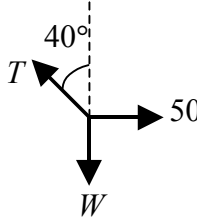
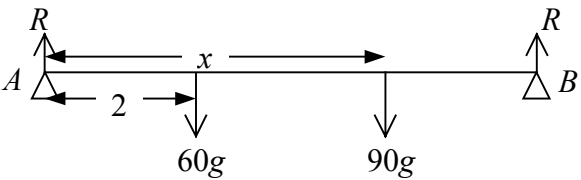
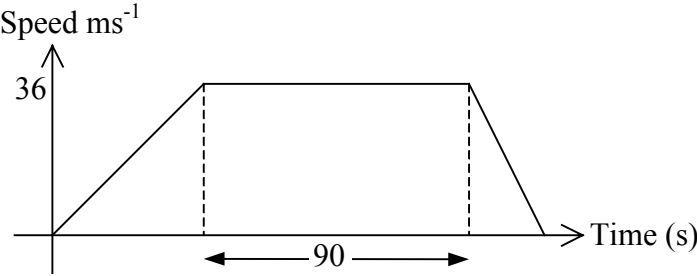
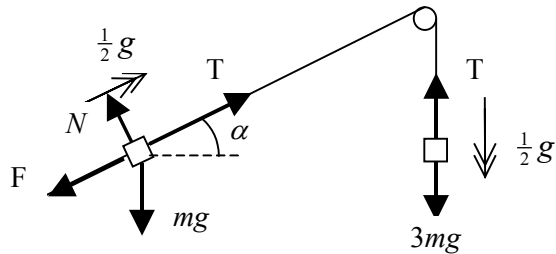


Question number	Scheme	Marks
<p>1. (a)</p> <p>(b)</p>	 <p><math>T \sin 40^\circ = 50 \Rightarrow T \approx 77.8 \text{ N}</math></p> <p>(↑) <math>W = T \cos 40^\circ</math></p> <p><math>W = 77.8 \cos 40^\circ \approx 59.6 \text{ N}</math></p>	<p>M1 A1, A1 (3)</p> <p>M1 A1</p> <p>M1 A1 (4)</p> <p><b>(7 marks)</b></p>
<p>2. (a)</p> <p>(b)</p>	<p>“<math>v = u + at</math>” <math>v_B = 10 + 3 \times 6 = 28 \text{ m s}^{-1}</math></p> <p>OA: “<math>v^2 = u^2 + 2as</math>” <math>10^2 = 0 + 2 \times 4 \times OA \Rightarrow OA = 12.5 \text{ m}</math></p> <p>AB: “<math>s = ut + \frac{1}{2} at^2</math>” <math>OB = 10 \times 6 + \frac{1}{2} \times 3 \times 36 = 114 \text{ m}</math></p> <p><math>OB = 12.5 + 114 = 126.5 \text{ m}</math></p>	<p>M1A1 (2)</p> <p>M1A1</p> <p>M1A1</p> <p>A1 ft (5)</p> <p><b>(7 marks)</b></p>
<p>3.</p> <p>(a)</p> <p>(b)</p> <p>(c)(i)</p> <p>(ii)</p>	 <p><math>R(\uparrow) R + R = 60g + 90g</math></p> <p><math>R = 75g = 735 \text{ N}</math></p> <p><math>M(A) 60g \cdot 2 + 90g \cdot x = 75g \cdot 6</math></p> <p><math>90x = 450 - 120 = 330</math></p> <p><math>x = \underline{3\frac{2}{3} \text{ m}}</math> accept AWRT 3.67</p>	<p>M1 A1 (2)</p> <p>M1 A1 A1 ft</p> <p>M1 A1 (5)</p> <p>B1</p> <p>B1 (2)</p> <p><b>(9 marks)</b></p>

Question number	Scheme	Marks
4. (a)	 <p>The graph shows Speed in <math>\text{ms}^{-1}</math> on the vertical axis and Time in seconds (s) on the horizontal axis. The speed starts at 0, increases linearly to a peak of 36 <math>\text{ms}^{-1}</math>, remains constant at 36 <math>\text{ms}^{-1}</math> for a duration of 90 seconds, and then decreases linearly to 0. Dashed vertical lines indicate the start and end of the constant speed phase.</p>	<p>Shape M1A1</p> <p>36,90 B1 (3)</p>
(b)	<p>Time to accelerate : time to decelerate</p> <p>18 s                      12 s</p> <p>Distance = area under graph</p> $= \frac{1}{2} \times 36 \times (90 + 120) \text{ m}$ $= 3780 \text{ m}$	<p>M1 A1</p> <p>M1 A1</p> <p>A1 (5)</p>
(c)	<p>There is no period of constant maximum velocity</p> <p>(OR “it speeds up and then immediately slows down again” OR “it attains a greater maximum speed”)</p>	<p>B1 (1)</p>
(d)	<p>Let greatest speed be <math>V \text{ m s}^{-1}</math> then</p> $\frac{1}{2} \times 150 \times V_{\text{max}} = 3780$ $V = 50.4$	<p>M1 A1</p> <p>A1</p> <p><b>(9 marks)</b></p>

Question number	Scheme	Marks
5.	<p>(a) Conservation of linear momentum applied</p> $3000 \times 3 - 4 \times 1000 = 4000 \times V$ $V = 1.25$ <p>Direction <math>AB</math></p> <p>(b) Impulse = <math>3000 [3 - 1.25]</math> Ns</p> $= 5250 \text{ Ns}$ <p>(c) Trucks are assumed to be particles</p> <p>(d) <math>F = ma \Rightarrow 250 = 4000 a</math></p> $a = \frac{1}{16}$ $v^2 = u^2 + 2as \Rightarrow 0 = (1.25)^2 - 2\left(\frac{1}{16}\right) d$ $d = 12.5$	<p>M1 A1</p> <p>A1</p> <p>A1 (4)</p> <p>M1 A1 ft</p> <p>A1 (3)</p> <p>B1 (1)</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1 (4)</p> <p><b>(12 marks)</b></p>
6.	 <p>(a) <math>B: 3mg - T = 3m \cdot \frac{1}{2}g</math></p> $T = \frac{3}{2}mg$ <p>(b) <math>A: T - F - mg \cdot \frac{3}{5} = m \cdot \frac{1}{2}g</math></p> $\Rightarrow F = \frac{2}{5}mg$ $N = mg \cdot \frac{4}{5}$ $\mu = \frac{F}{N} = \frac{1}{2}$	<p>M1 A1</p> <p>M1 A1 (4)</p> <p>M1 A1 A1</p> <p>M1 A1 ft</p> <p>M1 A1</p> <p>M1 A1 (9)</p> <p><b>(13 marks)</b></p>

Question number	Scheme	Marks
7. (a)	$\mathbf{r} = 20 \mathbf{i}$	B1
	$\mathbf{s} = (300 + 10t)\mathbf{i} + (10t)\mathbf{j}$	M1 A1 (3)
(b)	$\overrightarrow{AB} = \mathbf{s} - \mathbf{r} = (300 - 10t)\mathbf{i} + (10t)\mathbf{j}$	B1 ft (1)
(c)	Bearing of $B$ from $A$ $045^\circ \Rightarrow \overrightarrow{AB} //^e \mathbf{i} + \mathbf{j}$	M1
	$\Rightarrow \frac{10t}{300 - 10t} = 1$	M1 A1
	$\Rightarrow 10t = 300 - 10t \Rightarrow t = 15$	M1 A1 (5)
(d)	Distance = 300 $\Rightarrow  s - r ^2 = 300^2$	M1
	$\Rightarrow (300 - 10t)^2 + (10t)^2 = 300^2$	M1 A1 ft
	$\Rightarrow 300^2 - 6000t + 100t^2 + 100t^2 = 300^2$	A1 ft
	$\Rightarrow 200t^2 = 6000t$	
	$t = 0$ or $30 \Rightarrow t = 30$	M1A1 (6) <b>(15 marks)</b>