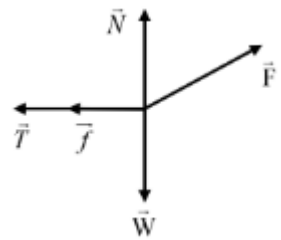
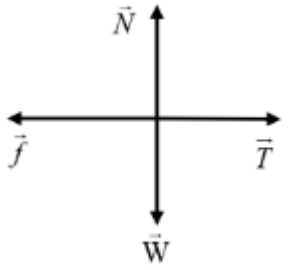
KOLEJ MATRIKULASI KEDAH

SKEMA JAWAPAN DAN PEMARKAHAN PRA PSPM PHYSICS 1 (SET 1)

SEMESTER 1, SESI 2023/2024

No	Suggested Answer	Marks
1(a)	$S_x = 4.5 \cos 75^o = 1.17$ m	GJU1
1(b)	$S_y = 4.5 \sin 75^o = 4.35$ m	GJU1
	TOTAL	2
2(a)(i)	$a_{ave} = Gradient\ of\ v - t\ graph$ $a_{ave=} = \frac{8-(-8)}{15-5}$ $a_{ave} = 1.6$ m s^{-2}	GJU1
2(a)(ii)	$Displacement = Area\ under\ v - t\ graph$ $s = \frac{1}{2}(-8)(5) + \frac{1}{2}(8)(5) = 0$ m $Distance\ travelled = \frac{1}{2}(8)(5) + \frac{1}{2}(8)(5)$ $d = 40$ m	K1 GJU1 G1 JU1
2(b)	$v = u + at$; $15 = u + 6.7a$ $a = \frac{15-u}{6.7}$ → (1) $s = ut + \frac{1}{2}at^2$; $90 = 6.7u + \frac{1}{2}a(6.7)^2$ → (2) *Substitute equation* (1) *into* (2) $6.7u + 22.445 = 90$ $u = 11.87$ m s^{-1} **OR** $s = \frac{1}{2}(v+u)t$; $90 = \frac{1}{2}(u+15)(6.70)$ $u = 11.87$ m s^{-1}	GJ1 JU1

2(c)(i)	$s_y = u_y t - \frac{1}{2} g t^2$ $-90 = (-u \sin 40)(3.5) - \frac{1}{2}(9.81)\ (3.52)^2$ $u = 13.30 \text{ m s}^{-1}$	 G1 JU1
2(c)(ii)	$S_x = u_x\, t$ $S_x = (13.30 \cos 40)(3.5) = 35.66 \text{ m}$	 GJU1
	TOTAL	10
3(a)	$\Sigma P_{ix} = \Sigma P_{fx}$ $m_A u_{Ax} + m_B u_{Bx} = m_A v_{Ax} + m_B v_{Bx}$ $m\ (40) + 0 = m\ (v_A \cos 60) + m\ (v_B \cos 20)$ $40 = 0.5\ v_A + 0.94\ v_B \quad \rightarrow \quad (1)$ $\Sigma P_{iy} = \Sigma P_{fy}$ $m_A u_{Ay} + m_B u_{By} = m_A v_{Ay} + m_B v_{BY}$ $0 + 0 = m\ (v_A \sin 60\ ) + m\ (-\ v_B \sin 20)$ $0.866\ v_A - 0.342\ v_B$ $v_B = 2.53 v_A \quad \rightarrow \quad (2)$ (2) into (1) $v_A = 13.89 \text{ m s}^{-1}$ $v_B = 35.17 \text{ m s}^{-1}$	K1 G1 G1 JU1 JU1
3(b)(i)	**BOX A**  	D1 (All forces with arrow and labelled correctly)

	BOX B  	D1 (All forces with arrow and labelled correctly)
3(b)(ii)	$\Sigma F_y = 0$ $N_A + F\sin\theta - W = 0$ $N_A + 70\sin 25 - (30)(9.81) = 0$ $N_A = 264.72$ N $F\cos\theta - T_A - f_A = 0$ $T_A = F\cos\theta - \mu N_A$ $T_A = 70\cos 25 - (0.05)(264.72) = 50.21$ N	G1 JU1 GJU1
3(b)(iii)	$\Sigma F_x = 0$ $T_A - f_B = 0$ $T_A = f_B$ $f_B = 50.21$ N $f_B = \mu N_B$ $(50.21) = (0.05)N_B$ $N_B = 1004.2\ N$ $\Sigma F_Y = 0$ $N_B - W = 0$ $(1004.2) = m\ (9.81)$ $m = 102.37$ kg	J1 J1 GJU1
	TOTAL	13
4(a)(i)	The principle of conservation of energy $\Sigma E_i = \Sigma E_f$	K1

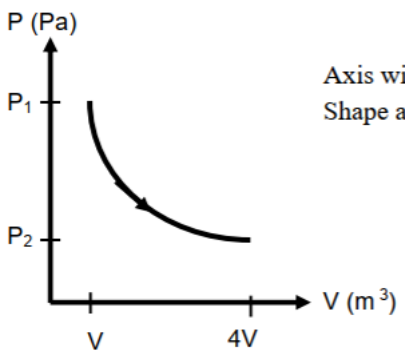
	$\frac{1}{2}mu_A{}^2 + mgh_A = \frac{1}{2}kx_{max}{}^2$ $\frac{1}{2}(0.10)(3.0)^2 + (0.10)(9.81)(3.0) = \frac{1}{2}500\,(x_{max})^2$ $x_{max} = 0.116$ m	GJU1
4(a)(ii)	When stiffer spring is used , k' > 500 N m^{-1} $\frac{1}{2}\,k'\,x_{max}{}^2 = \frac{1}{2}mu_A{}^2 + mgh_A$ $x_{max}{}^2 = \frac{1}{2}mu_A{}^2 + mgh_A$ $x_{max}{}^2 = \frac{2\,(\frac{1}{2}mu_A{}^2 + mgh_A)}{k'}$ $x_{max} = \sqrt{\frac{2\,(\frac{1}{2}mu_A{}^2 + mgh_A)}{k'}}$ $x_{max}\ \alpha\ \frac{1}{\sqrt{k'}}$ If k' is greater, x_{max} becomes smaller.	J1
4(b)	$W = area\ under\ F - s\ graph$ $W = \frac{1}{2}(6+4)(10) + \frac{1}{2}(3+4)(-5)$ $W = 32.50\,J$ $W = K_f - K_i = K_f - \frac{1}{2}mu^2$ $32.50 = K_f - \frac{1}{2}(2)(10)^2$ $K_f = 132.50$ J	K1 JU1
4(c)(i)	$P = \frac{W}{t} = \frac{K_f - K_i}{t}$ $P = \frac{\frac{1}{2}(2500)(12.0)^2 - 0}{8.0} = 22500$ W	GJU1

4(c)(ii)	$At\ t = 5.0\ s$ $v = u + at$ $v = 0 + (1.50)(5.0)$ $v = 7.50\ \text{m s}^{-1}$ $P = Fv\ and\ F = ma, hence\ P = mav$ $P = (2500)(1.50)(7.50)$ $P = 28\ 125\ \text{W}$	J1 JU1
	TOTAL	8
5(a)	$\Sigma F_y = 0$ $N - mg = 0 \quad , \quad N = mg$ $\Sigma F_x = F_c$ $F_c = \mu N$ $F_C = \mu mg$ $F_c = (0.72)(1\ 500)(9.81)$ $F_c = 1.06 \times 10^4\ \text{N}$	K1 G1 JU1
5(b)	$F_c = \frac{mv^2}{r}$ $v = \sqrt{\frac{(1.06 \times 10^4)(70)}{1500}}$ $v = 22.24\ \text{m s}^{-1}$	G1 JU1
	TOTAL	5
6(a)(i)	From the graph $U_{max} = 3\ \text{J}$ $U_{max} = \frac{1}{2} k {y_{max}}^2$ $3 = \frac{1}{2}\ (200) {y_{max}}^2$ $y_{max} = 0.173\ \text{m}$	K1 GJU1

6(a)(ii)	$K = U$ $\frac{1}{2}\ k\ (A^2 - \ y^2) = \frac{1}{2}\ ky^2$ $A^2 - y^2 = \ y^2$ $2y^2 = \ A^2$ $y = \frac{A}{\sqrt{2}} = \frac{y_{max}}{\sqrt{2}} = \frac{0.713}{\sqrt{2}} = 0.122$ m	GJU1
6(a)(iii)	$E = \frac{1}{2}\ k\ A^2$ $If\ A' = 2\ A$ $E' = \frac{1}{2} k\ (2A)^2$ $E' = \ 4\ (\frac{1}{2} kA^2\ )$ $E' = 4\ E$ The total energy of the system will become 4 times greater than initial total energy.	GJ1
6(b)(i)	$v = f\lambda$ $30 = f(1.6)$ $f = 18.75$ Hz $\omega = 2\pi\text{f} = 2\pi(18.75) = 37.5\pi$ rad s^{-1} $= 117.81$ rad s^{-1} $k = \frac{2\pi}{\lambda} = \frac{2\pi}{1.6} = 1.25\pi$ m^{-1} $= 3.93$ m^{-1}	GJU1 GJU1 GJU1
6(b)(ii)	$y(x,t) = 3.5x10^{-3} sin\ (37.5\pi\text{t} - 1.25\pi\text{x})$ *where x and y in meters and t in seconds.*	JU1
6(b)(iii)	$x = 0$ m $y(t) = 3.5x10^{-3}$ sin $(37.5\pi t)$ *where x and y in meters and t in seconds*	JU1
6(b)(iv)	Particle at $x = 1.4$ m, $y(x,t) = 3.5 \times 10^{-3}$ sin $(37.5\pi t - 1.25\pi\ (1.4))$ $y(x,t) = 3.5 \times 10^{-3}$ sin $(37.5\pi t - 1.75\pi\ )$ *where x and y in meters and t in seconds*	JU1

6(b)(v)	$V_{max} = \omega A = (37.5\pi)(3.5 \times 10^{-3}) = 0.41 \text{ m s}^{-1}$	GJU1
6(b)(vi)	$t = 0.05$ s and $x = 1.4$ m $y = 3.5 \times 10^{-3} \sin(37.5\pi(0.05) - 1.25\pi\ (1.40))$ $y = 1.34 \times 10^{-3}$ m $v_y = 0.412\cos(37.5\pi t - 1.25\pi x)$ $= 0.412 \cos(37.5\pi(0.05) - 1.25\ \pi(1.40))$ $v_y = 0.381 \text{ m s}^{-1}$	G1 JU1 G1 JU1
6(c)(i)	$f_1 = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$ $f_1 = \frac{1}{2(0.50)}\sqrt{\frac{40}{1 \times 10^{-3}}} = 200$ Hz	GJU1
6(c)(ii)	$For\ open\ ends\ tube, f_1 = \frac{v}{2L}$ $300 = \frac{343}{2L}$ $L = 0.572\ m$ $f_2 = f_3$ $\frac{2v}{2L} = \frac{3v}{4L'}$ $L' = \frac{3}{4}L$ $L' = \frac{3}{4}(0.572) = 0.429\ m$	GJU1 K1 GJU1
6(d)(i)	$f_a = \left(\frac{v}{v - v_s}\right) f_s$	

	$f_a = \left(\frac{340}{340\ -30}\right)500$ $f_a =$ 548.39 Hz	G1 JU1
6(d)(ii)	$f_a\ = \left(\frac{v}{v + v_s}\right)f_s$ $f_a = \left(\frac{340}{340 + 30}\right)500$ $f_a =$ 459.46 Hz	 G1 JU1
	TOTAL	23
7(a)	$Y = \frac{FL_o}{A\Delta L}$ $F = mg$ **Wire P** : $9.4 \times 10^{10} = \frac{(1300)(9.81)(6.6)}{(2.6 \times 10^{-4})\Delta L_p}$ $\Delta L_p = 3.44 \times 10^{-3}$ m = 3.44 mm **Wire Q** : $9.8 \times 10^{10} = \frac{(1300)(9.81)(6.6)}{(2.3 \times 10^{-4})\Delta L_Q}$ $\Delta L_Q = 3.734 \times 10^{-3}$ m = 3.734 mm Wire P is suitable to be used to support the box because its extension not exceed 3.55 mm	 K1 GJU1 GJU1 J1
7(b)	$\frac{Q}{t} = -kA\left(\frac{\Delta T}{L}\right)$ $\frac{Q}{5\ \times\ 60} =\ -0.80\ (0.95\ x\ 0.35)(\frac{-25}{0.5\ \times\ 10^{-2}}$ $Q =$ 399 000 J $= 3.99\ \times\ 10^5$ J	 G1 JU1

7(c)	$\Delta A = \beta A_o \Delta T$ $-4 = (48 \times 10^{-6}) A_o (25 - 155)$ $A_o = 641\ \text{cm}^2 = 0.064\ \text{m}^2$	G1 JU1
	TOTAL	8
8(a)(i)	$K = \frac{3}{2} kT$ $K = \frac{3}{2}(1.38 \times 10^{-23})(273.15 + 25) = 6.17 \times 10^{-21}\ \text{J}$	GJU1
	$U = \frac{1}{2} fNkT = \frac{1}{2} fnN_A kT$ $U = \frac{1}{2}(3)(1.5)(6.023 \times 10^{23})(1.38 \times 10^{-23})(273.1 + 25)$ $U = 5.57 \times 10^{3}\ \text{J}$	GJU1
8(b)	$v_{rms} = \sqrt{\frac{3RT}{M}}$ $v_{rms} = \sqrt{\frac{3\,(8.31)(263.15)}{0.046}}$ $v_{rms} = 377.65\ \text{m s}^{-1}$	G1 JU1
8(c)(i)	 Axis with unit and both label – D1 Shape and arrow – D1	D2

8(c)(ii)	$Q = \Delta U + W$ $Q = 0 + (5.6\ x\ 10^3)$ $Q = 5.60\ \times\ 10^3$ J Heat is absorbed	 G1 JU1 J1
8(c)(iii)	$W = nRT \ln \frac{V_2}{V_1}$ $5.6\ \times\ 10^3 = (2)(8.31)T \ln \frac{4V}{V}$ $T = 243.10$ K	 G1 JU1
	TOTAL	11
	TOTAL	80