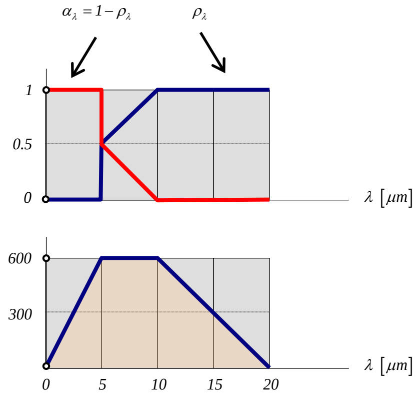
12.49 *7th*



a $\alpha_\lambda = 1-\rho_\lambda$

b $$G = \int_0^\infty G_\lambda \, d\lambda = \overbrace{\frac{5\cdot 600}{2} + 5\cdot 600 + \frac{10\cdot 600}{2}}^{\text{area under curve}} = 7500 \left[\frac{W}{m^2}\right]$$

c $$G_{\lambda,abs} = \alpha_\lambda \cdot G_\lambda$$

$$G_{abs} = \int_0^\infty G_{\lambda,abs}\, d\lambda = \int_0^\infty \alpha_\lambda G_\lambda d\lambda = \int_0^5 \alpha_\lambda G_\lambda d\lambda + \int_5^{10} \alpha_\lambda G_\lambda d\lambda + \int_{10}^{20} \alpha_\lambda G_\lambda d\lambda$$

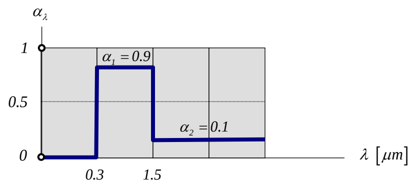
$$= \int_0^5 (1) G_\lambda d\lambda + \int_5^{10} \alpha_\lambda (600)\, d\lambda + \int_{10}^{20} (0) G_\lambda d\lambda$$

$$= \int_0^5 G_\lambda d\lambda + 600 \cdot \int_5^{10} \alpha_\lambda \, d\lambda$$

$$= \frac{5\cdot 600}{2} + 600 \cdot \frac{5\cdot 0.5}{2} = 2250 \left[\frac{W}{m^2}\right]$$

d $$\alpha = \frac{G_{abs}}{G} = \frac{2250}{7500} = 0.3$$

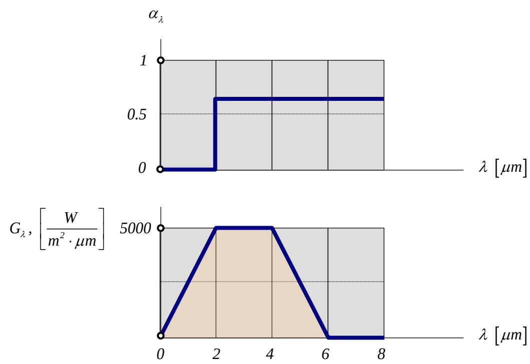
12.56 *7th*



$T_b = 5800K$ $\quad\alpha = \alpha_1 \cdot F_{0.3\to1.5}(T_b) + \alpha_2 \cdot F_{1.5\to\infty}(T_b) = (0.9)\cdot(0.881\text{-}0.0326)+(0.1)\cdot(1\text{-}0.881) = 0.775$

$T_s = 340K$ $\quad\varepsilon = \alpha_1 \cdot F_{0.3\to1.5}(T_s) + \alpha_2 \cdot F_{1.5\to\infty}(T_s) = (0.9)\cdot(0\text{-}0)+(0.1)\cdot(1\text{-}0) = 0.1$

12.57 *7th*



a $G_{\lambda,abs} = \alpha_\lambda \cdot G_\lambda$

$$G_{abs} = \int_0^\infty G_{\lambda,abs}\, d\lambda = \int_0^\infty \alpha_\lambda G_\lambda d\lambda = \int_0^2 \alpha_\lambda G_\lambda d\lambda + \int_2^4 \alpha_\lambda G_\lambda d\lambda + \int_4^6 \alpha_\lambda G_\lambda d\lambda$$

$$= \int_0^2 (0) G_\lambda d\lambda + \int_2^4 (0.6)(5000)\, d\lambda + \int_4^6 (0.6) G_\lambda d\lambda$$

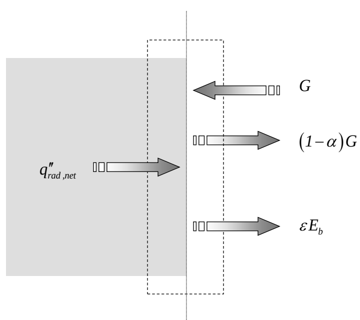
$$= 0 + (0.6)\cdot(5000)\cdot(2) + (0.6)\cdot\frac{2\cdot 5000}{2} = 9{,}000 \left[\frac{W}{m^2}\right]$$

$$G = \int_0^\infty G_\lambda\, d\lambda = \overbrace{\frac{2\cdot 5000}{2} + 2\cdot 5000 + \frac{2\cdot 5000}{2}}^{\text{area under curve}} = 20{,}000 \left[\frac{W}{m^2}\right]$$

$$\alpha = \frac{G_{abs}}{G} = \frac{9{,}000}{20{,}000} = 0.45$$

b $T_s = 1000K$

$$\varepsilon = \alpha_2 \cdot \left[1 - F_{0\to 2}(T_s)\right] = (0.6)\cdot(1 - 0.0667) = 0.56$$



c $q''_{rad,net} = \varepsilon E_b + (1-\alpha)G - G = \varepsilon E_b - \alpha G$

$$= (0.56)(5.67e-8)(1000)^4 - (0.45)(20{,}000) = 22{,}750 \left[\frac{W}{m^2}\right]$$

from the surface