

Mark Scheme (Results) January 2010

GCE

Mechanics M1 (6677)

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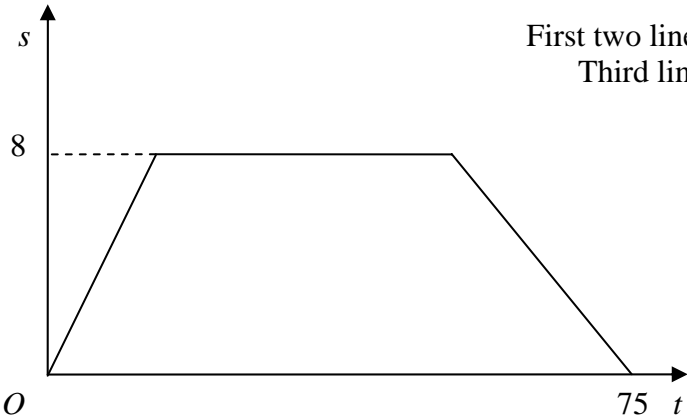
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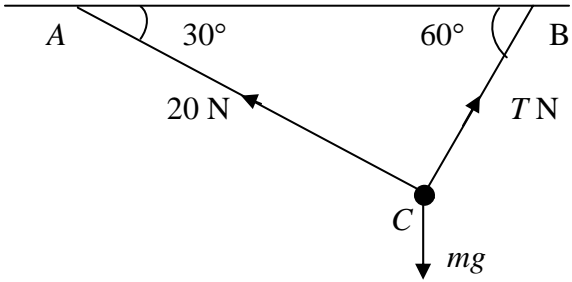
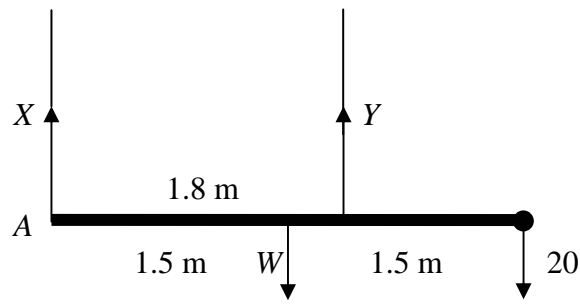
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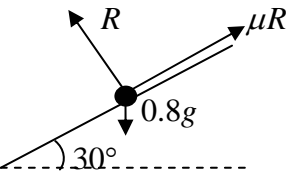
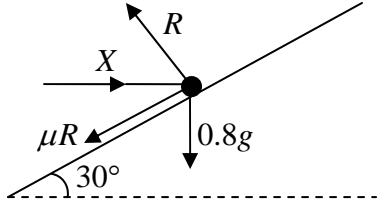
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Question Number	Scheme	Marks
Q1.	<p>(a) $I = 2 \times 12 - 2 \times 3 = 18 \text{ (N s)}$</p> <p>(b) LM $2 \times 12 - 8m = 2 \times 3 + 4m$ Solving to $m = 1.5$</p> <p><i>Alternative to (b)</i> $I = m(4 - (-8)) = 18$ Solving to $m = 1.5$</p>	<p>M1 A1 (2)</p> <p>M1 A1 DM1 A1 (4) [6]</p> <p>M1 A1 DM1 A1 (4)</p>
Q2.	<p>(a) </p> <p>(b) $\frac{1}{2} \times 8 \times (T + 75) = 500$ Solving to $T = 50$</p>	<p>B1 B1 B1 (3)</p> <p>M1 A2 (1,0) DM1 A1 (5) [8]</p>

Question Number	Scheme	Marks
Q3.	<div style="text-align: center;">  </div> <p>(a) R(\rightarrow) $20 \cos 30^\circ = T \cos 60^\circ$ $T = 20\sqrt{3}, 34.6, 34.64, \dots$</p> <p>(b) R($\uparrow$) $mg = 20 \sin 30^\circ + T \sin 60^\circ$ $m = \frac{40}{g} (\approx 4.1), 4.08$</p>	<p>M1 A2 (1,0) A1 (4)</p> <p>M1 A2 (1,0) A1 (4)</p> <p>[8]</p>
Q4.	<p>(a)</p> <div style="text-align: center;">  </div> <p>M (A) $W \times 1.5 + 20 \times 3 = Y \times 1.8$ $Y = \frac{5}{6}W + \frac{100}{3} *$</p> <p>(b) \uparrow $X + Y = W + 20$ or equivalent $X = \frac{1}{6}W - \frac{40}{3}$</p> <p>(c) $\frac{5}{6}W + \frac{100}{3} = 8 \left(\frac{1}{6}W - \frac{40}{3} \right)$ $W = 280$</p> <p>Alternative to (b) M(C) $X \times 1.8 + 20 \times 1.2 = W \times 0.3$ $X = \frac{1}{6}W - \frac{40}{3}$</p>	<p>M1 A2 (1, 0) A1 (4)</p> <p>M1 A1 A1 (3)</p> <p>M1 A1 ft A1 (3)</p> <p>[10]</p> <p>M1 A1 A1</p>

Question Number	Scheme	Marks
Q5.	<p>(a) $s = ut + \frac{1}{2}at^2 \Rightarrow 2.7 = \frac{1}{2}a \times 9$ $a = 0.6 \text{ (m s}^{-2}\text{)}$</p>	M1 A1 A1 (3)
	<p>(b)</p>  <p>$R = 0.8g \cos 30^\circ (\approx 6.79)$ Use of $F = \mu R$ $0.8g \sin 30^\circ - \mu R = 0.8 \times a$ $(0.8g \sin 30^\circ - \mu 0.8g \cos 30^\circ = 0.8 \times 0.6)$ $\mu \approx 0.51$ accept 0.507</p>	B1 B1 M1 A1 A1 (5)
	<p>(c)</p>  <p>$R \cos 30^\circ = \mu R \cos 60^\circ + 0.8g$ $(R \approx 12.8)$ $\rightarrow X = R \sin 30^\circ + \mu R \sin 60^\circ$ Solving for X, $X \approx 12$ accept 12.0</p>	M1 A2 (1,0) M1 A1 DM1 A1 (7) [15]
	<p>Alternative to (c)</p> <p>$R = X \sin 30^\circ + 0.8 \times 9.8 \sin 60^\circ$ $\mu R + 0.8g \cos 60^\circ = X \cos 30^\circ$</p> $X = \frac{\mu 0.8g \sin 60^\circ + 0.8g \cos 60^\circ}{\cos 30^\circ - \mu \sin 30^\circ}$ <p>Solving for X, $X \approx 12$ accept 12.0</p>	M1 A2 (1,0) M1 A1 DM1 A1 (7)

Question Number	Scheme	Marks
Q6.	(a) N2L A: $5mg - T = 5m \times \frac{1}{4}g$ $T = \frac{15}{4}mg$ *	M1 A1 A1 (3)
	(b) N2L B: $T - kmg = km \times \frac{1}{4}g$ $k = 3$	M1 A1 A1 (3)
	(c) The tensions in the two parts of the string are the same	B1 (1)
	(d) Distance of A above ground $s_1 = \frac{1}{2} \times \frac{1}{4}g \times 1.2^2 = 0.18g (\approx 1.764)$	M1 A1
	Speed on reaching ground $v = \frac{1}{4}g \times 1.2 = 0.3g (\approx 2.94)$	M1 A1
	For B under gravity $(0.3g)^2 = 2gs_2 \Rightarrow s_2 = \frac{(0.3)^2}{2}g (\approx 0.441)$ $S = 2s_1 + s_2 = 3.969 \approx 4.0$ (m)	M1 A1 A1 (7) [14]

Question Number	Scheme	Marks
Q7.	<p>(a)</p> $\mathbf{v} = \frac{21\mathbf{i} + 10\mathbf{j} - (9\mathbf{i} - 6\mathbf{j})}{4} = 3\mathbf{i} + 4\mathbf{j}$ <p>speed is $\sqrt{(3^2 + 4^2)} = 5 \text{ (km h}^{-1}\text{)}$</p> <p>(b)</p> $\tan \theta = \frac{3}{4} \quad (\Rightarrow \theta \approx 36.9^\circ)$ <p>bearing is 37, 36.9, 36.87, ...</p> <p>(c)</p> $\mathbf{s} = 9\mathbf{i} - 6\mathbf{j} + t(3\mathbf{i} + 4\mathbf{j})$ $= (3t + 9)\mathbf{i} + (4t - 6)\mathbf{j} \quad *$ <p style="text-align: right;">cso</p> <p>(d) Position vector of S relative to L is</p> $(3T + 9)\mathbf{i} + (4T - 6)\mathbf{j} - (18\mathbf{i} + 6\mathbf{j}) = (3T - 9)\mathbf{i} + (4T - 12)\mathbf{j}$ $(3T - 9)^2 + (4T - 12)^2 = 100$ $25T^2 - 150T + 125 = 0 \quad \text{or equivalent}$ $(T^2 - 6T + 5 = 0)$ $T = 1, 5$	<p>M1 A1</p> <p>M1 A1 (4)</p> <p>M1</p> <p>A1 (2)</p> <p>M1</p> <p>A1 (2)</p> <p>M1 A1</p> <p>M1</p> <p>DM1 A1</p> <p>A1 (6)</p> <p>[14]</p>

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