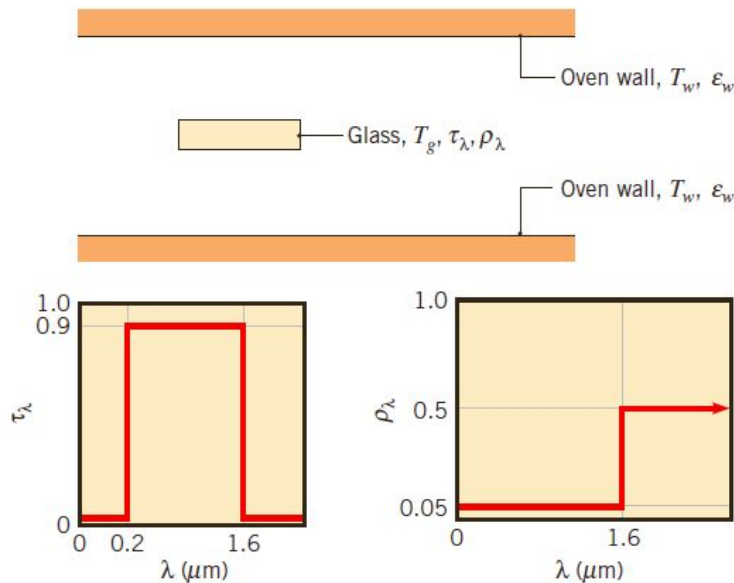


12.2 A horizontal, opaque surface at a steady-state temperature of 77°C is exposed to an airflow having a free stream temperature of 27°C with a convection heat transfer coefficient of $28 \text{ W/m}^2 \cdot \text{K}$. The emissive power of the surface is 628 W/m^2 , the irradiation is 1380 W/m^2 , and the reflectivity is 0.40. Determine the absorptivity of the surface. Determine the net radiation heat transfer rate for this surface. Is this heat transfer to the surface or from the surface? Determine the combined heat transfer rate for the surface. Is this heat transfer to the surface or from the surface?

12.76 A thermocouple whose surface is diffuse and gray with an emissivity of 0.6 indicates a temperature of 180°C when used to measure the temperature of a gas flowing through a large duct whose walls have an emissivity of 0.85 and a uniform temperature of 450°C .

(a) If the convection heat transfer coefficient between the thermocouple and the gas stream is $h = 125 \text{ W/m}^2 \cdot \text{K}$ and there are negligible conduction losses from the thermocouple, determine the temperature of the gas.

12.73 A special diffuse glass with prescribed spectral radiative properties is heated in a large oven. The walls of the oven are lined with a diffuse, gray refractory brick having an emissivity of 0.75 and are maintained at $T_w = 1800 \text{ K}$. Consider conditions for which the glass temperature is $T_g = 750 \text{ K}$.



- (a) What are the total transmissivity τ , the total reflectivity ρ , and the total emissivity ϵ of the glass?
- (b) What is the net radiative heat flux, $q''_{\text{net,in}}$ (W/m^2), to the glass?