Qu	Answer	Part Marks	Marks	Notes
1 (i)		M1		For attempting to find the height above the ground at the position of the post
	$s = (12\sin 30) \times 0.8 - g \times 0.8^2/2$	A1		1.6 m
	$H\ (= 1.6 - 0.5) = 1.1$ m	A1	3	
(ii)	$0 = 12\sin 30 - gt$	M1		$t = 0.6$
	Time $(= 0.8 - 0.6) = 0.2$ **AG**	A1	2	
2 (i)	$5 = 0.2\lambda/0.4$	M1		Tension = λext/l
	$\lambda = 10$ N	A1	2	
(ii)		B1√		Correct EE term
	$10(0.2^2/(2 \times 0.4) + (5/g)v^2)/2 = 0.3 \times 5$	M1		PE/KE/EE 3 terms
	$v = 2\ \text{m}\,s^{-1}$	A1	3	
(iii)		B1√		Correct EE term
	$10e^2/(2 \times 0.4) = 5(e + 0.1)$	M1		Energy equation
	$e = 0.483$	A1	3	
3 (i)	$-8 = 2x - x^2$	M1		Sub y = −8 in the given equation with an attempt to solve
	$x = 4$	A1	2	
(ii)	$\theta = 63.4°$	B1		From $\tan^{-1} 2$
	$-g x^2/(2v^2\cos^2\theta) = -x^2$	M1		
	$v = 5\ \text{m}\,s^{-1}$	A1	3	Accept 4.99
(iii)	$V^2 = (v\cos\theta)^2 + (v\sin\theta)^2 + 2 \times 8g$	M1		
	$V = 13.6\ \text{m}\,s^{-1}$	A1	2	
4 (i)	$(0.7 \times 0.4) \times 0.2 =$ $(0.28 - 0.03)x + 0.03 \times 0.1$	M1		
	$x = 0.212$ **AG**	A1		
	$(0.7 \times 0.4) \times 0.35 =$ $(0.28 - 0.03)y + 0.03 \times 0.2$	M1		
	$y = 0.368$	A1	4	
(ii)	$0.4F = 0.212 \times 70$	M1		Topples about A
	$F = 37.1$	A1	2	
(iii)	$\theta = \tan^{-1}[(0.4\text{-}0.212)/0.368]$	M1		

Qu	Answer	Part Marks	Marks	Notes
	$\theta = 27.1$	A1	2	
5 (i)	$t = 2$ **AG**	B1		From $0.6t = 0.3 \times 4$ or $1.5t - 3 = 0$
	$0.4a = 0.6t - 0.3 \times 0.4\,g$	M1		
	$a = 1.5t - 3$**AG**	A1	3	
(ii)	$v = \int (1.5t - 3)\,dt$	M1		
	$v = 0.75t^2 - 3t\ (+ c)$	A1		
	$0 = 0.75 \times 2^2 - 3 \times 2 + c$ (so c=3)	M1		Or uses limits with 2 and t
	$v = 0.75t^2 - 3t + 3$	A1	4	
(iii)	$x = \int (0.75t^2 - 3t + 3)\,dt$	M1		
	$x = 0.25t^3 - 1.5t^2 + 3t\ (+ k)$	A1√		ft c from (ii)
	$x = 0.25t^3 - 1.5t^2 + 3t - 2$	A1	3	
6 (i)	$B\cos 30 - A\sin 30 = 0.2g$	B1		Resolving vertically for P
	$B\cos 60 - A\cos 30 = 0.2 \times 1.2^2 / 0.4$	M1 A1		2 components of tension, N2L with accn = v^2/r
		M1		Attempts to eliminate one unknown
	A = 0.753 N	A1		
	B = 2.74 N	A1	6	
(ii)	$r = 0.8\sin 60$	B1		
		M1		Resolves vertically or uses N2L horizontally
	$B\cos 60 - A\cos 30 = 0.2g$	A1		
	$B\cos 30 - A\cos 60 = 0.2 \times 5^2 \times 0.8\sin 60$	A1		
		M1		For solving to find A
	A = 0	A1	6	