

The absorption line spectra for six hypothetical stars, each with different temperatures, are shown below. For each absorption line spectrum, the short wavelengths of light (or blue end) of the electromagnetic spectrum are shown on the left side, and the long wavelengths of light (or red end) of the spectrum are shown on the right side.



Star A
T = 30,000 K



Star B
T = 20,000 K



Star C
T = 12,000 K



Star D
T = 18,000 K



Star E
T = 8,000 K



Star F
T = 24,000 K

- 1) Do cold stars always appear to have a different (greater or fewer) number of lines in their absorption spectra than hot stars? Cite evidence from the above spectra to support your answer.

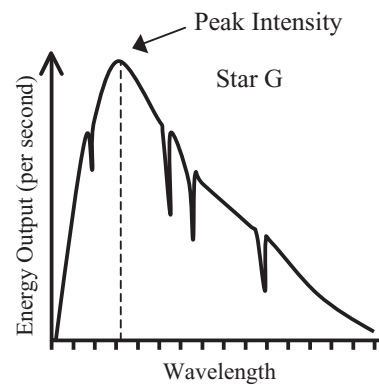
- 2) Do cold stars always appear to have more lines at either the blue or red ends of their absorption spectra than hot stars? Cite evidence from the above spectra to support your answer.

- 3) Consider the absorption line spectrum given below for Star G. Can you determine the approximate temperature for Star G by comparing its absorption line spectrum to the absorption line spectra and temperatures of Stars A–F given above? If so, write in your estimate in the space below; if not, explain why not.



Star G
T = _____ K

While it is difficult to directly estimate the temperature of a star from the lines in its absorption spectrum, we can always use the wavelength of the peak for the light emitted by a star to estimate temperature. The spectral curve on the graph at right illustrates the energy output versus wavelength for Star G (the same Star G as on the previous page). Again, the short (or blue) wavelengths of light are represented on the left side of the horizontal axis, and the long (or red) wavelengths of light are represented on the right end of the horizontal axis.

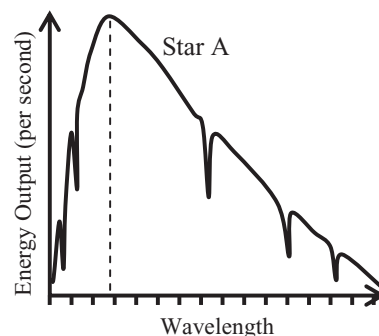


There are two important features represented on this spectral curve that you need to consider.

- The exact locations of the small dips, or absorption features, on the curve occur at the same wavelength as the dark lines that appear in the absorption line spectrum shown on the previous page.
- The wavelength at which the object's peak energy output occurs is directly related to the object's temperature. Hot objects have their peak energy output at short wavelengths—toward the blue end of the spectrum. Cooler objects have their peak energy output at long wavelengths—toward the red end of the spectrum.

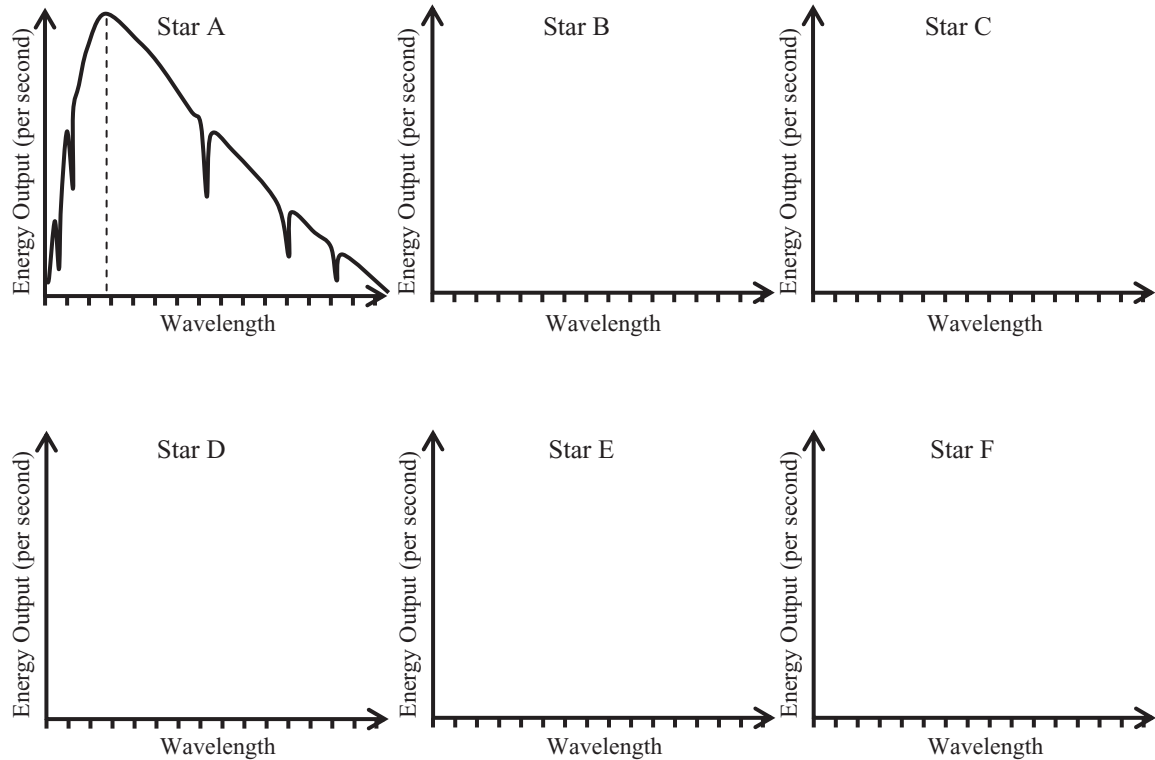
Although the total energy output of a star is affected by its temperature (and, therefore, so is the height of the spectral curve), for this activity, we will assume that the height (but not location) of the peak energy output, and the general shape of the spectral curves for Stars A–F, can be drawn nearly the same for each star. Only the location of the peak intensity and the location of the small dips, or absorption features, will be different for each star.

- 4) Examine the spectral curve shown at right for Star A (the same Star A as on the previous page). Note that Star G has a temperature of approximately 25,000 K, whereas Star A has a temperature of 30,000 K. With this information, would you say the location for the peak of Star A is drawn at approximately the correct wavelength as compared to the wavelength where the peak of Star G is drawn? Explain your reasoning.



- 5) Are the absorption features (dips) in the spectral curve for Star A drawn at approximately the correct wavelengths? Explain how you can tell.

- 6) Sketch spectral curves for Stars B–F on the corresponding graphs provided below. Do not worry about whether the heights of the spectral curves you draw are accurate. But, make sure your spectral curves include the absorption features and the peak intensities drawn at *approximately* the correct wavelengths.



- 7) Did you draw the peak intensity of each spectral curve at the same wavelength as the spectral curve for Star A? Why or why not?
- 8) If you were given a star's absorption line spectrum and its corresponding spectral curve shown on an energy output per second versus wavelength graph, how could you approximate the temperature of the star?

- 9) Consider the following statement made by a student regarding a star's temperature and its corresponding absorption line spectrum.

Student: *If I am looking at a star's absorption line spectrum and see that it has a lot of lines at the blue end of the spectrum, then the star must be hot because the blue lines are higher energy lines.*

Do you agree or disagree with this student? Explain your reasoning and support your answer by citing evidence from the absorption line spectra given for Stars A–G.