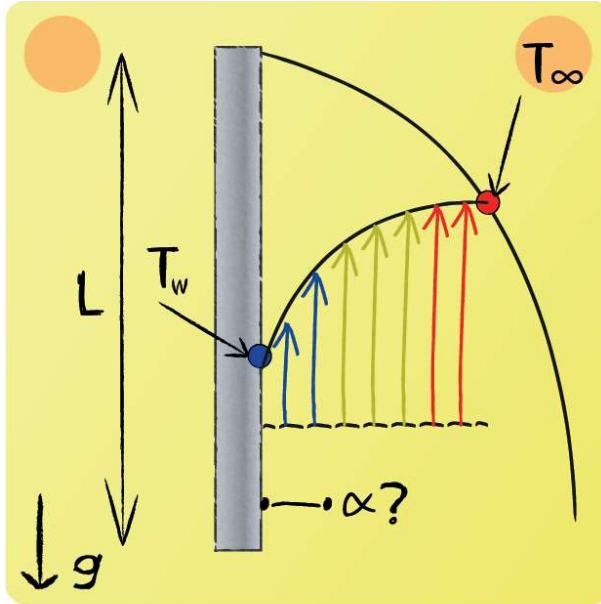# Heat Transfer Correlation 14

A vertical plate with a constant temperature stands in the non-moving water vapour (ideal gas). Calculate the mean heat transfer coefficient $\bar{\alpha}$.

Coefficient of volume expansion for an ideal gas:

$$\beta = \frac{1}{T_\mathrm{F}} = \frac{1}{\left(T_\mathrm{W} + T_\infty\right)/2} = 0.0028 \ \mathrm{K}^{-1}$$

And thus:

$$\mathrm{Gr_L} \cdot \mathrm{Pr} = \frac{g \cdot \beta \cdot (T_\mathrm{F} - T_\mathrm{w}) \cdot L^3}{\nu^2} \cdot \mathrm{Pr} = 1.56 \cdot 10^8$$

Nusselt number:

$$\overline{\mathrm{Nu_L}} = 0.535 \cdot \left(\mathrm{Gr_L} \cdot \mathrm{Pr}\right)^{\frac{1}{4}} = 59.79$$

Heat transfer coefficient:

$$\bar{\alpha} = \frac{\overline{\mathrm{Nu_L}} \cdot \lambda_\mathrm{f}}{L} = 3.00 \ \mathrm{W/m^2K}$$