

# EDEXCEL - LONDON EXAMINATIONS

Stewart House 32 Russell Square London WC1B 5DN

January 2001

FINAL

HMK

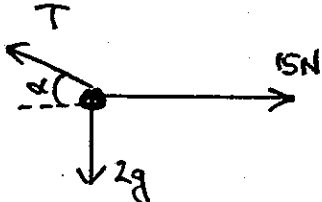
Advanced Supplementary/Advanced Level

17-01-01

General Certificate of Education

Subject MECHANICS 6677

Paper No. M1

Question number	Scheme	Marks
1. (a)	<p>Resolving vertically e.g. <math>R_p + R_Q = 70</math>  <math>R_p = 20 \Rightarrow R_Q = 50</math></p> <p>(b) A valid moments equation                      e.g. <math>R_p \times 0.5 + R_Q \times x = 70 \times \frac{3}{2}</math>  <math>20 \times 0.5 + 50 \times x = 70 \times \frac{3}{2}</math>                      Completing method to find AQ  <math>AQ = 1.9</math></p>	<p>M1                      A1 (2)</p> <p>M1                      A1 ft                      DM1                      A1 cao (4)</p>
2 1/2 (a)	 <p>ONE resolution equation e.g. <math>T \cos \alpha = 15</math> or <math>T \sin \alpha = 2g</math> are most likely but <math>T = 15 \cos \alpha + 2g \sin \alpha</math>, <math>2g \cos \alpha = 15 \sin \alpha</math> also possible as is also Lami's theorem.                      One equation correct; second independent eqn. correct (omission of g loses A1 only)  <math>\tan \alpha = \frac{2g}{15}</math> or <math>\frac{2}{15}</math> [<math>\tan \alpha = \frac{15}{2g}</math> scores M1 A0]                      Answer for <math>\alpha</math> as <math>53^\circ</math> or <math>52.6^\circ</math></p>	<p>M1                      A1 + A1                      M1 A1 ft                      A1 (6)</p>
(b)	<p>Using valid equation (line 1 M1 required) to extract value of T (or eliminating <math>\alpha</math> from valid eqns)  <math>T = 24.7</math> or <math>25</math></p>	<p>M1                      A1 (2)</p>

("Over accurate" answers in (a) or (b) or both which round to correct answer receive a penalty of -1 once overall)

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<p>3.(a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	<p>For particle A <math>T - 3mg = 3ma</math>            (Note <math>T - mg = ma</math> or <math>T - m = ma</math> etc scores <math>M_1</math>)  <math>T - 3mg = 3m\left(\frac{2}{5}g\right) \rightarrow T = \frac{21}{5}mg</math></p> <p>String is inextensible</p> <p>For particle B <math>kmg - T = km a</math>            (or system) <math>kmg - 3mg = (km + 3m)a</math>  <math>kg - \frac{21}{5}g = \frac{2}{5}kg</math> (or equivalent equation in <math>k</math> only)</p> <p>Solving <math>DM_1</math> dependent on first <math>M_1</math> in (c)  <math>k = 7</math></p> <p>Tension is of same magnitude throughout the string</p>	<p><math>M_1</math></p> <p><math>A_1 \rightarrow A_1(3)</math></p> <p><math>B_1</math> (1)</p> <p><math>M_1</math></p> <p><math>A_1</math> f.t.</p> <p><math>DM_1</math></p> <p><math>A_1</math> cas (4)</p> <p><math>B_1</math> (1)</p>
<p>4.(a)</p> <p>(b)</p> <p>(c)</p>	<p>At <math>t=0</math> <math>\underline{r}_P = 2\underline{i} - \underline{j}</math>; At <math>t=2</math>, <math>\underline{r}_P = 6\underline{i} + \underline{j}</math>            Velocity of P constant <math>\Rightarrow \underline{v}_P = \frac{(6\underline{i} + \underline{j}) - (2\underline{i} - \underline{j})}{2}</math>  <math>\underline{v}_P = 2\underline{i} + \underline{j}</math> (one slip in <math>\underline{i}</math> or <math>\underline{j}</math> only)</p> <p><math>\arctan \frac{1}{2}</math> (or <math>\arctan 2</math> allowed for <math>M_1</math>)  <math>26.6^\circ</math> only</p> <p><math>\vec{OC} = 2\underline{i} - \underline{j} + 5(2\underline{i} + \underline{j})</math> OR <math>6\underline{i} + \underline{j} + 3(2\underline{i} + \underline{j})</math>  <math>\vec{OC} = 12\underline{i} + 4\underline{j}</math>  <math> \vec{OC}  = \sqrt{12^2 + 4^2}</math></p> <p><math>OC = 12.6</math> only or equivalent f.t. answer            given to <u>1 decimal place</u> also depends on <math>M_1 + M_1</math></p>	<p><math>M_1 A_1</math></p> <p><math>A_1</math> f.t. (3)</p> <p><math>M_1</math></p> <p><math>A_1</math> (2)</p> <p><math>M_1</math></p> <p><math>A_1</math> f.t.</p> <p><math>M_1</math></p> <p><math>A_1</math> f.t. (4)</p>



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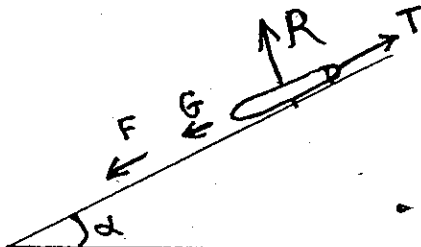
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7. (a)	$\alpha = \arctan \frac{5}{12}$ $\cos \alpha = \frac{12}{13}, \quad \sin \alpha = \frac{5}{13}$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <math>\alpha = 22.6^\circ</math>  <math>\cos \alpha = 0.923</math>, <math>\sin \alpha = 0.384</math> </div> $R = 78g \cos \alpha$ $F = 78g \cos \alpha (0.25)$ $G = 78g \sin \alpha$  <p>Newton II along slope attempted with T, F, G included</p> $T - F - G = 78 (0.5)$ <p>Solving for T (dependent on M1)</p> $T = 509.4 \quad (\text{accept this or } 510 \text{ or } 2 \text{ s.f. or } 509 \text{ or } 3 \text{ s.f. result only})$	<p>M1 A1</p> <p>B1</p> <p>M1 A1 ft.</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>(9)</p>
(4)	<p>Accelerating force down slope is <math>G - F</math> (or Friction reversed and T no longer included)</p> <p>Newton II <math>G - F = 78 a</math></p> $a = g \sin \alpha - \mu g \cos \alpha$ $= 9.8 \left( \frac{5}{13} - \frac{3}{13} \right)$ $= 1.5, 1.50, 1.51 \quad \text{or } \frac{2}{13} g \quad \text{Score A2}$ <p>other answers which round to 1.5 Score A1</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A2, 1.0 (6)</p>

H.M.K  
16/9/00