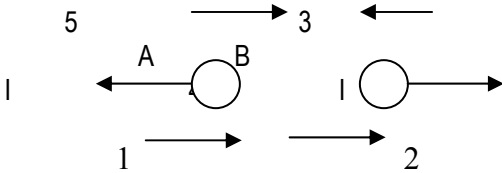


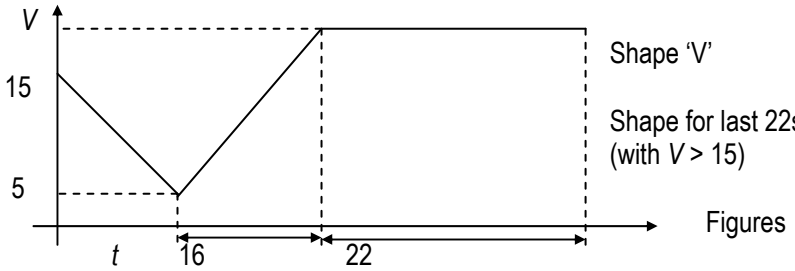
# Mark Scheme (Results) January 2008

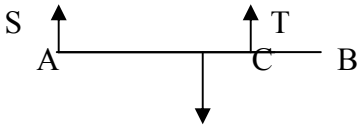
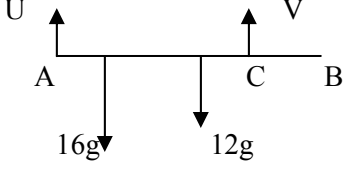
GCE

GCE Mathematics (6677/01)

January 2008  
6677 Mechanics M1  
Mark Scheme

Question Number	Scheme	Marks
1(a)	 $I = 4(5 - 1) = \underline{16 \text{Ns}}$	M1 A1 (2)
(b)	<p>CLM: <math>4 \times 5 - m \times 3 = 4 \times 1 + m \times 2</math></p> $\Rightarrow m = \underline{3.2}$ <p><b>or</b></p> $16 = m(3 + 2)$ $\Rightarrow m = \underline{3.2}$	M1 A1 DM1 A1 (4) <b>or</b> M1 A1 DM1 A1 (4) <b>6</b>
2(a)	$27 = 0 + \frac{1}{2}a \cdot 3^2 \Rightarrow a = \underline{6}$	M1 A1 (2)
(b)	$v = 6 \times 3 = \underline{18 \text{ m s}^{-1}}$	M1 A1 f.t. (2)
(c)	<p>From <math>t = 3</math> to <math>t = 5</math>, <math>s = 18 \times 2 - \frac{1}{2} \times 9.8 \times 2^2</math></p> $\text{Total ht.} = s + 27 = \underline{43.4 \text{ m}, 43 \text{ m}}$	M1 A1 f.t. M1 A1 (4) <b>8</b>

Question Number	Scheme	Marks
<p>3.(a)</p> <p>(b)</p> <p>(c)</p>	 <p>Shape 'V'</p> <p>Shape for last 22s (with <math>V &gt; 15</math>)</p> <p>Figures</p> <p><math>\frac{1}{2}(15 + 5) \times t = 120</math></p> <p><math>\Rightarrow t = 12 \rightarrow T = 12 + 16 + 22 = \underline{50 \text{ s}}</math></p> <p><math>120 + \frac{1}{2}(V + 5) \cdot 16 + 22V = 1000</math></p> <p>Solve: <math>30V = 840 \Rightarrow V = \underline{28}</math></p>	<p>B1</p> <p>B1</p> <p>B1 (3)</p> <p>M1</p> <p>M1 A1 (3)</p> <p>M1 <u>B1</u> A1</p> <p>DM1 A1</p> <p>(5)</p> <p><b>11</b></p>
<p>4.(a)</p> <p>(b)</p> <p>(c)</p>	<p>R (// plane): <math>49 \cos \theta = 6g \sin 30</math></p> <p><math>\Rightarrow \cos \theta = 3/5 *</math></p> <p>R (perp to plane): <math>R = 6g \cos 30 + 49 \sin \theta</math></p> <p><math>R \approx \underline{90.1 \text{ or } 90 \text{ N}}</math></p> <p>R (// to plane): <math>49 \cos 30 - 6g \sin 30 = 6a</math></p> <p><math>\Rightarrow a \approx \underline{2.17 \text{ or } 2.2 \text{ m s}^{-2}}</math></p>	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1</p> <p>DM1 A1 (4)</p> <p>M1 A2,1,0</p> <p>A1 (4)</p> <p><b>11</b></p>

Question Number	Scheme	Marks
5.(a)	 <p style="margin-left: 100px;"> <math>M(A): T \times 4 = 12g \times 2.5</math>  <math>T = \underline{7.5g \text{ or } 73.5 \text{ N}}</math> </p> <p style="margin-left: 100px;"> <math>R(\uparrow) S + T = 12g</math>  <math>\Rightarrow S = \underline{4.5g \text{ or } 44.1 \text{ N}}</math> </p>	<p>M1 A1 A1 M1 A1 (5)</p>
(b)	 <p style="margin-left: 100px;"> <math>M(A) V \times 4 = 16g \times y + 12g \times 2.5</math>  <math>V = \underline{4gy + 7.5g \text{ or } 39.2y + 73.5 \text{ N}}</math> </p>	<p>M1 A1 A1 (3)</p>
(c)	<p style="margin-left: 100px;"> <math>V \leq 98 \Rightarrow 39.2y + 73.5 \leq 98</math>  <math>\Rightarrow y \leq 0.625 = 5/8</math> </p> <p style="margin-left: 100px;">Hence “load must be no more than 5/8 m from A” (o.e.)</p>	<p>M1 DM1 A1 (3)</p>
6.(a)	<p style="margin-left: 100px;">Speed = <math>\sqrt{5^2 + 8^2} \approx \underline{9.43 \text{ m s}^{-1}}</math></p>	<p>M1 A1 (2)</p>
(b)	<p style="margin-left: 100px;">Forming <math>\arctan 8/5</math> or <math>\arctan 5/8</math> oe</p>	<p>M1</p>
(c)	<p style="margin-left: 100px;">Bearing = <math>360 - \arctan 5/8</math> or <math>270 + \arctan 8/5 = \underline{328}</math></p>	<p>DM1 A1 (3)</p>
(c)	<p style="margin-left: 100px;">At <math>t = 3</math>, p.v. of <math>P = (7 - 15)\mathbf{i} + (-10 + 24)\mathbf{j} = -8\mathbf{i} + 14\mathbf{j}</math></p>	<p>M1 A1</p>
(c)	<p style="margin-left: 100px;">Hence <math>-8\mathbf{i} + 14\mathbf{j} + 4(u\mathbf{i} + v\mathbf{j}) = \mathbf{0}</math></p>	<p>M1</p>
(c)	<p style="margin-left: 100px;"><math>\Rightarrow \underline{u = 2, v = -3.5}</math></p>	<p>DM1 A1 (5)</p>
(d)	<p style="margin-left: 100px;">p.v. of <math>P</math> <math>t</math> secs after changing course = <math>(-8\mathbf{i} + 14\mathbf{j}) + t(2\mathbf{i} - 3.5\mathbf{j})</math></p>	<p>M1</p>
(d)	<p style="margin-left: 100px;">= <math>7\mathbf{i} + \dots</math></p>	<p>DM1</p>
(d)	<p style="margin-left: 100px;">Hence total time = <math>\underline{10.5 \text{ s}}</math></p>	<p>A1 (3)</p>
		<p style="text-align: right;"><b>13</b></p>

Question Number	Scheme	Marks
7.(a)	$B: \quad 2mg - T = 2m \times 4g/9$ $\Rightarrow T = \underline{10mg/9}$	M1 A1 A1 (3)
(b)	$A: \quad T - \mu mg = m \times 4g/9$ <p>Sub for <math>T</math> and solve: <math>\mu = 2/3 *</math></p>	M1 B1 A1 DM1 A1 (5)
(c)	<p>When <math>B</math> hits: <math>v^2 = 2 \times 4g/9 \times h</math></p> <p>Deceleration of <math>A</math> after <math>B</math> hits: <math>ma = \mu mg \Rightarrow a = 2g/3</math></p> <p>Speed of <math>A</math> at <math>P</math>: <math>V^2 = 8gh/9 - 2 \times 2g/3 \times h/3</math></p> $\Rightarrow V = \frac{2}{3} \sqrt{gh}$	M1 A1 M1 A1 f.t. DM1 A1 (6)
(d)	Same tension on $A$ and $B$	B1 (1)  <b>15</b>