Question Number	Answer		Mark
12(a)	Use of $\sigma = F / A$	**(1)**	
	$\sigma = 3.8 \times 10^{8}$ Pa [accept N m^{-2}] **Or** $F_b = 170$ N **Or** $A_{min} = 3.6 \times 10^{-7}$ m^2	**(1)**	
	Valid comparison in consistent units and conclusion	**(1)**	**3**
	Example of calculation $\sigma = 150$ N $\div 3.97 \times 10^{-7}$ m$^2 = 3.78 \times 10^{8}$ Pa $3.78 < 4.20$ ∴ will not break		
12(b)(i)	Determine gradient of straight line section [straight line ends at 5 mm]	**(1)**	
	[$\Delta x \geq 3$ mm for gradient][Allow use of tangent at origin]	**(1)**	**2**
	$k = 1.30 \times 10^{4}$ (N m^{-1}) [acceptable range to be determined at pre-stand] [1.27 to 1.33][need to see third s.f.]		
	Example of calculation gradient = 60 / 4.6 = 13.0 gradient = k / N mm^{-1} $k = 13.0$ N mm$^{-1} = 1.30 \times 10^{4}$ N m^{-1}		
12(b)(ii)	Use of $k = EA/x$	**(1)**	
	$E = 1.3 \times 10^{11}$ Pa [or N m^{-2}](ecf from (b)(i))[their (b)(i) $\times 1.01 \times 10^{7}$ + unit]	**(1)**	**2**
	Example of calculation $E = k\,x / A$ $E = 1.3 \times 10^{4}$ N m$^{-1} \times 4.00 \div 3.97 \times 10^{-7}$ m^2 $E = 1.3 \times 10^{11}$ Pa		
	Total for question 12		**7**