

EDEXCEL - LONDON EXAMINATIONS

Stewart House 32 Russell Square London WC1B 5DN

January 2001

FINAL

HMK

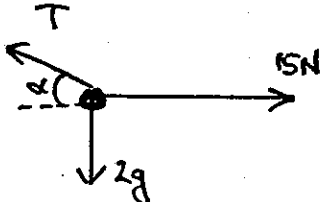
Advanced Supplementary/Advanced Level

17-01-01

General Certificate of Education

Subject MECHANICS 6677

Paper No. M1

Question number	Scheme	Marks
1. (a)	<p>Resolving vertically e.g. $R_p + R_Q = 70$ $R_p = 20 \Rightarrow R_Q = 50$</p> <p>(b) A valid moments equation e.g. $R_p \times 0.5 + R_Q \times x = 70 \times \frac{3}{2}$ $20 \times 0.5 + 50 \times x = 70 \times \frac{3}{2}$</p> <p>Completing method to find AQ AQ = 1.9</p>	<p>M1 A1 (2)</p> <p>M1 A1 ft DM1 A1 cao (4)</p>
2. (a)	 <p>ONE resolution equation e.g. $T \cos \alpha = 15$ or $T \sin \alpha = 2g$ are most likely but $T = 15 \cos \alpha + 2g \sin \alpha$, $2g \cos \alpha = 15 \sin \alpha$ also possible as is also Lami's theorem.</p> <p>One equation correct; second independent eqn. correct (omission of g loses A1 only)</p> <p>$\tan \alpha = \frac{2g}{15}$ or $\frac{2}{15}$ [$\tan \alpha = \frac{15}{2g}$ scores M1 A0]</p> <p>Answer for α as 53° or 52.6°</p>	<p>M1 A1 + A1 M1 A1 ft A1 (6)</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 $T - 3mg = 3ma$ (Note $T - mg = ma$ or $T - m = ma$ etc scores M_1) $T - 3mg = 3m\left(\frac{2}{5}g\right) \rightarrow T = \frac{21}{5}mg$</p> <p>String is inextensible</p> <p>For particle B $kmg - T = km a$ (or system) $kmg - 3mg = (km + 3m) a$ $kg - \frac{21}{5}g = \frac{2}{5}kg$ (or equivalent equation in k only) Solving DM_1 dependent on first M_1 in (c) $k = 7$</p> <p>Tension is of same magnitude throughout the string</p>	<p>M_1</p> <p>$A_1 \rightarrow A_1(3)$</p> <p>B_1 (1)</p> <p>M_1</p> <p>A_1 f.t.</p> <p>DM_1</p> <p>A_1 cas (4)</p> <p>B_1 (1)</p>
<p>4.(a)</p> <p>(b)</p> <p>(c)</p>	<p>At $t=0$ $\underline{r}_P = 2\underline{i} - \underline{j}$; At $t=2$, $\underline{r}_P = 6\underline{i} + \underline{j}$ Velocity of P constant $\Rightarrow \underline{v}_P = \frac{(6\underline{i} + \underline{j}) - (2\underline{i} - \underline{j})}{2}$ $\underline{v}_P = 2\underline{i} + \underline{j}$ (one slip in \underline{i} or \underline{j} only)</p> <p>$\arctan \frac{1}{2}$ (or $\arctan 2$ allowed for M_1) 26.6° only</p> <p>$\vec{OC} = 2\underline{i} - \underline{j} + 5(2\underline{i} + \underline{j})$ OR $6\underline{i} + \underline{j} + 3(2\underline{i} + \underline{j})$ $\vec{OC} = 12\underline{i} + 4\underline{j}$ $\vec{OC} = \sqrt{12^2 + 4^2}$ $OC = 12.6$ only or equivalent f.t. answer given to <u>1 decimal place</u> also depends on $M_1 + M_1$</p>	<p>$M_1 A_1$</p> <p>A_1 f.t. (3)</p> <p>M_1</p> <p>A_1 (2)</p> <p>M_1</p> <p>A_1 f.t.</p> <p>M_1</p> <p>A_1 f.t. (4)</p>

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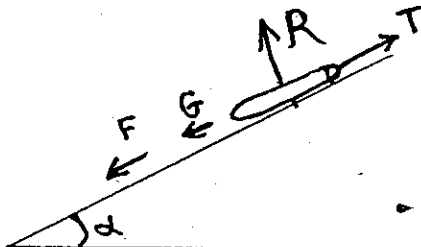
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7. (a)	$\alpha = \arctan \frac{5}{12}$ $\cos \alpha = \frac{12}{13}, \quad \sin \alpha = \frac{5}{13}$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> $\alpha = 22.6^\circ$ $\cos \alpha = 0.923$, $\sin \alpha = 0.384$ </div> $R = 78g \cos \alpha$ $F = 78g \cos \alpha (0.25)$ $G = 78g \sin \alpha$  <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 f.t.</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>(9)</p>
(4)	<p>Accelerating force down slope is $G - F$ (or Friction reversed and T no longer included)</p> <p>Newton II $G - F = 78 a$</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