

GCE

Edexcel GCE

Mechanics M2 (6678)

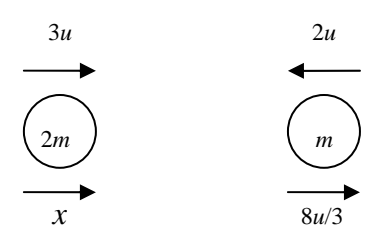
January 2006

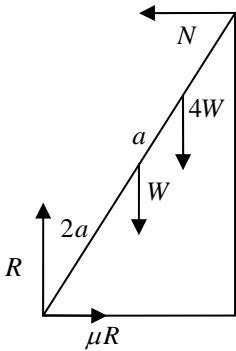
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Mark Scheme (Results)

January 2006  
6678 Mechanics M2  
Mark Scheme

Question Number	Scheme	Marks
1.	<p>(a) Kinetic Energy = <math>\frac{1}{2} \times 3 \times 8^2 = 96, \text{ J}</math></p> <p>(b) <math>F = \mu 3g</math> Work-Energy <math>\mu 3g \times 12 = 96</math> <math>\mu = 0.27 \text{ or } 0.272</math></p> <p><i>Alternative for (b)</i></p> <p style="text-align: center;"><math>a = \frac{8^2 - 0^2}{2 \times 12} = \frac{8}{3}</math></p> <p style="text-align: center;"><math>\mu 3g</math> N2L <math>\mu 3g = 3 \times \frac{8}{3}</math></p> <p style="text-align: center;"><math>\mu = 0.27 \text{ or } 0.272</math></p>	<p>B1 B1 (2)</p> <p>B1 M1 A1ft A1 (4)</p> <p>B1 M1 A1 A1 (4)</p> <p style="text-align: right;"><b>6</b></p>
2.	<p>(a) <math>\dot{\mathbf{r}} = (2t + 4)\mathbf{i} + (3 - 3t^2)\mathbf{j}</math> <math>\dot{\mathbf{r}}_3 = 10\mathbf{i} - 24\mathbf{j}</math>      substituting <math>t = 3</math> <math> \dot{\mathbf{r}}_3  = \sqrt{(10^2 + 24^2)} = 26 \text{ (ms}^{-1}\text{)}</math></p> <p>(b) <math>0.4(\mathbf{v} - (10\mathbf{i} - 24\mathbf{j})) = 8\mathbf{i} - 12\mathbf{j}</math>      ft their <math>\dot{\mathbf{r}}_3</math> <math>\mathbf{v} = 30\mathbf{i} - 54\mathbf{j} \text{ (ms}^{-1}\text{)}</math></p>	<p>M1 A1 M1 M1 A1 (5)</p> <p>M1 A1ft A1 (3)</p> <p style="text-align: right;"><b>8</b></p>
3.	<p>(a) <math>T_r = \frac{12000}{15} \text{ (= 800)}</math> N2L <math>800 - R = 1000 \times 0.2</math>      ft their 800 <math>R = 600 \text{ *}</math>      cso</p> <p>(b) <math>1000g \times \frac{1}{40} + T_r = R</math> <math>T_r = \frac{7000}{U}</math> <math>U \approx 20</math>      accept 19.7</p>	<p>M1 M1 A1ft A1 (4)</p> <p>M1 A1 M1 M1 A1 (5)</p> <p style="text-align: right;"><b>9</b></p>

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4.	<p>(a)</p> <div style="text-align: center;">  </div> <p>LM <math>6mu - 2mu = 2mx + \frac{8}{3}mu</math></p> <p style="text-align: center;"><math>\left(x = \frac{2}{3}u\right)</math></p> <p>NEL <math>\frac{8}{3}u - x = 5ue</math></p> <p>Solving to <math>e = \frac{2}{5}</math></p> <p>(b) Initial K.E. = <math>\frac{1}{2} \times 2m(3u)^2 + \frac{1}{2} \times m(2u)^2 = 11mu^2</math></p> <p>Final K.E. = <math>\frac{1}{2} \times 2m\left(\frac{2}{3}u\right)^2 + \frac{1}{2} \times m\left(\frac{8}{3}u\right)^2 = 4mu^2</math>    both M1</p> <p>Change in K.E. = <math>7mu^2</math> * M1 Subtracting and simplifying to <math>km u^2</math>    M1 A1 A1cso</p> <p>(c) <math>m\left(\frac{8}{3}u + v\right) = \frac{14}{3}mu</math></p> <p style="text-align: center;"><math>(v = 2u)</math></p> <p style="text-align: center;"><math>e = \frac{2}{8/3} = \frac{3}{4}</math></p>	<p>M1 A1</p> <p>M1 A1</p> <p>M1 A1</p> <p>(6)</p> <p>M1</p> <p>M1 A1</p> <p>(3)</p> <p>M1 A1</p> <p>M1 A1</p> <p>(4)</p> <p><b>13</b></p>

Question Number	Scheme	Marks
5.	<p>(a)</p> $12m\bar{x} = 6m \times 9$ $\bar{x} = 4\frac{1}{2}$ $12m\bar{y} = 16m - 8m$ $\bar{y} = \frac{2}{3}$ <p>(b) <math>(12+k)m \times 4 = 12m \times 4\frac{1}{2} + km \times 3</math> ft their <math>\bar{x}</math></p> $k = 6$ <p>(c) <math>18m \times \lambda = 12m \times \frac{2}{3}, \Rightarrow \lambda = \frac{4}{9}</math></p> <p>(d) <math>\tan \theta = \frac{4}{4/9}, \Rightarrow \theta \approx 83.7^\circ</math> ft their <math>\lambda</math>, cao</p>	<p>M1 A1 M1 A1 (4)</p> <p>M1 A1ft A1 (3)</p> <p>M1 A1 (2)</p> <p>M1 A1ft A1 (3) <b>12</b></p>
6.	 <p>(a)</p> $\uparrow R = 5W$ <p>M(B): <math>4W a \cos \theta + W \cdot 2a \cos \theta + \mu R 4a \sin \theta = R \cdot 4a \cos \theta</math>  Having enough equations &amp; solving them for <math>\mu</math>  <math display="block">\mu = 0.35</math></p> <p>(b)</p> $\uparrow S = (5+k)W$ <p>Use of <math>F = 0.35S</math> or <math>F \leq 0.35S</math></p> <p>M(B): <math>kW 4a \cos \theta + W \cdot 2a \cos \theta + F 4a \sin \theta = S \cdot 4a \cos \theta</math>  Having enough equations &amp; solving them for <math>k</math>  <math display="block">k = \frac{10}{7}</math> awrt 1.42  <math>k \mid \frac{10}{7}</math> ft their <math>k</math>, accept &gt; and decimals</p>	<p>B1 B1 M1 A1 M1 A1 (6)</p> <p>B1 M1 M1 A1 M1 A1 A1ft (7) <b>13</b></p>

Question Number	Scheme	Marks
7.	<p>(a) <math>u_x = 11 \cos 30^\circ</math>  <math>\rightarrow 11 \cos 30^\circ \times t = 10 \Rightarrow t = 1.05 \text{ (s)}</math>      <i>cao</i></p> <p>(b) <math>s = \underline{11 \sin 30^\circ} \times t - 4.9t^2 \approx 0.37</math>  <math>(2-1) - 0.37 = 0.63 \text{ (m)}</math></p> <p>(c) <math>V \cos 30^\circ \times t = 10 \quad \left( t = \frac{10}{V \cos 30^\circ} \right)</math>  <math>s = V \sin 30^\circ \times \frac{10}{V \cos 30^\circ} - \frac{4.9 \times 100}{V^2 \cos^2 \theta} = 1</math>  <math>V^2 = 136.86</math>  <math>V \approx 12</math>      <i>accept 11.7</i></p> <p>(d) <i>B</i> and/or <i>T</i> are not particles  ( They have extension giving a range of answers)</p>	<p>B1 M1 A1 (3)</p> <p>B1 M1 A1 A1 (4)</p> <p>M1 A1 M1 A1 M1 A1 (6)</p> <p>B1 (1) <b>14</b></p>