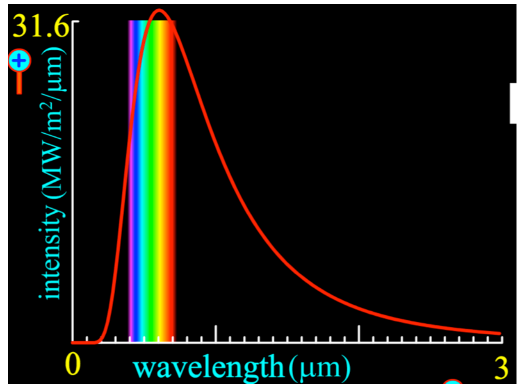
Blackbody spectrum worksheet

https://phet.colorado.edu/en/simulation/legacy/blackbody-spectrum



1. What is the peak spectral intensity (in units of MW/m^2·μm) emitted by the

- the surface of the earth,
- the surface of a hot oven,
- the surface of a light bulb filament,
- the surface of the sun.

2. How cold should you make an object if you want zero thermal radiation emitted?

3. What is the energy of a photon with wavelength corresponding to the spectral peak from

- the surface of the earth,
- the surface of a hot oven,
- the surface of a light bulb filament,
- the surface of the sun

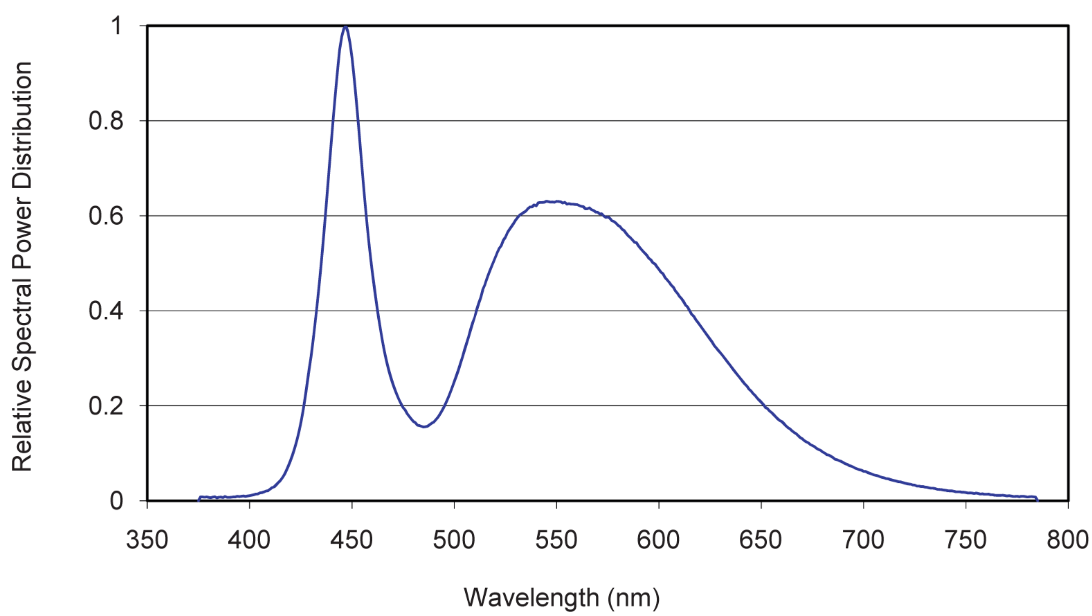
4. What fundamental constant has dimensions of energy per temperature?

5. Use your answer to number 4 to help you look for a mathematical relationship between the **energy of a photon at the spectral peak** and the **temperature of the glowing object**.

Note: Question 5 uses a technique called dimensional analysis to guess the equation relating different variables. Dimensional analysis is often very useful, but it won't help you figure out numerical coefficients in the equation.

6. Consider the blackbody spectrum emitted by an incandescent light bulb. Estimate what fraction of the emitted energy is wasted (i.e. not visible light).

7. The graph below shows the spectrum from an LED light bulb. This is **not** a "blackbody spectrum". Why is the LED more efficient than the incandescent light bulb?



8. Infra-red (IR) light has a wavelength anywhere between 0.7 μm – 1000 μm. I'm wearing IR goggles that are sensitive to λ = 5 μm. I pick up a signal from an object that is 300 K, and a signal from a similar sized object that is 345K. How much bigger is the signal from the 345 K object?