

GCE

Edexcel GCE

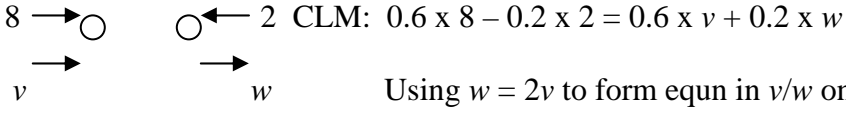
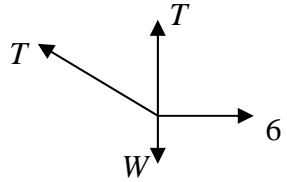
Mechanics M1 (6677)

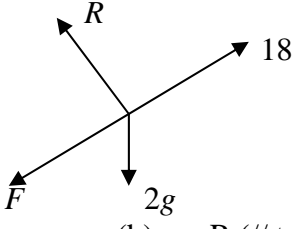
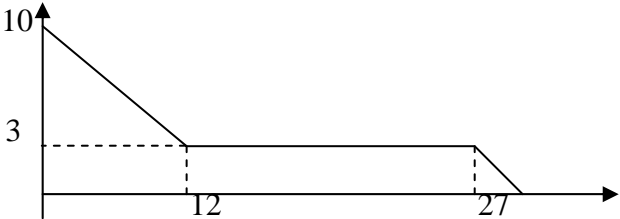
Summer 2005

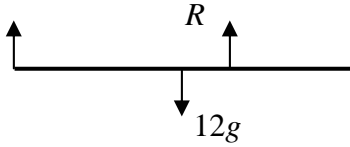
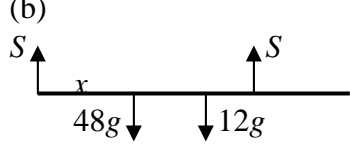
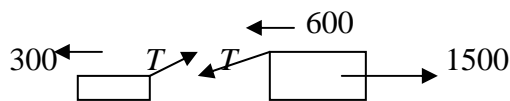
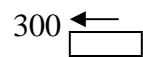
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Mark Scheme (Results)

June 2005
6677 Mechanics M1
Mark Scheme

Question Number	Scheme	Marks
1	<p>(a) '$v = u + at$': $74 = 2 + a \times 20 \Rightarrow a = \underline{3.6 \text{ m s}^{-2}}$</p> <p>(b) '$v^2 = u^2 + 2as$': $74^2 = 2^2 + 2 \times 3.6 \times AC$</p> <p>or '$s = ut + \frac{1}{2}at^2$': $AC = 2 \times 20 + \frac{1}{2} \times 3.6 \times 20^2$</p> <p style="padding-left: 40px;">$\Rightarrow AC = 760 \text{ m}$</p> <p style="padding-left: 40px;">Hence $BC = 1200 - 760 = \underline{440 \text{ m}}$</p>	<p>M1 A1 (2)</p> <p>M1 A1√ A1 B1√ (4)</p>
2	<p>  </p> <p>CLM: $0.6 \times 8 - 0.2 \times 2 = 0.6 \times v + 0.2 \times w$</p> <p style="padding-left: 40px;">Using $w = 2v$ to form equn in v/w only</p> <p style="padding-left: 40px;">Solve to get $v = \underline{4.4 \text{ m s}^{-1}}$</p> <p>(b) Impulse on B = $0.2(2 + 8.8)$</p> <p style="padding-left: 40px;">= $\underline{2.16 \text{ N s}}$</p>	<p>M1 A1 ↓ M1 ↓ M1 A1 (5)</p> <p>M1 A1√ A1 (3)</p>
3	<p>  </p> <p>(a) R(\rightarrow) $T \cos \alpha = 6$</p> <p style="padding-left: 40px;">$\rightarrow T = \underline{7.5 \text{ N}}$</p> <p>(b) R($\uparrow$) $T + T \sin \alpha = W$</p> <p style="padding-left: 40px;">Using same T's and solving</p> <p style="padding-left: 40px;">$\rightarrow W = \underline{12 \text{ N}}$</p>	<p>M1 A1 A1 (3)</p> <p>M1 A1 ↓ M1 A1 (4)</p>

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

Question Number	Scheme	Marks
6	 <p>(a) M(A): $12g \times 1.5 = R \times 2$ $R = \underline{9g \text{ or } 88.2 \text{ N}}$</p>  <p>(b) R(↑) $2S = 48g + 12g$ $S = 30g$</p> <p>M(A): $S \times 2 = 12g \times 1.5 + 48g \times x$ Sub for S and solve for x: $x = \underline{7/8 \text{ or } 0.875 \text{ or } 0.88 \text{ m}}$</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: $2500a = 1500 - 300 - 600$ $a = \underline{0.24 \text{ m s}^{-2}}$</p> <p>(b) Car: $T \cos 15 - 300 = 900a$ OR Lorry: $1500 - T \cos 15 - 600 = 1600a$ Sub and solve: $T \approx \underline{534 \text{ N}}$</p> <p>(c)  Deceleration of car = $300/900 = 1/3 \text{ m s}^{-1}$ Hence $6^2 = 2 \times 1/3 \times s \Rightarrow s = \underline{54 \text{ m}}$</p> <p>(d) Vertical component of T 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 = $\sqrt{5^2 + 8^2} \approx \underline{9.43 \text{ m s}^{-1}}$</p> <p>(b) p.v. of ball = $(2\mathbf{i} + \mathbf{j}) + (5\mathbf{i} + 8\mathbf{j})t$</p> <p>(c) North of <i>B</i> when <i>i</i> components same, i.e. $2 + 5t = 10$</p> <p style="text-align: center;">$t = \underline{1.6 \text{ s}}$</p> <p>(d) When $t = 1.6$, p.v. of ball = $10\mathbf{i} + 13.8\mathbf{j}$ (or <i>j</i> component = 13.8)</p> <p style="text-align: center;">Distance travelled by 2nd player = $13.8 - 6 = 6.8$</p> <p style="text-align: center;">Speed = $6.8 \div 1.6 = \underline{4.25 \text{ m s}^{-1}}$</p> <p><i>or</i> $[(2 + 5t)\mathbf{i} + (1 + 8t)\mathbf{j}] = [10\mathbf{i} + (7 + vt)\mathbf{j}]$ (pv's or <i>j</i> components same)</p> <p>Using $t = 1.6$: $1 + 12.8 = 7 + 1.6v$ (equn in <i>v</i> only)</p> <p style="text-align: center;">$v = \underline{4.25 \text{ m s}^{-1}}$</p> <p>(e) Allow for friction on field (i.e. velocity of ball not constant)</p> <p style="text-align: center;"><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) 2nd M1 – allow if finding displacement <i>vector</i> (e.g. if using wrong time) 3rd 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>