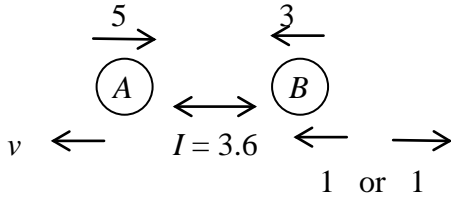
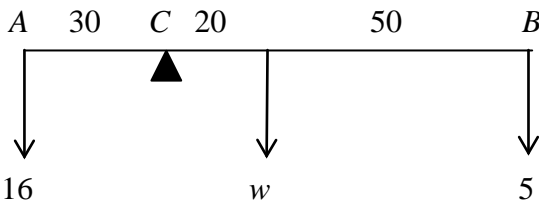
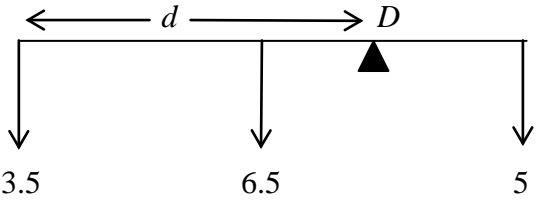
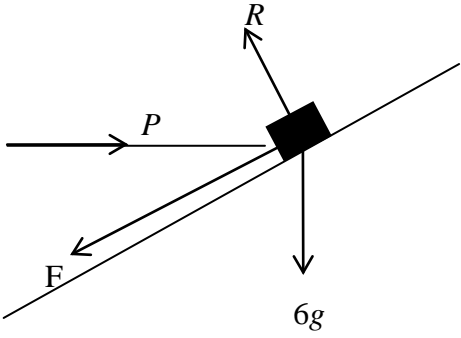
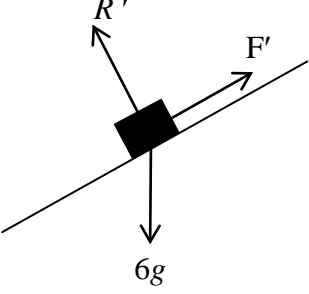
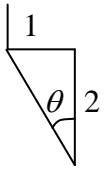
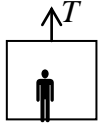
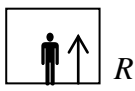


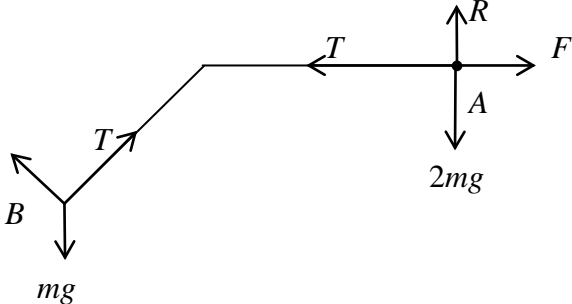
Question Number	Scheme	Marks
<p>1. (a)</p> <p>(b)</p>	$s = ut + \frac{1}{2}at^2 : 50 = 5 \times 4 + \frac{1}{2} \times a \times 4^2$ $\Rightarrow 30 = 8a \Rightarrow a = 3.75 \text{ m s}^{-1}$ $30^2 = 5^2 + 2 \times 3.75 \times s$ $\Rightarrow s = 116\frac{2}{3} \text{ m}$	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1 ft</p> <p>A1 (3)</p> <p>(6 marks)</p>
<p>2.</p>	 <p>Considering momentum of A: <math>3.6 = 0.5(5 + v)</math></p> $\Rightarrow v = 2.2 \text{ m s}^{-1}$ <p>Considering momentum of B: <math>3.6 = m(3 + 1)</math> or <math>m(3 - 1)</math></p> $m = 0.9 \text{ or } m = 1.8$	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1 (one)</p> <p>M1 A1 (both)</p> <p>(4)</p> <p>(7 marks)</p>
<p>3. (a)</p> <p>(b)</p> <p>(c)</p>	 $M(C): 16 \times 30 = w \times 20 + 5 \times 70$ <p>(3 terms)</p> $\Rightarrow w = 6.5 \text{ N}$  $M(D): 3.5d + 6.5(d - 50) = 5(100 - d)$ $\Rightarrow d = 55 \text{ cm}$	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A2ft</p> <p>(-1 eeo)</p> <p>A1 (4)</p> <p>B1 (1)</p> <p>(8 marks)</p>

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

Question Number	Scheme	Marks
<p>4. (a)</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>(b)</p> $R(\leftarrow): P = R \cos 60^\circ + F \cos 30^\circ$ $= 74.7 \text{ N (or 75 N)}$ <p>(c)</p>  <p>Component of weight (<math>\surd</math>) = <math>6g \cos 60^\circ</math> = 29.4 N</p> $R' = 6g \cos 30^\circ = 50.9 \text{ N}$ $F_{\max} = 0.4 R' = 20.36 \text{ N}$ <p>Since <math>29.4 &gt; 20.36</math>, the box moves</p>	<p>B1</p> <p>M1 A1</p> <p>A1 (4)</p> <p>M1 A1</p> <p>A1 (3)</p> <p>B1</p> <p>M1 A1</p> <p>M1</p> <p>A1 cso (5)</p> <p><b>(12 marks)</b></p>
<p>5. (a)</p>  <p>(b) <math>\mathbf{a} = \frac{1}{3}[(\mathbf{i} - 2\mathbf{j}) - (-5\mathbf{i} + 7\mathbf{j})]</math> <math>= (2\mathbf{i} - 3\mathbf{j}) \text{ m s}^{-2}</math></p> <p>(c) <math>\mathbf{F} = m\mathbf{a} = 4\mathbf{i} - 6\mathbf{j}</math> <math> \mathbf{F}  = \sqrt{(16 + 36)} = 7.21 \text{ N}</math></p> <p>(d) <math>\mathbf{v} = (-5 + 2t)\mathbf{i} + (7 - 3t)\mathbf{j}</math></p> <p>(e) <math>\mathbf{v}</math> parallel to <math>\mathbf{i} + \mathbf{j} \Rightarrow \frac{-5 + 2t}{7 - 3t} = 1</math> <math>\Rightarrow t = 2.4 \text{ s}</math></p>	<p><math>\tan \theta = \frac{1}{2} \Rightarrow \theta = 26.6^\circ</math> angle required = <math>153.4^\circ</math></p> <p>M1 A1</p> <p>A1 (3)</p> <p>M1</p> <p>A1 (2)</p> <p>M1</p> <p>M1 A1 (3)</p> <p>M1 A1ft (2)</p> <p>M1</p> <p>M1 A1 (3)</p> <p><b>(13 marks)</b></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 = <math>27 = \frac{1}{2} \times 1.5 \times 3 + 3T + \frac{1}{2} \times 2.5 \times 3</math></p> <p><math>\Rightarrow T = 7 \text{ s}</math></p>	<p>M1 A1</p> <p>A1 (3)</p>
(c)		<p>shape <math>0 \leq t \leq 8.5</math> B1</p> <p>shape <math>t &gt; 8.5</math> B1</p> <p>(2, 7 (ft), 2.5) B1 (3)</p>
(d)	<p>(System)</p>  <p><math>T - 200g = 200 \times 2</math></p> <p><math>\Rightarrow T = 2360 \text{ N}</math></p>	<p>M1 A1</p> <p>A1 (3)</p>
(e)	<p>(Man)</p>  <p><math>R - 80g = -80 \times 1.2</math></p> <p><math>\Rightarrow R = 688 \text{ N}</math></p>	<p>M1 A1</p> <p>A1 (3)</p> <p><b>(14 marks)</b></p>

Question Number	Scheme	Marks
7. (a)	 <p> <math>R = 2mg \Rightarrow F = 2\mu mg</math> </p> <p> <math>A: T - 2\mu mg = 2ma</math> </p> <p> <math>B: mg \times \frac{1}{2} - T = ma</math> </p> <p>           Eliminating <math>T: 3ma = \frac{1}{2}mg - 2\mu mg</math> </p> <p> <math>a = \frac{1}{6}(1 - 4\mu)g</math> (*)         </p> <p>           (b) <math>\mu = 0.2 \Rightarrow a = \frac{1}{30}g</math> </p> <p>           when string breaks: <math>v^2 = 2 \times \frac{1}{30}g \times h = \frac{1}{15}gh</math> </p> <p>           A decelerating with deceleration <math>f \Rightarrow 2mf = 2\mu mg</math> </p> <p> <math>f = \mu g = \frac{1}{5}g</math> </p> <p>           Hence distance travelled during deceleration is given by <math>\frac{1}{15}gh = 2 \times \frac{1}{5}gd</math> </p> <p> <math>\Rightarrow d = \frac{1}{6}h</math> </p> <p> <math>\therefore</math> Total distance = <math>\frac{7}{6}h</math> </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)