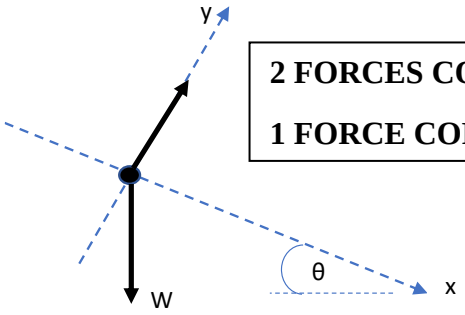
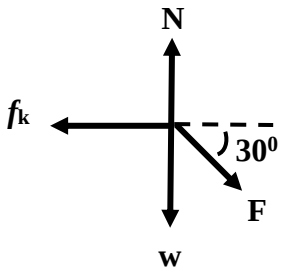
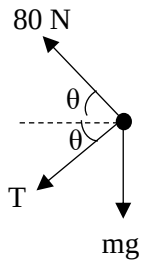
UNIT FIZIK
KOLEJ MATRIKULASI NEGERI SEMBILAN

Skema Jawapan dan Pemarkahan Ujian Selaras 2
Semester I Sesi 2023/2024

NO.	ANSWER SCHEME	MARK(S)
1	$[F] = [a][t] = [b][t^2]$ $[a] = \frac{[F]}{[t]} = \frac{MLT^{-2}}{T} = MLT^{-3}$ must have [ ]	K1 GJU1
		2
2 (a)	For time interval $t = 0\ s - 3\ s$ $a = \frac{v-u}{t_2-t_1} = \frac{5-0}{3-0} = \mathbf{1.67\ ms^{-2}}$ For time interval $t = 3\ s - 7\ s$ $a = \frac{v-u}{t_2-t_1} = \frac{-4-5}{7-3} = \mathbf{-2.25\ ms^{-2}}$ Must -ve	K1 (gradient) GJU1 GJU1
2 (b)	(i) $u_x = 23\cos 30° = 19.92\ ms^{-1}$ $u_y = 23\sin 30° = 11.5\ ms^{-1}$ at maximum height, $v_y = 0$ $v_y^2 = u_y^2 - 2gs_y$ $0 = 11.5^2 - 2(9.81)s_y$ $s_y = 6.74\ m$ Hence, maximum height from the ground is $s_y = 6.74 + 40 = \mathbf{46.74\ m}$ (ii) $u_y = 23\sin 30° = 11.50\ ms^{-1}$ $s_y = u_y t - \frac{1}{2}gt^2$ (s_y = -40m) $-40 = (11.50)t - \frac{1}{2}(9.81)t^2$ $\boldsymbol{t = 4.26\ s}$ *and* $t = -1.92\ s$ *(neglect)* (iii) $s_x = u_x t = 23\cos 30°\ (4.26)$ $s_x = 23\cos 30°\ (4.26)$ ecf t ? $s_x = \mathbf{84.85\ m}$	K1 G1 GJU1 K1 GJU1 G1 JU1
		10

3	(a) Change in momentum, $\Delta P = Area\ under\ the\ F - t\ graph$ $= \frac{1}{2}(10)(3.0 \times 10^3)$ $= 1.5 \times 10^4\ kgms^{-1}$@ Ns	K1 G1 JU1
	(b) (i) $\sum p_i = \sum p_f$ $mu = m_1v_1 + m_2v_2$ $(400)(300) = (50)(-120) + (350)v_2$ $v_2 = 360\ ms^{-1}$ Direction: to the right	K1 G1 JU1 J1
	(c) (i)  **2 FORCES CORRECT- 2 MARKS** **1 FORCE CORRECT- 1 MARK**	D2
	(ii) $\sum F_x = ma$ $mg \sin\theta = ma$ $(9.81)\sin 23 = a$ $3.83\ ms^{-2} = a$	K1 GJU1
	(iii) $v^2 = u^2 + 2as$ $v^2 = 0^2 + 2(3.83)12$ ecf a $v = 9.59\ ms^{-1}$	G1 JU1
		13
4	(a)  	

	$F_x - f_k = \sum F$ ---------- K1 $(F\cos\theta) - f_k = ma$ $(25\cos 30) - (10$ $F_{nett} = 11.65\ N$ $W_{nett} = F_{nett}\,(s)(\cos\theta)$ **$\cos 0^0$** ---------- K1 $W_{nett} = (11.65)\ (6)\ (\cos 0^0)$ $\boldsymbol{W_{nett} = 69.9\ J}$	**K1** **K1** G1 JU1
	(b) $\sum \boldsymbol{E_i} = \sum \boldsymbol{E_f}$ $mgh = \frac{1}{2}mv^2$ $\therefore$ ***Kinetic Energy*** $= \boldsymbol{mgh}$ ---------- K1 $= (2000)(9.81)(10) = \boldsymbol{196200\ J}$	**K1** GJU1
	(c) $P = \frac{W}{t} = \frac{E}{t} = \frac{mgh}{t}$ $\boldsymbol{P = \frac{mgh}{t}}$ $P = \frac{(10)(9.81)(15)}{(5)} = \boldsymbol{294.3\ W}$	**K1** GJU1
		8

5 (a)	$\theta = \sin^{-1}\frac{1}{1.25} = 53.13^{\circ}$  $\Sigma F_y = 0$ $80\sin 53.13^{\circ} - T\sin 53.13^{\circ} - (4 \times 9.81) = 0$ $T = 30.95$ N	K1 G1 JU1
5 (b)	$F_c = ma_c$ $80\cos 53.13^{\circ} + 30.95\cos 53.13^{\circ} = 4a_c$ $a_c = 16.64\ \text{ms}^{-2}$	G1 JU1
		5
6	(a) (i) $A = 5\ cm = 0.05\ m$ $\omega = \frac{2\pi}{T} = 2\pi$ $T = 1\ s$	JU1 JU1
	(a) (ii) $a_{\max} = A\omega^2$ $= 5\ x\ 10^{-2}(2\pi)^2$ $= 1.97\ m\ s^{-2}$	G1 JU1
	(a) (iii) $y = 5\sin 2\,(\pi\,(5)) = 0$ $K = \frac{1}{2}m\omega^2(A^2 - y^2)$ $K = \frac{1}{2}(3)(2\pi)^2((5\ x\ 10^{-2})^2 - 0^2)$ $= 0.15\ J$ $U = \frac{1}{2}m\omega^2(y^2)$ $U = \frac{1}{2}(3)(2\pi)^2(0^2)$ $= 0\ J$	K1 G1 JU1 G1 JU1
	(b) $\omega = 2\pi f = 2\pi(50) = 100\pi$ $v = f\lambda$ $100 = 50\lambda$ $\lambda = 2\ m$ $k = \frac{2\pi}{\lambda} = \frac{2\pi}{2} = \pi$ $y = 5\ x\ 10^{-2}\sin\ (100\pi t - \pi\ x)$ where y and x in meter and t in second	G1 G1 JU1

	(c) (i) $v = \sqrt{\frac{T}{\mu}}$ $v = \sqrt{\frac{135}{\frac{0.3}{3.5}}}$ $= 39.69\ m\ s^{-1}$ $v = f\lambda$ $\lambda = \frac{39.69}{200}$ $= 0.2\ m$	G1 JU1 G1 JU1
	(c) (ii) $f = \frac{nv}{2L}$ $n = \frac{200\ (2\ x\ 3.5)}{39.69}$ ecf v $= 35.27$ ≈ 35	G1 JU1
	(d) (i) Train approaches $f_a = \left(\frac{340-0}{340-35}\right)150$ $= 167.21\ Hz$ Train away $f_a = \left(\frac{340-0}{340+35}\right)150$ $= 136\ Hz$	G1 JU1 G1 JU1
	(d) (ii) $f_a = f$	J1
		23
7	(a) (i) $\sigma = \frac{F}{A}$ $= \frac{5}{\pi(0.2\times10^{-3})^2}$ $= 3.98 \times 10^7\ \text{Nm}^{-2}$	G1 JU1
7	(a) (ii) $U = \frac{1}{2}F\Delta l$ $= \frac{1}{2}(5)(0.9\times10^{-3})$ $= 2.25 \times 10^{-3}\text{J}$	G1 JU1
7	(b) (i) $\Delta L = \alpha L_0 \Delta T$ $= (11\times10^{-6})(0.5)(50-20)$ $= 1.65 \times 10^{-4}\ \text{m}$	G1 JU1
7	(b) (ii) $Y = \frac{FL_0}{A\Delta L}$	

	$200 \times 10^9 = \dfrac{F(0.5)}{\pi(1.5 \times 10^{-2})^2(1.65 \times 10^{-4})}$ .....ecf Δ I $F = 4.67 \times 10^4$ N	G1 JU1
		8
8	(a) (i) $v_{rms} = \sqrt{\dfrac{3PV}{Nm}} = 1420 \ldots\ldots\ldots\ldots\ldots\ldots (1)$ $v'_{rms} = \sqrt{\dfrac{3(3P)(V)}{Nm}} \ldots\ldots\ldots\ldots\ldots\ldots (2)$ (2) ÷ (1) $\dfrac{v'_{rms}}{1420} = \dfrac{\sqrt{\frac{3(3P)(V)}{Nm}})}{\sqrt{\frac{3PV}{Nm}}}$ $= 2.46 \times 10^3\ ms^{-1}$ (ii) $v_{rms} = \sqrt{\dfrac{3RT}{M}}$ $2.46 \times 10^3 = \sqrt{\dfrac{3(8.31)(T)}{4 \times 10^{-3}}} \ldots\ldots\ldots\ldots\ldots ecf\ v_{rms}$ $T = 970.97\ K$	K1 G1 JU1 G1 JU1
	(b) (i) $W = W_1 + W_2$ $= nRT \ln \frac{V_f}{V_i} + P(V_f - V_i)$ $= 1.5\ (8.31)(321) \ln \frac{0.3}{0.8} + 3.22 \times 10^3\ (0.8 - 0.3)$ $= -2.31 \times 10^3\ J$ (ii) $\Delta U = \frac{5}{2} nRT$ $dof = 5$ $= \frac{5}{2}\ (1.5)(8.31)(500 - 321)$ $= 5.58 \times 10^3\ J$	K1 G1 JU1 K1 G1 JU1
		11
	TOTAL	**80**