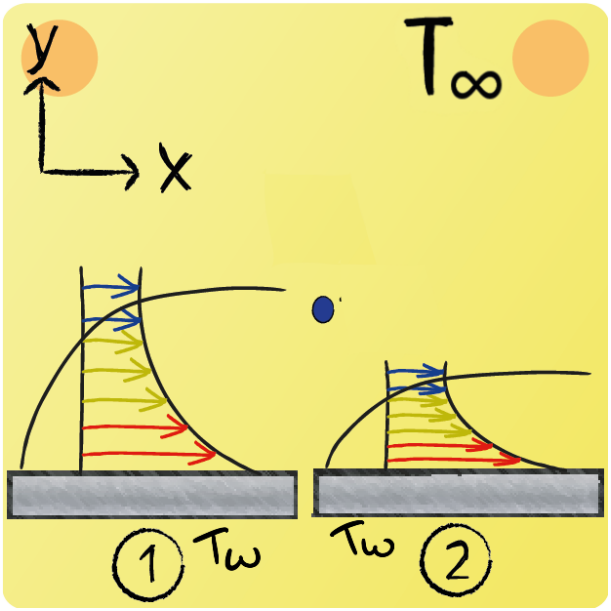
Lecture 2 - Question 1



Consider the following two thermal boundary layers. For the two boundary layers T_w and T_∞ are identical. Which of the two will have a bigger heat transfer coefficient? Assume steady-state heat transfer and an ideal gas.

For situation 1 the Prandtl number is smaller. Remembering the definition of the Prandtl number:

$$Pr = \frac{\nu}{a} = \frac{Diffusive\ Momentum\ transport}{Diffusive\ Heat\ transport}$$

The thermal boundary layer is smaller in case 2, which means that the heat transfer rate through the second boundary layer is higher. In other words, a higher heat transfer coefficient in the second case leads to a smaller thermal boundary layer thickness.