

1 to 7

5 x 1 = 5

- At the centre of Earth, the value of g is -----
- 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
- The simple pendulum whose time period of oscillation is 2 seconds is called a -----
- The average kinetic energy of a gas molecule is directly proportional to (a) Volume (b) Pressure (c) Temperature (d) Number of moles
- For which of the following shapes, the centre of mass does not lie on the body: (a) Pencil (b) Dice (c) Shotput (d) Bangle
- Steel is more elastic than rubber. (True/False)
- 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) $\frac{1}{v} = f\lambda$

8 to 14

5 x 2 = 10

- What is moment of inertia of a body? Name the factors on which moment of inertia of a body depend.
- The Velocity-time graph of a body with uniform acceleration is shown below. Obtain the equation of motion $S = ut + (1/2)at^2$ from the graph.
- What is meant by mean free path of a gas molecule?
Write down its expression and explain the terms.
- Match the following:

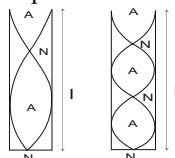
A	B
(a) Surface tension	(p) J/m^2
(b) Surface energy	(q) m
(c) Pressure	(r) N/m
(d) Capillary rise	(s) N/m^2

- What is a heat engine? Draw the block diagram of a heat engine showing its components (source, sink etc.)
- What is escape speed? Obtain the relation between escape speed and orbital velocity of satellite.
- Define power. Convert 1 kWh into joule.

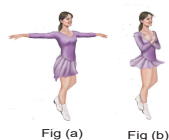
15 to 21

6 x 3 = 18

- (a) What is meant by unit of a physical quantity?
(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 ? (1+2)
- (a) What is modulus of elasticity. Give its SI unit and dimensions.
(b) What is an elastomer? Give an example. (2+1)
- The following figure shows vibrating modes of an air column. Find the ratio of frequencies of the two modes.



- (a) Explain the following types of thermodynamics systems:
(i) open system (ii) closed system
(b) State first law of thermodynamics. How does first law of thermodynamics obey law of conservation of energy? (1+2)
- (a) Define vector product of two vectors A and B .
(b) Two forces 5N and 7N act on a particle with an angle of 60° between their directions. Find the resultant force. (1+2)
- Differentiate between conservative and non-conservative forces. Give ONE example for each.
- (a) State and prove law of conservation of angular momentum.
(b) What happens when the spinning ice skater
(i) stretches her hands and
(ii) folds her hands as shown in the following figure:

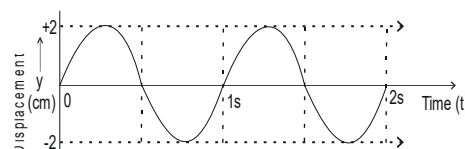


(2+1)

22 to 25

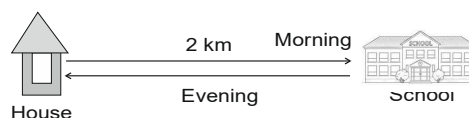
3 x 4 = 12

- (a) Differentiate between heat and temperature.
(b) At what temperature is the Fahrenheit scale reading equal to half of the Celsius scale reading? (2+2)
- (a) State Newton's second law of motion and hence define 1N force.
(b) A lift is going up with an acceleration equal to $2g$. A girl is inside the lift and her mass m . What will be the reaction of the floor on the girl? (2+2)
- (a) Define a simple harmonic motion (SHM)
(b) Draw the energy position graph of a SHM.
(c) In the following figure of a wave, find
(i) frequency and (ii) amplitude



(1+2+1)

- (a) Differentiate between distance and displacement.
(b) Assume that your school is located 2km 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? (2+2)

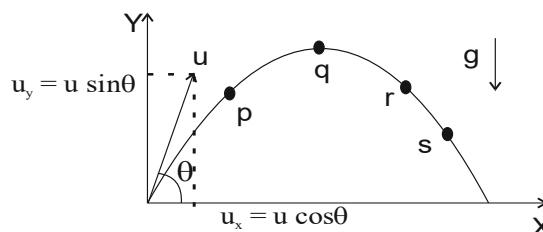


26 to 29

3 x 5 = 15

- (a) Define acceleration due to gravity at a place.
(b) Obtain the value of acceleration due to gravity near the surface of Earth. ($G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$, Mass of earth = $6 \times 10^{24} \text{ kg}$, Radius of earth = 6400 km)
(c) Show that the acceleration due to gravity varies with altitude. (1+1+3)

- (a) What is a projectile?
(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.



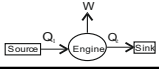
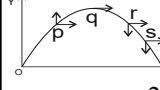
- (c) Obtain the expression for time of flight of the projectile. (1+2+2)

- (a) What is capillary rise?
(b) With the help of a diagram, derive an expression for capillary rise inside a narrow tube of radius r .
(c) Mercury has an angle of contact equal to 140° with soda lime glass. A narrow tube of radius 2mm, 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 $S = 0.456 \text{ Nm}^{-1}$, Density of mercury $\rho = 13.6 \times 10^3 \text{ kgm}^{-3}$) (1+2+2)

- (a) State Hooke's law of elasticity.
(b) Derive an expression for potential energy stored in a stretched spring.
(c) The length of a steel wire increases by 0.5 cm when it is loaded with a mass of 5kg. Calculate the work done in stretching the wire. (1+2+2)

Binu Baby

Principal, St Sebastian's HSS Koodaranhi

1 to 7			5 x 1 = 5		
1	Zero	1			
2	(b) Impulse	1			
3	Seconds Pendulum	1			
4	(c) Temperature	1			
5	(d) Bangle	1			
6	True	1			
7	(b) $f = v/\lambda$	1			
8 to 14			5 x 2 = 10		
8	Statement of moment of inertia or equation (1m) Any two factors on which inertia depends (1m)	1 1	2		
9	Displacement = Area under velocity-time graph (1 mark) $S = ut + (1/2)(v-u)t$ (1/2 mark) (1/2 mark) or Derivation of $S = ut + (1/2)at^2$ using graph (2 marks)	2 2	2		
10	Mean free path-Average distance travelled by a molecule between two consecutive collision equation $l = \frac{1}{\sqrt{2} n \pi d^2}$ Where d- diameter of gas molecules n- number density of gas molecules	1 1	2		
11	A B (a) (r) N/m (b) (p) J/m ² (c) (s) N/m ² (d) (q) m	1/2 1/2 1/2 1/2	2		
12	Heat engine-Device that converts thermal energy(heat energy) into mechanical energy or Heat into work or Any related attempt or 	2 2	2		
13	Definition of escape speed $V_0 = \sqrt{GM/R}$ $V_e = \sqrt{2GM/R} = \sqrt{2} V_0$ or $V_0 = \sqrt{GM/R}$ 1/2 mark $V_e = \sqrt{2GM/R}$ 1/2 mark or $V_e = \sqrt{2} V_0$ 1/2 mark	1 1	2		
14	Definition of power/ equation 1 KWh = 1000 x 3600 = 3.6 x 10 ⁶ J	1 1	2		
15 to 21			6 x 3 = 18		
15	(a) Definition of unit of a physical quantity (b) $[L] = c[T^2]$ (1 mark) $[c] = \frac{[L]}{[T^2]}$ Unit of c : m/s ² (1 mark) or $m = c s^2$ (1 mark) $c = m s^{-2}$ (1 mark) or Unit of c : m/s ² (2 marks)	1 2	3		
16	(a) Definition of modulus of elasticity SI unit : Pa or Nm ⁻² Dimension : ML ⁻¹ T ⁻² (b) Definition of elastomer (1 mark) or Graph of elastomer (1/2 mark) Example of elastomer (1/2 mark)	1 1/2 1/2 1	3		
17	$v_1 = v/\lambda = 3v/4l$ (1 mark) $v_2 = v/\lambda = 5v/4l$ (1 mark) $\therefore \frac{v_1}{v_2} = \frac{3v}{4l} \times \frac{4l}{5v} = \frac{3}{5} = 3:5$ (1 mark) or $v_1 : v_2 = 3:5$ (1 marks)	3	3		
18	(a) Any related attempt (b) Statement of I ST law / $\Delta Q = \Delta U + \Delta W$ (1 mark) Explanation for conservation of energy / Law of conservation of energy (1 mark)	1 2	3		
19	(a) $\vec{A} \times \vec{B} = AB \sin \theta \hat{n}$ or Definition (b) $F = \sqrt{F_1^2 + F_2^2 + 2F_1 F_2 \cos \theta}$ (1 mark) $= \sqrt{25 + 49 + 2 \times 5 \times 7 \cos 60}$ (1/2 mark) $= \sqrt{109} \text{ N}$ (1/2 mark) or $F = 10.44 \text{ N}$ (1/2 score)	1 2	3		
20	Definition of conservative force Definition of Non-conservative force Examples : 1/2 mark for each	1 1 1	3		
21	(a) Statement (1 mark) $\tau = \frac{dL}{dt}$ (1/2 score) If $\tau = 0$, $\frac{dL}{dt} = 0$ or $L = \text{a constant}$ (1/2 mark) (b) (i) Angular velocity decreases (1/2) (ii) Angular velocity increases (1/2)	2 1	3		
22 to 25			3 x 4 = 12		
22	(a) Definition of heat (1 mark) Definition of temperature (1 mark) (b) $F = (9/5)C + 32$ (1 mark) $F = \frac{C}{2} \therefore \frac{C}{2} = \frac{9}{5}C + 32$ $C = -24.6^\circ\text{C}$ (1 mark) $\therefore F = -12.3^\circ\text{F}$	2 2	4		
23	(a) Statement of Newton's second law (1 mark) Definition of 1N (1 mark) or $F = ma$ (1/2 score) (b) Lift moving up $R = mg + ma$ But $a = 2g \therefore R = mg + 2mg = 3mg$	2 2	4		
24	(a) Definition of SHM / equation of SHM (b) Energy position graph (c) (i) 1 Hz (1/2 score) (ii) 2 unit / 2 cm (1/2 score)	1 2 1	4		
25	(a) Definition of displacement (1 mark) Definition of distance (1 mark) (b) (i) Distance = 4 km (ii) Displacement = 0	2 2	4		
26 to 29			3 x 5 = 15		
26	(a) Definition of g / equation of g (b) $g = \frac{GM}{R^2} = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24}}{(6400 \times 10^3)^2} = 9.8 \text{ m/s}^2$ (c) Proof $g' = g(1 - \frac{2h}{R})$ or Proof $g = \frac{GM}{(R+h)^2}$	1 1 3	5		
27	(a) Definition of projectile (b)  1/2 each (c) Proof $T = \frac{2u \sin \theta}{g}$	1 2 2	5		
28	(a) Definition of capillary rise (b) Derivation of $h = \frac{2S \cos \theta}{r \rho g}$ or figure only (1/2 score) (c) $h = \frac{2S \cos \theta}{r \rho g} = \frac{2 \times 0.456 \times \cos 140}{2 \times 10^{-3} \times 13.6 \times 10^3 \times 9.8} = -0.00262 \text{ m} = -2.62 \times 10^{-3} \text{ m}$	1 2 2	5		
29	(a) Statement of Hooke's law (b) Proof $E = (1/2)kx^2$ (any method) (c) Work done = Energy stored $u = (1/2)kx^2$ $F = mg = 5 \times 9.8 = 49 \text{ N}$ $F = kx \therefore k = 49/0.5 \times 10^{-2} = 9800 \text{ N/m}$ $\therefore u = (1/2) \times 9800 \times (0.5 \times 10^{-2})^2 = 0.122 \text{ J}$ or Work done = $(1/2)F \times \Delta l = (1/2)mg \times \Delta l$ $= (1/2) \times 5 \times 9.8 \times 0.5 \times 10^{-2} = 0.122 \text{ J}$	1 2 2	5		