SAMPLE PAPER-05 (unsolved)
PHYSICS (Theory)
Class – XI

Time allowed: 3 hours   Maximum Marks: 70

General Instructions:

a)   All the questions are compulsory.
b)   There are **26** questions in total.
c)   Questions **1** to **5** are very short answer type questions and carry **one** mark each.
d)   Questions **6** to **10** carry **two** marks each.
e)   Questions **11** to **22** carry **three** marks each.
f)   Questions **23** is value based questions carry **four** marks.
g)   Questions **24** to **26** carry **five** marks each.
h)   There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in such questions.
i)   Use of calculators is **not** permitted. However, you may use log tables if necessary.
j)   You may use the following values of physical constants wherever necessary:

$$c = 3x10^8 m/s$$
$$h = 6.63x10^{-34} Js$$
$$e = 1.6x10^{-19} C$$
$$\mu_o = 4\pi x10^{-7} TmA^{-1}$$
$$\frac{1}{4\pi\varepsilon_0} = 9x10^9 Nm^2C^{-2}$$
$$m_e = 9.1x10^{-31} kg$$

1.   Give the order of precision of an atomic clock.

2.   If a light body and a heavy body have the same K.E, then which one will have greater momentum?

3.   Give reasons: "A piece of chalk will emit bubbles in all directions when put into water".

4.   What is the influence of temperature on the mean free path of a gas?

5.   What is the effect of highly soluble impurities on the surface tension of a liquid?

6.   Two satellites A and B go around a planet P in circular orbit having radius 4R and R. If the speed of the satellite 'a' is 3v, then find the speed of the satellite B?

7.   If a geostationary satellite is orbiting the earth at a height of 6R above the surface of the earth R being the radius of the earth, then what will be the time period of another satellite at a height 2.5 R from the surface of the earth?

8. Assume that a bullet P is fired from a gun when the angle of elevation of the gun is 30^0. Another bullet Q is fired from the gun when the angle of elevation is 60^0. If the vertical height attained in the second case is 'x' times the vertical height attained in the first case, find the value of 'x'?

9. Determine work done by the person if he slowly lifts a block of mass 'm' through a vertical height 'h' and then walks horizontally a distance 'd' while holding the block.

Or

Assume that the particle performs uniform circular motion with an angular momentum L. If the frequency of particle's motion is doubled and its K.E is halved, then what would happen to its angular momentum?

10. A particle is vibrating in S.H.M when the displacements of the particle from its equilibrium position are x_1 and x_2 it has velocities v_1 and v_2. Show that its time period is given by

$$T = 2\pi\sqrt{\frac{x_1^2 - x_2^2}{v_2^2 - v_1^2}}$$

11. What type of motion this body has if the distance travelled by a body is proportional to the square of time?

12. Assume that a ship is moving at a speed of 56 km h^{-1}. One second later, it is said to be moving at speed of 58 km h^{-1}. What would be its acceleration?

13. If a solid surface of mass 0.1 kg and radius 2.5 cm rolls without sliding with a uniform velocity of 0.1 ms^{-1} along a straight line on a smooth horizontal table, then find its total energy.

14. Sachin went to Praveen's house to play. They had a completion of high jump on the sofa. Praveen's mom warned them that they could get hurt. But they did not listen. Then came Praveen's father, a physics teacher explained them the working of spring. After that they all promised that they would never jump on the furniture.

    a) Give any two examples of the objects which work using springs.

    b) What do you think about the values of the boys?

    c) If a spring compressed by 0.2 m develops a restoring force of 20 N and if a body of mass 8 kg is placed on it, then find,

        i)   The force constant of the spring.

        ii)   Depression of the spring under the weight of the body

15. If the velocities of ten particles in ms^{-1} are 0,2,3,4,4,4,5,5,6,9, then calculate its average speed and r.m.s speed.

16. A body m_1 of mass 9 kg and another m_2 of mass 6 kg are connected by alight inextensible string. Consider a smooth inclined plane of inclination 30^0 over which one of them can be placed while the other hangs vertically and freely. Show that m_1 will drag m_2 up the whole length of the plane in half the time m_2 hanging vertically would take to draw m_1 up the plane.

17. In an experiment, Raghul found that the string vibrates in three loops when 'a' g was as mass of placed on the scale pan. In order to makes the string vibrate in nine loops, what should Raghul do?

18. If the block travels with uniform velocity, find the work done by this force during a displacement d of the block by assuming that a block of mass M is pulled along a horizontal surface by applying a force at an angle θ with horizontal with coefficient of friction between block and surface is µ.

Or

If a rod of weight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position and the distance between knife edges is d and the centre of mass of the rod is at a distance x from A, find the value of normal reactions at the knife edges A and B.

19. If a mass 'm' is allowed to roll down on an inclined plane 'θ' with the vertical height 'h', then find
    a) The velocity down the plane.
    b) Acceleration along the inclined plane.

20. Find the number of air molecules in the bulb if an electric bulb of volume 250 cm^3 was sealed off during manufactures at a pressure of 10^{-3} mm of Hg at 27^0C.

21. What is an adiabatic process? Prove that for an adiabatic process PV^{γ} = constant, where γ is the ratio of specific heat capacities

22. The magnitude of gravitational field at distance r_1 and r_2 from the centre of a uniform sphere of radius R and mass M are I_1 and I_2. Find the ratio of (I_1/I_2) if $r_1 > R$ and $r_2 < R$.

23. Vishal was working with an experiment where two cylinders A and B of equal capacity are connected to each other through a stop cock. 'A' contains a gas at standard temperature and pressure and 'B' is completely evacuated. The entire system is thermally insulated. If the stopcock is suddenly opened what would you think would happen to the
    a) Change in the internal energy of the gas.
    b) Change in the temperature of the gas.
    c) Final pressure of the gas in A and B.

24. Prove that for a particle in linear S.H.M the average K.E over a period of oscillation equals the average potential energy over the same period.

Or

If a string 1m long with mass 0.1 g/cm is under a tension of 400 N, then find its fundamental frequency.

25.

   a) Explain stress-strain relationship for a loaded steel wire.

   b) Define the following terms:

      i)   Yield point

      ii)   Tensile strength

      iii) Elastic limit

Or

A water pipe entering a hose has a diameter of 2 cm and the speed of water is 0.1 ms^{-1}. Eventually the pipe tapers to a diameter of 1 cm. calculate the speed of water in the tapered portion.

26. Assume that a simple pendulum in a stationary lift time period is T, then what would be the effect on the time period when the lift

   a) Moves up with uniform velocity 'v'

   b) Moves down with uniform velocity 'v'

   c) Moves up with uniform acceleration 'a'

Or

Assume that the wavelength of two notes in air are $\dfrac{80}{195}m$ and $\dfrac{80}{193}m$. If each note produces five beats per second with a third note of a fixed frequency, then calculate the velocity of sound in air.