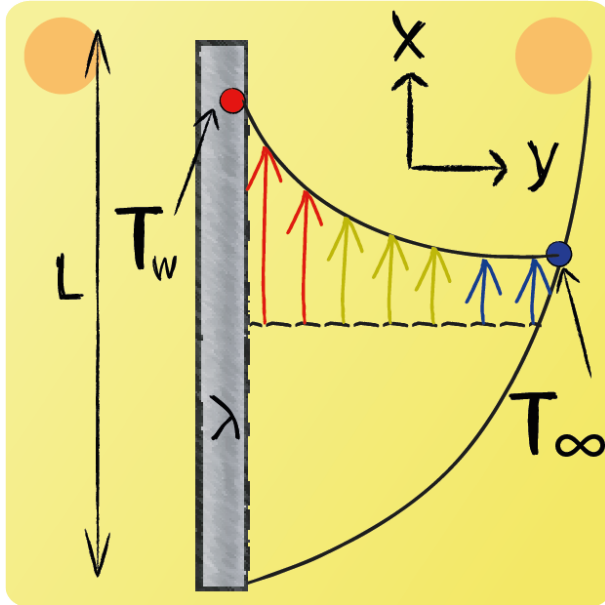# Lecture 3 - Question 5

Consider natural convection that is isothermal and laminar over a flat plate. $L = 0.1m$, $Gr_{\mathrm{L}} = 3.05 \cdot 10^6$, $Pr = 0.73$, $\lambda = 70\ W/mK$. Determine the average heat transfer coefficient. Assume steady-state heat transfer.

$$Gr_L \cdot Pr = 2.23 \cdot 10^6\ <\ 4 \cdot 10^9$$

$$\bar{Nu} = 0.677 \left(\frac{Pr}{0.952+Pr}\right)^{\frac{1}{4}} (Gr_L Pr)^{\frac{1}{4}}$$

$$\bar{Nu} = 0.677 \left(\frac{0.73}{0.952+0.73}\right)^{\frac{1}{4}} (3.05 \cdot 10^6 \cdot 0.73)^{\frac{1}{4}}\ =\ 21.23$$

$$\bar{\alpha} = \frac{\bar{Nu} \cdot \lambda}{L}\ =\ \frac{21.23 \cdot 70}{0.1}\ =\ 1.49 \cdot 10^4\ \left[\frac{W}{m^2 K}\right]$$