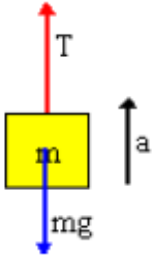


ANSWER SCHEME SET A

NO	ANSWER	MARKS
1	$F_x = -F_1 = -20 \text{ N}$ $F_y = F_2 = 25 \text{ N}$ $ F_{\text{net}} = \sqrt{F_x^2 + F_y^2}$ $= \sqrt{(-20)^2 + (25)^2}$ (*must have negative sign) $= 32.02 \text{ N}$	G1 JU1
TOTAL		2 MARKS
2.(a)(i)	$t_{\text{Total}} = ?$ $t = \frac{v - u}{a}$ $t = \frac{24.0 - 0}{1.50}$ $t = 16.0 \text{ s}$ $s = ut + \frac{1}{2}at^2$ $180 = 24.0t + 0$ $t = 7.5 \text{ s}$ $t_{\text{Total}} = 16.0 + 7.5 + 6.5 = 30.0 \text{ s}$	G1 JU1
2.(a)(ii)	$v_{\text{ave}} = ?$ $s = ut + \frac{1}{2}at^2$ $s = 0 + \frac{1}{2}(1.50)(16)^2$ $s = 192 \text{ m}$ $v_{\text{ave}} = \frac{S_f - S_i}{t_f - t_i}$ $v_{\text{ave}} = \frac{(192 + 180) - 0}{23.5 - 0}$ $v_{\text{ave}} = 15.83 \text{ m s}^{-1}$	G1 GJU1

	Block B $\sum F_y = ma$ $W - T = 22a$ $T = 22(9.81) - 22a$ $22(9.81) - 22a - 35(9.81)\sin 30^\circ = 35a$ $a = 0.774 \text{ ms}^{-2}$	K1 JU1
3.(c)(iii)	$T = 22(9.81) - 22(0.774)$ $T = 198.72 \text{ N}$	GJU1
TOTAL		13 MARKS
4 (a)(i)	 $T = mg + ma = (150)(9.81) + (150)(0.5) = 1546.50 \text{ N}$ $W_T = T(s) \cos 0 = (1546.5)(3) \cos 0 = 4.64 \times 10^3 \text{ J}$	K1 GJU1
4 (a)(ii)	$W_W = mg(s) \cos 180^\circ$ $W_W = (150)(9.81)(3) \cos 180^\circ$ $W_W = -4.41 \times 10^3 \text{ J}$	G1 JU1
4 (a)(iii)	$W_{Total} = W_T + W_W$ $W_{Total} = (4.64 \times 10^3) + (-4.41 \times 10^3)$ $W_{Total} = 0.23 \times 10^3 \text{ J}$	K1 GJU1
4 (b)	$12 \text{ km/h} \times (1000 \text{ m})/\text{km} \times (1 \text{ h})/(3600 \text{ s}) = 3.333 \text{ m/s} .$ $P = F \cdot v$ $F = \frac{P}{v} = \frac{7500}{3.33} = 2250 \text{ N}$	G1 JU1
	TOTAL	13 MARKS
5(i)	$\omega = \frac{2\pi}{T} = \frac{2\pi}{1.7} = 3.7 \text{ rads}^{-1}$ $a = r\omega^2 = (0.6)(3.7)^2 = 8.21 \text{ ms}^{-2}$	G1 JU1

5(ii)	$\omega = \frac{1 \text{ rev}}{2 \text{ mins}} \times \frac{2\pi \text{ rad}}{1 \text{ rev}} \times \frac{1 \text{ min}}{60 \text{ sec}} = 0.0524 \text{ rads}^{-1}$ $F_c = mr\omega^2$ $= (0.9)(0.6)(0.0524)^2$ $= 1.5 \times 10^{-3} \text{ N}$	<p>G1</p> <p>G1</p> <p>JU1</p>
TOTAL		5 MARKS
6.(a)(i)	<p>Given;</p> <p>$A = 25 \text{ cm}$</p> <p>$a_{\max} = 12.5 \text{ m s}^{-2}$</p> <p>$a_{\max} = A\omega^2$</p> <p>$12.5 = (0.25)\omega^2$</p> <p>$\omega = 7.07 \text{ rads}^{-1}$</p> <p>$\omega = \frac{2\pi}{T}$</p> <p>$T = \frac{2\pi}{7.07} = 0.89 \text{ s}$</p>	<p>G1</p> <p>JU1</p>
6.(a)(ii)	<p>Given;</p> <p>$y = 15 \text{ cm}$</p> <p>$v = \omega\sqrt{A^2 - y^2}$</p> <p>$= 7.07\sqrt{0.25^2 - 0.15^2}$</p> <p>$= 1.41 \text{ m s}^{-1}$</p>	<p>G1</p> <p>JU1</p>
6.(b)(i)	<p>Given;</p> <p>$v = 8 \text{ ms}^{-1}$ (to the left)</p> <p>$A = 20 \text{ mm}$</p> <p>$\lambda = 40 \text{ cm}$</p> <p>$v = f\lambda$</p> <p>$8 = f(0.4)$</p> <p>$f = 20 \text{ Hz}$</p>	<p>G1</p> <p>JU1</p>
6.(b)(ii)	<p>$y = A \sin(\omega t + kx)$</p> <p>$\omega = 2\pi f$</p> <p>$= 2\pi(20)$</p> <p>$= 40\pi \text{ rad s}^{-1}$</p> <p>$k = \frac{2\pi}{\lambda}$</p> <p>$= \frac{2\pi}{0.4}$</p> <p>$= 5\pi \text{ m}^{-1}$</p>	<p>G1</p> <p>G1</p>

6. d(ii)	$f_a = \left(\frac{343}{343 + 19.44} \right) 1000$ $= 946.36 \text{ Hz}$	K1 GJU1
	TOTAL	23 MARKS
7 (a)(i)	$\sigma = \frac{F}{A} = \frac{mg}{A} = \frac{(5)(9.81)}{(1.20 \times 10^{-6})}$ $\sigma = 4.09 \times 10^7 \text{ N m}^{-2}$	GJU1
7(a)(ii)	$\frac{U}{V} = \frac{1}{2} \sigma \varepsilon = \frac{1}{2} \frac{\sigma^2}{Y} = \frac{1}{2} \frac{(4.09 \times 10^7)^2}{(190 \times 10^9)}$ $\frac{U}{V} = 4.40 \times 10^3 \text{ J m}^{-3}$	G1 JU1
7(b)(i)	$\frac{\Delta T}{L} = \frac{(0 - 60)}{0.1} = -600 \text{ }^\circ\text{C m}^{-1}$	GJU1
7(b)(ii)	$\left(\frac{Q}{t} \right)_{cu} = \left(\frac{Q}{t} \right)_{steel}$ $-k_{cu} A \left(\frac{\Delta T}{L} \right)_{cu} = -k_{steel} A \left(\frac{\Delta T}{L} \right)_{steel}$ $(380) \left(\frac{60 - 100}{L} \right)_{cu} = 46(-600)$ $L = 0.55 \text{ m}$	K1 G1 JU1
7(c)	$\Delta A = \beta A_o \Delta T$ $(600 - 550) \times 10^{-4} = 2(2.3 \times 10^{-5})(550 \times 10^{-4})(T - 10)$ $T = 1986.28 \text{ }^\circ\text{C}$	GJU1
	TOTAL	8 MARKS
8(a)	<p><i>Using formula</i></p> $P = \frac{1}{3} \rho v_{rms}^2$ $\rho = \frac{3P}{v_{rms}^2}$ $= \frac{3(1.01 \times 10^5)}{(2500)^2}$ $= 0.048 \text{ kg m}^{-3}$	G1 JU1

8.(b)(i)	$K = \frac{3}{2}kT = \frac{3}{2}(1.38 \times 10^{-23})(310)$ $K = 6.417 \times 10^{-21} J$	G1 JU1
8.(b)(ii)	$U = \frac{f}{2}nRT = \frac{3}{2}(0.2)(8.31)(310)$ $U = 772.83 J$	G1 JU1
8.(c)(i)	Isothermal compression	J1
8.(c)(ii)	$W = nRT \ln \frac{V_f}{V_i}$ $W = (0.5)(8.31)(200) \ln \frac{0.004}{0.007}$ $= -465.04 J$	G1 JU1
8.(c)(iii)	$\Delta U = Q - W$ $\Delta U = 0$ $Q = W = -465.04 J$	K1 JU1
	TOTAL	11 MARKS