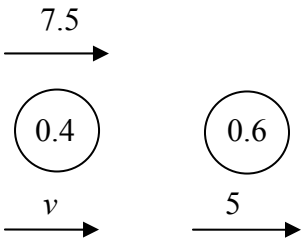
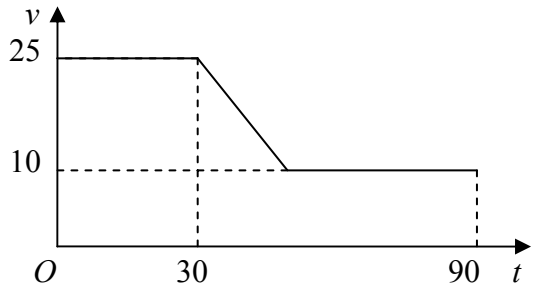
Mark Scheme (Results)
Summer 2008

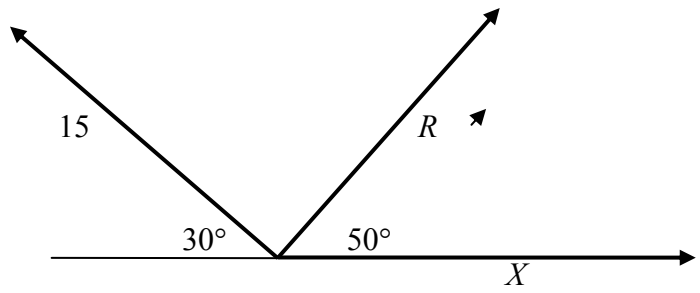
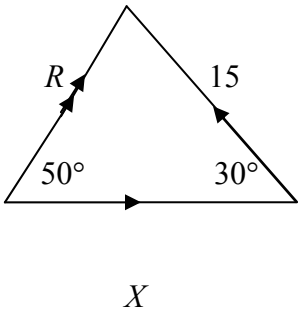
GCE

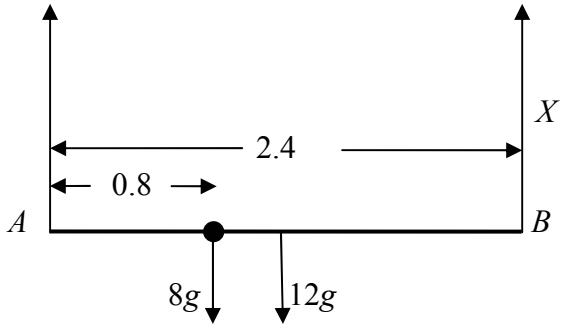
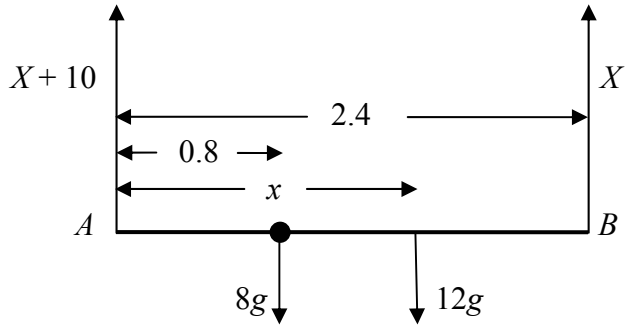
GCE Mathematics (6677/01)

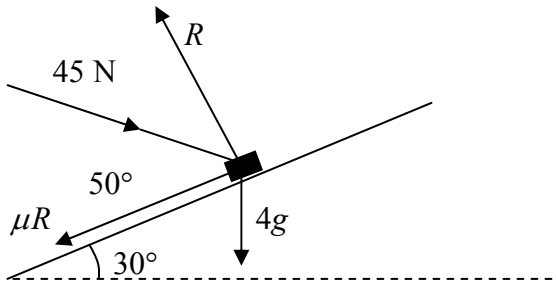
June 2008
6677 Mechanics M1
Final Mark Scheme

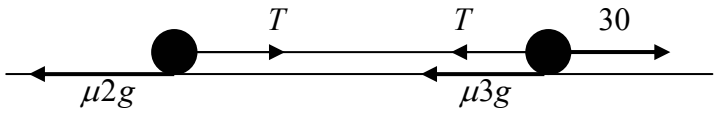
Question Number	Scheme	Marks
1.	(a) $I = mv \Rightarrow 3 = 0.4 \times v$ $v = 7.5 \ (\text{ms}^{-1})$	M1 A1 A1 **(3)**
	(b) 	
	LM $0.4 \times 7.5 = 0.4v + 0.6 \times 5$ $0 = 0.4v \Rightarrow v = 0$ * cso	M1 A1 A1 **(3)** **[6]**
2.	(a) $v^2 = u^2 + 2as \Rightarrow 17.5^2 = u^2 + 2 \times 9.8 \times 10$ Leading to $u = 10.5$	M1 A1 A1 **(3)**
	(b) $v = u + at \Rightarrow 17.5 = -10.5 + 9.8T$ $T = 2\frac{6}{7}$ (s)	M1 A1 f.t. DM1 A1 **(4)**
	Alternatives for (b) $s = (\frac{u+v}{2})T \Rightarrow 10 = (\frac{17.5 + -10.5}{2})T$ $\frac{20}{7} = T$	**[7]** M1A1 f.t. DM1A1 (4)
	OR $s = ut + \frac{1}{2}at^2 \Rightarrow -10 = 10.5t - 4.9t^2$ Leading to $T = 2\frac{6}{7}, \left(-\frac{5}{7}\right)$ Rejecting negative	M1 A1 f.t. DM1 A1 **(4)**
	(b) can be done independently of (a) $s = vt - \frac{1}{2}at^2 \Rightarrow -10 = -17.5t + 4.9t^2$ Leading to $T = 2\frac{6}{7}, \frac{5}{7}$ For final A1, second solution has to be rejected. $\frac{5}{7}$ leads to a negative u.	M1 A1 DM1 A1 **(4)**

Question Number	Scheme	Marks
3.	(a) $\tan\theta = \frac{8}{6}$ $\theta \approx 53°$	M1 A1 **(2)**
	(b) $\mathbf{F} = 0.4(6\mathbf{i}+8\mathbf{j})\ (= 2.4\mathbf{i}+3.2\mathbf{j})$ $\lvert\mathbf{F}\rvert = \sqrt{(2.4^2+3.2^2)} = 4$ *The method marks can be gained in either order.*	M1 M1 A1 **(3)**
	(c) $\mathbf{v} = 9\mathbf{i}-10\mathbf{j}+5(6\mathbf{i}+8\mathbf{j})$ $= 39\mathbf{i}+30\mathbf{j}\ (\text{ms}^{-1})$	M1 A1 A1 **(3)** **[8]**
4.	(a)  shape 25, 10, 30, 90	B1 B1 **(2)**
	(b) $30\times 25+\frac{1}{2}(25+10)t+10(60-t)=1410$ $7.5t = 60$ $t = 8\ (\text{s})$ $a = \frac{25-10}{8} = 1.875\ (\text{ms}^{-2})$ $1\frac{7}{8}$	M1 A1 A1 DM1 A1 M1 A1 **(7)** **[9]**

Question Number	Scheme	Marks
5.	(a) 	
	$(\uparrow)\quad 15\sin 30° = R\sin 50°$	M1 A1
	$R \approx 9.79\ (\text{N})$	DM1 A1 **(4)**
	(b) $(\rightarrow)\ X - 15\cos 30° = R\cos 50°$ ft their R	M1 A2 ft
	$X \approx 19.3\ (\text{N})$	DM1 A1 **(5)** **[9]**
	Alternatives using sine rule in (a) or (b); cosine rule in (b)	
	 (a) $\dfrac{R}{\sin 30°} = \dfrac{15}{\sin 50°}$	M1 A1
	$R \approx 9.79\ (\text{N})$	DM1 A1 (4)
	(b) $\dfrac{X}{\sin 100°} = \dfrac{15}{\sin 50°} = \dfrac{R}{\sin 30°}$	M1 A2 ft on R
	$X \approx 19.3\ (\text{N})$	DM1 A1 (5)
	$X^2 = R^2 + 15^2 - 2 \text{ x } 15 \text{ x } R\cos 100^o$	
	OR: cosine rule; any of $R^2 = X^2 + 15^2 - 2 \text{ x } 15 \text{ x } X\cos 30^o$	M1 A2 ft on R
	$15^2 = R^2 + X^2 - 2 \text{ x } X \text{ x } R\cos 50^o$	
	$X \approx 19.3\ (\text{N})$	DM1 A1 (5)

Question Number	Scheme	Marks
6.	(a) 	
	$M(A)$ $8g \times 0.8 + 12g \times 1.2 = X \times 2.4$	M1 A1
	$X \approx 85$ (N) accept 84.9, $\frac{26g}{3}$	DM1 A1 **(4)**
	(b) 	
	$R(\uparrow)$ $(X+10) + X = 8g + 12g$ $(X = 93)$	M1 B1 A1
	$M(A)$ $8g \times 0.8 + 12g \times x = X \times 2.4$	M1 A1
	$x = 1.4$ (m) accept 1.36	A1 **(6)** **[10]**

Question Number	Scheme	Marks
7.	(a) 	
	$R = 45\cos 40° + 4g\cos 30°$	M1 A2 (1, 0)
	$R \approx 68$ accept 68.4	DM1 A1 (5)
	(b) Use of $F = \mu R$	M1
	$F + 4g\sin 30 = 45\cos 50°$	M1 A2 (1, 0)
	Leading to $\mu \approx 0.14$ accept 0.136	DM1 A1 (6) **[11]**

Question Number	Scheme	Marks
8.	(a) 	
	$s = ut + \frac{1}{2}at^2 \Rightarrow 6 = \frac{1}{2}a \times 9$	M1
	$a = 1\frac{1}{3}\ \left(\text{ms}^{-2}\right)$	A1 **(2)**
	(b) N2L for system $30 - \mu 5g = 5a$ ft their a, accept symbol	M1 A1ft
	$\mu = \frac{14}{3g} = \frac{10}{21}$ or awrt 0.48	DM1 A1 **(4)**
	(c) N2L for P $T - \mu 2g = 2a$ ft their μ, their a, accept symbols	M1 A1 ft
	$T - \frac{14}{3g} \times 2g = 2 \times \frac{4}{3}$	
	Leading to $T = 12\ \left(\text{N}\right)$ awrt 12	DM1 A1 **(4)**
	Alternatively N2L for Q	
	$30 - T - \mu 3g = 3a$	M1 A1
	Leading to $T = 12\ \left(\text{N}\right)$ awrt 12	DM1 A1
	(d) The acceleration of P and Q (or the whole of the system) is the same.	B1 **(1)**
	(e) $v = u + at \Rightarrow v = \frac{4}{3} \times 3 = 4$	B1 ft on a
	N2L (for system or either particle)	
	$-5\mu g = 5a$ or equivalent	M1
	$a = -\mu g$	
	$v = u + at \Rightarrow 0 = 4 - \mu gt$	DM1
	Leading to $t = \frac{6}{7}\ \left(\text{s}\right)$ accept 0.86, 0.857	A1 **(4)**
		[15]