Using Stefan's and Wien's Laws to Understand the Brightness and Size of Stars

Name_____

> Purpose:
> - To provide you with necessary skills to use Stefan's and Wien's Law to estimate star brightness
> - To use the concepts of luminosity and surface area

Estimated Completion Time: 60 minutes
Resources needed:
- Calculator (preferably scientific)
- Textbook
- Web access is highly desirable

Applets that you will find useful:

Stellar
This applet helps you compare two different stars having different radii and temperatures.
Star Maker
This applet will do the math that you encounter when comparing star brightness as a function of size and temperature

Questions: The next 4 questions concern 3 hypothetical stars:

    a. Star A: T = 8000 K
    b. Star B: T = 3000 K
    c. Star C: T = 12 000 K

1. Determine the wavelength of maximum emission from stars A,B and C . (3 marks) (Show how you would use Wien's Law – **write out the equations and put in the appropriate numbers** but if you wish you can use an applet to do the calculations)

2. Use the applet Stellar to determine the amount of energy being emitted per second per square meter from each star. Express your results in units of Watts per square meter (W/m^2). Why can't we decide which of the 3 stars is the brightest? What additional piece of information would be needed to allow you to do this? (4 marks) (Again – show how you would use Stefan's law to solve this but you can use an applet to answer if you wish).

3. Explain what is meant by the term **luminosity.** Suppose that star B has a radius of 25 times that of our sun while star C has a radius of 5 times the sun. Use this to determine the ratio of the luminosity of the two stars. What is L_B/L_C? (4 marks)

$R_C = 5 R_o$

B

C

$R_B = 25 R_o$
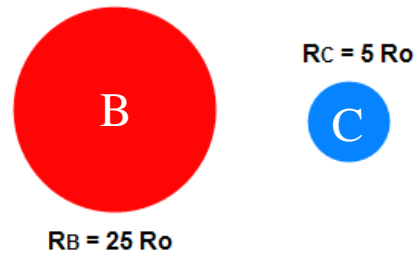
4. If stars B and C where both at the same distance how would their magnitudes compare? Which would be brightest and by how many magnitude units? (3 marks)

5. Use Stellarium to find the B-V colour index and spectral type for the following stars and then use StarMaker to estimate the temperatures of those stars: (10 marks). Why do you think the two programs give such different temperatures?

Star	B-V	Temperature (K)	Spectral Type
Alnilam			
Arcturus			
Mira			
Deneb			
Mirphak			

(Hint – once you locate the star click on it and read the information in the upper left hand corner of the screen)