.5 Calculate the area under speed-time graph to determine the distance traveled by the moving body

2.6.1 Derive equations of motion for a body moving with a uniform acceleration in a straight line

2.6 **Equations of motion**:

(1). $V_f = V_i + at$ (2). $S = Vit + \frac{1}{2} a t^2$ (3). $2as = V_f^2 - V_i^2$

2.6.2 Solve problems related to uniformly accelerated motion using appropriate equations

2.7 **Motion due to gravity**:

2.7.1 Solve problems related to freely falling bodies using $10ms^{-1}$ as the acceleration due to gravity

3. Dynamics:

3.1 **Force**:

3.1.1 Describe the concept of force and write its S.I units

3.1.2 Differentiate among different forces like gravitational force

3.1.3 Drag force, (push, pull), friction, electrostatic force, magnetic force; explain the

concept of force by practical examples of daily life

3.2 **Momentum:**

3.2.1 Define momentum

3.2.2 Solve problem related to force and momentum

3.2.3 State the law of conservation of momentum

3.2.4 Use the principle of conservation of momentum in the collision of two objects

3.2.5 Determine the velocity after collision of two objects using the law of conservation of momentum

3.2.6 Use the idea of momentum to explain safety features

3.3 **Newton's laws of motion:**

3.3.1 State Newton's laws of motion and inertia

3.3.2 Distinguish between mass and weight and solve problem using

(a). $F = ma$ & (b). $W = mg$

3.3.3 Derive the expression for the tension and acceleration in a string during motion of bodies connected by the string and passing over frictionless pulley using second law of motion

3.3.4 Discuss the result while you are sitting inside a bus when the bus

1. Starts moving suddenly
2. Stops moving suddenly
3. Turns a corner to the left suddenly

3.4 **Friction:**

3.4.1 Explain the effect of friction on the motion of a vehicle in the context of type of surface, road conditions including skidding, braking force

3.4.2 Demonstrate that rolling friction is much lesser than sliding friction

3.4.3 List various methods to reduce friction

3.5 **Uniform circular motion:**

3.5.1 Define centripetal force

3.5.2 Explain that motion in a curved path is due to a perpendicular force on a body than Changes direction of motion but not speed

3.5.3 Calculate centripetal force on a body moving in a circle using **mv^2/r**

4. Turning effect of forces:

4.1 **Forces on bodies:**

4.1.1 Define like and unlike parallel forces

4.2 **Addition of forces:**

4.2.1 State 'head to tail' rule of vector addition of forces / vectors

4.3 **Resolution of forces:**

4.3.1 Describe the resolution of force into its perpendicular components

4.3.2 Determine the magnitude and direction of a force from its perpendicular Components

4.4 **Moment of force:**

4.4.1 Define moment of force or torque as **moment = force × perpendicular distance from pivot to the line of action of force;**

4.4.2 Explain the turning effect of force by relating it to everyday life

4.5 **Principle of moments:**

4.5.1 State the principle of moments

4.5.2 Determine the weight of unknown object using principle of moments;

4.5.3 Explain that the upward forces on a light beam supported at its ends vary with the position of a heavy object placed on the beam

4.6 **Centre of mass:**

4.6.1 Define the centre of mass and centre of gravity of a body

4.7 **Couple:**

4.7.1 Define couple as a pair of forces tending to produce rotation

4.8 **Equilibrium:**

4.8.1 Prove that the couple has the same moments about all points

4.8.2 Define equilibrium and classify its types by quoting examples from everyday life

4.8.3 State the two conditions for equilibrium of a body

4.8.4 Solve problems on simple balanced systems when bodies are supported by one pivot only

4.8.5 Describe the states of equilibrium and classify them with common examples

4.9 **Stability:**

4.9.1 Explain effect of the position of the centre of mass (centre of gravity) on the stability of simple objects

5. Gravitation

5.1 **Law of gravitation:**

5.1.1 State Newton's law of gravitation

5.1.2 Explain that the gravitational forces are consistent with Newton's third law

5.1.3 Explain gravitational field as an example of field of force

5.1.4 Define weight (as the force on an object due to a gravitational field)

5.2.1 Calculate the mass of earth by using law of gravitation

5.2 **Measurement of mass of earth:**

5.2.2 Solve problems using Newton's law of gravitation

5.3 **Variation of 'g' with altitude:**

5.3.1 Explain that value of 'g' decreases with altitude from the surface of earth

5.4 **Motion of artificial satellites:**

5.4.1 Discuss the importance of Newton's law of gravitation in understanding the motion

Of satellites

5.5 **Earth and space:**

5.5.1 Explain that the moon orbits the earth and that some planets also have moons;

5.5.2 Explain that gravitational force;

- Causes the planets to orbit sun
- Causes the moon and artificial satellites to orbit earth
- Causes comets to orbit the sun

5.5.3 State that a galaxy is a large collection of billions of stars and a universe is a large collection of billions of galaxies*;*

5.5.4 Describe how the orbit of a comet differs that from a planet.

6. Work and Energy:

6.1 **Work:**

6.1.1 Define work and state its SI unit

6.1.2 Calculate work done

6.2 **Forms of energy:**

6.2.1 Define energy, kinetic energy and potential energy and state unit of energy

6.2.2 Prove that kinetic energy $\mathbf{K.E = \frac{1}{2} mv^2}$ and potential energy $\mathbf{P.E = mgh}$ and solve problems using these equations;

6.3 **Kinetic energy and potential energy:**

6.3.1 Identify forms of energy stored in various objects at different positions and states

6.4 **Major sources of energy**:

6.4.1 Describe the processes by which energy is converted from one form to another with Reference to:

- Fossil fuel energy
- Hydroelectric generation
- Solar energy
- Nuclear energy
- Geothermal energy
- Wind energy
- Biomass energy

6.4.2 State mass energy equation $\mathbf{E = mc^2}$ and solve problems using it

6.4.3 Describe the process of electricity generation by drawing a block diagram of the Process from fossil fuel input to electricity output

6.4.4 List the environmental issues associated with power generation

6.4.5 Differentiate energy sources as non renewable and renewable energy sources with examples of each

6.4.6 Explain systems such as a filament lamp, a power station, a vehicle traveling at a Constant speed on a level road and draw energy flow diagrams through steady state

6.5 **Efficiency:**

6.5.1 Define efficiency of a working system and calculate the efficiency of energy Conversion using the formula

- **Efficiency = energy converted into the required form / total energy input**

6.5.2 Reason why a system cannot have an efficiency of 100%

6.6 **Power:**

6.6.1 Define power and calculate power from the formula;

- **Power = work done / time taken**

6.6.2 Define the unit of power "watt" in SI and convert it into horse power

6.6.3 Solve problems using mathematical relations learnt in this unit.

7. Properties of Matter:

7.1 **Kinetic molecular model of matter:**

7.1.1 State and explain kinetic molecular model of matter (solid, liquid and gas forms)

7.1.2 Describe the fourth state of matter i.e. 'plasma

7.2 **Density:**

7.2.1 Define the term density

7.2.2 Compare the densities of a few solids, liquids and gases

7.3 **Pressure:**

7.3.1 Define the term pressure (as force acting normally on unit area);

7.3.2 Explain how pressure varies with force and area in the context of everyday examples

7.4 **Atmospheric pressure:**

7.4.1 Explain atmospheric pressure

7.4.2 Describe the use of the height of a liquid column to measure the atmospheric pressure

7.4.3 Describe that atmospheric pressure decreases with the increase in height above the Earth's surface

7.4.4 Explain that changes in atmospheric pressure in a region may indicate a change in the weather

7.5 **Pressure in liquids:**

7.5.1 State Pascal's law

7.5.2 Apply and demonstrate the use with examples of Pascal's law

7.5.3 State relation for pressure beneath a liquid surface to depth and to density i.e. **(P = ρgh)** and solve problems using this equation;

7.5.4 State Archimedes principle

7.5.5 Determine the density of an object using Archimedes principle.

7.6 **Up thrust:**

7.6.1 Explain the significance of up thrust exerted by a liquid on a body

7.7 **Principle of floatation:**

7.7.1 State the principle of floatation

7.8 **Elasticity:**

7.8.1 Define elasticity
7.8.2 Explain that a force may produce a change in size and shape of a body.

7.9 **Stress, strain and young's modulus:**

7.9.1 Define the terms Stress, Strain and Young's modulus
7.9.2 State Hooke's law and explain elastic limit.

8. Thermal Properties of Matter:

8.1 **Temperature and heat:**

8.1.1 Define temperature (as quantity which determine the direction of flow of thermal energy)
8.1.2 Define heat (as the energy transferred resulting from the temperature difference between two objects)

8.2 **Thermometer:**

8.2.1 List basic thermometric properties for a material to construct a thermometer
8.2.2 Convert the temperature from one scale to another (Fahrenheit, Celsius and Kelvin scales)
8.2.3 Describe rise in temperature of a body in term of an increase in its internal energy

8.3 **Specific heat capacity:**

8.3.1 Define the terms heat capacity and specific heat capacity

8.4 **Latent heat of fusion:**

8.4.1 Describe heat of fusion and heat of vaporization (as energy transfer without a change of temperature for change of state)

8.5 **Latent heat of vaporization:**

8.5.1 Describe experiments to determine heat of fusion and heat of vaporization of ice And water respectively by sketching temperature-time graph on heating ice

8.6 **Evaporation:**

8.6.1 Explain the process of evaporation and the difference between boiling and evaporation
8.6.2 Explain that evaporation causes cooling
8.6.3 List the factors which influence surface evaporation

8.7 **Thermal expansion:**

8.7.1 Describe qualitatively the thermal expansion of solids (linear and volumetric expansion)
8.7.2 Explain the thermal expansion of liquids (real and apparent expansion)
8.7.3 Solve numerical problems based on the mathematical relations learnt in this unit.

9. Transfer of Heat:

9.1 **The three process of heat transfer:**

9.1.1 State thermal energy is transferred from a region of higher temperature to a region Of lower temperature

9.1.2 Explain in terms of molecules and electrons, how heat transfer occurs in solids

9.1.3 State the factors affecting the transfer of heat through solid conductors and hence, define the term 'Thermal Conductivity'

9.1.4 Solve problems based on thermal conductivity of solid conductors;

9.1.5 Write examples of good and bad conductors of heat and describe their uses

9.2 **Conduction:**

9.2.1 Explain insulation reduces energy transfer by conduction

9.3 **Convection:**

9.3.1 Explain the convection currents in fluids due to difference in density

9.3.2 State some examples of heat transfer by convection in everyday life

9.4 **Radiation:**

9.4.1 Describe the process of radiation from all objects

9.5 Consequences and everyday application of heat transfer

9.5.1Eexplain energy transfer by radiation does not require a medium and that the rate of energy transfer is affected by;

Colour and texture of the surface

Surface temperature

Surface area