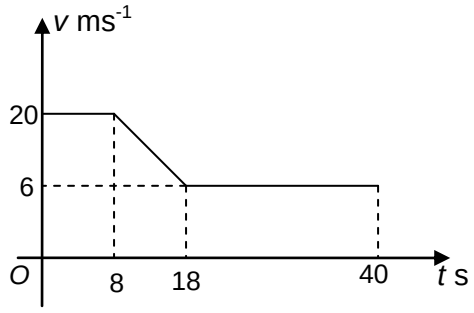
Q	Solution	Mark	Notes

1(a)



B1	(0, 20) to (8, 20) Or (18, 6) to (40, 6)	
B1	(8, 20) to (18, 6)	
B1	completely correct with all units and labels.	

1(b) Deceleration = gradient of graph — M1 — any correct method

$D = \frac{20-6}{18-8}$ — A1 — ft graph +/-

$D = \underline{1.4\ ms^{-2}}$ — A1 — cao

OR

Use of $v = u + at$, $v=6$, $u=20$, $t=10$ — M1

$6 = 20 + 10a$ — A1 — allow –a

$a = -1.4\ ms^{-2}$

Magnitude of acceleration = $\underline{1.4\ ms^{-2}}$ — A1 — cao

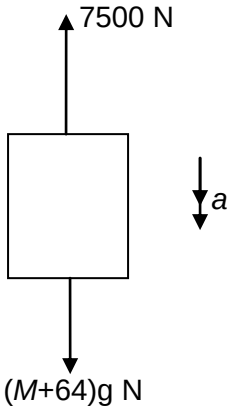
1(c) Distance AB = Area under graph — M1 — used. Oe

$= (8 \times 20) + 0.5(20 + 6)\times 10 + (22 \times 6)$ — B1 — any correct area, ft graph

$= 160 + 130 + 132$

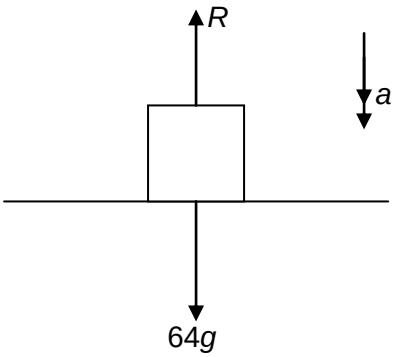
$= \underline{422\ m}$ — A1 — cao

Q	Solution	Mark	Notes



2(a)

N2L applied to lift and person	M1	dim correct equation, forces opposing
$(M + 64)g - 7500 = (M+64) \times 0.425$	A1	correct equation
$M = \underline{736}$	A1	

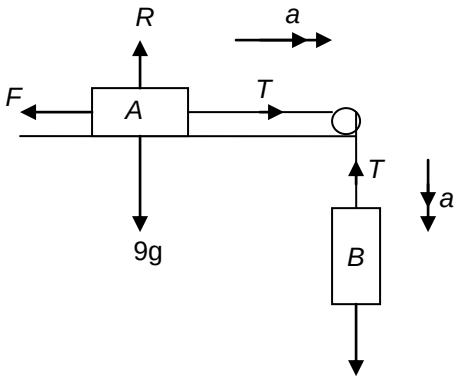


2(b)

N2L applied to person	M1	$64g$ and R opposing Dim correct equation
$64g - R = 64a$	A1	correct equation
$R = 64 \times 9.8 - 64 \times 0.425$		
$R = \underline{600\text{ N}}$	A1	

Q	Solution	Mark	Notes
3(a)	$v^2 = u^2 + 2as$, v=0, a=(±)9.8, s=18.225	M1	oe used
	$0 = u^2 - 2 \times 9.8 \times 18.225$	A1	
	$u = \underline{18.9}$	A1	convincing
3(b)	Use of $s = ut + 0.5at^2$, s=(±)2.8, a=(±)9.8, u=18.9	M1	oe
	$-2.8 = 18.9t + 0.5 \times (-9.8)t^2$	A1	
	$4.9t^2 - 18.9t - 2.8 = 0$		
	$7t^2 - 27t - 4 = 0$		
	$(7t + 1)(t - 4) = 0$	m1	correct method for solving quad equ seen
	$t = \underline{4}$s	A1	cao

Q	Solution	Mark	Notes

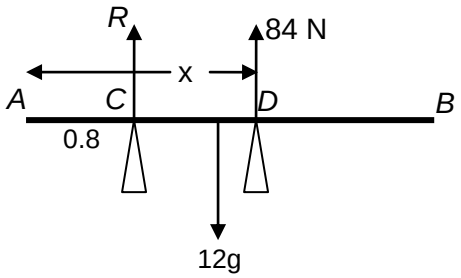


4

5

4(a)	N2L applied to B		
	$5g - T = 5a$	M1	dim correct equation 5g and T opposing.
	$T = 5 \times 9.8 - 5 \times 1.61$	A1	
	$T = \underline{40.95\text{ N}}$	A1	cao
	$R = 9g = (88.2\text{ N})$	B1	si
	$F = 9\mu g = (88.2\mu)$	B1	si
	N2L applied to A	M1	dim correct equation T and F opposing
	$T - F = 9a$	A1	
	$T - 88.2\mu = 9 \times 1.61$		
	$\mu = \underline{0.3}$	A1	cao
4(b)	limiting friction $= 9\mu g = 9 \times 0.6g = 5.4g$	B1	
	Limiting friction $> 5g$		
	Particle will remain at rest	R1	oe
	$T = 5g = \underline{49\text{ N}}$	B1	

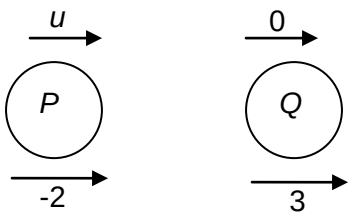
Q	Solution	Mark	Notes



5

5(a)(i)	Resolve vertically	M1	all forces, no extras
	$R + 84 = 12g$	A1	
	$R = \underline{33.6}$	A1	cao
5(a)(ii)	Moments about C	M1	equation, no extra force oe
	$12g \times 0.2 = 84(x - 0.8)$	B1	any correct moment
		A1	correct equation
	$84x = 12g \times 0.2 + 84 \times 0.8$		
	$x = \underline{1.08}$	A1	cao
5(b)	When about to tilt about C, $R_D = 0$	M1	si
	Moments about C	m1	equation, no extra force
	$Mg \times 0.8 = 12g \times 0.2$		
	$M = \underline{3}$	A1	

Q	Solution	Mark	Notes



6.

6(a)	Conservation of momentum	M1	equation required, only 1 sign error.
	$2u + 5 \times 0 = 2 \times (-2) + 5 \times 3$	A1	correct equation
	$u = \underline{5.5}$	A1	
6(b)	Restitution	M1	only 1 sign error
	$3 - (-2) = -e(0 - 5.5)$	A1	ft u
	$e = \frac{10}{11} = 0.909$	A1	cao
6(c)	Impulse = change of momentum	M1	for P or Q
	$I = 5(3 - 0)$		
	$I = \underline{15\ (\text{Ns})}$	A1	+ required
6(d)	$v' = ev$	M1	used
	$v' = 0.25 \times 3$		
	$v' = \underline{0.75\ \text{ms}^{-1}}$	A1	+ required

Q	Solution	Mark	Notes
7.(a)	Resolve	M1	attempted
	$X = 85 - 40 + 75\cos\alpha$	B1	any correct resolution
	$X = 85 - 40 + 75 \times 0.8$	A1	all correct accept cos36.9
	$X = 105$		
	Resolve	M1	attempted
	$Y = 60 - 75\sin\alpha$		
	$Y = 60 - 75 \times 0.6$	A1	all correct, accept sin 36.9
	$Y = 15$		
	$R = \sqrt{105^2 + 15^2}$	M1	
	$R = 75\sqrt{2} = \underline{106.066\ \text{N}}$	A1	cao
	$\theta = \tan^{-1}\left(\frac{15}{105}\right)$	M1	allow reciprocal
	$\theta = \underline{8.13°}$	A1	cao
7(b)	N2L applied to particle	M1	dim correct equation
	$75\sqrt{2} = 5a$		
	$a = 15\sqrt{2} = \underline{21.21\ \text{ms}^{-2}}$	A1	ft *R* if first 2 M's gained.

Q	Solution			Mark	Notes
8.	Area	from *AD*	from *AB*		
	APCD 48	3	4	B1	
	PBC 24	8	8/3	B1	
	Circle 4π	3	3	B1	
	Lamina $(72-4\pi)$	x	y	B1	areas
8(a)	Moments about *AD*			M1	equation
	$48 \times 3 + 24 \times 8 = 4\pi \times 3 + (72 - 4\pi)x$			A1	ft table
	$x =$ 5.02 cm			A1	cao
	Moments about *AB*			M1	equation
	$48 \times 4 + 24 \times 8/3 = 4\pi \times 3 + (72 - 4\pi)y$			A1	ft table
	$y =$ 3.67 cm			A1	cao
8(b)	*AQ* = 3.67 cm			B1	ft *y*