Indian School Al Wadi Al Kabir
Final Examination 2024-2025

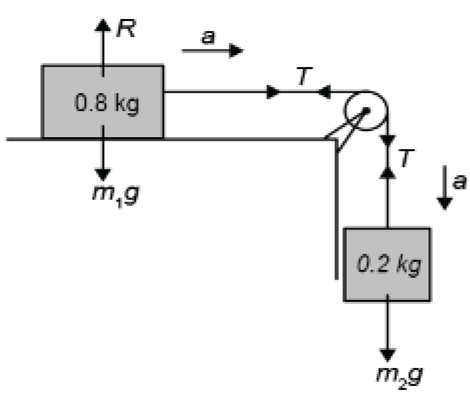
Class: XI   Subject: Physics (042)   Max. marks: 70
Date: 26/02/2025   SET-I   Time: 3 hours

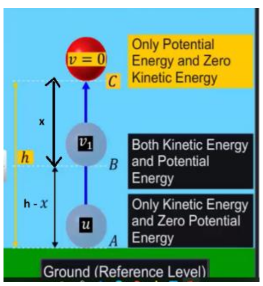
GENERAL INSTRUCTIONS

(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.

		MARKING SCHEME	TOTAL MARKS
	SECTION A		
1.	(d) Its velocity is zero and acceleration is equal to acceleration due to gravity (g).	1	1
2.	(b)125m	1	1
3.	(c)Thrice as high as ball B	1	1
4.	(a) 20J	1	1
5.	(d) The rocket will move at a constant velocity.	1	1
6.	(a) 3.14 rad/s^2	1	1
7.	(b) K/ 2	1	1
8.	d) height of the liquid level in the tubes A and C is the same	1	1
9.	(d) infinite	1	1

10.	(b) 0.5atm	1	1
11.	(d) between two collisions the molecules travel with uniform velocity.	1	1
12.	a) Higher amplitude	1	1
13.	(c) If Assertion is true but Reason is false.	1	1
14.	(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1	1
15)	(c) If Assertion is true but Reason is false.	1	1
16)	(d) If both Assertion and Reason are false.	1	1
	[SECTION – B]		
17)	$s = ut + \frac{1}{2}at^2$ Here, $a = -g$ (since gravity acts downward). Substituting the values: $0 = 49t - \frac{1}{2} \cdot 9.8t^2$ $0 = 49t - 4.9t^2$ $t = \frac{49}{4.9} = 10\,\text{s}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2
18)	$T^2 = \frac{4\pi^2 r^3}{GM}$ Taking dimensions on both sides, we get $[T]^2 = \frac{[L]^3}{[M^{-1}L^3T^{-2}M]} = [M^0L^0T^2]$ $\therefore$ LHS = RHS	1 + 1	2
	OR		
	Dimensions of pressure $= \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$ $\therefore$ Dimensions of $\frac{a}{V^2} = ML^{-1}T^{-2}$ Dimensions of a	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	

	$= ML^{-1}T^{-2}(V^3)^2$ $= (ML^{-1}T^{-2})(L^3)^2$ $= ML^{-1}T^{-2}L^6 = ML^5T^{-2}$ Similarly dimensions of b is same as that of volume. **Dimensions of b is L^3 .**	$\frac{1}{2}$	
19)	It states that the angular momentum will remain constant as long as the net torque acting on the system is zero. Any one example.	1 1	2
20)	Burns produced by steam. Steam at 100ºC steam has more heat equivalent to latent heat of vapourisation than water at 100ºC	1 1	2
21.	$\omega = 314$ $2\Pi f = 314$ $f = \frac{314}{2\Pi} = 50Hz$ $V = \frac{\omega}{k} = \frac{314}{1 \cdot 57} = 200m / S$	½ ½ ½ + ½	
	[SECTION – C] **(7x3=21 marks)**		
22)		1 ½	3

	m_1 = 0.8kg, m_2 = 0.2kg. The forces on the two blocks and tension in the string are shown in the figure. Let the two blocks move with common magnitude of acceleration a. Along the horizontal, the block of mass m_1 is acted upon by the force due to the tension in the string. ∴ $T = m_1 a$ ....(i) Since the block m_2 moves with an acceleration a in the downward direction, ∴ $m_2 g - T = m_2 a$ ....(ii) From (i) and (ii), we get $a = \frac{m_2 g}{m_1 + m_2} = \frac{0.2 \times 9..8}{0.8 + 0.2} = 1.96 m/s^2$ $a = 1.96 m/s^2$ From equation (i) $T = m_1 a = 0.8 \times 1.96$ T = 1.56N	½ ½ ½	
23)	This principle states that if only the conservative forces are doing work on a body, then its total mechanical energy(kinetic energy + potential energy)remains constant.  AT POINT C : The body is at rest. K.E of the body = 0 as the velocity is zero P.E of the body = mgh Total mechanical energy = K.E + P.E = mgh ------ (1) AT POINT B : Suppose the body falls freely through height 'x' and reaches the point B with velocity v. Then $v2 - 02 = 2gx$ $v2 = 2gx$ $KB = \frac{1}{2} mv2 = \frac{1}{2} m\, x\, 2gx = mgx$ $UB = mg(h - x)$ Total mechanical energy = $K_B + U_B = mgx + mg(h - x)$	1 1/2 1/2	3

	$= mgh$ ------------------(2) • AT POINT A: Suppose the body finally reaches a point A on the ground with velocity 'v'. Then • $v2\ - 02 = 2gh\quad or\quad v2 = 2gh$ • $KA = \frac{1}{2}mv'2\ = \frac{1}{2}m\,2gh = mgh$ • $U_A = 0$ as h= 0 TOTAL MECHANICAL ENERGY = $K_A + U_A = mgh$ Graph	½ 1/2	
24)	(i) Definition of free fall (ii) h = 32 km , R = 6400 km $$g_h = g\left(1 - \frac{2h}{R}\right) = g - 2\frac{gh}{R}$$ $$g - gh = \frac{2gh}{R}$$ Percentage decrease in weight – $$= \frac{mg - mg_h}{mg} \times 100 = g\frac{-g_h}{g}\times 100$$ $$= \frac{2gh}{g \times R} \times 100 = \frac{2h}{R} \times 100 = \frac{2\times 32\times 100}{6400}$$ = 1%	1 ½ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ -$\frac{1}{2}$	3
	OR	½ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ -$\frac{1}{2}$	

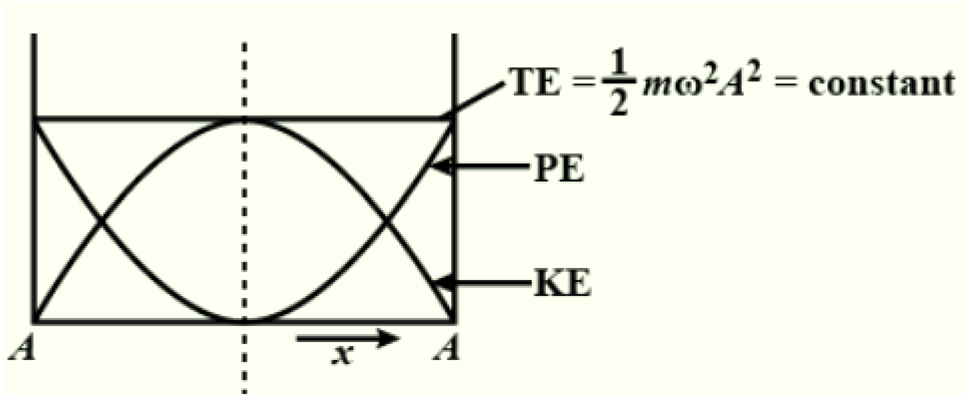
	Here, $h = 500km = 0.5 \times 10^6 m,$ $R = 6.5 \times 10^6 m.$ $r = R + h = 6.5 \times 10^6 + 0.5 \times 10^6$ $= 7.0 \times 10^6 m.$ (a) Now, $g' = g\left(\frac{R}{R+h}\right)^2$ $= 9.8\left(\frac{6.5 \times 10^6}{7.0 \times 10^6}\right)^2 = 8.45ms^{-2}$ (b) Centripetal force on the satellite, $F = mv^2/r$ $\therefore$ centreipetel acceleration, $a = \frac{F}{m} = \frac{v^2}{r} = \frac{\left(\sqrt{gR^2/r}\right)^2}{r}$ $= \frac{gR^2}{r^2} = g.\frac{R^2}{(R+h)^2} = 8.45ms^{-2}$	½ ½	
25)	(i) Due to elastic fatigue. Explanation (ii) $l = 5 \times 10^{-2}m, \Delta l = 0.2cm = 0.2 \times 10^{-2}m, F = 8N$ Shearing strain $= \frac{\Delta l}{l} = \frac{0.2}{5} = 0.04$ Shearing stress $= \frac{F}{l \times l} = \frac{8}{(5 \times 10^{-2})^2} = 3200\,Nm^{-2}$ Modulus of rigidity, $\eta = \frac{\text{Shearing stress}}{\text{Shearing strain}} = \frac{3200}{0.04} = 80000Nm^{-2} = 8 \times l0^4Nm^{-2}$	1 $\frac{1}{2}$ $\frac{1}{2}$ ½ ½	3
26)	(i) Definition of Stokes law Derivation	1 2	3
27)	(i) Any one postulate of kinetic theory of gases. (ii) Statement of law of equipartition of energy.	1/2 1	3

	the average energy per molecule is $3(\frac{1}{2}k_BT) + 2(\frac{1}{2}k_BT) = \frac{5}{2}k_BT$ The total internal energy per mole of the gas is $E = \frac{5}{2}N_Ak_BT$. $\therefore C_V = \frac{dE}{dT} = \frac{5}{2}N_Ak_B = \frac{5}{2}R$ and $C_P = C_V + R = \frac{5}{2}R + R = \frac{7}{2}R$ $\frac{c_P}{c_v} = \frac{7}{5} = 1\cdot 4$	$\frac{1}{2}$ ½ $\frac{1}{2}$	
28)	velocity of an object under SHM is $\frac{dx}{dt} = v_x = -\omega x_m \sin(\omega t + \phi)$ potential energy $U = \frac{1}{2}kx^2 = \frac{1}{2}k x_m^2 \cos^2(\omega t + \phi)$ Kinetic energy $K = \frac{1}{2}mv_x^2 = \frac{1}{2}m\omega^2 x_m^2 \sin^2(\omega t + \phi)$ the total energy, E, of the system is, $E = U + K$ $= \frac{1}{2}kA^2\cos^2(\omega t + \phi) + \frac{1}{2}kA^2\sin^2(\omega t + \phi)$ $= \frac{1}{2}kA^2[\cos^2(\omega t + \phi) + \sin^2(\omega t + \phi)]$ Using the familiar trigonometric identity, the value of the expression in the brackets is unity. Thus, $E = \frac{1}{2}kA^2$	1 1 $\frac{1}{2}$ $\frac{1}{2}$	3
	CASE STUDY BASED QUESTIONS		

29)	(I) (c) To pull, as the frictional force get reduced during pulling. (II) (b) 2.5 m/s^2 (iii) (d) Coefficient of friction remains the same OR (c) Limiting friction and rolling friction (iv) (d) 180^{o}	1 1 1 1	4
30)	(i) (A) Proportional limit (ii) (C) Tensile strength (iii) (B) up to *OB* OR (D) Young's modulus (iv) (A) 10^{11} N/m^2	1 1 1 1	4
	SECTION E		
31)	(a) diagram Derivation of maximum height Time of flight Horizontal range (b) The range of the projectile $R = \frac{u^2 \sin 2\theta}{g}$, R will be the maximum, if $\sin 2\theta = 1 \Rightarrow 2\theta = 90^\circ \Rightarrow \theta = 45^\circ$ Then, $R_{max} = \frac{u^2}{g}$ So the maximum height attained by the projectile is: $H = \frac{u^2 \sin^2 45^\circ}{2g} = \frac{u^2}{g} \times \frac{1}{2} = \frac{R_{max}}{4} \Rightarrow R_{max} = 4H$	½ 1/2 1 1 ½ ½ ½ ½	5

	OR		
	Statement of parallelogram law of vectors. Diagram and derivation Here, $P = Q = x$ (say) and $R = \frac{3}{2}x$ Now $R = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$ $\therefore \frac{3}{2}x = \sqrt{x^2 + x^2 + 2x \times x \times \cos\theta}$ or $\frac{9}{4}x^2 = 2x^2 + 2x^2\cos\theta$ or $\cos\theta = \frac{1}{8} = 0{\cdot}1250$	1 ½ ½ 1 ½ 1/2 1 /2 1/2	
32)	[i] Bernoulli's principle states that in a streamline flow of an ideal liquid , the sum of pressure energy, potential energy per unit volume and kinetic energy per unit volume is always a constant. Diagram Let ρ be the density of the fluid. Whatever mass of the fluid enters the pipe at section A in time Δt, an equal mass of fluid flows out at section b in time Δt. At section A Work done on the liquid column of certain mass m = W = force x displacement $W = P_1 \times a_1 \times$ displacement $= P_1 \times$ volume of water $= P_1 \times$ mass/density $= P_1 m/\rho$= pressure energy Kinetic energy $= \frac{1}{2} m v_1^2$ Potential energy $= mgh_1$ Total energy at A $= P_1 m/\rho + \frac{1}{2} m v_1^2 + mgh_1$	1 ½ $\frac{1}{2}$ ½ ½	5

	Similarly total energy ay B = $P_2 m/\rho + \frac{1}{2} m v_2^2 + mgh_2$ According to law of conservation of energy T.E at A = T.E at B $P_1 m/\rho + \frac{1}{2} m v_1^2 + mgh_1 = P_2 m/\rho + \frac{1}{2} m v_2^2 + mgh_2$ Dividing by m/ρ we get $P_1 + \rho v_1^2/2 + \rho g h_1 = P_2 + \rho v_2^2/2 + \rho g h_2$ i.e $P + \rho v^2/2 + \rho g h$ = a constant any one application OR (i) It is maximum constant velocity acquired by the body while falling freely in a viscous medium. Derivation of terminal velocity. (ii) Statement of Pascal's law Application (Any one)	½ ½ 1 1 1 +1 1 1	
33)	(i)Definition of simple harmonic motion Derivation or time period of oscillation of simple pendulum. Diagram Derivation (ii) Maximum velocity $v_m = a\omega = a\left(\frac{2\pi}{T}\right)$ $T = \frac{2\pi a}{v_m} = 2 \times \frac{22}{7} \times \frac{(7 \times 10^{-3})}{4.4}$ $= 10^{-2}$ sec = 0.01 sec. OR (i) Expression for total energy (ii) Graphical representation	1 ½ 1 + 1 ½ ½ ½ 2 ½	5

		1	
	Total energy (E) in SHM is given as; $E = \frac{1}{2}KA^2 = \frac{1}{2}m\omega^2A^2$	[$\frac{1}{2}$]	
	$\therefore E \propto A^2$	$\frac{1}{2}$	
	$\frac{E_1}{E_2} = \left(\frac{A_1}{A_2}\right)^2 = \left(\frac{2}{5}\right)^2 = \frac{4}{25}$	$\frac{1}{2}$	