Question Number	Answer		Mark
17(a)	The greater the length of the rope, the greater the extension for a given force	**(1)**	
	Stiffness $k = F / \Delta x$ so stiffness decreases (if extension increases).	**(1)**	**2**
17(b)(i)	Use of $E = \frac{\sigma}{\varepsilon}$ **and** $\sigma = \frac{F}{A}$ **and** $\epsilon = \frac{\Delta x}{x}$	**(1)**	
	Use of $F = k\Delta x$	**(1)**	
	$k = 1.35 \times 10^5$ (N m^{-1})	**(1)**	**3**
	Example of calculation 2.70×10^9 N m^{-2} = $F \times 6.00$ m ÷ (3.00×10^{-4} m^2 × ΔL) F = (2.70×10^9 N m^{-2} × 3.00×10^{-4} m^2 ÷ 6.00 m) × $\Delta L = k\,\Delta x$ $k = \frac{F}{\Delta L} = \frac{2.70 \times 10^9 \text{ N m}^{-2} \times 3.00 \times 10^{-4} \text{ m}^2}{6.00 \text{ m}}$ $= 1.35 \times 10^5$ N m^{-1}		
17(b)(ii)	Correct use of factor of 2 to calculate F or Δx	**(1)**	
	Use of $\Delta F = k\Delta x$	**(1)**	
	1.85×10^{-2} (m) (allow ecf from (i))	**(1)**	**3**
	Example of calculation F = 5 000 N/ 2 = 2 500 N $\Delta x = \frac{F}{k} = \frac{2\,500 \text{ N}}{1.35 \times 10^5 \text{ N m}^{-1}} = 1.85 \times 10^{-2}$ m		
17(b)(iii)	Use of $\Delta E_{el} = ½ F\Delta x$	**(1)**	
	ΔE_{el} = 23.1 J (allow ecf from (ii))	**(1)**	**2**
	Example of calculation ΔE_{el} = 0.5 ×2 500 N ×1.85 ×10^{-2} m = 23.13 J		
17(c)	Use of W = $F\Delta$s (to find the work done in lifting the load)	**(1)**	
	Compares 7 500 J with their calculated value in b(iii) and draws suitable conclusion	**(1)**	**2**
	Example of calculation Work done by pulley system = 5×10^3 N × 1.5 m = 7 500 J 23(.1) (J) << 7 500 (J) ∴ not significant		
	Total for question 17		**12**