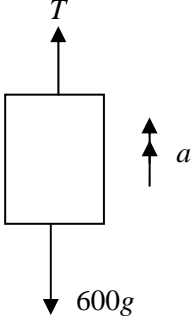
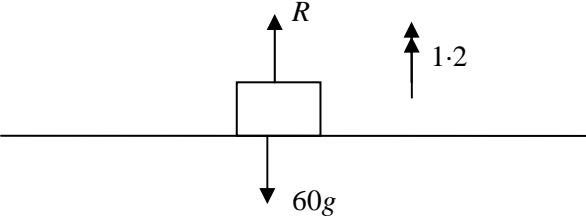
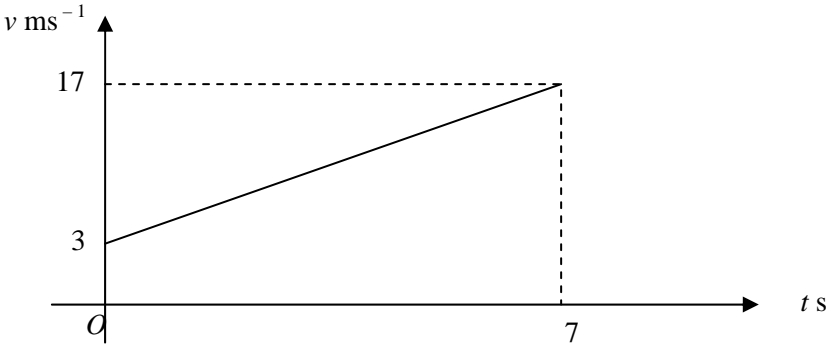
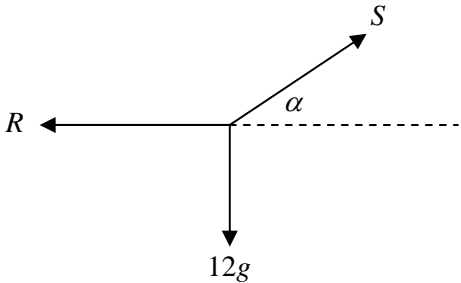


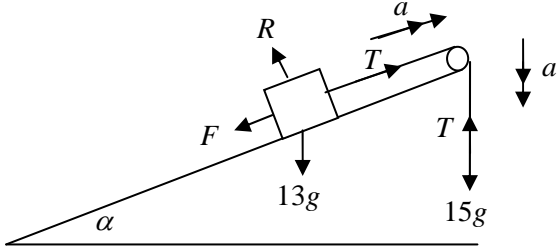
M1

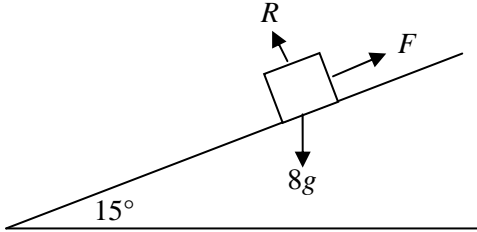
Question	Solution	Mark	Notes
1(a)	$v = u + at, u = 1, a = 9.8, t = 2.5$ $v = 1 + 9.8 \times 2.5$ $= \underline{25.5 \text{ (ms}^{-1}\text{)}}$	M1 A1 A1	Accept \pm values for u and a . Correct equation, accept \pm accept \pm
1(b)	$s = ut + 0.5at^2, u = 1, a = 9.8, t = 2.5$ $= 1 \times 2.5 + 0.5 \times 9.8 \times 2.5^2$ $= \underline{33.125\text{(m)}}$	M1 A1 A1	Accept \pm values for u and a . equivalent method Correct equation, accept \pm . ft (a) if applicable. accept \pm . ft (a) if applicable.

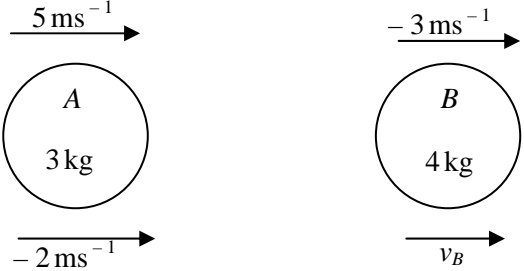
Question	Solution	Mark	Notes
2(a)	 <p>N2L applied to lift $T - 600g = 600a$ $a = \underline{1.2}$</p>	M1 A1 A1	dim correct, opposing T and $600g$ correct equation cao
2(b)	 <p>N2L applied to person $R - 60g = 60 \times 1.2$ $R = \underline{660 \text{ (N)}}$</p>	M1 A1 A1	Dim correct, opposing R and $60g$. Correct equation. FT a ft candidate's a , both Ms required.

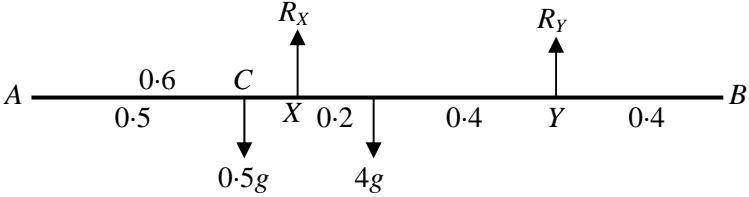
Question	Solution	Mark	Notes
3(a)	<p>Consider motion from A to B</p> $s = ut + 0.5at^2, t = 2, s = 10$ $10 = 2u + 0.5a \times 2^2$ $10 = 2u + 2a$ <p>Consider motion from A to C</p> $v = u + at, v = 17, t = 7$ $17 = u + 7a$ <p>Solve simultaneously</p> $a = 2$ $u = 3$	<p>M1 A1</p> <p>M1 A1</p> <p>m1 A1 A1</p>	<p>Correct substitution of values</p> <p>Depends on both previous Ms cao ft slip if both equations correct</p>
3(b)		<p>M1 A1</p>	<p>ft u</p>
3(c)	<p>Distance AC = $0.5(3 + 17) \times 7$ = <u>70(m)</u></p>	<p>M1 A1</p>	<p>correct method for area under graph oe ft u if appropriate</p>

Question	Solution	Mark	Notes
4.			
4(a)	Resolve vertically $S \sin \alpha = 12g$ $S = \underline{196(\text{N})}$	M1 A1 A1	attempt at resolution to get equ, accept cos correct equation cao
4(b)	Resolve horizontally $S \cos \alpha = R$ $R = \underline{156.8 (\text{N})}$	M1 A1 A1	attempt at resolution to get equ, accept sin correct equation ft S , depends on both previous Ms

Question	Solution	Mark	Notes
5.	 <p>N2L applied to B $15g - T = 15a$</p> <p>N2L applied to A $T - 13g \sin \alpha = 13a$ $T - 5g = 13a$</p> <p>Solve equations simultaneously Adding $15g - 5g = 28a$ $a = \underline{3.5 \text{ (ms}^{-2}\text{)}}$ $T = \underline{94.5 \text{ (N)}}$</p>	M1 A1 M1 A1 m1 A1 A1	dim correct, opposing T and $15g$. correct equation dim correct, opposing T and $13g$ resolved. Correct equation depends on both Ms cao ft if both equations correct.

Question	Solution	Mark	Notes
6.			
6(a)	Resolve perpendicular to plane $R = 8g\cos 15^\circ$	M1 A1	dim correct, accept sin
	Resolve parallel to plane $F = 8g\sin 15^\circ$	M1 A1	dim correct, accept cos
	Least $\mu = F/R$ Least $\mu = \tan 15^\circ = 0.26795 = \underline{0.28}$ (to 2 d. p.)	M1 A1	award if seen in (a) or (b) cao. do not penalise unrounded correct answers.
6(b)	$F = 0.1 \times 8g\cos 15^\circ$ $8g\sin 15^\circ - 0.1 \times 8g\cos 15^\circ = 8a$ $a = \underline{1.59(14)}$	A1 M1 A1 A1	Attempt at N2L. correct equation. cao

Question	Solution	Mark	Notes
7.			
7(a)	<p>Conservation of momentum</p> $3 \times 5 + 4 \times (-3) = 3 \times (-2) + 4v_B$ $15 - 12 = -6 + 4v_B$ $v_B = \underline{2.25 \text{ (ms}^{-1}\text{)}}$	<p>M1 A1 A1</p>	<p>Attempted, no more than 1 sign error correct equation cao</p>
7(b)	<p>Restitution</p> $2.25 - (-2) = -e(-3 - 5)$ $4.25 = 8e$ $e = \underline{0.53125}$	<p>M1 A1 A1</p>	<p>Attempted. Only one sign error in vel. any correct equation ft (a) if >-3</p>
7(c)	<p>Required Impulse = $3(5 + 2)$ = $\underline{21 \text{ (Ns)}}$</p>	<p>M1 A1</p>	<p>allow negative answer.</p>

Question	Solution	Mark	Notes
8.			
8(a)	<p>Moments about X</p> $0.5g \times 0.1 = 4g \times 0.2 - R_Y \times 0.6$ $0.6R_Y = 0.8g - 0.05g$ $R_Y = \underline{1.25g} = \underline{12.25 \text{ (N)}}$ <p>Resolve vertically</p> $R_X + R_Y = 0.5g + 4g$ $R_X = 4.5g - 1.25g$ $= \underline{3.25g} = \underline{31.85 \text{ (N)}}$	<p>M1 B1 A1</p> <p>A1</p> <p>M1 A1</p> <p>A1</p>	<p>Attempt at equation, oe correct equation A1, one correct mom B1</p> <p>cao</p> <p>Attempted. dim correct. any correct equation</p> <p>ft R</p>
8(b)	<p>On point of turning about X, $R_Y = 0$</p> <p>Moments about X</p> $(0.5 + M)g \times 0.1 = 4g \times 0.2$ $0.5 + M = 8$ $M = \underline{7.5 \text{ (kg)}}$	<p>M1 m1 A1</p> <p>A1</p>	<p>Any equivalent method to obtain equation correct equation</p>

Question	Solution	Mark	Notes																
9.	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%; text-align: center;">Area</td> <td style="width: 15%; text-align: center;">from Oy</td> <td style="width: 15%; text-align: center;">from Ox</td> </tr> <tr> <td>OAP</td> <td style="text-align: center;">108</td> <td style="text-align: center;">12</td> <td style="text-align: center;">3</td> </tr> <tr> <td>PBQ</td> <td style="text-align: center;">12</td> <td style="text-align: center;">12</td> <td style="text-align: center;">7</td> </tr> <tr> <td>Lamina</td> <td style="text-align: center;">96</td> <td style="text-align: center;">x</td> <td style="text-align: center;">y</td> </tr> </table> <p>$x = 12$</p> <p>Moments about Ox $108 \times 3 = 12 \times 7 + 96y$ $y = \underline{2.5}$</p>		Area	from Oy	from Ox	OAP	108	12	3	PBQ	12	12	7	Lamina	96	x	y	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>M1A1</p> <p>A1</p>	<p>B1 for 3</p> <p>B1 for 7</p> <p>B1 for 108, 12, 96</p> <p>ft values from table</p> <p>cao</p> <p>ft (a)</p> <p>ft (a)</p>
	Area	from Oy	from Ox																
OAP	108	12	3																
PBQ	12	12	7																
Lamina	96	x	y																
9(b)	<p>$\tan \theta = (6 - 25)/4$ $\theta = \underline{41.2^\circ}$</p>																		