SAMPLE PAPER-04 (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. What is the K.E. per molecule of a gas whose pressure is P?
2. Give the dimensional formula for torque.
3. Expand: LASER.

4. Assume that the Young's modulus of a wire of length L and radius 'r' is Y, if the length is reduced to L/2 and radius r/2, then what will be its Young's modulus?

5. Define an oblique collision.

6. Find the minimum speed at which there will not be any slack of the spring if a body of mass 500 g tied to a string of length 1 m is revolved in the vertical circle with a constant speed.

7. If a body of mass 'M' at rest is struck by a moving body of mass 'm', then prove that the fraction of the initial K.E of moving mass 'm' transferred to the struck body is $\dfrac{4Mm}{(m+M)^2}$

8. If $x = at^2 + bt + c$, where 'x' is displacement as a function of time, then give the dimensions of a, b and c.

9. Find the height to which water at 4^0C will rise in a capillary tube of 10^{-3} m diameter by taking angle of contact $\theta = 0^0$ and T =0.072 Nm^{-1}

Or

Why a hallow shaft is stronger than a solid shaft made form the same and equal amounts of materials?

10. If R be the horizontal range for inclination θ and h be the maximum height reached by the projectile, show that maximum range is given by $\dfrac{R^2}{8h} + 2h$.

11. A nucleus is at rest in the laboratory frame of reference, show that if it disintegrates into two smaller nuclei the products must move in opposite directions?

12. Suresh has to prove that a body projected in horizontal direction with a uniform velocity from top of tower follow parabola path. How would he prove?

13. Find the specific heat of the body, when 0.2 kg of a body at 100^0C is dropped into 0.5 kg of water at 10^0C, the resulting temperature is 16^0C. Given: Specific heat of water is 4.2 x 10^3 I/kg/^{0}C

14. The length and breadth of a rectangular lamina are records as a= (15.12 ± 0.01) cm and b = (10.15 ± 0.01) cm. what is the percentage error in its area

15. If a metallic wire has resistance of 20 ohm at 20^0C and a resistance of 21.2 ohm at 30^0C, then calculate the temperature coefficient of resistance.

Or

Calculate the fall in temperature when a gas initially at 72^0C is expanded suddenly to eight times the original volume. Given that $\gamma = \dfrac{5}{3}$

16. A) If the second overtone of an open pipe has same frequency as the first overtone of a closed pipe 2m long, then what is the length of the open pipe?

B) Discuss the Newton's formula for the velocity of longitudinal waves in air.

17. Calculate the temperature at which r.m.s velocity of a gas molecule is same as that of a molecule of another gas at 47^0C if the molecular weight of first and second gases is 64 and 32 respectively.

18. The distance between earth and moon is 3.8 x 10^5 km and the mass of earth is 81 times the mass of the moon. Deduce the position of a point on the line joining the centres of earth and moon, where the gravitational field is zero. What would be the value of gravitational field there due to earth and moon separately?

19. If a particle of mass 08 kg is executing simple harmonic motion with amplitude of 1.0 metre and periodic time $\dfrac{11}{7}$ sec, then find the velocity and the K.E of the particle at the moment when its displacement is 0.6 metre.

20. Ram was driving his truck with a velocity 'v' suddenly noticed a brick wall in front of him at a distance 'd'. What is your conclusion about his decision? Is it better for him to apply brakes or to make a circular turn without applying brakes in order to just avoid crashing in to the wall? Justify your answer.

21. Two bodies A and B having masses m_1 and m_2 have equal K.E if P_A and P_B are their respective moments, then prove that the ratio of momenta is equal to the square root of ratio of respective masses.

22. Calculate the efficiency of a Carnot's engine working between steam point and ice point.

23. Priya went to a hill station with her school mates and was fascinated about the beauty of the mountains and the roads. She asked her teacher how such roads have been made which seem so unapproachable. The teacher was explaining to her about the remote sensing satellites.

   a) Define remote sensing satellites.

   b) If a remote sensing satellite of the earth moves in a circular orbit at a height of 800 km above the surface of the earth, then find the orbital speed and the period of revolution of satellite by assuming the radius of earth to 6×10^6 m.

   c) What is the orbit that is followed by the remote sensing satellite?

24. Two particles execute S.H.M of same amplitude and frequency on parallel lines. They pass one another when moving in opposite directions each time their displacement is one third their amplitude. What is the phase difference between them?

Or

What would be the amplitude wavelength and velocity of the wave represented by $\phi(x,t) = s\sin(6\pi t - 4x)$ where 'x' the distance and 't' the times are in SI units?

25. If a motor boat covers the distance between two spots on the river in time of 8 hours and 12 hours downstream and upstream, then what is the time required for the boat to cover this distance in still water?

Or

Assume that an aeroplane is flying in a horizontal direction with velocity of 300 km/hr and at a height of 1960 m. When it is vertically above the point A on the ground, a body is dropped from it which strikes the ground at point B. Calculate the distance AB.

26. If A particle located at x = 0 at time t = 0 starts moving along the positive x direction with a velocity v that varies as $v = \alpha\sqrt{x}$, then

    a) How do the displacement, velocity and acceleration of the particle vary with time?

    b) What is the average of the particle over the first metres of its path?

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

If a body is projected with some initial velocity making an angle θ with the horizontal, show that its path is a parabola. Then find,

    a) The maximum height attained

    b) Time for maximum height

    c) Horizontal range

    d) Maximum horizontal range

    e) The time of flight.