7 (a)	$T = \dfrac{\lambda \frac{2}{5} l}{l}$	
	$mg\sin\alpha = \frac{3}{5}mg = \frac{2}{5}\lambda$	M1A1
	$\lambda = \frac{3}{2}mg$ *	A1 (3)
(b)(i)	$\frac{3}{5}mg - T = m\ddot{x}$	M1
	$\frac{3}{5}mg - \frac{1}{l}\left(\frac{2}{5}l + x\right)\times\frac{3}{2}mg = m\ddot{x}$	dM1A1
	$\ddot{x} = -\frac{3g}{2l}x$ $\quad\therefore$ SHM	A1
(ii)	B is the equilibrium position or $x = 0$ at B	B1 (5)
(c)	Time $= \frac{1}{4}\times\frac{2\pi}{\omega} = \frac{\pi}{2}\sqrt{\frac{2l}{3g}}$ oe	M1A1ft (2)
(d)	$-\frac{2}{5}l = \frac{4}{5}l\cos\omega t = \frac{4}{5}l\cos\sqrt{\frac{3g}{2l}}t$	M1
	$\frac{2}{3}\pi = \sqrt{\frac{3g}{2l}}t \Rightarrow t = \frac{2}{3}\pi\sqrt{\frac{2l}{3g}}$ oe	A1ft
	At nat length $v^2 = \omega^2\left(a^2 - x^2\right) = \frac{3g}{2l}\left(\frac{16}{25}l^2 - \frac{4}{25}l^2\right) = \frac{36gl}{50}$	M1A1ft
	Once string is slack accel is $\frac{3}{5}g$ down the plane.	
	$0 = \frac{6}{5}\sqrt{\frac{gl}{2}} - \frac{3}{5}gt'$	M1
	Total time $= \frac{2}{3}\pi\sqrt{\frac{2l}{3g}} + 2\sqrt{\frac{l}{2g}}$ oe	A1 **cso** (6)
		[16]

(a)	
M1	Resolve down the slope. Weight must be resolved and Hooke's Law attempted.
A1	Correct equation, including correct use of (unsimplified) Hooke's Law. Trig need not be substituted.
A1*	Given result obtained convincingly. We must see $\frac{2l}{5}$ and trig must be substituted before final result given.
(b) (i)	
M1	Equation of motion along slope, in T. Allow with *ma*.
dM1	Hooke's Law applied, with a variable extension. Allow with *ma*. Dependent on previous M mark.
A1	Correct unsimplified equation. Must now be $m\ddot{x}$
A1	$\ddot{x} = -\frac{3g}{2l}x$ $\therefore$ SHM Must have conclusion.
(ii)	
B1	*B* is the equilibrium position **or** $x = 0$ at *B*.
(c)	
M1	Complete method to find a quarter period for their ω. Must have come from an equation of the form $\ddot{x}$ or $a = \pm\omega^2 x$, but ignore dimensions of their ω.
A1ft	Correct time (ft their ω)
(d)	
M1	Complete method to find the time to string becoming slack. Must be using $x = \pm\frac{2}{5}l, a = \frac{4}{5}l$
	If using sin $\frac{2}{5}l = \frac{4}{5}l\sin\omega t_1 \rightarrow t_1 = \frac{\pi}{6}\sqrt{\frac{2l}{3g}}$ $\therefore t = \frac{\pi}{2}\sqrt{\frac{2l}{3g}} + \frac{\pi}{6}\sqrt{\frac{2l}{3g}}$
A1ft	Correct expression for time until string becomes slack. Follow through their ω.
M1	Complete method to find speed when string becomes slack
	Energy alternative $\frac{1}{2}mv^2 = \frac{1}{2}\times\frac{3mg}{2}\times\left(\frac{6l}{5}\right)^2 - mg\times\frac{6l}{5}\times\frac{3}{5}$
A1ft	Correct v or v^2 Follow through their ω.
M1	Complete method to find **total** time for *P* to come to rest.
A1 **cso**	Correct time, in any form. **Must have come from correct working in whole question.**

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