

# Mark Scheme (Results) January 2007

GCE

GCE Mathematics

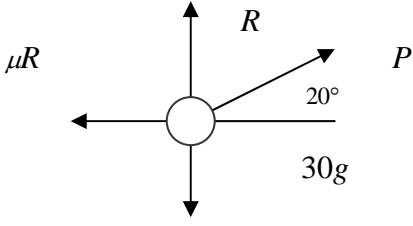
Mechanics M1 (6677)



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6677 Mechanics M1  
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Question Number	Scheme	Marks
1.	<p>(a) <math>P \sin 30^\circ = 24</math> <math>P = 48</math></p> <p>(b) <math>Q = P \cos 30^\circ</math> <math>\approx 41.6</math>      accept <math>24\sqrt{3}</math>, awrt 42</p>	<p>M1 A1 A1    <u>3</u></p> <p>M1 A1 A1    <u>3</u>    <b>6</b></p>
2.	<p>(a) M(C) <math>80 \times x = 120 \times 0.5</math> <math>x = 0.75</math> *      cso</p> <p>(b) Using reaction at C = 0 M(D) <math>120 \times 0.25 = W \times 1.25</math>      ft their x <math>W = 24</math> (N)</p> <p>(c) i      <math>X = 24 + 120 = 144</math> (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>    <b>10</b></p>
3.	<p>(a) <math>\mathbf{a} = \frac{(15\mathbf{i} - 4\mathbf{j}) - (3\mathbf{i} + 2\mathbf{j})}{4} = 3\mathbf{i} - 1.5\mathbf{j}</math></p> <p>(b) N2L    <math>\mathbf{F} = m\mathbf{a} = 6\mathbf{i} - 3\mathbf{j}</math>      ft their <math>\mathbf{a}</math> <math> \mathbf{F}  = \sqrt{(6^2 + 3^2)} \approx 6.71</math> (N)      accept <math>\sqrt{45}</math>, awrt 6.7</p> <p>(c) <math>\mathbf{v}_6 = (3\mathbf{i} + 2\mathbf{j}) + (3\mathbf{i} - 1.5\mathbf{j})6</math>      ft their <math>\mathbf{a}</math> <math>= 21\mathbf{i} - 7\mathbf{j}</math> (<math>\text{ms}^{-1}</math>)</p>	<p>M1 A1 <u>2</u></p> <p>M1 A1 M1 A1 <u>4</u></p> <p>M1 A1ft A1    <u>1</u>    <b>9</b></p>

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

Question Number	Scheme	Marks
6.	<p>(a)</p>  <p>Use of <math>F = \mu R</math></p> <p><math>P \cos 20^\circ = \mu R</math></p> <p>i <math>R + P \sin 20^\circ = 30g</math></p> <p><math>P \cos 20^\circ = \mu(30g - P \sin 20^\circ)</math></p> $P = \frac{0.4 \times 30g}{\cos 20^\circ + 0.4 \sin 20^\circ}$ <p><math>\approx 110 \text{ (N)}</math>      accept 109</p> <p>(b)</p> <p>i <math>R + 150 \sin 20^\circ = 30g</math></p> <p><math>(R \approx 242.7)</math></p> <p>N2L    <math>\bar{\varphi}</math> <math>150 \cos 20^\circ - \mu R = 30a</math></p> $a \approx \frac{150 \cos 20^\circ - 0.4 \times 242.7}{30}$ <p><math>= 1.5 \text{ (ms}^{-2}\text{)}</math>      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>    <b>14</b></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> <b>16</b>
	<i>A maximum of one mark can be lost for giving too great accuracy.</i>	