

# Mark Scheme (Results) Summer 2009

GCE

GCE Mathematics (6677/01)

June 2009  
6677 Mechanics M1  
Mark Scheme

Question Number	Scheme	Marks
Q1	$45 = 2u + \frac{1}{2}a2^2 \Rightarrow 45 = 2u + 2a$ $165 = 6u + \frac{1}{2}a6^2 \Rightarrow 165 = 6u + 18a$ <p style="text-align: center;">eliminating either <math>u</math> or <math>a</math></p> $u = 20 \text{ and } a = 2.5$	M1 A1 M1 A1 M1 A1 A1 <b>[7]</b>
Q2 (a) (b)	$\tan \theta = \frac{p}{2p} \Rightarrow \theta = 26.6^\circ$ $\mathbf{R} = (\mathbf{i} - 3\mathbf{j}) + (p\mathbf{i} + 2p\mathbf{j}) = (1 + p)\mathbf{i} + (-3 + 2p)\mathbf{j}$ <p style="text-align: center;"><math>\mathbf{R}</math> is parallel to <math>\mathbf{i} \Rightarrow (-3 + 2p) = 0</math></p> $\Rightarrow p = \frac{3}{2}$	M1 A1 (2) M1 A1 DM1 A1 (4) <b>[6]</b>
Q3 (a)  (b)	<p>For A:</p> $-\frac{7mu}{2} = 2m(v_A - 2u)$ $v_A = \frac{u}{4}$ <p>For B:</p> $\frac{7mu}{2} = m(v_B - -3u)$ $v_B = \frac{u}{2}$ <p>OR CLM:</p> $4mu - 3mu = 2m\frac{u}{4} + mv_B$ $v_B = \frac{u}{2}$	M1 A1 A1 (3) M1 A1 A1 (3) OR M1 A1 A1 (3) <b>[6]</b>

Question Number	Scheme	Marks
Q4	$0.5g \sin \theta - F = 0.5a$ $F = \frac{1}{3}R \text{ seen}$ $R = 0.5g \cos \theta$ <p>Use of <math>\sin \theta = \frac{4}{5}</math> or <math>\cos \theta = \frac{3}{5}</math> or decimal equiv or decimal angle e.g <math>53.1^\circ</math> or <math>53^\circ</math></p> $a = \frac{3g}{5} \text{ or } 5.88 \text{ m s}^{-2} \text{ or } 5.9 \text{ m s}^{-2}$	M1 A1 A1 B1 M1 A1 B1 DM1 A1 <b>[9]</b>
Q5	$F = P \cos 50^\circ$ $F = 0.2R \text{ seen or implied.}$ $P \sin 50^\circ + R = 15g$ <p>Eliminating <math>R</math>; Solving for <math>P</math> ;  <math>P = 37</math> (2 SF)</p>	M1 A1 B1 M1 A1 A1 DM1; D M1; A1 <b>[9]</b>
Q6	<p>(a) For whole system: <math>1200 - 400 - 200 = 1000a</math></p> $a = 0.6 \text{ m s}^{-2}$ <p>(b) For trailer: <math>T - 200 = 200 \times 0.6</math></p> $T = 320 \text{ N}$ <p><b>OR:</b> For car: <math>1200 - 400 - T = 800 \times 0.6</math></p> $T = 320 \text{ N}$ <p>(c) For trailer: <math>200 + 100 = 200f</math> or <math>-200f</math></p> $f = 1.5 \text{ m s}^{-2} \text{ (-1.5)}$ <p>For car: <math>400 + F - 100 = 800f</math> or <math>-800f</math></p> $F = 900$ <p>(N.B. For both: <math>400 + 200 + F = 1000f</math>)</p>	M1 A1 A1 (3) M1 A1 ft A1 <b>OR:</b> M1 A1 ft A1 (3) M1 A1 A1 M1 A2 A1 (7) <b>[13]</b>

Question Number	Scheme	Marks
Q7 (a)	$M(Q), 50g(1.4 - x) + 20g \times 0.7 = T_p \times 1.4$ $T_p = 588 - 350x \quad \text{Printed answer}$	M1 A1 A1 (3)
(b)	$M(P), 50gx + 20g \times 0.7 = T_Q \times 1.4 \quad \text{or} \quad R(\uparrow), T_p + T_Q = 70g$ $T_Q = 98 + 350x$	M1 A1 A1 (3)
(c)	<p>Since <math>0 &lt; x &lt; 1.4</math>, <math>98 &lt; T_p &lt; 588</math> and <math>98 &lt; T_Q &lt; 588</math></p>	M1 A1 A1 (3)
(d)	$98 + 350x = 3(588 - 350x)$ $x = 1.19$	M1 DM1 A1 (3) [12]
Q8 (a)	$ \mathbf{v}  = \sqrt{1.2^2 + (-0.9)^2} = 1.5 \text{ m s}^{-1}$	M1 A1 (2)
(b)	$(\mathbf{r}_H =) 100\mathbf{j} + t(1.2\mathbf{i} - 0.9\mathbf{j}) \text{ m}$	M1 A1 (2)
(c)	$(\mathbf{r}_K =) 9\mathbf{i} + 46\mathbf{j} + t(0.75\mathbf{i} + 1.8\mathbf{j}) \text{ m}$	M1 A1
(d)	$\overrightarrow{HK} = \mathbf{r}_K - \mathbf{r}_H = (9 - 0.45t)\mathbf{i} + (2.7t - 54)\mathbf{j} \text{ m} \quad \text{Printed Answer}$ <p>Meet when <math>\overrightarrow{HK} = \mathbf{0}</math></p> $(9 - 0.45t) = 0 \quad \text{and} \quad (2.7t - 54) = 0$ $t = 20 \text{ from both equations}$ $\mathbf{r}_K = \mathbf{r}_H = (24\mathbf{i} + 82\mathbf{j}) \text{ m}$	M1 A1 A1 DM1 A1 cso (5) [13]