

GCE

Edexcel GCE

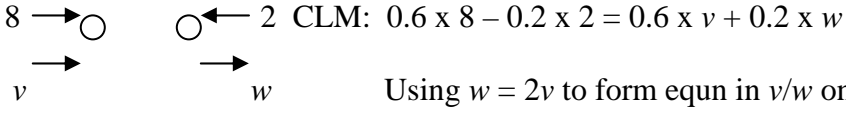
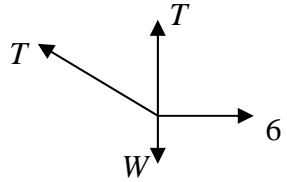
Mechanics M1 (6677)

Summer 2005

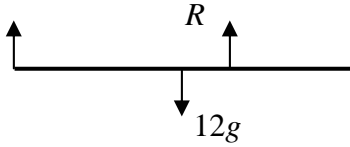
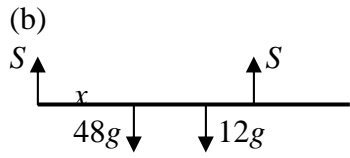
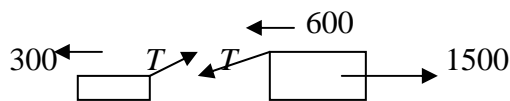
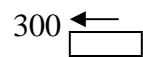
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Mark Scheme (Results)

**June 2005**  
**6677 Mechanics M1**  
**Mark Scheme**

Question Number	Scheme	Marks
1	<p>(a) '<math>v = u + at</math>': <math>74 = 2 + a \times 20 \Rightarrow a = \underline{3.6 \text{ m s}^{-2}}</math></p> <p>(b) '<math>v^2 = u^2 + 2as</math>': <math>74^2 = 2^2 + 2 \times 3.6 \times AC</math></p> <p>or '<math>s = ut + \frac{1}{2}at^2</math>': <math>AC = 2 \times 20 + \frac{1}{2} \times 3.6 \times 20^2</math></p> <p style="padding-left: 40px;"><math>\Rightarrow AC = 760 \text{ m}</math></p> <p style="padding-left: 40px;">Hence <math>BC = 1200 - 760 = \underline{440 \text{ m}}</math></p>	<p>M1 A1 (2)</p> <p>M1 A1√ A1 B1√ (4)</p>
2	<p>  </p> <p style="padding-left: 100px;">Using <math>w = 2v</math> to form equn in <math>v/w</math> only</p> <p style="padding-left: 40px;">Solve to get <math>v = \underline{4.4 \text{ m s}^{-1}}</math></p> <p>(b) Impulse on <math>B = 0.2(2 + 8.8)</math></p> <p style="padding-left: 40px;"><math>= \underline{2.16 \text{ N s}}</math></p>	<p>M1 A1 ↓ M1 ↓ M1 A1 (5)</p> <p>M1 A1√ A1 (3)</p>
3	<p>  </p> <p>(a) R(<math>\rightarrow</math>) <math>T \cos \alpha = 6</math></p> <p style="padding-left: 40px;"><math>\rightarrow T = \underline{7.5 \text{ N}}</math></p> <p>(b) R(<math>\uparrow</math>) <math>T + T \sin \alpha = W</math></p> <p style="padding-left: 40px;">Using same <math>T</math>'s and solving</p> <p style="padding-left: 40px;"><math>\rightarrow W = \underline{12 \text{ N}}</math></p>	<p>M1 A1 A1 (3)</p> <p>M1 A1 ↓ M1 A1 (4)</p>

Question Number	Scheme	Marks
4	<p>(a) R (perp to plane): <math>R = 2g \cos 20</math>  <math>\approx \underline{18.4 \text{ or } 18 \text{ N}}</math></p> <p>(b) R (// to plane): <math>18 - 2g \sin 20 - F = 2a</math></p> <p><math>F = 0.6 R</math> used</p> <p>Sub and solve: <math>a = \underline{0.123 \text{ or } 0.12 \text{ m s}^{-2}}</math></p>	<p>M1 A1  A1  (3)  M1 A1  B1  ↓  M1 A1  (5)</p>
5	<p>(a) </p> <p>Shape <math>0 &lt; t &lt; 12</math>  Shape <math>t &gt; 12</math>  Figures</p> <p>(b) Distance in 1<sup>st</sup> 12 s = <math>\frac{1}{2} \times (10 + 3) \times 12</math> or <math>(3 \times 12) + \frac{1}{2} \times 3 \times 7</math>  <math>= \underline{78 \text{ m}}</math></p> <p>(c) <b>either</b>  distance from <math>t = 12</math> to <math>t = 27 = 15 \times 3 = 45</math>  <math>\therefore</math> distance in last section = <math>135 - 45 = 12 \text{ m}</math></p> <p><math>\frac{1}{2} \times 3 \times t = 12,</math>  <math>\Rightarrow t = 8 \text{ s}</math></p> <p>hence total time = <math>27 + 8 = \underline{35 \text{ s}}</math></p> <p><b>or</b> Distance remaining after 12 s = <math>135 - 78 = 57 \text{ m}</math></p> <p><math>\frac{1}{2} \times (15 + 15 + t) \times 3 = 57</math>  <math>\Rightarrow t = 8</math></p> <p>Hence total time = <math>27 + 8 = \underline{35 \text{ s}}</math></p>	<p>B1  B1  B1  (3)  M1  A1  (2)  B1√  M1 A1√  A1  A1  (5)  B1√  M1 A1√  A1  A1</p>

Question Number	Scheme	Marks
6	 <p>(a) M(A): <math>12g \times 1.5 = R \times 2</math>  <math>R = \underline{9g \text{ or } 88.2 \text{ N}}</math></p>  <p>(b) R(↑) <math>2S = 48g + 12g</math>  <math>S = 30g</math></p> <p>M(A): <math>S \times 2 = 12g \times 1.5 + 48g \times x</math>  Sub for <math>S</math> and solve for <math>x</math>: <math>x = \underline{7/8 \text{ or } 0.875 \text{ or } 0.88 \text{ m}}</math></p>	<p>M1 A1  A1  (3)</p> <p>M1 A1</p> <p>M1 A2,1,0  ↓ ↓  M1 A1  (7)</p>
7	 <p>(a) Lorry + Car: <math>2500a = 1500 - 300 - 600</math>  <math>a = \underline{0.24 \text{ m s}^{-2}}</math></p> <p>(b) Car: <math>T \cos 15 - 300 = 900a</math> OR Lorry: <math>1500 - T \cos 15 - 600 = 1600a</math>  Sub and solve: <math>T \approx \underline{534 \text{ N}}</math></p> <p>(c)  Deceleration of car = <math>300/900 = 1/3 \text{ m s}^{-1}</math>  Hence <math>6^2 = 2 \times 1/3 \times s \Rightarrow s = \underline{54 \text{ m}}</math></p> <p>(d) Vertical component of <math>T</math> now removed  Hence normal reaction is increased</p>	<p>M1 A1  A1  (3)</p> <p>M1 A1  ↓ ↓  M1 A1  (4)</p> <p>M1 A1  M1 A1  (4)</p> <p>M1  A1 cso  (2)</p>

Question Number	Scheme	Marks
8	<p>(a) Speed of ball = <math>\sqrt{5^2 + 8^2} \approx \underline{9.43 \text{ m s}^{-1}}</math></p> <p>(b) p.v. of ball = <math>(2\mathbf{i} + \mathbf{j}) + (5\mathbf{i} + 8\mathbf{j})t</math></p> <p>(c) North of <i>B</i> when <i>i</i> components same, i.e. <math>2 + 5t = 10</math></p> $t = \underline{1.6 \text{ s}}$ <p>(d) When <math>t = 1.6</math>, p.v. of ball = <math>10\mathbf{i} + 13.8\mathbf{j}</math> (or <i>j</i> component = 13.8)</p> <p style="padding-left: 40px;">Distance travelled by 2<sup>nd</sup> player = <math>13.8 - 6 = 6.8</math></p> <p style="padding-left: 80px;">Speed = <math>6.8 \div 1.6 = \underline{4.25 \text{ m s}^{-1}}</math></p> <p style="padding-left: 40px;"><i>or</i> <math>[(2 + 5t)\mathbf{i} + (1 + 8t)\mathbf{j}] = [10\mathbf{i} + (7 + vt)\mathbf{j}]</math> (pv's or <i>j</i> components same)</p> <p style="padding-left: 40px;">Using <math>t = 1.6</math>: <math>1 + 12.8 = 7 + 1.6v</math> (equn in <i>v</i> only)</p> <p style="padding-left: 80px;"><math>v = \underline{4.25 \text{ m s}^{-1}}</math></p> <p>(e) Allow for friction on field (i.e. velocity of ball not constant)</p> <p style="padding-left: 40px;"><i>or</i> allow for vertical component of motion of ball</p> <hr/> <p>(a) M1 Valid attempt at speed (square, add and squ. root cpts)</p> <p>(b) M1 needs non-zero p.v. + (attempt at veloc vector) x <i>t</i>. Must be vector</p> <p>(d) 2<sup>nd</sup> M1 – allow if finding displacement <i>vector</i> (e.g. if using wrong time)  3<sup>rd</sup> M1 for getting speed as a <i>scalar</i> (and final answer must be as a scalar). But if they get e.g. '4.25j', allow M1 A0</p> <p>(e) Allow 'wind', 'spin', 'time for player to accelerate', size of ball  Do not allow on their own 'swerve', 'weight of ball'.</p>	<p>M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>M1 A1 ↓ M1 A1 ↓ M1 A1 (6)</p> <p>M1 A1 ↓ M1 A1 ↓ M1 A1</p> <p>B1 (1)</p>