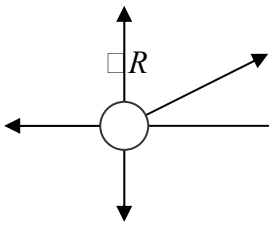
edexcel

January 2007
6677 Mechanics M1
Mark Scheme

Question Number	Scheme	Marks
1.	(a) $P\sin 30° = 24$ $P = 48$	M1 A1 A1 3
	(b) $Q = P\cos 30°$ ≈ 41.6 accept $24\sqrt{3}$, awrt 42	M1 A1 A1 3 **6**
2.	(a) M(C) $80 \times x = 120 \times 0.5$ $x = 0.75$ ✱ cso	M1 A1 A1 3
	(b) Using reaction at $C = 0$ M(D) $120 \times 0.25 = W \times 1.25$ ft their x $W = 24$ (N)	B1 M1 A1 A1 4
	(c) i $X = 24 + 120 = 144$ (N) ft their W	M1 A1ft 2
	(d) The weight of the rock acts precisely at B.	B1 1 **10**
3.	(a) $\mathbf{a} = \dfrac{(15\mathbf{i} - 4\mathbf{j}) - (3\mathbf{i} + 2\mathbf{j})}{4} = 3\mathbf{i} - 1.5\mathbf{j}$	M1 A1 2
	(b) N2L $\mathbf{F} = m\mathbf{a} = 6\mathbf{i} - 3\mathbf{j}$ ft their $\mathbf{a}$ $\lvert\mathbf{F}\rvert = \sqrt{(6^2 + 3^2)} \approx 6.71$ (N) accept $\sqrt{45}$, awrt 6.7	M1 A1 M1 A1 4
	(c) $\mathbf{v}_6 = (3\mathbf{i} + 2\mathbf{j}) + (3\mathbf{i} - 1.5\mathbf{j})6$ ft their $\mathbf{a}$ $= 21\mathbf{i} - 7\mathbf{j}$ (m s^{-1})	M1 A1ft A1 1 **9**

Question Number	Scheme	Marks
4.	(a) CLM $0.3u = 0.3\times(-2) + 0.6\times 5$	M1 A1
	$u = 8$	M1 A1 4
	(b) $I = 0.6\times 5 = 3 \quad (\text{Ns})$	M1 A1 2
	(c) $v = u + at \Rightarrow 5 = a\times 1.5 \quad \left(a = \frac{10}{3}\right)$	M1 A1
	N2L $R = 0.6\times\frac{10}{3} = 2$	M1 A1 4 **10**
5.	(a) $v^2 = u^2 + 2as \Rightarrow 0^2 = 21^2 - 2\times 9.8\times h$	M1 A1
	$h = 22.5 \quad (\text{m})$	A1 3
	(b) $v^2 = u^2 + 2as \Rightarrow v^2 = 0^2 + 2\times 9.8\times 24$ or equivalent	M1 A1
	$(= 470.4)$	
	$v \approx 22 \quad (\text{m s}^{-1})$ accept 21.7	A1 3
	(c) $v = u + at \Rightarrow -\sqrt{470.4} = 21 - 9.8t$ or equivalent	M1 A2 (1, 0)
	– 1 each error	
	$t \approx 4.4 \quad (\text{s})$ accept 4.36	A1 4 **10**

Question Number	Scheme	Marks
6.	(a) 	
	Use of $F = \mu R$	B1
	↔ $P\cos 20° = \mu R$	M1 A1
	↑ $R + P\sin 20° = 30g$	M1 A1
	$P\cos 20° = \mu(30g - P\sin 20°)$	M1
	$P = \dfrac{0.4\times 30g}{\cos 20° + 0.4\sin 20°}$	M1
	$\approx 110 \quad (\text{N})$ accept 109	A1 8
	(b) ↑ $R + 150\sin 20° = 30g$	M1 A1
	$(R \approx 242.7)$	
	N2L ↔ $150\cos 20° - \mu R = 30a$	M1 A1
	$a \approx \dfrac{150\cos 20° - 0.4\times 242.7}{30}$	M1
	$= 1.5\ (\text{ms}^{-2})$ accept 1.46	A1 6 **14**

Question Number	Scheme	Marks
7.	(a) N2L Q $2g - T = 2a$	M1 A1
	N2L P $T - 3g\sin 30° = 3a$	M1 A1 4
	(b) $2g - 3g\sin 30° = 5a$	M1
	$a = 0.98$ (ms^{-2}) ★ cso	A1 2
	(c) $T = 2(g - a)$ or equivalent	M1
	≈ 18 (N) accept 17.6	A1 2
	(d) The (magnitudes of the) accelerations of P and Q are equal	B1 1
	(e) $v^2 = u^2 + 2as \Rightarrow v^2 = 2\times 0.98\times 0.8$ $(=1.568)$	M1
	$v \approx 1.3$ (m s^{-1}) accept 1.25	A1 2
	(f) N2L for P $-3g\sin 30° = 3a$	
	$a = (-)\frac{1}{2}g$	M1 A1
	$s = ut + \frac{1}{2}at^2 \Rightarrow 0 = \sqrt{1.568}t - \frac{1}{2}4.9t^2$ or equivalent	M1 A1
	$t = 0.51$ (s) accept 0.511	A1 5 **16**
	A maximum of one mark can be lost for giving too great accuracy.	