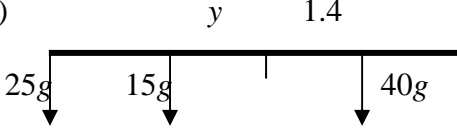
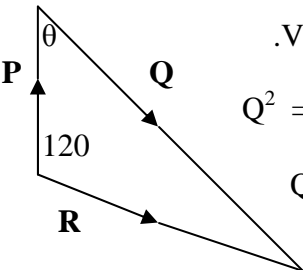
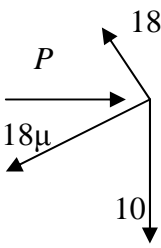
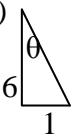
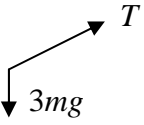
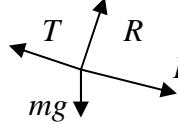



Question Number	Scheme	Marks
1.	<p>(a) Distance after 4 s = <math>16 \times 4 - \frac{1}{2} \times 9.8 \times 4^2</math>  <math>= -14.4 \Rightarrow h = (+) \underline{14.4 \text{ m}}</math></p> <p>(b) <math>v = 16 - 9.8 \times 4</math>  <math>= -23.2 \Rightarrow \text{speed} = (+) \underline{23.2 \text{ m s}^{-1}}</math></p>	<p>M1 A1  A1  (3)  M1 A1  A1  (3)  <b>6</b></p>
2.	<p>(a) CLM: <math>3 \times 4 + 2 \times 1.5 = 5 \times v</math>  <math>\Rightarrow v = \underline{3 \text{ m s}^{-1}}</math></p> <p>(b) (i) CLM: <math>3 \times 4 - m \times 4 = -3 \times 2 + m \times 1</math>  <math>\Rightarrow m = \underline{3.6}</math></p> <p>(ii) <math>I = 3.6(4 + 1)</math> [or <math>3(4 + 2)</math>]  <math>= \underline{18 \text{ N s}}</math></p>	<p>M1 A1  A1  (3)  M1 A1  A1  (3)  M1  A1√  (2)  <b>8</b></p>

Question Number	Scheme	Marks
3.	<p>(a) M(C): <math>25g \times 2 = 40g \times x</math>  <math>x = \underline{1.25 \text{ m}}</math></p> <p>(b) Weight/mass acts at mid-point; or weight/mass evenly distributed (o.e.)</p> <p>(c)  M(C):  <math>40g \times 1.4 = 15g \times y + 25g \times 2</math>                      Solve: <math>y = \underline{0.4 \text{ m}}</math></p>	<p>M1 A1                      A1                      (3)                      B1                      (1)                      M1 A1                      ↓                      M1 A1                      (4)                      8</p>
4.	<p><math>\mathbf{R} = 10\sqrt{3}/2 \mathbf{i} - 5\mathbf{j}</math></p> <p>Using <math>\mathbf{P} = 7\mathbf{j}</math> and <math>\mathbf{Q} = \mathbf{R} - \mathbf{P}</math> to obtain <math>\mathbf{Q} = 5\sqrt{3}\mathbf{i} - 12\mathbf{j}</math></p> <p>Magnitude = <math>\sqrt{[(5\sqrt{3})^2 + 12^2]} \approx \underline{14.8 \text{ N}}</math> (AWRT)</p> <p>angle with <math>\mathbf{i} = \arctan(12/5\sqrt{3}) \approx 64.2^\circ</math></p> <p>bearing <math>\approx \underline{144^\circ}</math> (AWRT)</p> <p>Alternative method</p>  <p>.Vector triangle correct</p> $Q^2 = 10^2 + 7^2 + 2 \times 10 \times 7 \cos 60$ <p><math>Q \approx \underline{14.8 \text{ N}}</math> (AWRT)</p> $\frac{14.8}{\sin 120} = \frac{10}{\sin \theta}$ <p><math>\Rightarrow \theta = 35.8, \Rightarrow \text{bearing } 144</math> (AWRT)</p>	<p>M1 A1                      ↓                      M1 A1                      ↓                      ↓ M1 A1                      M1 A1                      A1                      (9)                      B1                      M1 A1                      A1                      M1 A1 √                      ↓                      M1 A1, A1                      9</p>

Question Number	Scheme	Marks
5.	 <p>(a) R( perp to plane):  <math>P \sin 30 + 10 \cos 30 = 18</math>                      Solve: <math>P \approx \underline{18.7 \text{ N}}</math></p> <p>(b) R( // plane):  <math>P \cos 30 = 10 \sin 30 + F</math>  <math>F = 18\mu</math> used                      Sub and solve: <math>\mu = \underline{0.621 \text{ or } 0.62}</math></p> <p>(c) Normal reaction now = <math>10 \cos 30</math>                      Component of weight down plane = <math>10 \sin 30 (= 5 \text{ N})</math> (seen)  <math>F_{\max} = \mu R_{\text{new}} \approx 5.37 \text{ N}</math> (AWRT 5.4)  <math>5.37 &gt; 5 \Rightarrow</math> does not slide</p>	<p>M1 A1                      ↓                      M1 A1                      (4)</p> <p>M1 A1                      M1                      ↓↓                      M1 A1                      (5)</p> <p>M1 A1                      B1                      ↓                      M1                      A1 cso                      (5)</p> <p><b>14</b></p>

Question Number	Scheme	Marks
6.	<p>(a) Speed of <math>A = \sqrt{1^2 + 6^2} \approx \underline{6.08 \text{ m s}^{-1}}</math></p> <p>(b)  <math>\tan \theta = 1/6 \Rightarrow \theta \approx 9.46^\circ</math> Bearing <math>\approx \underline{351}</math></p> <p>(c) P.v. of <math>A</math> at time <math>t = (2 - t)\mathbf{i} + (-10 + 6t)\mathbf{j}</math> p.v. of <math>B</math> at time <math>t = (-26 + 3t)\mathbf{i} + (4 + 4t)\mathbf{j}</math> (E.g.) <math>\mathbf{i}</math> components equal <math>\Rightarrow 2 - t = -26 + 3t \Rightarrow t = 7</math> <math>\mathbf{j}</math> components at <math>t = 7</math>: <math>A: -10 + 6t = 32</math> <math>B: 4 + 4t = 32</math> Same, so collide at <math>t = 7</math> s at point with p.v. <math>(-5\mathbf{i} + 32\mathbf{j})</math> m</p> <p>(d) New velocity of <math>B = \frac{8}{5}(3\mathbf{i} + 4\mathbf{j}) \text{ m s}^{-1}</math> P.v. of <math>B</math> at 7 s = <math>-26\mathbf{i} + 4\mathbf{j} + 1.6(3\mathbf{i} + 4\mathbf{j}) \times 7 = 7.6\mathbf{i} + 48.8\mathbf{j}</math> <math>\underline{PB} = \mathbf{b} - \mathbf{p} = 12.6\mathbf{i} + 16.8\mathbf{j}</math> (in numbers) Distance = <math>\sqrt{12.6^2 + 16.8^2} = \underline{21 \text{ m}}</math></p>	<p>M1 A1 (2)</p> <p>M1 A1 A1 (3)</p> <p>B1 (either)</p> <p>M1 A1</p> <p>↓ M1</p> <p>A1 cso (5)</p> <p>B1</p> <p>M1 A1 ↓ M1 ↓ M1 A1 (6)</p> <p><b>16</b></p>

Question Number	Scheme	Marks
7.	<p>(a)  A: <math>3mg \sin 30 - T = 3m \cdot \frac{1}{10}g</math>  <math>\Rightarrow T = \frac{6}{5}mg</math></p> <p>(b)  F: R(perp): <math>R = mg \cos 30</math>  R(//): <math>T - mg \sin 30 - F = m \cdot \frac{1}{10}g</math>  Using <math>F = \mu R</math>  <math>\frac{6}{5}mg - \frac{1}{2}mg - \mu mg \frac{\sqrt{3}}{2} = \frac{1}{10}mg</math>  <math>\rightarrow \mu = \underline{0.693 \text{ or } 0.69 \text{ or } \frac{2\sqrt{3}}{5}}</math></p> <p>(c)  Magn of force on pulley = <math>2T \cos 60 = \frac{6}{5}mg</math>  Direction is vertically downwards</p>	<p>M1 A1  A1  (3)</p> <p>M1 A1  M1 A2, 1, 0  M1  ↓↓↓  M1  A1  (8)</p> <p>M1 A1 ✓  B1 (cso)  (3)</p> <p><b>14</b></p>