

Mark Scheme (Results)

January 2011

GCE

GCE Mechanics M1 (6677) Paper 1

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Publications Code UA026577

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General Instructions for Marking

1. The total number of marks for the paper is 75.
2. The Edexcel Mathematics mark schemes use the following types of marks:
 - **M** marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
 - **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
 - **B** marks are unconditional accuracy marks (independent of M marks)
 - Marks should not be subdivided.

3. Abbreviations

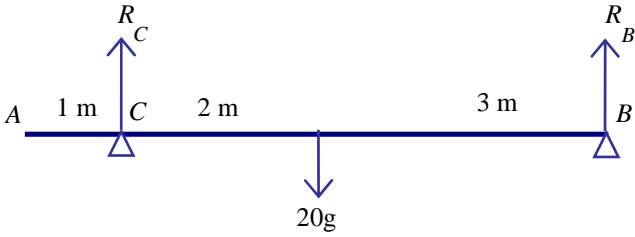
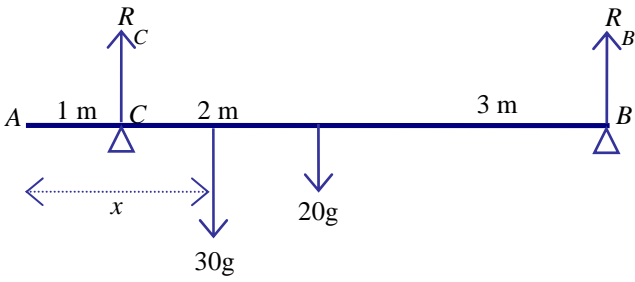
These are some of the traditional marking abbreviations that will appear in the mark schemes.

- bod - benefit of doubt
- ft - follow through
- the symbol $\sqrt{}$ will be used for correct ft
- cao - correct answer only
- cso - correct solution only. There must be no errors in this part of the question to obtain this mark
- isw - ignore subsequent working
- awrt - answers which round to
- SC: special case
- oe - or equivalent (and appropriate)
- dep - dependent
- indep - independent
- dp decimal places
- sf significant figures
- * The answer is printed on the paper
- \square The second mark is dependent on gaining the first mark

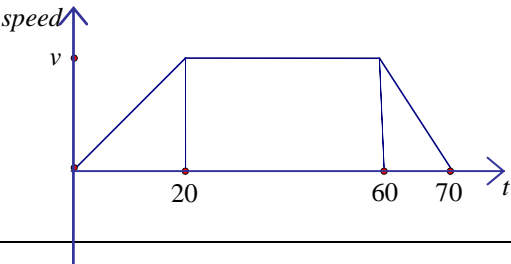
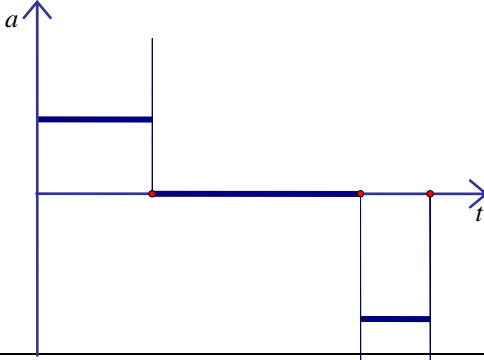
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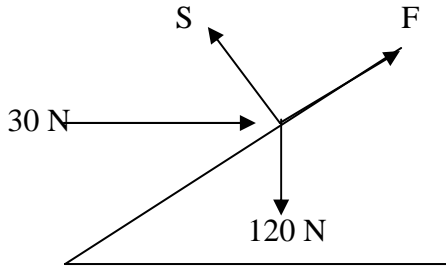
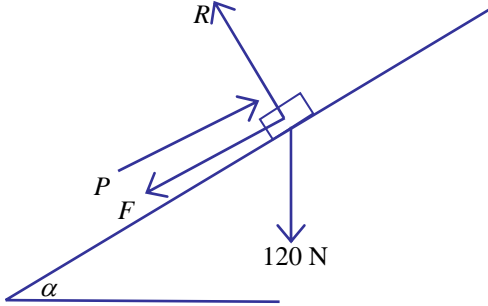
Question Number	Scheme	Marks
1. (a)	Conservation of momentum: $4m - 6 = m + 9$ $m = 5$	M1 A1 A1 (3)
(b)	Impulse = change in momentum $= 3 \times 3 - (3 \times -2) = 15$	M1 A1 (2) [5]

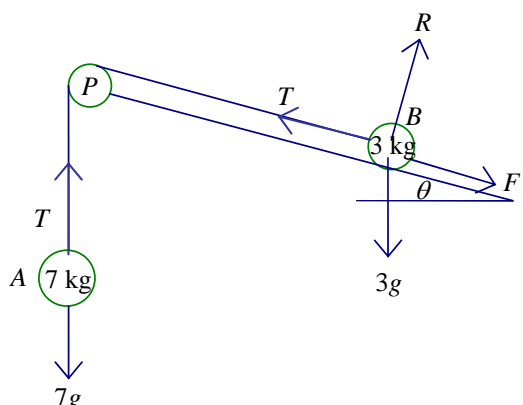
Question Number	Scheme	Marks
2. (a)	$-6.45 = u - 9.8 \times 0.75$ $0.9 = u$ **	M1 A1 A1 (3)
(b)	$0 = 0.81 - 2 \times 9.8 \times s$ $s = 0.041$ or 0.0413	M1 A1 (2)
(c)	$h = -0.9 \times 0.75 + 4.9 \times 0.75^2$ $h = 2.1$ or 2.08	M1 A1 A1 (3) [8]

Question Number	Scheme	Marks
3.	<p>(a)</p>  <p>Taking moments about B: $5 \times R_C = 20g \times 3$ $R_C = 12g$ or $60g/5$ or 118 or 120</p> <p>Resolving vertically: $R_C + R_B = 20g$ $R_B = 8g$ or 78.4 or 78</p>	<p>M1A1 A1</p> <p>M1 A1</p> <p>(5)</p>
(b)	 <p>Resolving vertically: $50g = R + R$</p> <p>Taking moments about B:</p> $5 \times 25g = 3 \times 20g + (6 - x) \times 30g$ $30x = 115$ $x = 3.8 \text{ or better or } 23/6 \text{ oe}$	<p>B1</p> <p>M1 A1 A1</p> <p>A1</p> <p>(5) [10]</p>

Question Number	Scheme	Marks
4. (a)	$\text{speed} = \sqrt{2^2 + (-5)^2}$ $= \sqrt{29} = 5.4 \text{ or better}$	M1 A1 (2)
(b)	$((7\mathbf{i} + 10\mathbf{j}) - (2\mathbf{i} - 5\mathbf{j}))/5$ $= (5\mathbf{i} + 15\mathbf{j})/5 = \mathbf{i} + 3\mathbf{j}$ $\mathbf{F} = m\mathbf{a} = 2(\mathbf{i} + 3\mathbf{j}) = 2\mathbf{i} + 6\mathbf{j}$	M1 A1 A1 DM1 A1ft (5)
(c)	$\mathbf{v} = \mathbf{u} + \mathbf{a}t = (2\mathbf{i} - 5\mathbf{j}) + (\mathbf{i} + 3\mathbf{j})t$ $(-5 + 3t)\mathbf{j}$ <p>Parallel to $\mathbf{i} \Rightarrow -5 + 3t = 0$</p> $t = 5/3$	M1 A1 M1 A1 (4) [11]

Question Number	Scheme	Marks
5.		
(a)		
(i)	 <p>1st section correct</p> <p>2nd & 3rd sections correct</p> <p>Numbers and v marked correctly on the axes.</p>	<p>B1</p> <p>B1</p> <p>DB1</p>
(ii)	 <p>1st section correct</p> <p>2nd section correct</p> <p>3rd section correct and no "extras" on the sketch</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>(6)</p>
(b)	$\frac{70 + 40}{2} \times v = 880$ $v = 880 \times \frac{2}{110} = 16$	<p>M1 A1</p> <p>DM1 A1</p> <p>(4)</p> <p>[10]</p>

Question Number	Scheme	Marks
6. (a)	 <p>Resolving perpendicular to the plane: $S = 120 \cos \alpha + 30 \sin \alpha$ $= 114 \text{ *}$</p>	M1 A1 A1 A1 (4)
(b)	 <p>Resolving perpendicular to the plane: $R = 120 \cos \alpha$ $= 96$ $F_{\max} = \frac{1}{2} R$</p> <p>Resolving parallel to the plane: In equilibrium: $P_{\max} = F_{\max} + 120 \sin \alpha$ $= 48 + 72 = 120$</p>	M1 A1 A1 M1 M1 A(2,1,0) A1 (8)
(c)	$30 + F = 120 \sin \alpha \text{ OR } 30 - F = 120 \sin \alpha$ So $F = 42 \text{ N}$ acting up the plane.	M1 A1 A1 (3) [15]

Question Number	Scheme	Marks
7. (a)	 <p> $\tan \theta = \frac{5}{12}$ $\sin \theta = \frac{5}{13}$ $\cos \theta = \frac{12}{13}$ </p> <p>For A: $7g - T = 7a$ For B: parallel to plane $T - F - 3g \sin \theta = 3a$ perpendicular to plane $R = 3g \cos \theta$ $F = \mu R = 3g \cos \theta = 2g \cos \theta$</p> <p>Eliminating T, $7g - F - 3g \sin \theta = 10a$ Equation in g and a: $7g - 2g \times \frac{12}{13} - 3g \frac{5}{13} = 7g - \frac{39}{13}g = 4g = 10a$ $a = \frac{2g}{5}$ oe or 3.9 or 3.92</p>	<p>M1 A1 M1 A1 M1 A1 M1</p> <p>DM1 DM1</p> <p>A1 (10)</p>
(b)	<p>After 1 m,</p> $v^2 = u^2 + 2as, \quad v^2 = 0 + 2 \times \frac{2g}{5} \times 1$ $v = 2.8$	<p>M1 A1 (2)</p>
(c)	<p>$-(F + 3g \sin \theta) = 3a$ $\frac{2}{3} \times 3g \times \frac{12}{13} + 3g \times \frac{5}{13} = 3g = -3a, \quad a = -g$ $v = u + at, \quad 0 = 2.8 - 9.8t,$ $t = \frac{2}{9.8}$ oe, 0.29. 0.286</p>	<p>M1 A1 DM1 A1 (4) [16]</p>

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