

EDEXCEL

190 High Holborn London WC1V 7BH

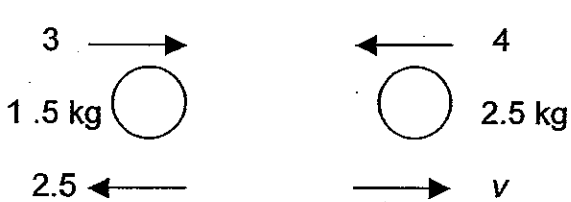
January 2005

Advanced Subsidiary/Advanced Level

General Certificate of Education

Subject: **Mechanics**

Paper: **M1**

Question Number	Scheme	Marks
1	 <p>(a) CLM: $1.5 \times 3 - 2.5 \times 4 = -1.5 \times 2.5 + 2.5 \times v$ $\Rightarrow v = \underline{-0.7 \text{ m s}^{-1}}$</p> <p>(b) Direction of Q unchanged</p> <p>(c) Impulse = $1.5 (3 + 2.5)$ $= \underline{8.25 \text{ N s}}$</p>	M1 A1 A1 (3) A1√ (1) M1 A1, A1 (3)
	<p>(a) Accept +/- 0.7 for final answer</p> <p>(b) Mark is an A mark, i.e. cao = cso, but allow √ if clear from working/diagram</p> <p>(c) Allow M1 even if signs incorrect, but must be one mass x difference/sum of two speeds the mass chosen.</p>	

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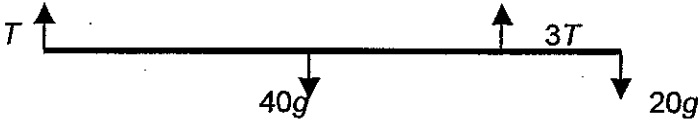
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2	 <p>(a) R(↑): $T + 3T = 40g + 20g$ $T = 15g$, so tension at C is <u>45g or 441 N or 440 N</u></p> <p>(b) M(B) $15g \times 3 + 45g \times d = 40g \times 1.5$ Solve: $d = \underline{1/3 \text{ or } 0.33 \text{ or } 0.333 \text{ m}}$</p> <hr/> <p>(a) Allow M1 for a potentially complete method to find T or $3T$.</p> <p>(b) Allow for moments about other points. Apply normal rules about extra/missing terms</p>	M1 A1 (2) M1 A2,1,0√ M1 A1 (5)

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3	(a) Distance = $\frac{1}{2} \times 4 \times 9 + 16 \times 9$ or $\frac{1}{2} (20 + 16) \times 9$ $= \underline{162 \text{ m}}$	M1 A1 (2)
	(b) Distance over last 5 s = $\frac{1}{2}(9 + u) \times 5$ $162 + \frac{1}{2}(9 + u) \times 5 = 200$ $\Rightarrow u = \underline{6.2 \text{ m s}^{-1}}$	M1 M1 A1√ A1 (4)
	(c) $6.2 = 9 + 5a$ $a = (-) \underline{0.56 \text{ m s}^{-2}}$	M1 A1√ A1 (3)
<p>(a) M1 for valid attempt to find area (as triangle + rectangle, or as trapezium)</p> <p>(b) M1 for valid attempt to find area of the trap. M1 for setting up equn appropriately; A1√ on '162' (only)</p> <p>(c) M1 for forming valid equation in a only (but allow their 'a' as acceleration or deceleration) A1√ on 6.2 only.</p>		

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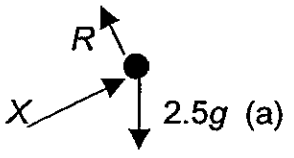
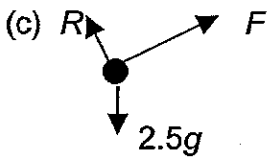
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4	 <p>(a) $R = 2.5g \cos 20$ $\approx \underline{23.0 \text{ or } 23 \text{ N}}$</p>	M1 A1 (2)
	<p>(b) $X = 0.4 \times 23.0 + 2.5g \sin 20$ $\approx \underline{17.6 \text{ or } 18 \text{ N}}$</p>	M1 A2,1,0√ A1 (4)
	 <p>In equil. $F = 2.5g \sin 20 \approx 8.38 \text{ or } 8.4 \text{ N}$ $\mu R = 0.4 \times 2.5g \cos 20 \approx 9.21 \text{ or } 9.2 \text{ N}$ $8.4 < 9.2$ (comparison)</p>	B1 B1 M1
	<p>Since $F < \mu R$ remains in equilibrium (cso)</p>	A1 (4)

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5	(a) 's = ut + ½at ² ' for B: $0.4 = \frac{1}{2} a(0.5)^2$	M1 A1
	$a = \underline{3.2 \text{ m s}^{-2}}$	A1 (3)
	(b) N2L for B: $0.8g - T = 0.8 \times 3.2$	M1 A1√
	$T = \underline{5.28 \text{ or } 5.3 \text{ N}}$	M1 A1 (4)
	(c) A: $F = \mu \times 0.5g$	B1
N2L for A: $T - F = 0.5a$	M1 A1	
Sub and solve $\mu = \underline{0.75 \text{ or } 0.751}$	↓ M1 A1 (5)	
(d) Same acceleration for A and B.	B1 (1)	

Question Number	Scheme	Marks
65	<p>(a) $16^2 = 20^2 - 2 \times a \times 24 \Rightarrow a = \underline{3 \text{ m s}^{-2}}$</p> <p>(b) $v^2 = 20^2 - 2 \times 3 \times 30$ $v = \underline{\sqrt{220} \text{ or } 14.8 \text{ m s}^{-1}}$</p> <p>(c) $0.3 = m \times 3 \Rightarrow m = 0.1 \text{ kg (*)}$</p> <p>(d) $0.1(w + \sqrt{220}) = 2.4$ $w = 9.17$ $0 = 9.17 - 3 \times t$ $t \approx \underline{3.06 \text{ s}}$</p>	<p>M1 A1 (2)</p> <p>M1 A1√ A1 (3)</p> <p>M1 A1 (2)</p> <p>M1 A1√ A1 ↓ M1 A1√ A1 (6)</p>
	<p>(d) If use 14.8 instead of $\sqrt{220}$, this gives $w = 9.2$ and $t = 3.07$: allow full marks from clear working.</p>	

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7	<p>(a) $\mathbf{v}_P = \{(29\mathbf{i} + 34\mathbf{j}) - (20\mathbf{i} + 10\mathbf{j})\}/3 = \underline{(3\mathbf{i} + 8\mathbf{j}) \text{ m s}^{-1}}$</p> <p>(b) $\mathbf{p} = (20\mathbf{i} + 10\mathbf{j}) + (3\mathbf{i} + 8\mathbf{j})t$ $\mathbf{q} = (14\mathbf{i} - 6\mathbf{j}) + 12\mathbf{j}t$</p> <p>(c) $\mathbf{q} - \mathbf{p} = (-6 - 3t)\mathbf{i} + (-16\mathbf{i} + 4t)\mathbf{j}$ $d^2 = (-6 - 3t)^2 + (-16 + 4t)^2$ $= 36 + 36t + 9t^2 + 16t^2 - 128t + 256$ $= 25t^2 - 92t + 292$ (*)</p> <p>(d) $25t^2 - 92t + 292 = 225$ $25t^2 - 92t + 67 = 0$ $(t - 1)(25t - 67) = 0$ $t = 67/25$ time \approx 161 mins, or 2 hrs 41 mins, or 2.41 am, or 0241</p>	<p>M1 A1 (2)</p> <p>M1 A1 M1 A1 (4)</p> <p>M1 A1 ↓ M1 ↓ M1 A1 (cso) (5)</p> <p>M1 A1 ↓ M1 A1 A1 (5)</p>
<p>(c) Allow for $\mathbf{q} - \mathbf{p}$ or $\mathbf{p} - \mathbf{q}$. But signs must be consistent for A marks. Final A1 is cso for fully consistent working form PQ or QP.</p> <p>(d) 2nd M1 for valid method to solve quadratic.</p>		