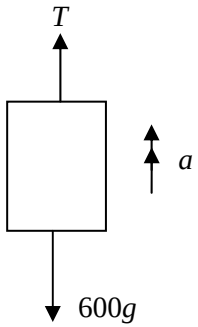
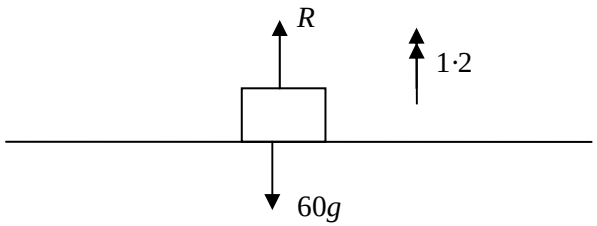
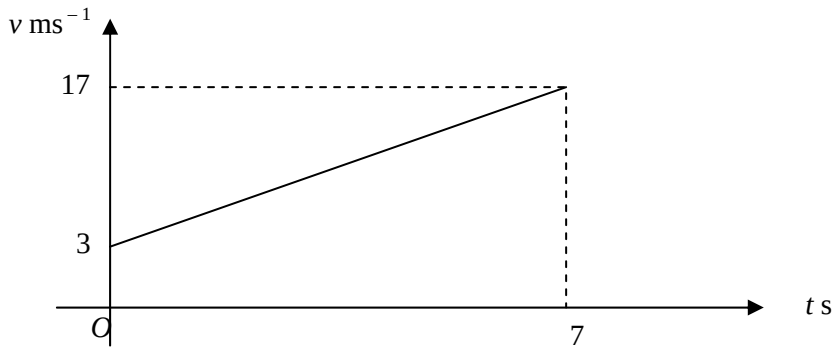
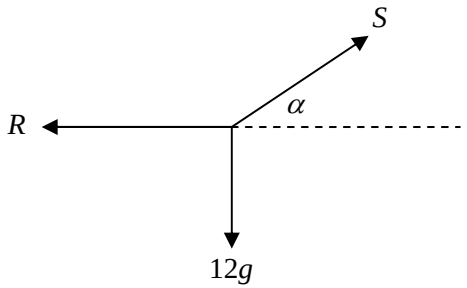
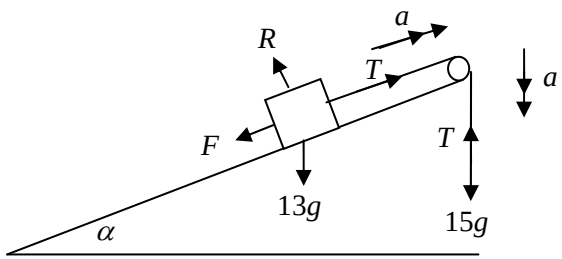
M1

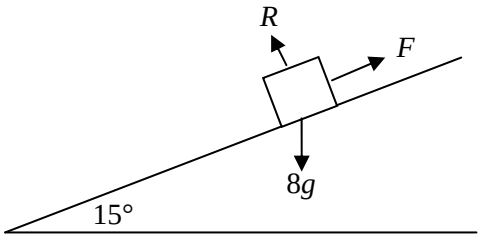
Question	Solution	Mark	Notes
1(a)	$v = u + at$, $u = 1$, $a = 9.8$, $t = 2.5$ $v = 1 + 9.8 \times 2.5$ $= \underline{25.5\ (ms^{-1})}$	M1 A1 A1	Accept ± values for u and a. Correct equation, accept ± accept ±
1(b)	$s = ut + 0.5at^2$, $u = 1$, $a = 9.8$, $t = 2.5$ $= 1 \times 2.5 + 0.5 \times 9.8 \times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

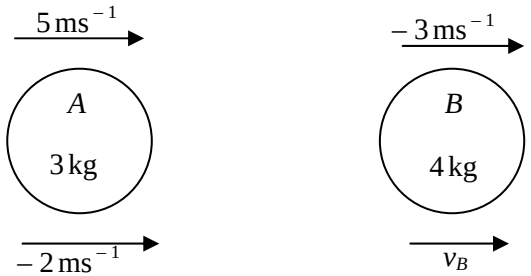
Question	Solution	Mark	Notes
2(a)	 N2L applied to lift $T - 600g = 600a$ $a = \underline{1.2}$	M1 A1 A1	dim correct, opposing T and $600g$ correct equation cao
2(b)	 N2L applied to person $R - 60g = 60 \times 1.2$ $R = \underline{660\ (\text{N})}$	M1 A1 A1	Dim correct, opposing R and $60g$. Correct equation.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

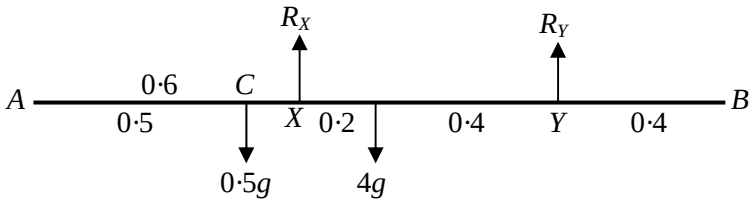
Question	Solution	Mark	Notes
3(a)	Consider motion from A to B $s = ut + 0.5at^2$, $t = 2$, $s = 10$ $10 = 2u + 0.5a \times 2^2$ $10 = 2u + 2a$ Consider motion from A to C $v = u + at$, $v = 17$, $t = 7$ $17 = u + 7a$ Solve simultaneously $a = 2$ $u = 3$	 M1 A1 M1 A1 m1 A1 A1	 Correct substitution of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

Question	Solution	Mark	Notes
4.			
4(a)	Resolve vertically $S \sin\alpha = 12g$ $S =$ <u>196(N)</u>	M1 A1 A1	attempt at resolution to get equ, accept cos correcr equation cao
4(b)	Resolve horizontally $S \cos\alpha = R$ $R =$ <u>156.8 (N)</u>	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.			
	N2L applied to *B* $15g - T = 15a$	M1 A1	dim correct, opposing *T* and 15*g*. correct equation
	N2L applied to *A* $T - 13g\sin\alpha = 13a$ $T - 5g = 13a$	M1 A1	dim correct, opposing *T* and 13*g* resolved. Correct equation
	Solve equations simultaneously Adding $15g - 5g = 28a$	m1	depends on both Ms
	$a = \underline{3.5\ (ms^{-2})}$	A1	cao
	$T = \underline{94.5\ (N)}$	A1	ft if both equations correct.

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

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

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

Question	Solution	Mark	Notes
9.			
	Area from *Oy* from *Ox* *OAP* 108 12 3 *PBQ* 12 12 7 Lamina 96 x y	B1 B1 B1	B1 for 3 B1 for 7 B1 for 108, 12, 96
	$x = 12$	B1	
	Moments about *Ox* $108 \times 3 = 12 \times 7 + 96y$ $y = \underline{2.5}$	M1 A1 A1	 ft values from table cao
9(b)	$\tan\theta = (6 - 25)/4$ $\theta = \underline{41.2°}$	M1A1 A1	ft (a) ft (a)