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Question: When the temperature of a black surface is doubled, what happens to the total energy emitted per unit time?

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

Solution The total energy goes up by a factor of 16!

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Figure 1: The peak goes to twice the frequency, but since the low-frequency limit is $P \propto \omega^2 T$ it ends up 8 times as tall, and twice as wide. Thus the area under the curve (which gives the total energy per time) increases by a factor of 16.

When we integrate a blackbody spectral distribution (add up all of the energy from individual oscillators) we get

$$\text{Intensity of light from surface of blackbody} = \sigma T^4 \tag{1}$$

where σ is the Stefan-Boltzmann constan, which has a value of $\sigma = 5.7 \times 10^{-8} \frac{\text{J}}{\text{s}\cdot\text{m}^2} \frac{1}{\text{K}^4}$. This is called the **Stefan-Boltzmann Law** and describes the total thermal radiation from anything that is black.