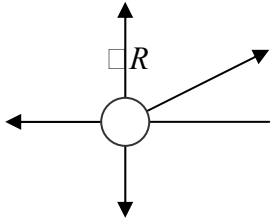


January 2007
6677 Mechanics M1
Mark Scheme

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

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

Question Number	Scheme	Marks
6.	<p>(a)</p>  <p style="margin-left: 150px;">R P</p> <p style="margin-left: 150px;">20°</p> <p style="margin-left: 150px;">$30g$</p> <p style="margin-left: 150px;">Use of $F = \mu R$</p> <p style="margin-left: 100px;">$\bar{\Phi}$ $P \cos 20^\circ = \mu R$</p> <p style="margin-left: 100px;">i $R + P \sin 20^\circ = 30g$</p> <p style="margin-left: 150px;">$P \cos 20^\circ = \mu(30g - P \sin 20^\circ)$</p> <p style="margin-left: 150px;">$P = \frac{0.4 \times 30g}{\cos 20^\circ + 0.4 \sin 20^\circ}$</p> <p style="margin-left: 150px;">$\approx 110 \text{ (N)}$ accept 109</p> <p>(b)</p> <p style="margin-left: 100px;">i $R + 150 \sin 20^\circ = 30g$</p> <p style="margin-left: 150px;">$(R \approx 242.7)$</p> <p>N2L $\bar{\Phi}$ $150 \cos 20^\circ - \mu R = 30a$</p> <p style="margin-left: 150px;">$a \approx \frac{150 \cos 20^\circ - 0.4 \times 242.7}{30}$</p> <p style="margin-left: 150px;">$= 1.5 \text{ (ms}^{-2}\text{)}$ accept 1.46</p>	<p>B1</p> <p>M1 A1</p> <p>M1 A1</p> <p>M1</p> <p>M1</p> <p>A1 <u>8</u></p> <p>M1 A1</p> <p>M1 A1</p> <p>M1</p> <p>A1 <u>6</u> 14</p>

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