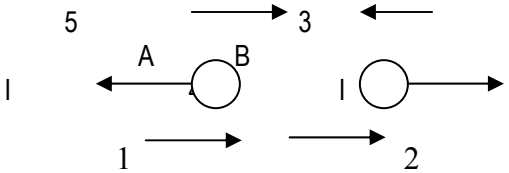


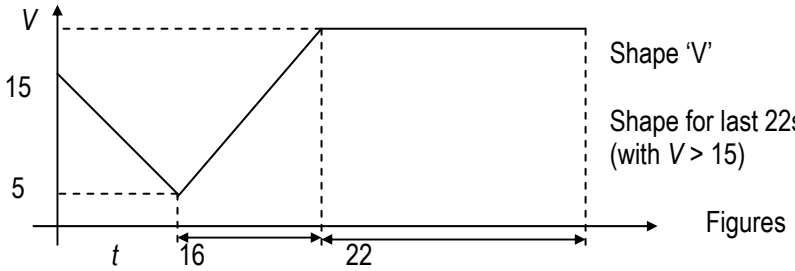
Mark Scheme (Results) January 2008

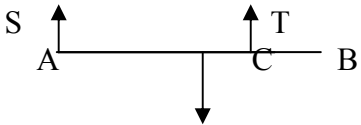
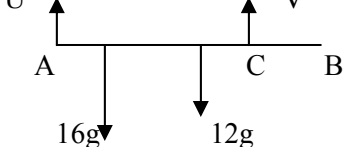
GCE

GCE Mathematics (6677/01)

January 2008
6677 Mechanics M1
Mark Scheme

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

| 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 |
| | | |