

GCE

Edexcel GCE

Mathematics

Mechanics 1 M1 (6677)

June 2008

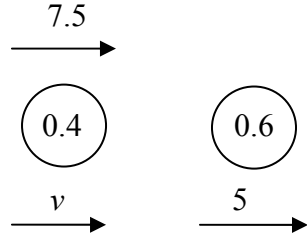
advancing learning, changing lives

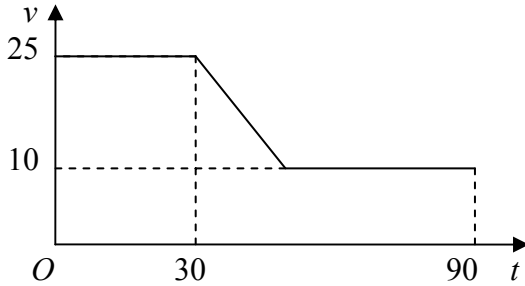
Mark Scheme (Final)

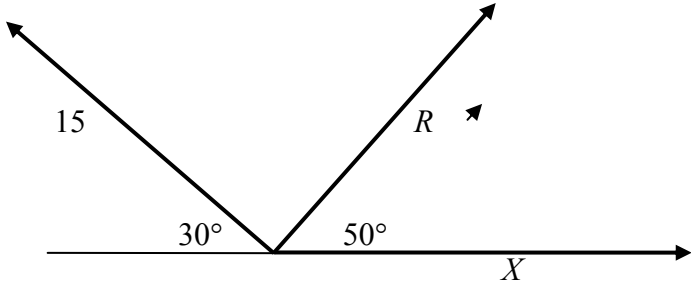
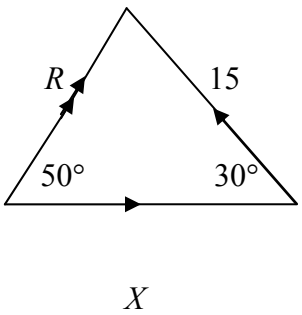
General Marking Guidance

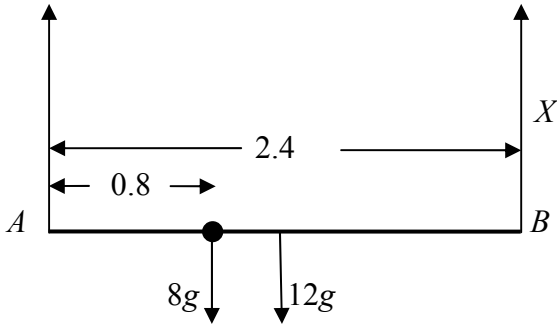
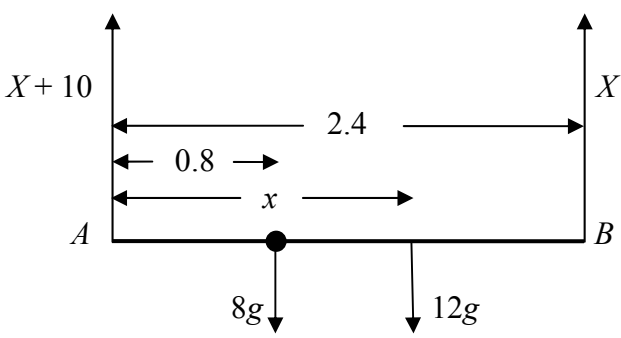
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

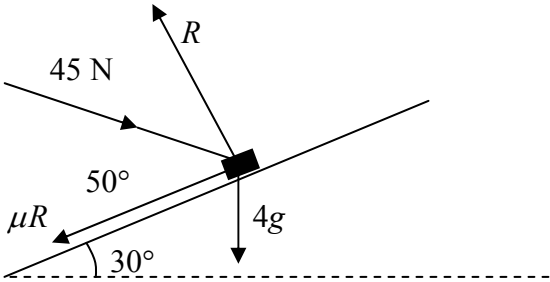
June 2008
6677 Mechanics M1
Final Mark Scheme

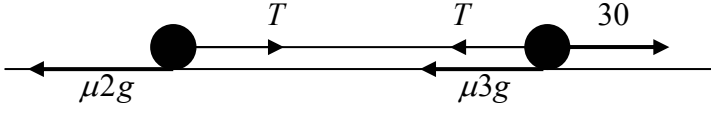
Question Number	Scheme	Marks
1.	<p>(a) $I = mv \Rightarrow 3 = 0.4 \times v$ $v = 7.5 \text{ (ms}^{-1}\text{)}$</p> <p>(b) </p> <p>LM $0.4 \times 7.5 = 0.4v + 0.6 \times 5$ $0 = 0.4v \Rightarrow v = 0 \quad *$</p>	<p>M1 A1 A1 (3)</p> <p>M1 A1 A1 (3) [6] cso</p>
2.	<p>(a) $v^2 = u^2 + 2as \Rightarrow 17.5^2 = u^2 + 2 \times 9.8 \times 10$ Leading to $u = 10.5$</p> <p>(b) $v = u + at \Rightarrow 17.5 = -10.5 + 9.8T$ $T = 2\frac{6}{7} \text{ (s)}$</p> <p>Alternatives for (b)</p> $s = \left(\frac{u+v}{2}\right)T \Rightarrow 10 = \left(\frac{17.5 + -10.5}{2}\right)T$ $\frac{20}{7} = T$ <p>OR $s = ut + \frac{1}{2}at^2 \Rightarrow -10 = 10.5t - 4.9t^2$ Leading to $T = 2\frac{6}{7}, \left(-\frac{5}{7}\right)$ Rejecting negative</p> <p>(b) can be done independently of (a) $s = vt - \frac{1}{2}at^2 \Rightarrow -10 = -17.5t + 4.9t^2$</p> $\text{Leading to } T = 2\frac{6}{7}, \frac{5}{7}$ <p>For final A1, second solution has to be rejected. $\frac{5}{7}$ leads to a negative u.</p>	<p>M1 A1 A1 (3)</p> <p>M1 A1 ft. DM1 A1 (4) [7]</p> <p>M1A1 ft. DM1A1 (4)</p> <p>M1 A1 ft. DM1 A1 (4)</p> <p>M1 A1 DM1</p> <p>A1 (4)</p>

Question Number	Scheme	Marks
3.	<p>(a) $\tan \theta = \frac{8}{6}$ $\theta \approx 53^\circ$</p> <p>(b) $\mathbf{F} = 0.4(6\mathbf{i} + 8\mathbf{j}) (= 2.4\mathbf{i} + 3.2\mathbf{j})$ $\mathbf{F} = \sqrt{(2.4^2 + 3.2^2)} = 4$ <i>The method marks can be gained in either order.</i></p> <p>(c) $\mathbf{v} = 9\mathbf{i} - 10\mathbf{j} + 5(6\mathbf{i} + 8\mathbf{j})$ $= 39\mathbf{i} + 30\mathbf{j} \text{ (ms}^{-1}\text{)}$</p>	<p>M1 A1 (2)</p> <p>M1 M1 A1 (3)</p> <p>M1 A1 A1 (3) [8]</p>
4.	<p>(a) </p> <p>shape 25, 10, 30, 90</p> <p>(b) $30 \times 25 + \frac{1}{2}(25 + 10)t + 10(60 - t) = 1410$ $7.5t = 60$ $t = 8 \text{ (s)}$ $a = \frac{25 - 10}{8} = 1.875 \text{ (ms}^{-2}\text{)}$</p>	<p>B1 B1 (2)</p> <p>M1 <u>A1</u> A1</p> <p>DM1 A1</p> <p>M1 A1 (7) [9]</p>

Question Number	Scheme	Marks
5.	<p>(a) </p> <p>(↑) $15\sin 30^\circ = R\sin 50^\circ$ $R \approx 9.79$ (N)</p> <p>(b) $(\rightarrow) X - 15\cos 30^\circ = R\cos 50^\circ$ ft their R $X \approx 19.3$ (N)</p> <p>Alternatives using sine rule in (a) or (b); cosine rule in (b)</p> <p></p> <p>(a) $\frac{R}{\sin 30^\circ} = \frac{15}{\sin 50^\circ}$ $R \approx 9.79$ (N)</p> <p>(b) $\frac{X}{\sin 100^\circ} = \frac{15}{\sin 50^\circ} = \frac{R}{\sin 30^\circ}$ $X \approx 19.3$ (N)</p> <p>OR: cosine rule; any of $R^2 = X^2 + 15^2 - 2 \times 15 \times X \cos 30^\circ$ $15^2 = R^2 + X^2 - 2 \times X \times R \cos 50^\circ$ $X \approx 19.3$ (N)</p>	<p>M1 A1 DM1 A1 (4)</p> <p>M1 A2 ft DM1 A1 (5) [9]</p> <p>M1 A1 DM1 A1 (4)</p> <p>M1 A2 ft on R DM1 A1 (5)</p> <p>M1 A2 ft on R DM1 A1 (5)</p>

Question Number	Scheme	Marks
6.	<p>(a)</p>  <p>$M(A)$ $8g \times 0.8 + 12g \times 1.2 = X \times 2.4$</p> <p>$X \approx 85 \text{ (N)}$ accept 84.9, $\frac{26g}{3}$</p> <p>(b)</p>  <p>$R(\uparrow)$ $(X + 10) + X = 8g + 12g$</p> <p>$(X = 93)$</p> <p>$M(A)$ $8g \times 0.8 + 12g \times x = X \times 2.4$</p> <p>$x = 1.4 \text{ (m)}$ accept 1.36</p>	<p>M1 A1</p> <p>DM1 A1 (4)</p> <p>M1 B1 A1</p> <p>M1 A1</p> <p>A1 (6)</p> <p>[10]</p>

Question Number	Scheme	Marks
7.	<p>(a)</p>  <p> $R = 45 \cos 40^\circ + 4g \cos 30^\circ$ $R \approx 68$ </p> <p>accept 68.4</p> <p>(b)</p> <p>Use of $F = \mu R$</p> <p>$F + 4g \sin 30 = 45 \cos 50^\circ$</p> <p>Leading to $\mu \approx 0.14$</p> <p>accept 0.136</p>	<p>M1 A2 (1, 0) DM1 A1 (5)</p> <p>M1 M1 A2 (1, 0) DM1 A1 (6) [11]</p>

Question Number	Scheme	Marks
8.	<p>(a)</p>  $s = ut + \frac{1}{2}at^2 \Rightarrow 6 = \frac{1}{2}a \times 9$ $a = 1\frac{1}{3} \text{ (ms}^{-2}\text{)}$ <p>(b) N2L for system $30 - \mu 5g = 5a$ ft their a, accept symbol</p> $\mu = \frac{14}{3g} = \frac{10}{21} \quad \text{or} \quad \text{awrt } 0.48$ <p>(c) N2L for P $T - \mu 2g = 2a$ ft their μ, their a, accept symbols</p> $T - \frac{14}{3g} \times 2g = 2 \times \frac{4}{3}$ <p>Leading to $T = 12 \text{ (N)}$ awrt 12</p> <p>Alternatively N2L for Q</p> $30 - T - \mu 3g = 3a$ <p>Leading to $T = 12 \text{ (N)}$ awrt 12</p> <p>(d) The acceleration of P and Q (or the whole of the system) is the same.</p> <p>(e) $v = u + at \Rightarrow v = \frac{4}{3} \times 3 = 4$</p> <p>N2L (for system or either particle)</p> $-5\mu g = 5a$ $a = -\mu g$ $v = u + at \Rightarrow 0 = 4 - \mu g t$ <p>Leading to $t = \frac{6}{7} \text{ (s)}$ accept 0.86, 0.857</p>	<p>M1</p> <p>A1 (2)</p> <p>M1 A1ft</p> <p>DM1 A1 (4)</p> <p>M1 A1 ft</p> <p>DM1 A1 (4)</p> <p>M1 A1</p> <p>DM1 A1</p> <p>B1 (1)</p> <p>B1 ft on a</p> <p>M1</p> <p>DM1</p> <p>A1 (4)</p> <p>[15]</p>