

## Chapter 34 Problem 19 <sup>†</sup>

### Given

$$T = 5800 \text{ K}$$

### Solution

a) Find the wavelength of peak radiance.

The wavelength for maximum radiance is given by Wien's displacement law.

$$\lambda_{\max} T = 2.898 \times 10^{-3} \text{ m} \cdot \text{K}$$

Solving for the wavelength gives

$$\lambda_{\max} = \frac{2.898 \times 10^{-3} \text{ m} \cdot \text{K}}{T}$$

$$\lambda_{\max} = \frac{2.898 \times 10^{-3} \text{ m} \cdot \text{K}}{5800 \text{ K}} = 5.00 \times 10^{-7} \text{ m}$$

This wavelength corresponds to bluish-green light.

b) Find the median wavelength (where half the power is radiated above this wavelength and half below).

The equation for median wavelength is

$$\lambda_{\text{median}} T = 4.11 \times 10^{-3} \text{ m} \cdot \text{K}$$

Solving for wavelength gives

$$\lambda_{\text{mean}} = \frac{4.11 \times 10^{-3} \text{ m} \cdot \text{K}}{T}$$

$$\lambda_{\text{mean}} = \frac{4.11 \times 10^{-3} \text{ m} \cdot \text{K}}{5800} = 7.09 \times 10^{-7} \text{ m}$$

This wavelength corresponds to red light. Therefore, half of the energy from the sun is radiated away as infrared and longer wavelength and the other half is visible, ultra-violet and shorter wavelengths.

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<sup>†</sup>Problem from Essential University Physics, Wolfson