Problem Solving

a) Temperature of a star & desired resolution >>> diameter of the viewing telescope

$T \rightarrow \boxed{T\lambda_{peak} = .3\ cm\cdot K} \rightarrow \lambda_{peak}$

$\theta \rightarrow \boxed{\theta = \lambda / D} \rightarrow D$

b) The masses of two stars >>> ratio of their temperature

$M_1 \& M_2 \rightarrow \frac{M_1}{M_2}$

$\frac{M_1}{M_2} \rightarrow \boxed{\frac{L_1}{L_2} = \left(\frac{M_1}{M_2}\right)^4} \rightarrow \frac{L_1}{L_2}$

$\frac{M_1}{M_2} \rightarrow \boxed{\frac{R_1}{R_2} = \left(\frac{M_1}{M_2}\right)^{.75}} \rightarrow \frac{R_1}{R_2}$

$\rightarrow \boxed{\frac{L_1}{L_2} = \frac{4\pi R_1^2 \sigma T_1^4}{4\pi R_2^2 \sigma T_2^4} = \left(\frac{R_1}{R_2}\right)^2 \left(\frac{T_1}{T_2}\right)^4} \rightarrow \frac{T_1}{T_2}$

c) Apparent Brightness & luminosity of a star >>> parallax

$b, L \rightarrow \boxed{b = \frac{L}{4\pi d^2}} \rightarrow d \rightarrow \boxed{d = 1/p} \rightarrow p$

d) Mass loss per second due to fusion & radius >>> Peak wavelength

First: $E = mc^2 \xrightarrow[\text{divide both by s}]{} \frac{E}{s} = \frac{m}{s}c^2 \rightarrow L = \frac{m}{s}c^2$

$\frac{M}{s} \rightarrow \boxed{L = \left(\frac{m}{s}\right)c^2} \rightarrow L \rightarrow \boxed{L = 4\pi R^2 \sigma T^4} \rightarrow T \rightarrow \boxed{\lambda_{peak} T = .3\ cm\cdot K} \rightarrow \lambda_{peak}$

$R \rightarrow \boxed{L = 4\pi R^2 \sigma T^4}$

e) Observed peak wavelength & velocity >>> brightness at the surface of the star.

$\lambda_{obs}, V \rightarrow \boxed{\frac{|\lambda_{obs} - \lambda_o|}{\lambda_o} = \frac{\Delta\lambda}{\lambda_o} = \frac{v}{c}} \rightarrow \lambda_o \rightarrow \boxed{\lambda_{peak} T = .3\ cm\cdot K}$

$\rightarrow T \rightarrow \boxed{\mathcal{E} = \sigma T^4} \rightarrow \mathcal{E}$