Question Number	Answer		Mark
18(a)	Two corresponding pairs of values of V and t read from graph	**(1)**	**4**
	Use of $V = V_0 e^{-\frac{t}{RC}}$ **Or** Use of ln V = ln $V_0 - \frac{t}{CR}$	**(1)**	
	C= 497 (μF) (Range 463 μF to 520 μF)	**(1)**	
	Comparison of calculated value to tolerance calculated using 10% and conclusion as to whether it is in tolerance **Or** use of difference between calculated and labelled value to calculate percentage difference and conclusion as to whether it is in tolerance	**(1)**	
	OR Use of $V = V_0 / e$ (4.4 V) to find time constant (74 s) **Or** intercept with t axis using initial tangent to find time constant	**(1)**	
	Use of time constant = RC	**(1)**	
	C= 493 (μF) (Range 463 μF to 520 μF)	**(1)**	
	Comparison of calculated value to tolerance calculated using 10% and conclusion as to whether it is in tolerance **Or** use of difference between calculated and labelled value to calculate percentage difference and conclusion as to whether it is in tolerance	**(1)**	
	Example of calculation $\frac{4.1\ \text{V}}{12\ \text{V}} = \text{e}^{-\frac{80\ \text{s}}{150 \times 10^3\ \Omega \times C}}$ $C = -\frac{80\ \text{s}}{150 \times 10^3\ \Omega \times \ln\left(\frac{4.1\ \text{V}}{12\ \text{V}}\right)} = 4.97 \times 10^{-4}\ \text{F}$ Largest C = 1.1 × 470 μF = 517 μF The capacitance is 497 μF which is less than the maximum value of 517 μF, so value is within tolerance		

18(b)	Use of $W = \frac{1}{2}.\frac{Q^2}{C}$	**(1)**	
	Use of $W = \frac{1}{2}CV^2$	**(1)**	
	Calculates ratio of energies stored and makes comparison to 1000 and suitable conclusion **Or** Applies factor of 1000 to one calculated energy and makes comparison to the other energy and suitable conclusion	**(1)**	**3**
	Example of calculation $W = \frac{1}{2}.\frac{(56\ \text{C})^2}{47\ \text{F}} = 33.4\ \text{J}$ $W = \frac{1}{2} \times 470\ \times 10^{-6} \times (12\ \text{V})^2 = 0.0338\ \text{J}$ $\text{Ratio} = \frac{33.4\ \text{J}}{0.0338\ \text{J}} = 987$ Ratio of energies stored is 990 which is close to 1000, so claim is accurate		
	Total for question 18		**7**