Question Number	Answer		Mark
16(a)	At the top of the main sequence (1) Accept a sketch of H-R diagram with the stars correctly marked on the main sequence		**1**
16(b)	Use of $\lambda_{\max}T = 2.898 \times 10^{-3}$ m K	(1)	
	$\lambda_{\max} = 9.7 \times 10^{-8}$ m	(1)	**2**
	Example of calculation $\lambda_{\max} = \dfrac{2.898 \times 10^{-3}\text{m K}}{3.00 \times 10^4 \text{K}} = 9.66 \times 10^{-8}$ m		
16(c)	Use of $L = \sigma T^4 A$	(1)	
	$r = 2.3 \times 10^{10}$ m	(1)	**2**
	Example of calculation $5.37 \times 10^5 \times 3.85 \times 10^{26}\text{W} = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-1} \times 4\pi \times r^2 \times (2.75 \times 10^4 \text{ K})^4$ $\therefore r = \sqrt{\dfrac{2.07 \times 10^{32}\text{W}}{5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-1} \times 4\pi \times \left(2.75 \times 10^4 \text{K}\right)^4}} = 2.25 \times 10^{10}$ m		

Question Number	Answer		Mark
16(d)	Use of $I = \dfrac{L}{4\pi d^2}$	(1)	
	$I_A = 4.6 \times 10^{-8}$ Wm^{-2} and $I_M = 3.6 \times 10^{-8}$ Wm^{-2} **Or** $\dfrac{I_A}{I_M} = 1.25$	(1)	
	Comparison of the intensities of the two stars and appropriate deduction. Dependent on MP1	(1)	
	OR		
	Alnilam is about 6 times as luminous as Mintaka, but Alnilam is twice as far away		
	And the intensity of a star is given by $I = \dfrac{L}{4\pi d^2}$ **Or** The intensity of a star is proportional to luminosity and inversely proportional to the distance squared Dependent on MP1	(1)	
	Hence the intensity of Alnilam is greater than that from Mintaka and so Mintaka has the lower intensity. Dependent on MP1 and MP2.	(1)	
	<u>Example of calculation</u>	(1)	**3**
	$\dfrac{I_A}{I_M} = \dfrac{L_A}{L_M} \times \left(\dfrac{d_M}{d_A}\right)^2$		
	$\therefore \dfrac{I_A}{I_M} = \dfrac{5.37 \times 10^5}{9.0 \times 10^4} \times \left(\dfrac{8.7 \times 10^{18} \text{ m}}{1.9 \times 10^{19} \text{ m}}\right)^2 = 1.25$		
	Total for question 16		**8**