SAMPLE PAPER-01 (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:

$c = x10^{8} \, m/s$

$h = 6.63 x10^{-34} \, Js$

$e = 1.6 x10^{-19} \, C$

$\mu_o = 4\pi x10^{-7} \, TmA^{-1}$

$\dfrac{1}{4\pi\varepsilon_0} = 9x10^{9} \, Nm^{2}C^{-2}$

$m_e = 9.1 x10^{-31} \, kg$

1.   A person sitting in a train moving with constant velocity along a straight line throws a ball vertically upwards. Will the ball return to thrower's hand? Why?

2.   A thief jumps from the roof og a house with a box of weight 'W' on his head. What will be the weight of the box as experienced by the thief during jump?

3.   Define elastic limit.

4.   Can a body have energy without momentum?

5.   Why two holes are made to empty oil tin?

6.   Derive a relation between linear velocity and angular velocity.

7.   Find the value of 60J per min on a system that has 100g, 100 cm and 1 min as the base units.

8.   Why does a cyclist bend inwards from vertical position while taking a turn?

9. Water is flowing out of a cylinder through a horizontal tube of length 50 cm and diameter 0.4mm. The tube is 50cm below the water level in a cylinder. How much water will flow out per minute? [Coefficient of viscosity of water = 4×10^{-3} Pas]

Or

In a plant, a sucrose solution of coefficient of viscosity 1.5×10^{-3} Nsm^{-2} is driven at a velocity of 10^{-3} ms^{-1} through xylem vessel of radius 2µm and length 5µm. Find the hydrostatic pressure difference across the length of xylem vessel.

10. What is centre of mass of a system? Write an expression for the same.

11.

   a) Define torque.

   b) Define angular momentum.

   c) Derive a relation between the above two.

12. Derive an expression for the frequency υ of vibration of a stretched string which depends on a) Its length l , b) Its linear density m and c) The tension in the string T.   Constant $k = \dfrac{1}{2\pi}$

   Or

   In measuring the resistance of the given coil by the metre bridge apparatus, the following values were observed 2.43Ω, 2.47Ω, 2.54Ω, 2.37Ω and 2.72Ω. Find a) The resistance of the given coil b) Mean absolute error c) Percentage error d) Express the result in proper form.

13. A projectile is fired horizontally with a velocity of 98 m/s from the top of a hill 490m high. Find a) The time taken to reach the ground b) The distance of the target from the hill and c) The velocity with which the projectile hits the ground.

14. State and prove work energy theorem for a variable force.

15. Find the apparent weight of a man travelling in a lift when it is a) Travelling with uniform velocity b) Accelerating upwards c) Accelerating downwards.

16. Define centripetal acceleration. Derive an expression for centripetal acceleration moving with a uniform speed along a circular path of radius.

17. What is terminal velocity? Derive an expression for the terminal velocity of a small spherical body falling through a viscous medium.

18. An automobile moves on a road with a speed of 54kmph. The radius of its wheel is 0.35m. What is the average negative torque transmitted by its brakes to a wheel if the vehicle is brought to rest in 15 s? The moment of inertia of the wheel about the axis of rotation is $3kgm^2$.

19. Explain the behaviour of a metallic wire suspended from a rigid support when load is gradually increased with a suitable stress - strain graph.

20. Determine the angle of banking so as to minimize the wear and tear of the tyres of a car negotiating a banked curve.

21. State and prove conservation of linear momentum. Explain why a gun recoils when a bullet is fired from it.

22. Derive an expression for the work done during an isothermal expansion.

23. One day Prabhu and his colleague Shiva were crossing the railway line. At that time, Prabhu got a phone call from his boss asking him about the doubts in the balance sheet he prepared. He started explaining without anticipating the danger. His colleague Shiva heard the sound of a distant train and realized that it is approaching them before he could see that as it is a blind turning. Swiftly Shiva pushed his friend out of the railway track. What are the values exhibited by Prabhu and Shiva?

24. State and prove Bernoulli's theorem.

<div align="center">Or</div>

What is surface tension? Why the bristles of a paint brush come closer when dipped in paint? Derive an expression for excess pressure inside a liquid drop over outside.

25. What is perfectly elastic collision? Obtain an expression for the final velocities for the bodies undergoing elastic collision in one dimension. Also prove that if the masses are equal after collision the velocities get interchanged.

<div align="center">Or</div>

A body tied to a string is made to revolve in a vertical circle. Derive an expression for the minimum velocity of the body at the lowest point and highest point. Find an expression for the tension at the lowest and highest point.

26. Show that for small oscillations the motion of a simple pendulum is simple harmonic. Derive an expression for its time period by using oscillation principles.

<div align="center">Or</div>

What is Doppler Effect? Obtain an expression for apparent frequency heard by the observer when

a) Observer is in motion and source at rest.

b) Source is in motion and observer at rest.