Name: Hr:

This simulation may be found at: http://phet.colorado.edu/en/simulation/blackbody-spectrum

OR google search: "PHET Blackbody" and choose the first link.

Question: We all know that objects glow when they are heated up. What colors of light are given off as the temperature is changed?

Today you will be using a simulation from the PHET website that deals with this phenomena, called: blackbody radiation. We will find out what color and intensity of light is emitted as the temperature of an object is changed.

The simulation consists of: 1. A graph of light intensity (light power / area) vs. the wavelength of the light emitted. The rainbow is the range of light frequencies that make up the colors of light we can see with our eyes – the **visible spectrum.** 2. A slider, digital scale and thermometer where different temperatures can be set. 3. A blue, green, and red dot that displays which visible colors are in the light as well as their intensity. **In addition, a star showing the combined brightness and what the three colors will look like if blended together.**

You may need to zoom in or out on either axis to see the curve on the graph. All temperatures are in Kelvins.

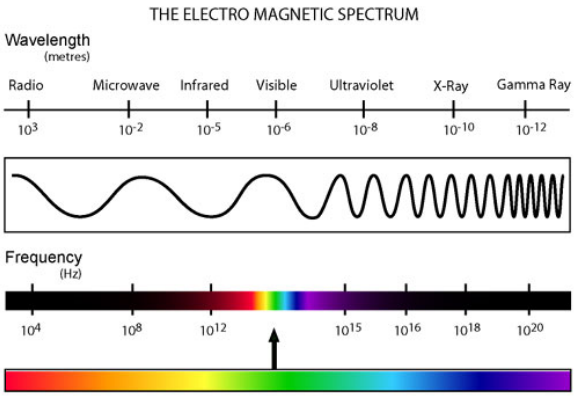
Part 1 – 'Cool Temperatures'

1. Manually change the temperature until you cannot see the star anymore.

a. What is the minimum temperature to see the star with your eyes?

b. What is the peak color for a star the same temperature as the Sun?

c. A star of 700K gives off light, yet humans can't see it. If you zoom in, you can see it gives off light. Why can't *you see* a star that has a temperature of 700k?



RED VIOLET

d. Zoom in again to a 700K star. What kind of light does it give off? Is the wavelength long or short? Use the chart (above) to help.

e. The surface of the coolest visible stars is red (They're called red _____ and red _____). See your astronomy notes (Sun Part II) or look it up. Compare the temperature of these coolest stars to the temperature of an oven. Which one is hotter? What kind of light does an oven give off? Why can't you easily see the light an oven gives off?

Part 2 – A Little Warmer

2. Adjust the temperature until it is equal to an incandescent light bulb filament. You may need to zoom in using the + button on the Y axis.

a. What is the temperature of a light bulb filament?

b. What is the peak light color for an incandescent light bulb?

a. Sketch the graph for the light bulb. Sketch where the visible light spectrum is on the graph.

d. According to your graph, is an incandescent light bulb efficient at giving off visible light? **Why or why not**? (How can you tell a light bulb is on if you cannot see it?)

Part 3 – Star Temperatures

1a. What seems to happen to star color as the temperature is raised?

1b. What happens to star intensity (brightness) as the temperature is raised? (you may have to zoom out or in and use the graph to explain)

2. According to the graph, a blue star (10,000K or more) is much more intense (brighter) than a red star. What portion of the spectrum is the peak of a blue star located in?

3. What is the relationship between star temperature and frequency?

4. According to the graph, what color of visible light has the longest wavelength? _____

5. According to the graph, what color of visible light has the shortest wavelength? _____

6. Which color of visible light has the highest frequency?(most waves per second)_____

7. Which color of visible light has the lowest frequency? _____

8. Does our star, the Sun, emit non-visible light? What kinds, if so?

9. Why do only some frequencies of light easily reach the Earth's surface? (you will have to look up this answer, and there are multiple frequencies that don't reach us at 100% intensity. Any example with an explanation will do; UV, infrared, etc.) Think back to why the stratosphere's temperature increases with height for an example.