

# Mark Scheme (Results)

## January 2011

GCE

### GCE Mechanics M1 (6677) Paper 1

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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

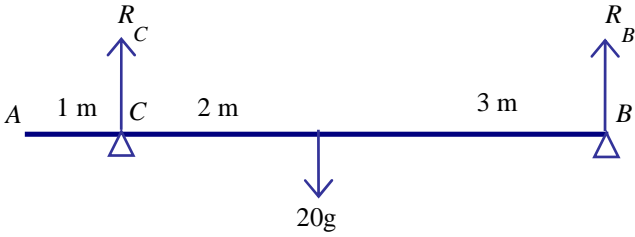
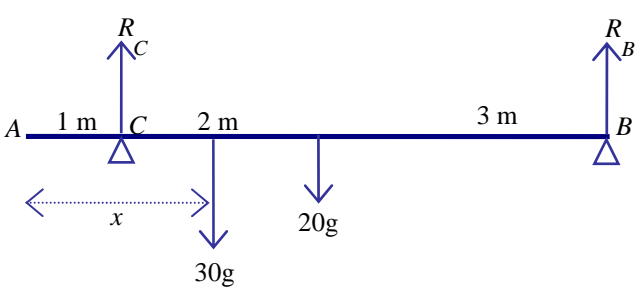
These are some of the traditional marking abbreviations that will appear in the mark schemes.

- bod - benefit of doubt
- ft - follow through
- the symbol  $\surd$  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

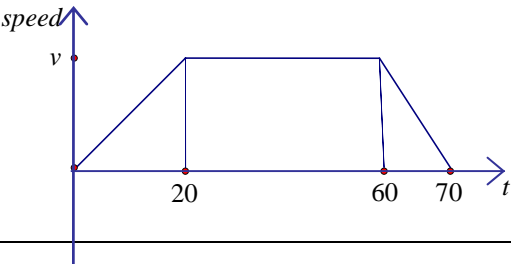
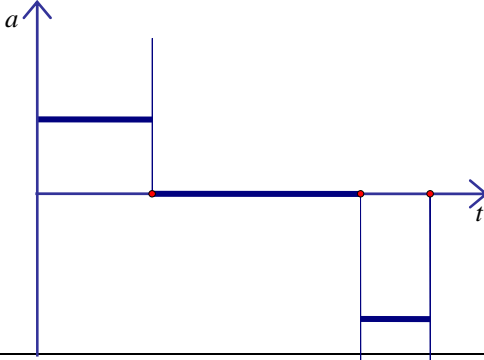
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Question Number	Scheme	Marks
1. (a)	Conservation of momentum: $4m - 6 = m + 9$ $m = 5$	M1 A1 A1 (3)
(b)	Impulse = change in momentum $= 3 \times 3 - (3 \times -2) = 15$	M1 A1 (2) [5]

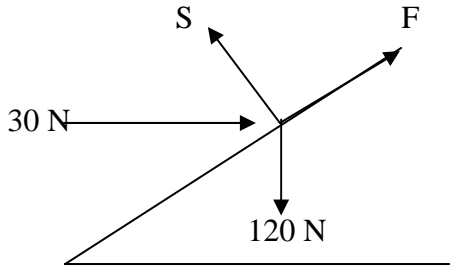
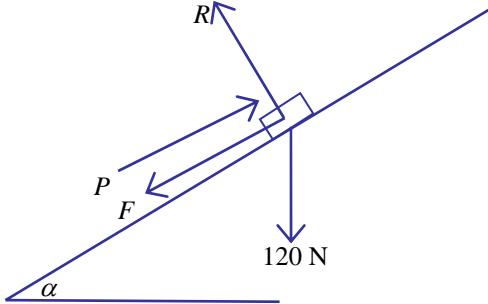
Question Number	Scheme	Marks
2. (a)	$-6.45 = u - 9.8 \times 0.75$ $0.9 = u \quad **$	M1 A1 A1 (3)
(b)	$0 = 0.81 - 2 \times 9.8 \times s$ $s = 0.041 \text{ or } 0.0413$	M1 A1 (2)
(c)	$h = -0.9 \times 0.75 + 4.9 \times 0.75^2$ $h = 2.1 \text{ or } 2.08$	M1 A1 A1 (3) [8]

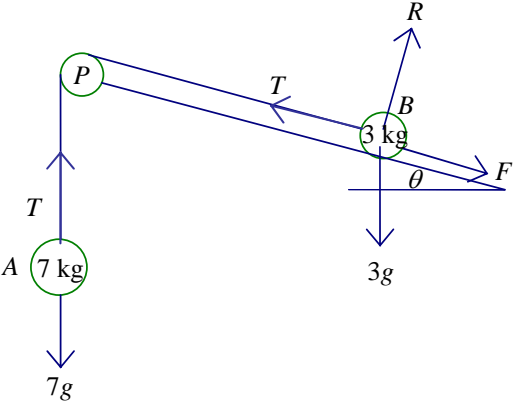
Question Number	Scheme	Marks
<p>3.</p> <p>(a)</p>	 <p>Taking moments about B: <math>5 \times R_C = 20g \times 3</math>  <math>R_C = 12g</math> or <math>60g/5</math> or <math>118</math> or <math>120</math></p> <p>Resolving vertically: <math>R_C + R_B = 20g</math>  <math>R_B = 8g</math> or <math>78.4</math> or <math>78</math></p>	<p>M1A1 A1</p> <p>M1 A1</p> <p>(5)</p>
<p>(b)</p>	 <p>Resolving vertically: <math>50g = R + R</math></p> <p>Taking moments about B:</p> $5 \times 25g = 3 \times 20g + (6 - x) \times 30g$ $30x = 115$ $x = 3.8$ or better or $23/6$ 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)	$\frac{((7\mathbf{i} + 10\mathbf{j}) - (2\mathbf{i} - 5\mathbf{j}))}{5}$ $= \frac{(5\mathbf{i} + 15\mathbf{j})}{5} = \mathbf{i} + 3\mathbf{j}$ $\mathbf{F} = m\mathbf{a} = 2(\mathbf{i} + 3\mathbf{j}) = 2\mathbf{i} + 6\mathbf{j}$	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 <math>\mathbf{i} \Rightarrow -5 + 3t = 0</math></p> $t = 5/3$	M1 A1 M1 A1 (4) [11]

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



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

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



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