(b) Radiation Equilibrium

At equilibrium, power absorbed equals power emitted: $I(\pi R^2) + \sigma(4\pi R^2)T_{\text{env}}^4 = \sigma(4\pi R^2)T_{\text{eq}}^4$.

$$T_{\text{eq}}^4 = \frac{I}{4\sigma} + T_{\text{env}}^4$$

$$T_{\text{eq}} = \left(\frac{2400}{4(5.67 \times 10^{-8})} + (300.15)^4\right)^{1/4} \approx 369.7\,\text{K}$$