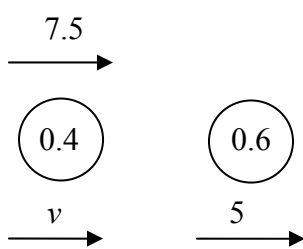


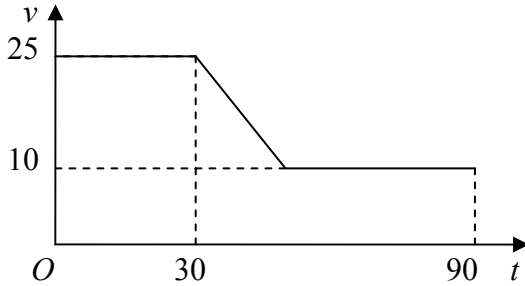
Mark Scheme (Results) Summer 2008

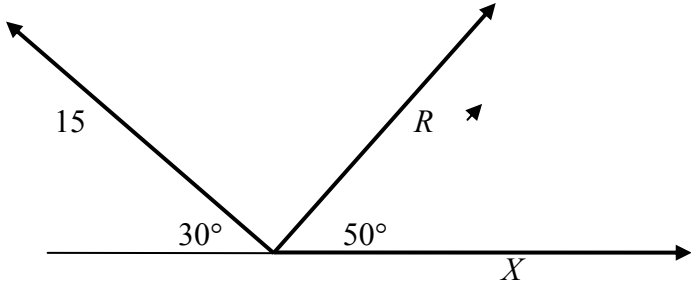
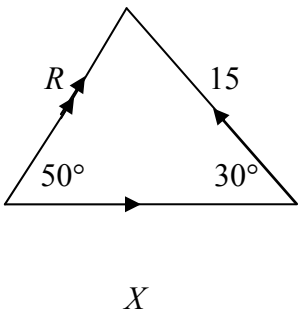
GCE

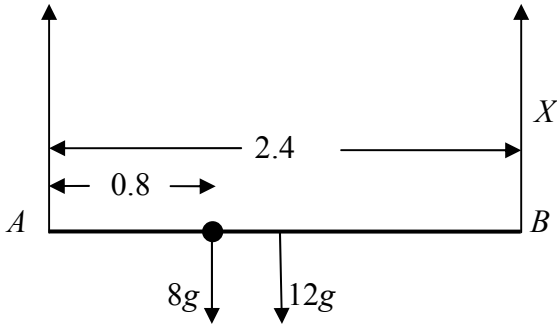
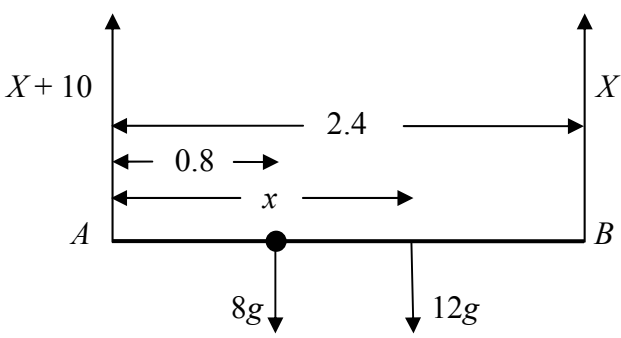
GCE Mathematics (6677/01)

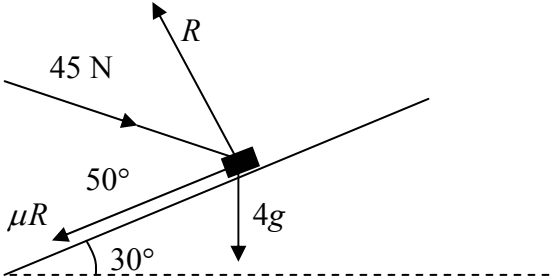
June 2008
6677 Mechanics M1
Final Mark Scheme

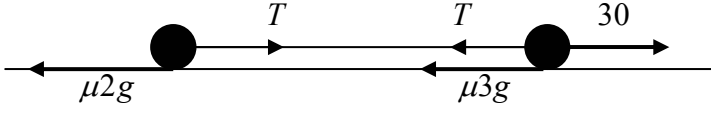
Question Number	Scheme	Marks
1.	<p>(a) $I = mv \Rightarrow 3 = 0.4 \times v$ $v = 7.5 \text{ (ms}^{-1}\text{)}$</p> <p>(b) </p> <p>LM $0.4 \times 7.5 = 0.4v + 0.6 \times 5$ $0 = 0.4v \Rightarrow v = 0 \quad *$</p>	<p>M1 A1 A1 (3)</p> <p>M1 A1 A1 (3) [6]</p>
2.	<p>(a) $v^2 = u^2 + 2as \Rightarrow 17.5^2 = u^2 + 2 \times 9.8 \times 10$ 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) $s = vt - \frac{1}{2}at^2 \Rightarrow -10 = -17.5t + 4.9t^2$ Leading to $T = 2\frac{6}{7}, \frac{5}{7}$</p> <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 f.t. DM1 A1 (4) [7]</p> <p>M1A1 f.t. DM1A1 (4)</p> <p>M1 A1 f.t. DM1 A1 (4)</p> <p>M1 A1 DM1 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>(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>shape 25, 10, 30, 90 B1 B1 (2)</p> <p>M1 <u>A1</u> A1 DM1 A1 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> $F + 4g \sin 30 = 45 \cos 50^\circ$ 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>