Express the Planck radiation formula in terms of wavelength.

Solution:

The Planck spectral radiance of blackbodies in frequency form

$$B_\nu(T) = \frac{2h\nu^3}{c^2} \frac{1}{e^{\frac{h\nu}{k_B T}} - 1}$$

The spectral radiance in wavelength form

$$B_\lambda(T) = B_\nu(T) \left|\frac{d\nu}{d\lambda}\right|$$

Since

$$\nu = \frac{c}{\lambda}, \qquad d\nu = -\frac{c}{\lambda^2} d\lambda$$

we get

$$B_\lambda(T) = \frac{2h\left(\frac{c}{\lambda}\right)^3}{c^2} \frac{1}{e^{\frac{h\frac{c}{\lambda}}{k_B T}} - 1} \left|-\frac{c}{\lambda^2}\right|$$

$$= \frac{2hc^2}{\lambda^5} \frac{1}{e^{\frac{hc}{\lambda k_B T}} - 1}$$

Answer: $B_\lambda(T) = \frac{2hc^2}{\lambda^5} \frac{1}{e^{\frac{hc}{\lambda k_B T}} - 1}$