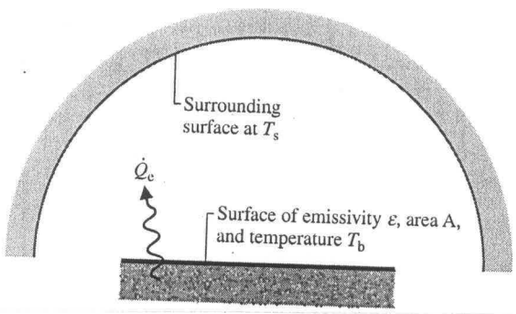
PROBLEM 2.49

(a) Referring to Fig. 2.13, determine the net rate of radiant exchange, in W, for $\varepsilon = 0.8$, A = 0.125 m^2, $T_b = 475$ K, $T_s = 298$ K.



Using Eq. 2.33,

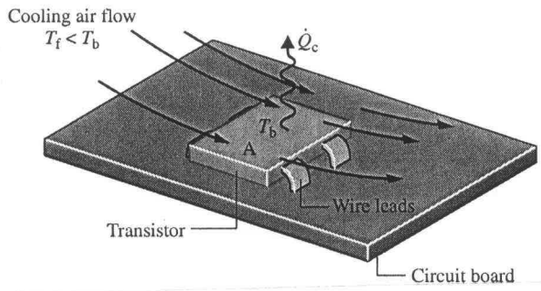
$$\dot{Q}_e = \epsilon \sigma A [T_b^4 - T_s^4]$$

$$= (0.8)\left(\frac{5.67\ W}{10^8\ m^2 \cdot K^4}\right)(0.125\ m^2)\left[(4.75\times10^2)^4 - (2.98\times10^2)^4\right] K^4$$

$$= 0.8(5.67)(0.125)\left[(4.75)^4 - (2.98)^4\right] W$$

$$= 243.93\ W \longleftarrow$$

(b) Referring to Fig. 2.14, determine the rate of convection heat transfer from the surface to the air, in W, for h = 10 W/m^2 · K, A = 0.125 m^2, $T_b = 305$ K, $T_f = 298$ K.



Using Eq. 2.34,

$$\dot{Q}_c = h A [T_b - T_f]$$

$$= \left(10\frac{W}{m^2 \cdot K}\right)(0.125\ m^2)[305 - 298]\ K$$

$$= 8.75\ W \longleftarrow$$