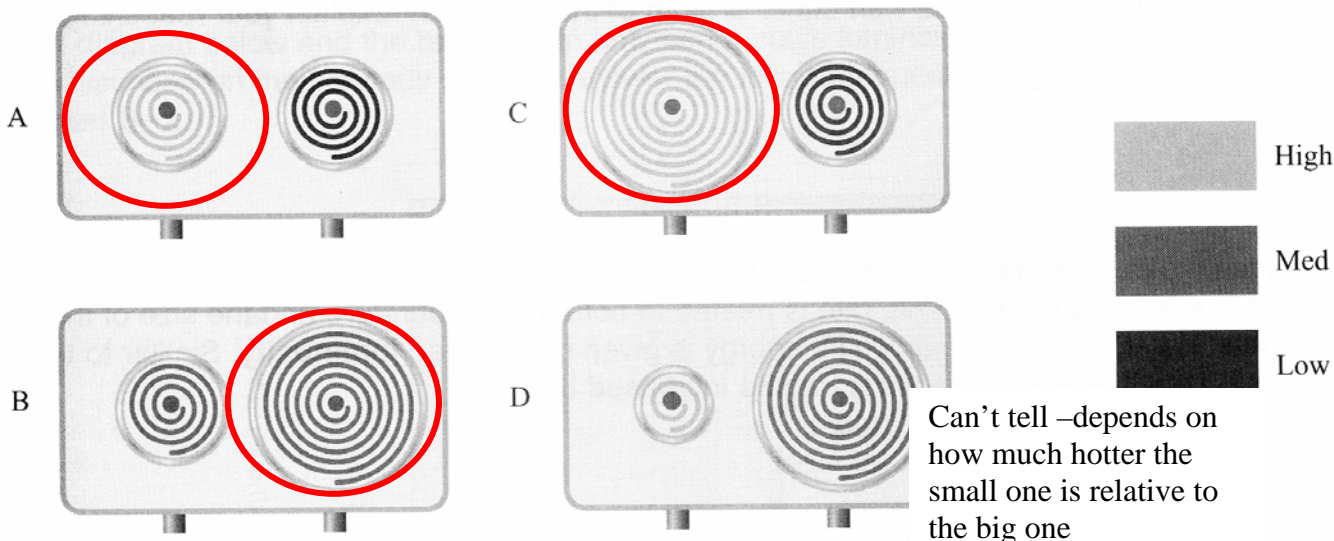


**Part I: Luminosity, Temperature and Size**

Imagine you are comparing the abilities of electric hot plates of different sizes and temperatures to cook fully two identical large pots of spaghetti. Note that the pots are all as large as the largest hot plate. When a hot plate is at one of the temperature settings (low, med, high), the hot plate is depicted as a shade of gray as shown in question 1. The lighter the shade of gray, the higher the temperature setting of the hot plate.

- 1) For each pair of hot plates shown below, circle the one that will cook the large pot of spaghetti more quickly. If there is no way to tell, state that explicitly.



- 1) If you use two hot plates of the same size, can you assume that the hot plate that can cook a large pot of spaghetti first is at the higher temperature? Which lettered example above supports your answer?

**YES – Letter A is this case.**

- 2) If you use two hot plates at the same temperature, can you assume that the hot plate that can cook a large pot of spaghetti first is larger? Which lettered example above supports your answer?

**YES – Letter B is this case.**

- 3) If you use two hot plates of different sizes, can you assume that the hot plate that can cook a large pot of spaghetti first is at a higher temperature? Which lettered example above supports your answer?

**NO – if a hot plate were enough bigger it could cook faster even if it was cooler. Letter D might represent such a case.**

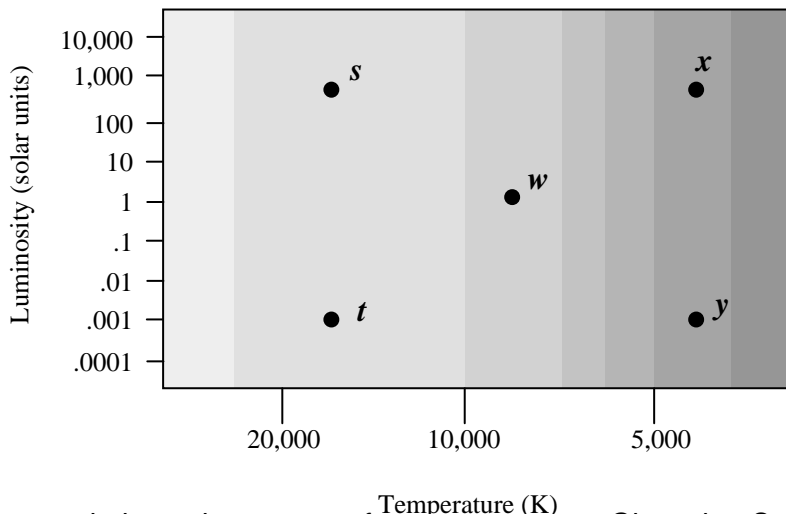
The time for the spaghetti to cook is determined by the rate at which the hot plate transfers energy to the pot. This rate is related to both the temperature and the size of the hot plate. For stars, the rate at which energy is given off is called **luminosity**. Similar to the above example, a star's luminosity can be increased by:

- increasing its temperature; and/or
- increasing its surface area (or size).

This relationship between luminosity, temperature and size allows us to make comparisons between stars.

**Part II: Application to the H-R Diagram**

The graph below plots the luminosity of a star on the vertical axis against the star's surface temperature on the horizontal axis. This type of graph is called an H-R diagram. Use the H-R diagram below and the relationship between a star's luminosity, temperature and size (as described on the previous page) to answer the following questions concerning the stars labeled **s – y**.



- 4) Stars **s** and **t** have the same surface temperature. Given that Star **s** is actually much more luminous than Star **t**, what can you conclude about the size of Star **s** compared to Star **t**? Explain your answer.

**Star s must be larger than star t. Since they have the same temperature, the only other variable affecting the luminosity is the star's surface area which is proportional to its size.**

- 5) Star **s** has a greater surface temperature than Star **x**. Given that Star **x** is actually just as luminous as Star **s**, what can you conclude about the size of Star **x** compared to Star **s**? Explain your answer.

**Star x must be much larger since it has a lower temperature. A larger size (larger surface area) can compensate for its lower temperature.**

- 6) Based on the information presented in the H-R diagram, which star is larger, **x** or **y**? Explain. **Star x must be larger because its luminosity is higher at the same temperature as y.**