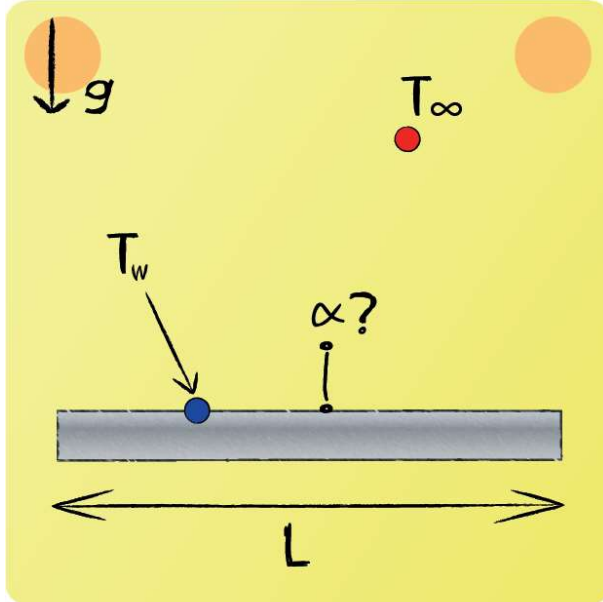


Heat Transfer Correlation 20



A horizontal plate stands in a non-moving ideal gas. Calculate the mean heat transfer coefficient $\bar{\alpha}$ on the upper surface.

Coefficient of volume expansion for an ideal gas:

$$\beta = \frac{1}{T_F} = \frac{1}{(T_W + T_\infty)/2} = 0.0035 \text{ K}^{-1}$$

And thus:



$$\text{Gr}_L \cdot \text{Pr} = \frac{g \cdot \beta \cdot (T_\infty - T_W) \cdot L^3}{\nu^2} \cdot \text{Pr} = 3.20 \cdot 10^5$$

Nusselt number:

$$\overline{\text{Nu}}_L = 0.27 \cdot (\text{Gr}_L \cdot \text{Pr})^{\frac{1}{4}} = 6.42$$

Heat transfer coefficient:

$$\bar{\alpha} = \frac{\overline{\text{Nu}}_L \cdot \lambda_f}{L} = 5.01 \text{ W/m}^2\text{K}$$