SECTION – A

Answer any 5 questions from 1 to 7. Each carries 1 score. **(5 × 1 = 5)**

1. At the centre of Earth, the value of g is _____

2. A graph is drawn with time along x axis and force along y axis. The area under the graph represents

   (a) torque (b) impulse

   (c) momentum (d) couple

3. The simple pendulum whose time period of oscillation is 2 seconds is called a ____.

4. The average kinetic energy of a gas molecule is directly proportional to

   (a) Volume (b) Pressure

   (c) Temperature (d) Number of moles

5. For which of the following shapes, the centre of mass does not lie on the body ?

   (a) Pencil (b) Dice

   (c) Shotput (d) Bangle

6. Steel is more elastic than rubber. (True / False)

7. The frequency, wavelength and velocity of a wave are related by the equation

   (a) $v = \frac{f}{\lambda}$ (b) $f = \frac{v}{\lambda}$

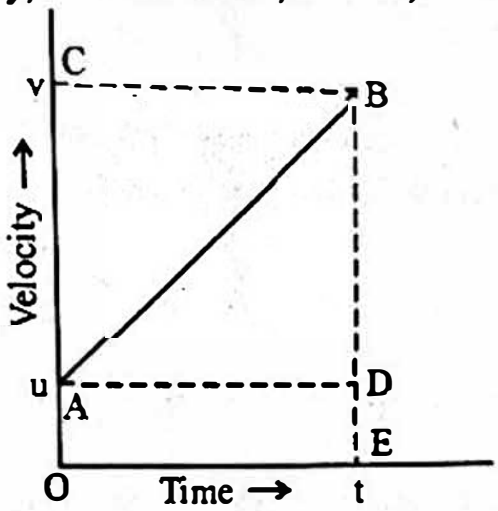
   (c) $v = \frac{\lambda}{f}$ (d) $\frac{1}{v} = f\lambda$

SECTION – B

Answer any 5 questions from 8 to 14. Each carries 2 scores. **(5 × 2 = 10)**

8. What is moment of inertia of a body ? Name the factors on which moment of inertia of a body depend.

9. The velocity-time graph of a body with uniform acceleration is shown below. Obtain the equation of motion $S = ut + \frac{1}{2}at^2$ from the graph. (S – displacement, u – initial velocity, v – final velocity, a – acceleration, t – time)



10. What is meant by mean free path of a gas molecule ? Write down its expression and explain the terms.

11. Match the following :

A	B
(a) Surface tension	(p) J/m^2
(b) Surface energy	(q) m
(c) Pressure	(r) N/m
(d) Capillary rise	(s) N/m^2

12. What is a heat engine ? Draw the block diagram of a heat engine showing its components (source, sink etc.)

13. What is escape speed ? Obtain the relation between escape speed and orbital velocity of satellite.

14. Define power. Convert 1 kWh into joule.

SECTION – C

Answer any 6 questions from 15 to 21. Each carries 3 scores. **(6 × 3 = 18)**

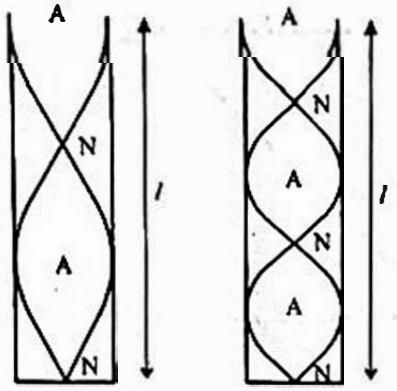
15. (a) What is meant by unit of a physical quantity ? **(1)**

(b) Distance moved by a body is expressed as $x = a + bt + ct^2$ where x is in metre and t is in seconds. What is the unit of c ? **(2)**

16. (a) Define modulus of elasticity. Give its SI unit and dimensions. (2)

(b) What is an elastomer ? Give an example. (1)

17. The following figure shows vibrating modes of an air column. Find the ratio of frequencies of the two modes.



18. (a) Explain the following types of thermodynamic systems : (1)

(i) open system

(ii) closed system

(b) State first law of thermodynamics. How does first law of thermodynamics obey law of conservation of energy ? (2)

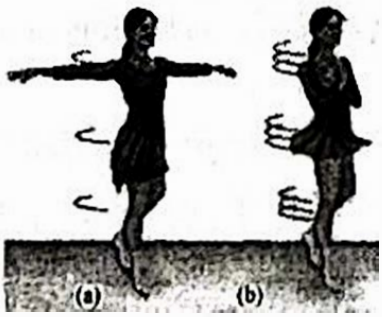
19. (a) Define vector product of two vectors $\vec{A}$ and $\vec{B}$. (1)

(b) Two forces 5 N and 7 N act on a particle with an angle of 60° between their directions. Find the resultant force. (2)

20. Differentiate between conservative and non-conservative forces. Give ONE example for each.

21. (a) State and prove law of conservation of angular momentum. (2)

(b) What happens when the spinning ice skater (i) stretches her hands and (ii) folds her hands as shown in the following figure : (1)



SECTION – D

Answer any 3 questions from 22 to 25. Each carries 4 scores. **(3 × 4 = 12)**

22. (a) Differentiate between heat and temperature. **(2)**

(b) At what temperature is the Fahrenheit scale reading equal to half of the Celsius scale reading ? **(2)**

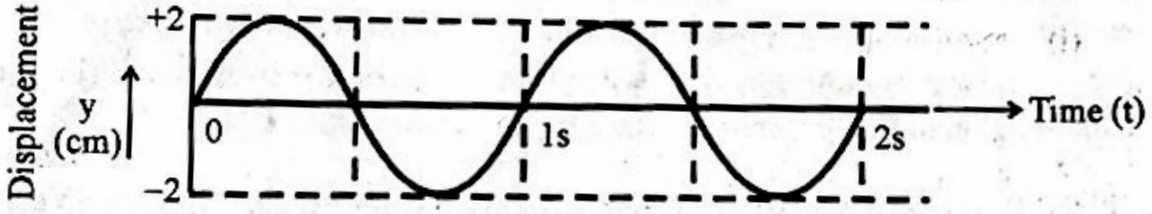
23. (a) State Newton's second law of motion and hence define 1 N force. **(2)**

(b) A lift is going up with an acceleration equal to 2g. A girl is inside the lift and her mass is m. What will be the reaction of the floor on the girl ? **(2)**

24. (a) Define a simple harmonic motion (SHM). **(1)**

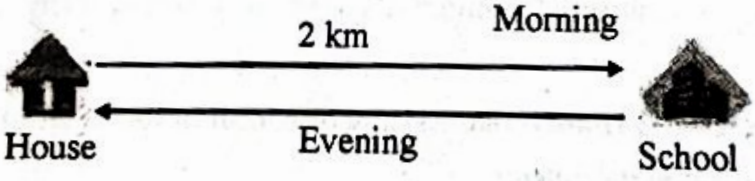
(b) Draw the energy position graph of a SHM. **(2)**

(c) In the following figure of a wave, find i) frequency and ii) amplitude. **(1)**



25. (a) Differentiate between distance and displacement. **(2**

(b) Assume that your school is located 2 km away from your home. In the morning, you are going to school and in the evening, you are coming back to home. What is the total (i) distance travelled (ii) displacement when you reach home ? **(**



SECTION – E

Answer any 3 questions from 26 to 29. Each carries 5 scores. **(3 × 5 =**

26. (a) Define acceleration due to gravity at a place.

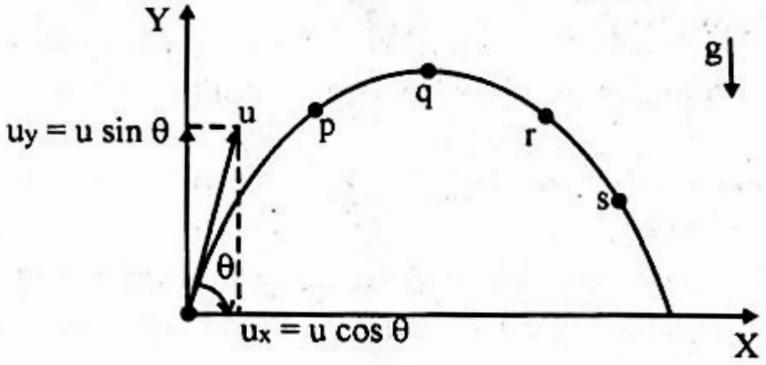
(b) Obtain the value of acceleration due to gravity near the surface of earth.

($G = 6.67 \times 10^{-11}\ Nm^2\ kg^{-2}$, Mass of earth = 6×10^{24} kg, Radius of earth = 6400 km

(c) Show that the acceleration due to gravity varies with altitude.

27. (a) What is a projectile ? (1)

(b) Complete the following figure showing the variation of horizontal and vertical components of velocity of a projectile at the points p, q, r and s. (2)



(c) Obtain the expression for time of flight of the projectile. (2)

28. (a) What is capillary rise ? (1)

(b) With the help of a diagram, derive an expression for capillary rise inside a narrow tube of radius r. (2)

(c) Mercury has an angle of contact equal to 140° with soda lime glass. A narrow tube of radius 2 mm, made of this glass is dipped in a trough containing mercury. By what amount does the mercury dip down in the tube relative to the liquid surface outside ? (Surface tension of mercury S = 0.456 N m^{-1}, Density of mercury $\rho = 13.6 \times 10^3$ kg m^{-3}) (2)

29. (a) State Hooke's law of elasticity. (1)

(b) Derive an expression for potential energy stored in a stretched spring. (2)

(c) The length of a steel wire increases by 0.5 cm when it is loaded with a mass of 5 kg. Calculate the work done in stretching the wire. (2)
