

**SAMPLE PAPER-03 (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:

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.63 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg}$$

1. What is the effect on the time by mass if two masses are in the ratio of 1:2 thrown vertically up with the same speed?
2. Can a body in linear motion be in equilibrium?
3. What is the value of bulk modulus for an incompressible liquid?
4. Explain the shape of the graph obtained between pressure  $P$  and  $\frac{1}{V}$  for the perfect gas at constant temperature.
5. Differentiate velocity head and pressure head.
6. What is the velocity of the body within error limits if a body travels uniformly a distance of  $(13.8 \pm 0.2) \text{ m}$  in a time  $(4.0 \pm 0.3) \text{ s}$ ?
7. Explain that the total linear momentum of an isolated system of interacting particles is conserved.

8. Prove that:  $\theta = \omega_0 t + \frac{1}{2} \alpha t^2$ , where the letters have their usual meanings.
9. How would you show the change of potential energy and kinetic energy of a block attached to a spring which obeys Hooke's law graphically?

Or

If a wire is stretched by a certain force, its elongation is 'a' and if the second wire of the same material has four times the length and double the radius of the first wire is stretched by the same force as before, what would its elongation.

10. Calculate the coefficient of performance of the refrigerator if the temperature in the freezer of a refrigerator is being maintained at  $-13^\circ\text{C}$  and room temperature on a particular day was  $42^\circ\text{C}$ .
11. The displacement  $x$  of a particle moving in one dimension under the action of a constant force is related to time by the equation  $t = \sqrt{x} + 3$ , where  $x$  is in meter and  $t$  in second. Calculate the work done by the force  $F$  in the first 6 second.
12. If a hammer of mass 1 kg strikes on the head of the nail with velocity of  $10 \text{ m s}^{-1}$ . It drives the nail 1 cm into a wooden block, then find the force applied by the hammer and the time of impact.
13. Explain with reason: The volume of an ideal gas is  $V$  at a pressure  $P$ . On increasing the pressure by  $\Delta P$ , the change in volume of the gas ( $\Delta V_1$ ) under isothermal and ( $\Delta V_2$ ) under adiabatic conditions. Is  $\Delta V_1 > \Delta V_2$  or vice-versa.
14. A particle of mass 0.1 kg is held between two rigid supports by two springs of force constants 8 N/m and 2 N/m. If the particle is displaced along the direction of the length of the springs, calculate its frequency of vibration.

Or

Prove that the frequency of  $n$ th harmonic mode in a vibrating string which is closed at both the end is 'n' times the frequency of the first harmonic mode.

15. When a sample gas A initially at the same temperature and pressure are compressed isothermally from volume  $v$  to  $\frac{V}{2}$  and a sample gas B initially at the same temperature and pressure are compressed adiabatically from volume  $v$  to  $\frac{V}{2}$ , then in which case do you think the pressure will be high. Justify your answer
16. If the displacement of two particle executing simple harmonic motion are represented by equations  $y_1 = 4 \sin (10t + \theta)$  and  $y_2 = 5 \cos 10t$ , then what is the phase different between the velocities of these particle?

17. State Hook's law.

If the length and diameter of two wires made up of same material are in the ratio 1:2 each, what is the ratio of their Young's Modulus?

18. Establish the kinetic equation  $s = ut + \frac{1}{2}at^2$  from velocity-time graph for uniformly accelerated motion.

19. A particle of mass 'm' is executing simple harmonic oscillations of amplitude.

a) At  $x = \frac{A}{2}$  what fraction of its energy is potential?

b) What fraction is kinetic?

20. Obtain the formula for the gravitational red shift by considering a photon of frequency 'v' has energy 'hv' and mass  $[hv/c^2]$ , the magnitude of the red-shift for light of wavelength  $5000\text{\AA}$  from a star of mass  $10^{32}\text{ kg}$ , radius =  $10^6\text{ km}$ ,  $G = 6.67 \times 10^{-11}\text{ Nm}^{-2}$  and  $c = 3 \times 10^8\text{ ms}^{-1}$

21. If two mutually perpendicular forces of 8N and 6N acts on the same body of mass 10kg, then calculate

a) Net force acting on the body

b) Magnitude of the acceleration of the body

c) Direction of acceleration of the body

22. If a steam engine delivers  $5.4 \times 10^8\text{ J}$  of work per minute and services  $3.6 \times 10^9\text{ J}$  of heat per minute from its boiler, then

a) What is the efficiency of the engine?

b) How much heat is wasted per minutes?

23. Rahul when working in physics lab brought two bodies having temperatures  $T_1$  and  $T_2$  in contact.

But found that the temperature of the system may not be  $\frac{(T_1 + T_2)}{2}$ . What would be the reason?

What values of Rahul is displayed?

24. A uniform pressure P is exerted on all sides of a solid cube. It is heated through  $t^\circ\text{C}$  in order to bring its volume back to the value it had before the application of pressure. Find the value of t.

Or

a) State the law of floatation.

b) Compute the volume in  $\text{m}^3$  of a life preserver of SG 0.20 which worn by a boy weighing 60 kg and having SG equal to 0.9 will just support him, if  $\frac{3}{4}$  of his body is submerged in fresh water of density  $1000\text{ kg m}^{-3}$  by assuming that the life preserver is completely submerged.

25. Deduce the three basic kinematic equations by calculus methods.

Or

- a) Define angular velocity
- b) What is meant by angular acceleration?
- c) If the total speed  $V_1$  of a projectile at its greatest height is  $\sqrt{\frac{6}{7}}$  of its speed  $V_2$  when it is at half its greatest height, then show that the angle of projection is  $30^\circ$ .

26.

- a) Prove that if a liquid taken in a U-tube is disturbed from the state of equilibrium, then it will oscillate simple harmonically.
- b) Give the expressions for the angular frequency and time period.

Or

If the intensities due to two sources of sound are  $I_0$  and  $4I_0$ , what is the intensity at a point where the phase difference between two waves are

- a)  $0^\circ$
- b)  $\pi$
- c)  $\pi/2$