Mechanics 2 Elasticity

8(a)	$\frac{100}{0.4}e = 10\times 9.8$	M1		Use of Hookes law and equilibrium
	$e = 0.392$ m			
	Length $= 0.392 + 0.4 = 0.792$	A1	2	Correct length
(b)	$EPE = \frac{1}{2}\times\frac{100}{0.4}\times 0.6^2 = 45$ J AG	M1		Use of EPE formula
		A1	2	Correct value from correct working
(c)(i)	$45 = \frac{1}{2}\times\frac{100}{0.4}(x-0.4)^2 + \frac{1}{2}\times 10v^2 + 10\times 9.8(1-x)$	M1		Expression for EPE with $(x\pm 0.4)^2$
		A1		Correct EPE
	$45 = 125(x-0.4)^2 + 5v^2 + 98(1-x)$	M1		Four term energy equation
	$5v^2 = 98x - 98 + 45 - 125x^2 + 100x - 20$	B1		Correct GPE
	$v^2 = 39.6x - 25x^2 - 14.6$	A1		Correct equation
		dM1		Solving for v^2
	AG	A1	7	Correct result from correct working
(ii)	$39.6x - 25x^2 - 14.6 = 0$			
	$25x^2 - 39.6x + 14.6 = 0$	M1		Solving quadratic
	$x = \frac{39.6 \pm \sqrt{39.6^2 - 4\times 25\times 14.6}}{2\times 25}$			
	$= 1$ or 0.584	A1		Correct solutions
	$x = 0.584$	A1	3	Appropriate value selected
				SC Only correct answers given award M1A1.
	Total		**14**	

8(a)	$2g = \frac{49\times x}{0.5}$	M1		
		A1		
	$\underline{x = 0.2}$	A1	3	
(b)	$\text{EPE} = \frac{49\times(0.2)^2}{2\times 0.5}$	M1		
	$= 1.96$ (J)	A1	2	
(c)(i)	$1.96 = \frac{49\times x^2}{2\times 0.5} + 0.8\times 9.8\times(0.2+x)$	M1		All terms attempted for M1
		A3		-1 EE from A3
	$x^2 + 0.16x - 0.008 = 0$	A1	5	
(ii)	$x = \frac{0.16 \pm \sqrt{0.16^2 + 4\times 0.008}}{2}$	M1		
	$x = 0.04$	A1	2	$x = 0.04$ only identified
	Total		**12**	

6(a)	EPE is $\frac{\lambda x^2}{2l}$			
	$= \frac{200(0.5)^2}{2\times 2}$	M1		
	$= 12.5$ J	A1	2	
(b)	When string becomes slack,			
	using $\frac{1}{2}mv^2$ = loss in EPE:	M1		NB Using $\sqrt{5}$ to answer (a) and thus (b) $\Rightarrow$ no marks
	$\frac{1}{2} \times 5 \times v^2 = 12.5$	A1		
	Speed is $\sqrt{5}$ m s^{-1}	A1	3	AG
(c)	Resolving vertically, $R = 5g$	B1		
	$F = \mu R$	M1		
	$0.4 \times 5g = 2g$	M1		
	Using change in energy = work done:			
	$2g \times 0.5 =$	M1		M1 for force × distance
	$\frac{1}{2}\times 5 \times \left(\sqrt{5}^2\right) - \frac{1}{2}\times 5 \times v^2$	A1,A1		A1 first term (or 12.5) A1 second term (inc $-$)
	$9.8 = 12.5 - \frac{5}{2}v^2$			
	$v^2 = 1.08$			
	Speed is 1.04 m s^{-1}	A1	7	
	Total		**12**	