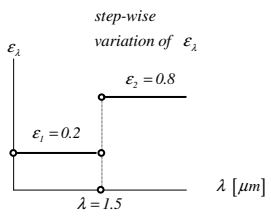
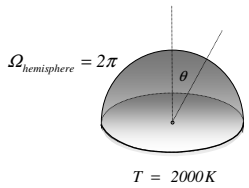
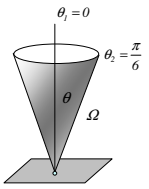
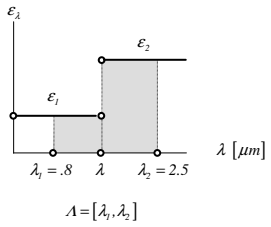
12.39 $\left(7^{th}\ Ed\right)$







$$\Omega: \begin{matrix} 0 \le \theta \le \frac{\pi}{6} \\ 0 \le \phi \le 2\pi \end{matrix}$$



$\Lambda = [\lambda_1, \lambda_2]$

a

$$\varepsilon = \frac{E}{E_b} = \frac{\int_0^\infty E_\lambda d\lambda}{E_b} = \frac{\int_0^\infty \varepsilon_\lambda E_{\lambda b} d\lambda}{E_b} = \varepsilon_1 F_{0\to\lambda=1.5}(T=2000K) + \varepsilon_2 F_{\lambda=1.5\to\infty}(T=2000K) = (0.2)\cdot(0.2732)+(0.8)\cdot(1-0.2732) = 0.636$$

b

$$E_{\lambda,\Omega} = \int_\Omega I_{\lambda,\theta}\cos\theta\, d\omega$$

$$= I_{\lambda,n}\int_\Omega \cos\theta\, d\omega$$

$$= I_{\lambda,n}\int_{\phi=0}^{2\pi}\int_{\theta=0}^{\pi/6} \cos\theta\ \sin\theta\, d\theta d\phi$$

$$= 2\pi I_{\lambda,n}\int_{\theta=0}^{\pi/6} \cos\theta\ \sin\theta\, d\theta$$

$$= 2\pi I_{\lambda,n}\int_{\theta=0}^{\pi/6} \sin\theta\, d[\sin\theta]$$

$$= 2\pi I_{\lambda,n}\left[\frac{\sin^2\theta}{2}\right]_0^{\pi/6}$$

$$= \pi I_{\lambda,n}\left[\frac{1}{4}-0\right]$$

$$= \frac{\pi I_{\lambda,n}}{4}$$

$$= \frac{E_\lambda}{4}$$

$$E_{\Lambda,\Omega} = \int_\Lambda E_{\lambda,\Omega} d\lambda$$

$$= \int_{\lambda_1}^{\lambda_2} E_{\lambda,\Omega} d\lambda$$

$$= \frac{1}{4}\int_{\lambda_1}^{\lambda_2} E_\lambda\, d\lambda$$

$$= \frac{1}{4}\int_{\lambda_1}^{\lambda_2} \varepsilon_\lambda E_{b\lambda}\, d\lambda$$

$$= \frac{1}{4}\left[\int_{\lambda_1}^{\lambda} \varepsilon_\lambda E_{b\lambda}\, d\lambda + \int_{\lambda}^{\lambda_2} \varepsilon_\lambda E_{b\lambda}\, d\lambda\right]$$

$$= \frac{E_b}{4}\left[\varepsilon_1 \frac{\int_{\lambda_1}^{\lambda} E_{b\lambda}\, d\lambda}{E_b} + \varepsilon_2 \frac{\int_{\lambda}^{\lambda_2} E_{b\lambda}\, d\lambda}{E_b}\right]$$

$$= \frac{E_b}{4}\left[\varepsilon_1 F_{\lambda_1\to\lambda} + \varepsilon_2 F_{\lambda\to\lambda_2}\right]$$

$$= \frac{E_b}{4}\left[\varepsilon_1\left(F_{0\to\lambda} - F_{0\to\lambda_1}\right) + \varepsilon_2\left(F_{0\to\lambda_2} - F_{0\to\lambda}\right)\right]$$

$$= \frac{\sigma T^4}{4}\underbrace{\left[\varepsilon_1\left(F_{0\to\lambda} - F_{0\to\lambda_1}\right) + \varepsilon_2\left(F_{0\to\lambda_2} - F_{0\to\lambda}\right)\right]}_{\varepsilon_\Lambda}$$

$$= \frac{\sigma T^4}{4}(0.339)$$

$$= 76{,}900\ \left[\frac{W}{m^2}\right]$$