

Wednesday, February 12, 2025

Example #1 Black body radiation from ~~to~~ a hot star

The surface of a hot star has a temperature of 10,000 K.

→ Calculate ~~it~~ its peak emission wavelength λ and its luminosity L .

Wien's law : $\lambda_{\max} = \frac{2.9 \times 10^6}{T} = \frac{2.9 \times 10^6}{10,000}$

λ_{\max} (nm (nanometers)) T (Kelvin)

$= \frac{2.9 \times 10^{6-4}}{10^4} = 2.9 \times 10^{6-2} = 2.9 \times 10^2$

$\Rightarrow \lambda_{\max} = 290 \text{ nm}$ ultraviolet $= 290 \text{ nm}$

Luminosity = $L = \sigma T^4$ (Kelvin)

$= (5.67 \times 10^{-8}) (10^4)^4 = 5.67 \times 10^{-8} \times 10^{16}$

$= 5.67 \times 10^8 \text{ W/m}^2$

\Rightarrow The luminosity is $L = 5.67 \times 10^8 \text{ W/m}^2$