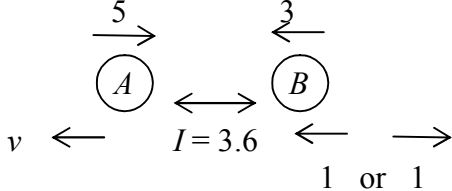
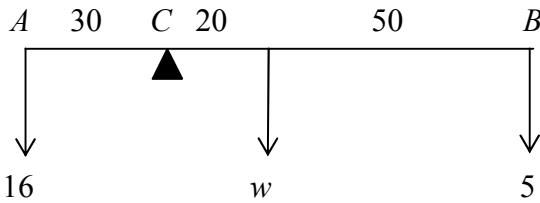
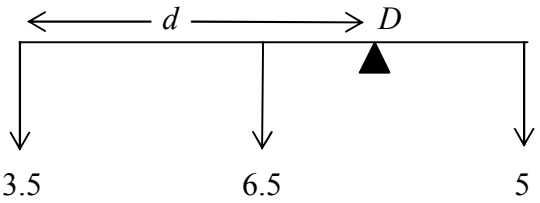
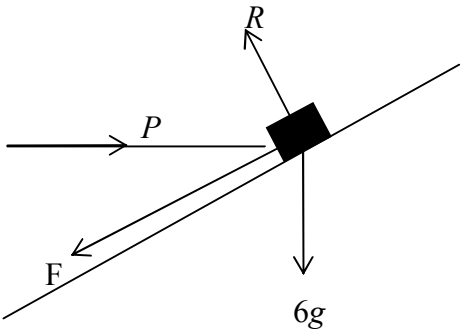
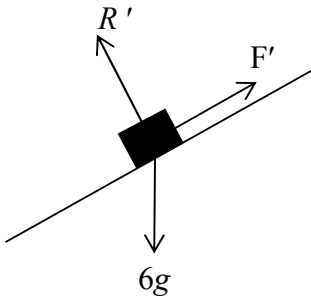
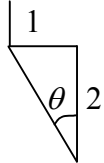


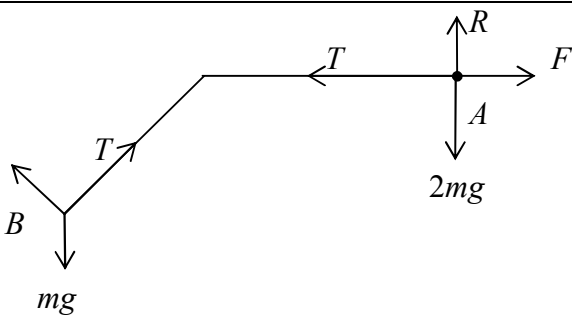
Question Number	Scheme	Marks
1.	<p>(a) $s = ut + \frac{1}{2}at^2 : 50 = 5 \times 4 + \frac{1}{2} \times a \times 4^2$ $\Rightarrow 30 = 8a \Rightarrow a = 3.75 \text{ m s}^{-1}$</p> <p>(b) $30^2 = 5^2 + 2 \times 3.75 \times s$ $\Rightarrow s = 116\frac{2}{3} \text{ m}$</p>	<p>M1 A1 A1 (3) M1 A1 ft A1 (3) (6 marks)</p>
2.	 <p>Considering momentum of A: $3.6 = 0.5(5 + v)$ $\Rightarrow v = 2.2 \text{ m s}^{-1}$</p> <p>Considering momentum of B: $3.6 = m(3 + 1)$ or $m(3 - 1)$ $m = 0.9$ or $m = 1.8$</p>	<p>M1 A1 A1 (3) M1 A1 (one) M1 A1 (both) (4) (7 marks)</p>
3.	<p>(a)</p>  <p>M(C): $16 \times 30 = w \times 20 + 5 \times 70$ (3 terms) $\Rightarrow w = 6.5 \text{ N}$</p> <p>(b)</p>  <p>M(D): $3.5d + 6.5(d - 50) = 5(100 - d)$ $\Rightarrow d = 55 \text{ cm}$</p> <p>(c) Tension equal along string, i.e. tensions = weights throughout or no contributions from strings in moments equation</p>	<p>M1 A1 A1 (3) M1 A2ft (-1 eoo) A1 (4) B1 (1) (8 marks)</p>

(ft = follow through mark; -1eeoo = minus one mark for each error or omission)

Question Number	Scheme	Marks
<p>4. (a)</p>	 <p> $F = \frac{2}{5} R$ $R(\uparrow): R \cos 30^\circ - F \cos 60^\circ = 6g$ $R \frac{\sqrt{3}}{2} - \frac{2}{5} R - \frac{1}{2} = 6g$ $\Rightarrow R = 88.3 \text{ N (or 88 N)}$ </p>	<p>B1</p> <p>M1 A1</p> <p>A1 (4)</p>
<p>(b)</p>	<p> $R(\leftarrow): P = R \cos 60^\circ + F \cos 30^\circ$ $= 74.7 \text{ N (or 75 N)}$ </p>	<p>M1 A1</p> <p>A1 (3)</p>
<p>(c)</p>	 <p> Component of weight (\sphericalangle) = $6g \cos 60^\circ$ $= 29.4 \text{ N}$ $R' = 6g \cos 30^\circ = 50.9 \text{ N}$ $F_{\max} = 0.4 R' = 20.36 \text{ N}$ Since $29.4 > 20.36$, the box moves </p>	<p>B1</p> <p>M1 A1</p> <p>M1</p> <p>A1 cso (5)</p> <p>(12 marks)</p>
<p>5. (a)</p>	 <p> $\tan \theta = \frac{1}{2} \Rightarrow \theta = 26.6^\circ$ angle required = 153.4° </p>	<p>M1 A1</p> <p>A1 (3)</p>
<p>(b)</p>	<p> $\mathbf{a} = \frac{1}{3}[(\mathbf{i} - 2\mathbf{j}) - (-5\mathbf{i} + 7\mathbf{j})]$ $= (2\mathbf{i} - 3\mathbf{j}) \text{ m s}^{-2}$ </p>	<p>M1</p> <p>A1 (2)</p>
<p>(c)</p>	<p> $\mathbf{F} = m\mathbf{a} = 4\mathbf{i} - 6\mathbf{j}$ $\mathbf{F} = \sqrt{16 + 36} = 7.21 \text{ N}$ </p>	<p>M1</p> <p>M1 A1 (3)</p>
<p>(d)</p>	<p> $\mathbf{v} = (-5 + 2t)\mathbf{i} + (7 - 3t)\mathbf{j}$ </p>	<p>M1 A1ft (2)</p>
<p>(e)</p>	<p> \mathbf{v} parallel to $\mathbf{i} + \mathbf{j} \Rightarrow \frac{-5 + 2t}{7 - 3t} = 1$ $\Rightarrow t = 2.4 \text{ s}$ </p>	<p>M1</p> <p>M1 A1 (3)</p> <p>(13 marks)</p>

(cso = correct solution only)

Question Number	Scheme	Marks
6. (a)		<p>shape B1</p> <p>(3, 2.5) B1 (2)</p>
(b)	<p>Area = 27 = $\frac{1}{2} \times 1.5 \times 3 + 3T + \frac{1}{2} \times 2.5 \times 3$</p> <p>$\Rightarrow T = 7 \text{ s}$</p>	<p>M1 A1</p> <p>A1 (3)</p>
(c)		<p>shape $0 \leq t \leq 8.5$ B1</p> <p>shape $t > 8.5$ B1</p> <p>(2, 7 (ft), 2.5) B1 (3)</p>
(d)	<p>(System)</p> <p>$T - 200g = 200 \times 2$</p> <p>$\Rightarrow T = 2360 \text{ N}$</p>	<p>M1 A1</p> <p>A1 (3)</p>
(e)	<p>(Man)</p> <p>$R - 80g = -80 \times 1.2$</p> <p>$\Rightarrow R = 688 \text{ N}$</p>	<p>M1 A1</p> <p>A1 (3)</p> <p>(14 marks)</p>

Question Number	Scheme	Marks
<p>7. (a)</p>	 <p> $R = 2mg \Rightarrow F = 2\mu mg$ $A: T - 2\mu mg = 2ma$ $B: mg \times \frac{1}{2} - T = ma$ </p> <p>Eliminating T: $3ma = \frac{1}{2}mg - 2\mu mg$</p> <p>$a = \frac{1}{6}(1 - 4\mu)g$ (*)</p> <p>(b) $\mu = 0.2 \Rightarrow a = \frac{1}{30}g$</p> <p>when string breaks: $v^2 = 2 \times \frac{1}{30}g \times h = \frac{1}{15}gh$</p> <p>A decelerating with deceleration $f \Rightarrow 2mf = 2\mu mg$</p> <p>$f = \mu g = \frac{1}{5}g$</p> <p>Hence distance travelled during deceleration is given by $\frac{1}{15}gh = 2 \times \frac{1}{5}gd$</p> <p>$\Rightarrow d = \frac{1}{6}h$</p> <p>$\therefore$ Total distance = $\frac{7}{6}h$</p> <p>(c) Any two from: weight of pulley; friction at pulley; friction on slope; weight of string; string extensible; ‘spin’ of particle</p>	<p>B1</p> <p>M1 A1</p> <p>M1 A1</p> <p>M1</p> <p>A1 (7)</p> <p>B1</p> <p>M1 A1</p> <p>B1</p> <p>M1</p> <p>A1 cso (6)</p> <p>B1 B1 (2)</p> <p>(15 marks)</p>

((*) indicates final line is given on the paper; cso = correct solution only)