

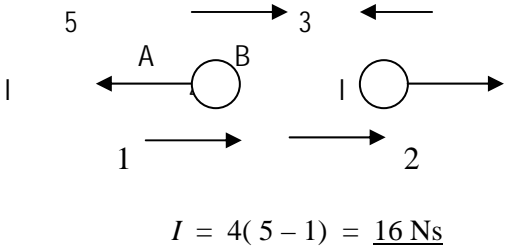
Mark Scheme (Results)

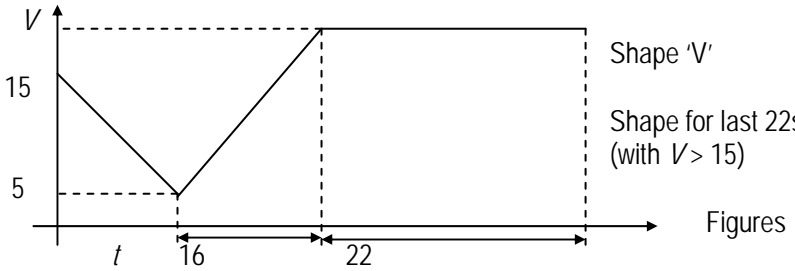
January 2008

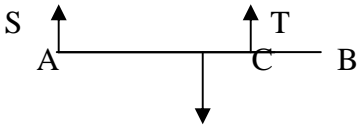
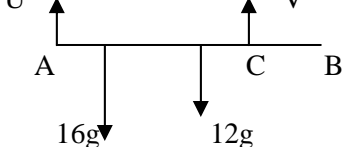
GCE

GCE Mathematics (6677/01)

January 2008
6677 Mechanics M1
Mark Scheme

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

Question Number	Scheme	Marks
3.(a)		<p>B1</p> <p>B1</p> <p>B1 (3)</p>
(b)	$\frac{1}{2}(15 + 5) \times t = 120$ $\Rightarrow t = 12 \rightarrow T = 12 + 16 + 22 = \underline{50 \text{ s}}$	<p>M1</p> <p>M1 A1 (3)</p>
(c)	$120 + \frac{1}{2}(V + 5) \cdot 16 + 22V = 1000$ $\text{Solve: } 30V = 840 \Rightarrow V = \underline{28}$	<p>M1 <u>B1</u> A1</p> <p>DM1 A1 (5)</p> <p>11</p>
4.(a)	<p>R (// plane): $49 \cos \theta = 6g \sin 30$</p> $\Rightarrow \cos \theta = 3/5 *$	<p>M1 A1</p> <p>A1 (3)</p>
(b)	<p>R (perp to plane): $R = 6g \cos 30 + 49 \sin \theta$</p> $R \approx \underline{90.1 \text{ or } 90 \text{ N}}$	<p>M1 A1</p> <p>DM1 A1 (4)</p>
(c)	<p>R (// to plane): $49 \cos 30 - 6g \sin 30 = 6a$</p> $\Rightarrow a \approx 2.17 \text{ or } 2.2 \text{ m s}^{-2}$	<p>M1 A2,1,0</p> <p>A1 (4)</p> <p>11</p>

Question Number	Scheme	Marks
5.(a)	 <p style="margin-left: 100px;"> $M(A): T \times 4 = 12g \times 2.5$ $T = \underline{7.5g \text{ or } 73.5 \text{ N}}$ </p> <p style="margin-left: 100px;"> $R(\uparrow) S + T = 12g$ $\Rightarrow S = \underline{4.5g \text{ or } 44.1 \text{ N}}$ </p>	M1 A1 A1 M1 A1 (5)
(b)	 <p style="margin-left: 100px;"> $M(A) V \times 4 = 16g \times y + 12g \times 2.5$ $V = \underline{4gy + 7.5g \text{ or } 39.2y + 73.5 \text{ N}}$ </p>	M1 A1 A1 (3)
(c)	$V \leq 98 \Rightarrow 39.2y + 73.5 \leq 98$ $\Rightarrow y \leq 0.625 = 5/8$ <p style="margin-left: 40px;">Hence “load must be no more than 5/8 m from A” (o.e.)</p>	M1 DM1 A1 (3) 11
6.(a)	$\text{Speed} = \sqrt{5^2 + 8^2} \approx \underline{9.43 \text{ m s}^{-1}}$	M1 A1 (2)
(b)	Forming $\arctan 8/5$ or $\arctan 5/8$ oe	M1
(c)	Bearing = $360 - \arctan 5/8$ or $270 + \arctan 8/5 = \underline{328}$	DM1 A1 (3)
(d)	At $t = 3$, p.v. of $P = (7 - 15)\mathbf{i} + (-10 + 24)\mathbf{j} = -8\mathbf{i} + 14\mathbf{j}$ Hence $-8\mathbf{i} + 14\mathbf{j} + 4(u\mathbf{i} + v\mathbf{j}) = \mathbf{0}$ $\Rightarrow \underline{u = 2, v = -3.5}$	M1 A1 M1 DM1 A1 (5)
(d)	p.v. of P t secs after changing course = $(-8\mathbf{i} + 14\mathbf{j}) + t(2\mathbf{i} - 3.5\mathbf{j})$ $= 7\mathbf{i} + \dots$ Hence total time = $\underline{10.5 \text{ s}}$	M1 DM1 A1 (3) 13

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