

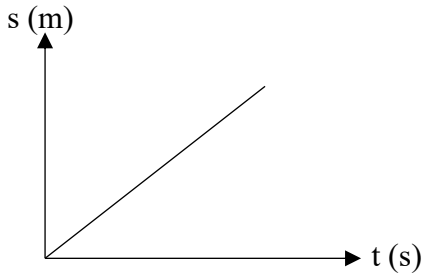
SUGGESTED ANSWER

TRIAL 1

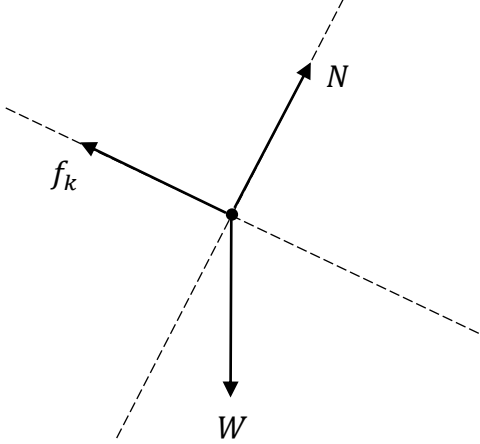
PHYSICS

SESSION 2023/2024

NO	ANSWERS	MARKS
1	$LHS = RHS$ $[a] = [ut^2] = [vt^2]$ $LT^{-2} = (LT^{-1})(T^2) = (LT^{-1})(T^2)$ $LT^{-2} \neq LT = LT$ <p>OR</p> <p>This is not a homogenous equation</p>	G1 <i>(bracket must be included)</i> J1
	Total	2 marks

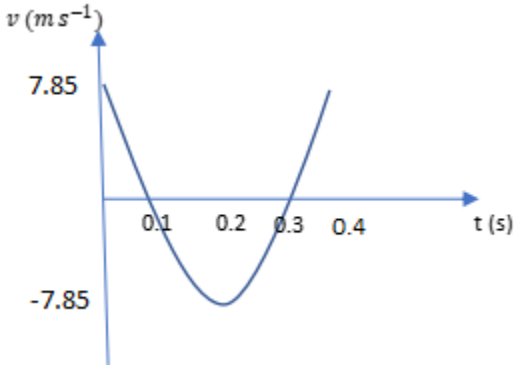
NO	ANSWERS	MARKS
2 (a) (i)	 <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Shape-D1 Both correct label axis –D1 </div>	D2
2 (a) (ii)	$a = \frac{v - u}{t_2 - t_1}$ $a = \frac{0 - 8}{16 - 12} = -2 \text{ m s}^{-2}$ $-2 = \frac{-10 - 8}{T - 12}$ $T = 21 \text{ s}$	GJ1 G1 JU1
2 (b) (i)	$s_x = u_x t$ $25 = (u_x)(1.8)$ $u_x = 13.89 \text{ m s}^{-1}$	G1 JU1
2 (b) (ii)	$s_y = u_y t - \frac{1}{2} g t^2$ $-(100 - s_{yB}) = 0 - \frac{1}{2} (9.81)(1.8)^2$ $s_{yB} = 84.11 \text{ m}$	K1 G1 JU1
	Total	10 marks

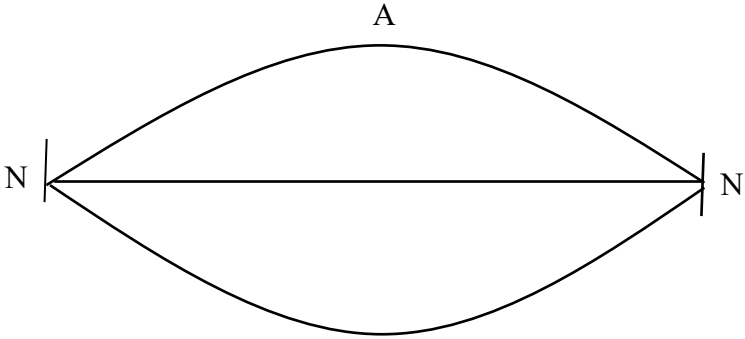
NO	ANSWERS	MARKS
3 (a) (i)	$\Sigma p_i = \Sigma p_f$ $m_1 u_1 + m_2 u_2 = (m_1 + m_2)v$ $(0.002)(800) + m_2(0) = (0.002 + m_2)(3.19)$ $m_2 = 0.5 \text{ kg}$	K1 G1 JU1
3 (a) (ii)	<p>Initial</p> $\Sigma K_i = \frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2$ $= \frac{1}{2} (0.002)(800)^2 + \frac{1}{2} (5)(0)^2$ $= 640 \text{ J}$ <p>Final</p> $\Sigma K_f = \frac{1}{2} (m_1 + m_2) v^2$ $= \frac{1}{2} (0.002 + 5)(3.19)^2$ $= 2.55 \text{ J}$ $\Sigma K_i \neq \Sigma K_f$ <p>\therefore inelastic collision</p>	GJU1 GJU1 J1

<p>3 (b) (i)</p>		<p>D2</p> <p>All 3 labelled forces are correct with correct arrows</p> <p>*Deduct 1 mark for each wrong forces and arrows</p>
<p>3 (b) (ii)</p>	$\Sigma F_x = ma$ $W \sin \theta - f_k = ma$ $(2)(9.81) \sin 30^\circ - f_k = (2)(4)$ $f_k = 1.81 \text{ N}$ $\Sigma F_y = 0$ $N - W \cos \theta = 0$ $N - (2)(9.81) \cos 30^\circ = 0$ $N = 16.99 \text{ N}$ $f_k = \mu N$ $1.81 = \mu(16.99)$ $\mu = \mathbf{0.1065}$	<p>K1</p> <p>G1</p> <p>K1</p> <p>G1</p> <p>GJU1</p>
	<p>Total</p>	<p>13 marks</p>

NO	ANSWERS	MARKS
4 (a) (i)	$W_w = (mg \cos \theta)s$ $W_w = (5(9.81) \cos 180)10$ $W_w = -490.5 \text{ J}$	G1 JU1
4 (a) (ii)	$U = mgh$ $U = 5(9.81)(10)$ $U = 490.5 \text{ J}$	GJU1
4 (a) (iii)	$P_{ave} = \frac{W}{t}$ $P_{ave} = \frac{490.5}{2}$ $P_{ave} = 245.25 \text{ W}$	GJU1
4 (b) (i)	$\text{work done} = \text{area under the graph}$ $W = 30 (4)$ $W = 120 \text{ J}$	K1 GJU1
4 (b) (ii)	$W = \Delta K$ $W = \frac{1}{2}mv^2 - 0$ $120 = \frac{1}{2}(40)v^2 - 0$ $v = 2.45 \text{ m s}^{-1}$	G1 JU1
	Total	8 marks

NO	ANSWERS	MARKS
5 (a) (i)	$\omega = \frac{200(2\pi)}{60} = \frac{20\pi}{3} \text{ rad s}^{-1}$ $\omega = 2\pi f$ $\frac{20\pi}{3} = 2\pi f$ $f = 3.3 \text{ Hz}$	GJ1 GJU1
5 (a) (ii)	$a_c = r\omega^2 = (2.4)(20.94)^2$ $a_c = 1052.36 \text{ m s}^{-2}$	 GJU1
5 (b)	$\sum F_c = \frac{mv^2}{r}$ $\mu_s N = \frac{mv^2}{r}$ $(0.5)(m)(9.81) = \frac{(m)v^2}{45}$ $v = 14.86 \text{ m s}^{-1}$	 G1 JU1
	Total	5 marks

NO	ANSWERS	MARKS
6 (a) (i)	$\omega = \frac{2\pi}{T} = \frac{2\pi}{0.4}$ $\omega = 5\pi \text{ rad s}^{-1} = 15.71 \text{ rad s}^{-1}$	GJU1
6 (a) (ii)	$v = Aw \cos \omega t = 0.5(5\pi) \cos(5\pi t)$ $v = 7.85 \cos(5\pi t)$ 	<p>G1</p> <p>D1 (axis and label values v_{max} and T)</p> <p>D1 (shape of the graph)</p>
6 (b) (i)	$A = 3 \text{ m}$	J1
6 (b) (ii)	$v_{max} = A\omega = 3 (50)$ $v_{max} = 150 \text{ m s}^{-1}$	<p>G1</p> <p>JU1</p>
6 (b) (iii)	$k = \frac{2\pi}{\lambda}$ $0.2 = \frac{2\pi}{\lambda}$ $\lambda = 10\pi \text{ m} = 31.42 \text{ m}$ <p>The distance between consecutive antinodes is half the wavelength of the $\lambda/2$.</p> $\frac{\lambda}{2} = \frac{10\pi}{2} = 5\pi \text{ m} = 15.7 \text{ m}$	<p>G1</p> <p>K1</p> <p>GJU1</p>

6 (c) (i)	<div>  </div> <div style="border: 1px solid black; padding: 5px; margin-top: 20px;"> Correct shape-D1 Correct label nodes and antinodes –D1 </div>	D2
6 (c) (ii)	<div> $f_n = \frac{n}{2L} \sqrt{\frac{T}{\mu}}$ </div> <div> $n = 1$ </div> <div> $\mu = \frac{m}{l}$ </div> <div> $\mu = \frac{0.2 \times 10^{-3}}{80 \times 10^{-2}}$ </div> <div> $\mu = 2.5 \times 10^{-4} \text{ kg m}^{-1}$ </div> <div> $f_1 = \frac{1}{2(80 \times 10^{-2})} \sqrt{\frac{180}{2.5 \times 10^{-4}}}$ </div> <div> $f_1 = 530.33 \text{ Hz}$ </div>	<div>K1</div> <div>G1</div> <div>GJU1</div>

<p>6 (c)</p> <p>(iii)</p>	$f_n = \frac{n}{2L} \sqrt{\frac{T}{\mu}}$ $\mu = \frac{m}{l}$ $\mu = \frac{3.3 \times 10^{-3}}{80 \times 10^{-2}}$ $\mu = 4.125 \times 10^{-3} \text{ kg m}^{-1}$ $f_1 = \frac{1}{2(80 \times 10^{-2})} \sqrt{\frac{180}{4.125 \times 10^{-3}}}$ $f_1 = 130.56 \text{ Hz}$ <p>Fundamental frequency decreases</p>	<p>G1</p> <p>G1</p> <p>JU1</p> <p>J1</p>
<p>6 (d)</p>	$v_s = \frac{1}{2}(340) = 170 \text{ m s}^{-1}$ $f_a = \frac{v}{v - v_s} f$ $f_a = \frac{340}{340 - 170} (1 \times 10^3)$ $f_a = 2000 \text{ Hz}$ <p>The apparent frequency increases</p>	<p>K1</p> <p>G1</p> <p>JU1</p> <p>J1</p>
	<p>Total</p>	<p>23 marks</p>

NO	ANSWERS	MARKS
7 (a)	$\varepsilon = \frac{\Delta L}{L_o} = \frac{0.766 - 0.755}{0.755} = 0.0146$ $F = YA\varepsilon$ $F = 1.30 \times 10^{11} (3.75 \times 10^{-7}) 0.0146$ $F = 711.75 \text{ N}$	<p>G1</p> <p>GJU1</p>
7 (b)	$A = \frac{\pi d^2}{4} = \frac{\pi (1.6 \times 10^{-2})^2}{4} = 2.01 \times 10^{-4} \text{ m}^2$ $\frac{Q}{t} = -kA \left(\frac{\Delta T}{L} \right)$ $\frac{Q}{t} = -(380) (2.01 \times 10^{-4}) \left(\frac{0 - 100}{25 \times 10^{-2}} \right)$ $\frac{Q}{t} = 30.55 \text{ W}$	<p>G1</p> <p>G1</p> <p>JU1</p>
7 (c)	$\beta = 2\alpha$ $A = A_0(1 + \beta \Delta T)$ $\frac{\pi d^2}{4} = \frac{\pi d_o^2}{4} [1 + \beta \Delta T]$ $d^2 = (2.0 \times 10^{-2}) [1 + 2(2.5 \times 10^{-5} (60 - 20))]$ $d = 2.002 \times 10^{-2} \text{ m}$	<p>K1</p> <p>G1</p> <p>JU1</p>
	Total	8 marks

NO	ANSWERS	MARKS
8 (a)	$U = \frac{f}{2}nRT$ $U = \frac{5}{2}(2)(8.31)(380.26)$ $U = 15800 J$	<p>G1</p> <p>JU1</p>
8 (b)	$Q = +1500 J, \Delta U = -800 J$ $\Delta U = Q - W$ $-800 = 1500 - W$ $W = 2300 J$	<p>G1</p> <p>JU1</p>
8 (c)	$U = \frac{f}{2}nRT$ $f = 3$ $U = \frac{f}{2}pV$ $U = \frac{3}{2}(4.0 \times 10^5)(4 \times 10^{-6})$ $U = 2.4 J$	<p>K1</p> <p>G1</p> <p>JU1</p>
8 (d) (i)	$W_{RS} = p\Delta V$ $W_{RS} = 1 (100 - 200)$ $= -100 J$	<p>G1</p> <p>JU1</p>
8 (d) (ii)	$\Delta U_{PQR} = \Delta U_{RP} = -\Delta U_{PR} = -300 J$ $W_{RSP} = W_{RS} + W_{SP} = -100 + 0 = -100 J$ $Q_{RSP} = W_{RSP} + \Delta U_{PQR}$ $Q_{RSP} = -100 + (-300)$ $Q_{RSP} = -400 J$	<p>K1</p> <p>GJU1</p>
	Total	11 marks