

EDEXCEL FOUNDATION

Stewart House 32 Russell Square London WC1B 5DN

January 2002

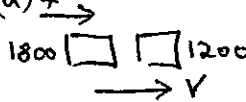
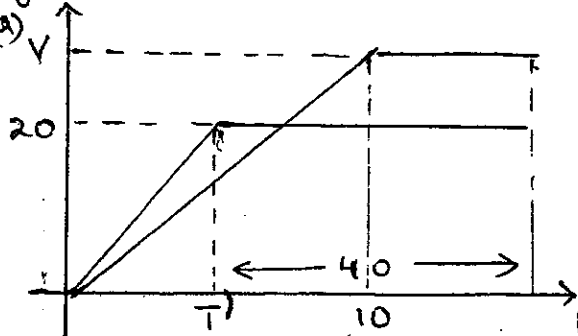
Advanced Supplementary/Advanced Level

General Certificate of Education

Subject MECHANICS 6677

Paper No. M1



Question number	Scheme	Marks
1.	$\text{Impulse} = \text{change in mom}^m = 0.3(8+6)$ $= \underline{4.2 \text{ N s}}$	M1 A1 A1 (3)
2.	<p>(a) </p> $1800 \cdot 4 = (1800 + 1200) v$ $v = \underline{2.4 \text{ m s}^{-1}}$ <p>(b)</p> $R \cdot 8 = 3000 \cdot 2.4$ $R = \underline{900}$	M1 A1 A1 (3) M1 A1 \sqrt{v} A1 (3) (6)
3.	<p>(a) "v = u + at" : $60 = 12 + 4a \rightarrow a = \underline{12 \text{ m s}^{-2}}$ (*)</p> <p>(b) "s = ut + $\frac{1}{2}at^2$" : $0A = 12 \cdot 4 + \frac{1}{2} \cdot 12 \cdot 4^2$ $= \underline{144 \text{ m}}$</p> <p>(c) "v² = u² + 2as" : $v^2 = 12^2 + 2 \cdot 12 \cdot 72$ $v = \underline{43.3 \text{ m s}^{-1}}$</p>	M1 A1 (2) M1 A1 A1 (3) M1 A1 $\sqrt{0A}$ A1 (3)
4.	<p>(a) </p> <p>One shape correct B1</p> <p>2nd shape correct rel. to first B1</p> <p>Figs (10, 20, 40) B1 (3)</p> <p>Contd.</p>	

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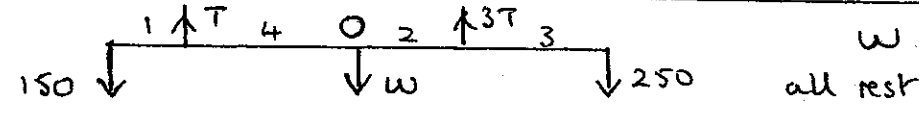
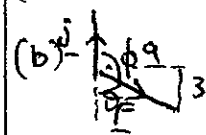
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4.	<p>(b) Scooter: dist travelled = area under graph</p> $850 = \frac{1}{2}T \cdot 20 + 20 \cdot 40$ $\Rightarrow T = \underline{5s}$ <p>(c) Van: $850 = \frac{1}{2}V \cdot 10 + V(40 - 5)$</p> $\Rightarrow V = \underline{21.25 \text{ m s}^{-1}}$	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1 $\sqrt{(T)}$</p> <p>A1 (3)</p> <p>(9)</p>
5.	<p>(a) </p> <p>(b) $M(O): 150 \cdot 5 + 3T \cdot 2 = T \cdot 4 + 250 \cdot 5$</p> <p>Solve $T = \underline{250 \text{ N}}$</p> <p>[Allow M1 A2, 1, 0 for moments eqn² abt any pt. Then M1 A1 for complete sol² $\rightarrow T =$]</p> <p>(c) $R(\uparrow) 4T = 400 + W \rightarrow W = \underline{600 \text{ N}}$</p> <p>(M1 needs complete sol² $\rightarrow W/A =$)</p> <p>(d) By having weight act at <u>centre/mid-pt.</u></p>	<p>B1</p> <p>B1 (2)</p> <p>M1 A2, 1, 0</p> <p>\downarrow</p> <p>M1 A1 (5)</p> <p>M1 A1 (2)</p> <p>B1 (1)</p> <p>(10)</p>
6.	<p>(a) $\underline{F} = (6\underline{i} + 2\underline{j}) + (3\underline{i} - 5\underline{j}) = (9\underline{i} - 3\underline{j}) \text{ N}$</p> <p>(b)  $\tan \theta = \frac{9}{3} \Rightarrow \theta = 71.6^\circ$</p> $\phi = \underline{108.4^\circ}$ <p>(c) "$\underline{F} = m\underline{a}$" $\Rightarrow \underline{a} = (3\underline{i} - \underline{j}) \text{ m s}^{-2}$</p> <p>(d) $\underline{v} = (-2\underline{i} + \underline{j}) + 2(3\underline{i} - \underline{j}) = 4\underline{i} - \underline{j}$</p> <p>Speed = $\sqrt{4^2 + 1^2} = \underline{4.12 \text{ m s}^{-1}}$</p>	<p>B1 (1)</p> <p>M1 A1 $\sqrt{(F)}$</p> <p>A1 (3)</p> <p>M1 A1 $\sqrt{(F)}$</p> <p>(2)</p> <p>M1, M1, A1 $\sqrt{(a)}$</p> <p>M1 A1 (5)</p> <p>(11)</p>

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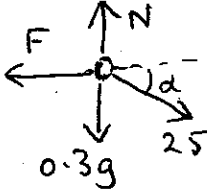
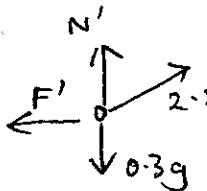
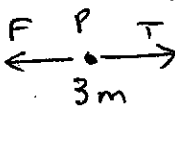
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7.	<p>(a) </p> <p>R(↑) $N = 0.3 \times 9.8 + 2.5 \sin \alpha$ $(= 2.94 + 1.5 = 4.44 \text{ N})$</p> <p>R(→) $F = 2.5 \cos \alpha (= 2 \text{ N})$</p> <p>$F = \mu N \rightarrow \mu = \frac{2}{4.44} \approx \underline{0.45}$</p> <p>(b) </p> <p>$N' = 0.3 \times 9.8 - 2.5 \sin \alpha = \underline{1.44 \text{ N}}$</p> <p>$F' \leq \mu N'$. $N' < N \Rightarrow F'_{\text{max}}$ less</p> <p>But F' must $= 2.5 \cos \alpha$ for equilib.</p> <p>Hence equilib. <u>not</u> possible</p>	<p>M1 A2, 1, 0</p> <p>M1 A1</p> <p>M1 M1 A1 (8)</p> <p>M1 A1 (2)</p> <p>M1</p> <p>A1 cso (2)</p> <p>(12)</p>
8.	<p></p> <p>(a) P: $T - F = 3ma$ Q: $5mg - T = 5ma$</p> <p>(b) $F = 0.6 \times 3mg (= 1.8mg)$ Hence $5mg - 1.8mg = 8ma$ $a = \underline{0.4g}$</p> <p>(c) Sub: $T = 3ma + F$ or $5mg - 5ma$ $\rightarrow T = \underline{3mg}$</p> <p>(d) Speed when Q hits floor: $v^2 = 2 \times 0.4g \times h$ $= \frac{4}{5}gh$</p> <p>Decel² of P: $3mf = 1.8mg \Rightarrow f = 0.6g$</p> <p>Dist moved by P: $\frac{4}{5}gh = 2 \cdot \frac{3}{5}g \cdot s$ $\Rightarrow s = \underline{\frac{2}{3}h}$</p>	<p>M1 A1</p> <p>M1 A1 (4)</p> <p>M1 A1</p> <p>M1 A1 (4)</p> <p>M1 A1 (2)</p> <p>M1 A1 ✓</p> <p>M1 A1</p> <p>M1 A1 (6)</p> <p>(16)</p>