

Black Body Radiation

NAME **KEY**

Black Body Radiation is temperature based production of light. The thermal energy makes the atoms and electrons vibrate causing light from the waves they create in electromagnetic fields.

Use the graphs found in **Black Body Radiation Data** on Schoology to draw some conclusions about some stars based on their light. There is an example at the top to help you read the graphs, and you'll need a calculator to do the math.

1. Use the Star Black Body Spectrums from the data document to find the wavelength of the peak (or λ_{PEAK})

Star Name	Peak Wavelength (nm) These are my estimates that are not perfect, but I just look for my kids to be close.	Surface Temp (K) I decided to round to two sig figs, because this is all based on estimates by eye.	Spectral Type Again, these are estimates based on the scale on the next slide, I just look for kids to be close to me to count as understanding
Alnitak	80 nm	36,000	O9
Lambda Taurus	110 nm	26,000	B2
Betelgeuse	950 nm	3100	M1
Aldebaran	650 nm	4500	K4
Gamma Taurus	550 nm	5300	G9
Theta Taurus	285 nm	10,000	A0
Arneb	390 nm	7400	F1

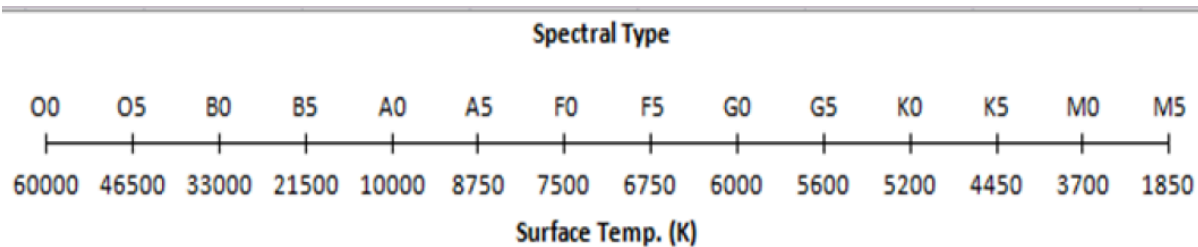
2. From the Peak wavelength we can calculate what the temperature of the star is by using the following equation:

$$(\lambda_{\text{PEAK}})(\text{Temperature}) = 2,898,000 \text{ nm K}$$

where λ_{PEAK} is in nm, and Temp is in Kelvin. **Rearrange the equation so that Temperature is by itself.**

3. Calculate the Surface Temperature of each star in Kelvin using the equation, and record the temperatures in the table above.

4. Use the graph below to estimate the spectral type of each star based on its temperature (K). Each letter counts up from zero to 9, going from left to right.



5. Rank the stars by temperature from hot to cold.

Alnitak, Lambda Taurus, Theta Taurus, Arneb, Gamma Taurus, Aldebaran, Betelgeuse

6. Given what you found today which star should be the brightest (as in most light produced) and which should be the least bright.

The hottest star should be the most bright (that said temperature is not the only factor) so **Alnitak**, and then **Betelgeuse** would be least bright

7. If a star is moving quickly away from Earth, should it be red-shifted or blue-shifted?

If a star is moving **away** from Earth it should be **Redshifted**.

8. Given what you decide for #7, how should that affect the estimated temperature of the star? (You would use a similar process as in #1-3 to estimate the temperature)

While we have methods for correcting for redshift, **the star would initially appear to be colder than it actually is.**

9. In the space below, draw a rough sketch of the black body spectra of Betelgeuse, Aldebaran, and Arneb **all on one set of axes**. (Think about peak wavelength, height, shape, and size)

I don't pay especially close attention to how accurate the peak wavelengths are, but I am looking for the curves to be nesting properly like Russian Dolls and their curves should **NOT** intersect ever. So something like the crude image below.

