



PART-A

I. Answer ALL the following questions.

10 x 1=10

1. Express one parsec in light years.
2. Which component of velocity remains constant throughout the trajectory of the projectile?
3. What is the measure of inertia of a body in the case of linear motion?
4. Where is the position of centre of mass of a circular ring located?
5. What is the weight of the object at the centre of the earth?
6. State Pascal's law?
7. Define Bulk modulus.
8. At what temperature all the states of water co-exist in thermal equilibrium.
9. Define phase of a particle executing simple harmonic motion.
10. Rain drops are spherical in shape. Give reason.

PART - B

II. Answer any FIVE of the following questions.

5 x 2=10

11. Name any two basic forces in nature.
12. Draw position-time graph of two objects moving in a straight line when their relative velocity is
i) zero ii) non-zero.
13. A vector of magnitude 10 makes an angle 60^0 with x-axis. What are its rectangular components?
14. What are contact and non-contact forces?
15. State and explain parallel axes theorem.
16. Distinguish between streamline flow and turbulent flow.
17. What are i) Damped oscillations? ii) Forced oscillations?
18. Define mean free path. Write the expression for mean free path of a molecule.

PART - C

III. Answer any FIVE of the following questions.

5 x 3=15

19. A physical quantity X is calculated from $X = \frac{ab^2}{\sqrt{c}}$. Calculate the percentage error in X when percentage error in measuring a, b and c are 4, 2 and 3 respectively.
20. Derive $F=ma$ where the symbols have their usual meaning.
21. State whether work done is positive, negative or zero in the following cases
i) Work done by gravity, when a body is projected upwards.
ii) Work done by centripetal force, on a body in a uniform circular motion.
iii) Work done by an external agent, when a spring is stretched.
22. Define moment of inertia and radius of gyration. Write the expression for moment of inertia of a solid sphere about an axis passing through a diameter.
23. Mention any three properties of thermal radiation.
24. Derive an expression for acceleration due to gravity at a height h above the surface of earth.
25. State and explain the equation of continuity.
26. Arrive at the expression for the time period of a loaded spring.

PART - D

IV. Answer any TWO of the following questions.

2 x 5 = 10

27. Derive an expression for centripetal acceleration of a body performing uniform circular motion.
28. Derive the expression for final velocities of two bodies in one dimensional elastic collision.
29. State and prove the law of conservation of angular momentum. Mention any one illustration of conservation of angular momentum.

V. Answer any TWO of the following questions.**2 x 5 = 10**

30. Derive an expression for pressure exerted by an ideal gas..
31. What is Doppler effect? Derive an expression for apparent frequency of sound when the source is moving away from a stationary observer.
32. What is an isothermal process? Derive an expression for work done during isothermal process.

VI. Answer any THREE of the following questions.**3 x 5 = 15**

33. A ball is thrown upwards with a speed of 100 ms^{-1} . Calculate the velocity with which the ball hits the ground. Neglect air resistance. Take $g=10 \text{ ms}^{-2}$.
34. A hammer weighing 1kg moving with the speed of 10ms^{-1} strikes the head of a nail driving it 10cm into a wall. Neglecting the mass of the nail, calculate i) the acceleration during impact ii) the time interval of the impact iii) impulse.
35. A satellite orbits the earth at a height of 500km from the surface. Calculate its i) kinetic energy ii) potential energy and iii) total energy.

$$M_{\text{earth}} = 6 \times 10^{24} \text{ kg}$$

$$m_{\text{satellite}} = 300 \text{ kg}$$

$$R_{\text{earth}} = 6.4 \times 10^6 \text{ m and}$$

$$G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}.$$

36. A brass boiler has a base area of 0.15 m^2 and thickness 1cm. It boils water at the rate of 6kg/min when placed on a gas stove. Estimate the temperature of the part of the flame in contact with the boiler. Thermal conductivity of brass = $109 \text{ Js}^{-1} \text{ m}^{-1} \text{ K}^{-1}$, heat of vaporisation of water = $2256 \times 10^3 \text{ Jkg}^{-1}$.
37. Displacement of a progressive wave is given by $y = 0.002 \sin (20x - 50t)$, where y is in metres and t is in seconds. Calculate i) amplitude ii) wavelength iii) velocity of the wave.
