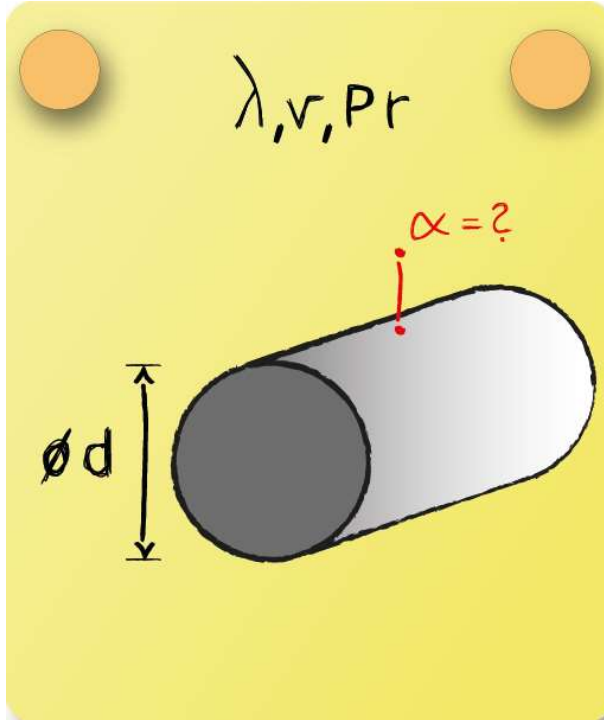# Heat Transfer Correlation 16

A cylinder with a constant temperature stands in non-moving ideal gas. Calculate the mean heat transfer coefficient $\bar{\alpha}$.

Coefficient of volume expansion for an ideal gas:

$$\beta = \frac{1}{T_{\mathrm{F}}} = \frac{1}{(T_{\mathrm{W}} + T_\infty)/2} = 0.0032 \ \mathrm{K}^{-1}$$

And thus:

$$\mathrm{Gr_d} \cdot \mathrm{Pr} = \frac{g \cdot \beta \cdot (T_{\mathrm{W}} - T_\infty) \cdot d^3}{\nu^2} \cdot \mathrm{Pr} = 2.86 \cdot 10^6$$

Nusselt number:

$$\overline{\mathrm{Nu_d}} = 0.53 \cdot (\mathrm{Gr_d} \cdot \mathrm{Pr})^{\frac{1}{4}} = 21.79$$

Heat transfer coefficient:

$$\bar{\alpha} = \frac{\overline{\mathrm{Nu_d}} \cdot \lambda_{\mathrm{f}}}{d} = 5.60 \ \mathrm{W/m^2K}$$