Classical limit At low frequencies, the spectral intensity is given by

$$S_\omega(\omega) \approx \frac{\omega^2 k_B T}{4\pi^3 c^2} \qquad \text{where } \hbar\omega \ll k_B T \tag{1}$$

Draw a graph with the classical limit of S_ω on the vertical axis, and the frequency ω (or alternatively $\hbar\omega$) on the horizontal axis. Sketch this relationship for the two temperatures $T = 300$ K and $T = 600$ K.

High-frequency quantum limit At high frequencies, when the energy quanta are much greater than $k_B T$, the spectral intensity becomes

$$S_\omega(\omega) \approx \frac{\hbar\omega^3}{4\pi^3 c^2} e^{-\frac{\hbar\omega}{k_B T}} \qquad \text{where } \hbar\omega \gg k_B T \tag{2}$$

On the same graph sketch use this high frequency limit to sketch the spectral distribution over the entire frequency range at the same two temperatures.

Find the total Using your graphs, try to estimate the ratio between the **intensity** at the two temperatures. Keep in mind that the **intensity** is the integral of the **spectral intensity** over all possible frequencies.

When we double the temperature does the intensity

1. Increase by 2 times
2. Increase by 4 times
3. Increase by 8 times
4. Increase by 16 times