Question Number	Scheme	Marks
7a)	$\frac{4(x-2)}{2}=\frac{2(7-x-3)}{3}$	M1A1A1
	$6(x-2)=2(4-x)$	
	$x=2.5(\text{m})$ *	A1
		(4)
ALT	$(T_A=)\frac{4x}{2}=\frac{2y}{3}(=T_B)$ $x+y=2$	M1A1
	$x=\frac{1}{2}$ or $y=1.5$	A1
	Distance AO = 2.5 (m)	A1
7bi)	$2\ddot{y}=\frac{2(1.5-y)}{3}-\frac{4(y+0.5)}{2}$ OR $2\ddot{y}=\frac{4(-y+0.5)}{2}-\frac{2(1.5+y)}{3}$ (y measured towards B) (y measured towards A)	M1A1
	$\ddot{y}=-\frac{4}{3}y=-\omega^2 y$ $\therefore$ SHM	M1A1
		(4)
7bii)	$\omega^2=\frac{4}{3}$	B1
	$(2v_{\max}=6\Rightarrow)v_{\max}=3(\text{ms}^{-1})$	B1
	$v_{\max}=a\omega=\frac{2a}{\sqrt{3}}$ Accept $1.2a$ or better	M1
	$3=a\frac{2}{\sqrt{3}}$ $a=\frac{3\sqrt{3}}{2}$ (m) Accept 2.6 or better	A1
		(4)
7c)	$v^2=\frac{4}{3}\left(\frac{27}{4}-\left(\frac{3}{2}\right)^2\right)$	M1
	$v=\sqrt{6}\ (\text{ms}^{-1})$ Accept 2.4 or better	A1 (2)

Question Number	Scheme	Marks
7d)	$\frac{3}{2}=\frac{3\sqrt{3}}{2}\sin(\omega t)$	M1A1
	$t=0.53(\text{s})$ or better	A1
		(3)
ALT	$x=a\cos\omega t \Rightarrow 1.5=\frac{3\sqrt{3}}{2}\cos\left(\frac{2}{\sqrt{3}}\right)t$	
	$\text{time } =\frac{\pi}{2}\times\frac{\sqrt{3}}{2}-\frac{\sqrt{3}}{2}\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$	M1A1
	t = 0.53 or better	A1
		[17]

(a)		
M1	Equate tension in the two strings. Must be using $k\lambda\frac{x}{l}$ and the sum of the extensions must be 2	
A1	Correct LHS	
A1	Correct RHS	
A1*	Given result found from fully correct working.	
ALT		
M1	Obtain 2 equations using the tensions in the 2 strings and sum of extensions = 2 Must be using $k\lambda\frac{x}{l}$	
A1	2 correct equations	
A1	Correct extension for either string	
A1*	Obtain given result from fully correct working.	

b i)		
M1	Equation of motion with two variable tensions. Allow a or $\ddot{y}$	
A1	Correct equation. Allow a or $\ddot{y}$	
M1	Rearrange to required form. Must now be $\ddot{y}$	
A1	Correct result, from fully correct working **and** concluding statement.	
(ii)		
B1	Correct ω or ω^2	
B1	$v_{\max} = 3$ or $2v_{\max} = 6$ seen explicitly or used	
M1	Use $v_{\max} = a\omega$ with their ω or use $v^2 = \omega^2\left(a^2 - x^2\right)$ with their ω and $x = 0$	
A1	$a = \dfrac{3\sqrt{3}}{2}$ (allow 2.6 or better)	
(c)		
M1	Use of $v^2 = \omega^2\left(a^2 - x^2\right)$ with $x = 1.5$ and their ω and a OR attempt an energy equation with the correct number of terms	
A1	$v = \sqrt{6}$ (2.4 or better)	
7(d)		
M1	Use of $x = a\sin(\omega t)$, with $x = 1.5$ and their ω and a	
A1ft	Correct equation. Ft their ω and a	
A1	$t = 0.53$ or better $\left(t = 0.533021.....\right)$	
ALT		
M1	Complete method using cosine.	
A1ft	Correct equation (or equations) follow through their ω and a	
A1	$t = 0.53$ or better $\left(t = 0.533021.....\right)$	

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