

PHYSICS

CBSE Class XI | Vacation Assignment | Set 1

Time Allowed: 3 Hours	Maximum Marks: 70
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General Instructions

1. All questions are compulsory unless an internal choice is stated.
2. Use SI units. Draw labelled diagrams wherever required.
3. Show formulas, substitutions and working for numerical questions. Use $g = 9.8 \text{ m s}^{-2}$ unless stated otherwise.

Section A — Objective / Very Short Answer (16 marks)

Q1–Q8. Choose the correct answer. ($8 \times 1 = 8$)

1. The dimensional formula of impulse is: (a) MLT^{-1} (b) ML^2T^{-2} (c) MLT^{-2} (d) $ML^{-1}T^{-1}$
2. The slope of a velocity–time graph represents: (a) displacement (b) acceleration (c) momentum (d) force
3. If the net external force on a body is zero, its momentum: (a) must be zero (b) remains constant (c) increases (d) decreases
4. The work done by centripetal force in uniform circular motion is: (a) positive (b) negative (c) zero (d) variable
5. The SI unit of coefficient of viscosity is: (a) Pa s (b) N m (c) J s (d) kg m s^{-1}
6. At the highest point of vertical upward motion, the acceleration is: (a) zero (b) g upward (c) g downward (d) variable
7. Escape speed from a planet depends on its mass M and radius R as: (a) $\sqrt{GM/R}$ (b) $\sqrt{2GM/R}$ (c) GM/R^2 (d) $2GM/R$
8. In an ideal gas, average translational kinetic energy is proportional to: (a) pressure only (b) volume only (c) absolute temperature (d) density

Q9–Q12. Answer in one or two sentences. ($4 \times 2 = 8$)

9. Distinguish between accuracy and precision.
10. State the principle of conservation of linear momentum.
11. What is meant by the centre of mass of a system?
12. Define specific heat capacity and state its SI unit.

Section B — Short Answer (18 marks)

- Q13. Use dimensional analysis to check whether the relation $s = ut + \frac{1}{2}at^2$ is dimensionally consistent. (3)
- Q14. A car increases its speed uniformly from 5 m s^{-1} to 25 m s^{-1} in 4 s. Calculate acceleration and distance travelled. (3)
- Q15. A 4 kg body moving at 6 m s^{-1} is brought to rest in 3 s. Find the average retarding force. (3)
- Q16. State and explain the work–energy theorem. A 2 kg object speeds up from 3 m s^{-1} to 7 m s^{-1} ; calculate the net work done. (3)
- Q17. Explain why a small drop of liquid tends to be spherical. Define surface tension. (3)
- Q18. State any three assumptions of the kinetic theory of an ideal gas. (3)

Section C — Long Answer / Numerical (24 marks)

- Q19. Derive the expression for the maximum height and time of flight of a projectile projected vertically upward with initial speed u . (4)

Q20. A 5 kg block is pulled on a horizontal surface by a 30 N force. If the coefficient of kinetic friction is 0.2, calculate the acceleration. Take $g = 10 \text{ m s}^{-2}$. (4)

Q21. Derive the relation between acceleration due to gravity g and universal gravitational constant G for a planet of mass M and radius R . Calculate g for $M = 6 \times 10^{24} \text{ kg}$ and $R = 6.4 \times 10^6 \text{ m}$. (4)

Q22. Explain the first law of thermodynamics. A system absorbs 500 J of heat and does 180 J of work. Find the change in internal energy. (4)

Q23. A solid sphere rolls without slipping down an inclined plane. Explain the energy transformations and write the condition for rolling without slipping. (4)

Q24. Explain Bernoulli's principle and give two practical applications. State the assumptions under which it applies. (4)

Section D — Case-based / Application (12 marks)

Q25. A student measures the period of a pendulum five times and obtains 1.92 s, 1.96 s, 1.94 s, 1.95 s and 1.93 s. (a) Calculate the mean period. (2) (b) Why are repeated measurements useful? (2)

Q26. A satellite moves in a circular orbit around Earth. (a) What provides the centripetal force? (2) (b) What happens to orbital speed if the orbital radius increases? (2)

Q27. A metal spoon is placed in hot tea. Heat travels through the spoon to its handle. (a) Name the dominant mode of heat transfer in the spoon. (1) (b) Explain the process using particle/electron behaviour. (3)