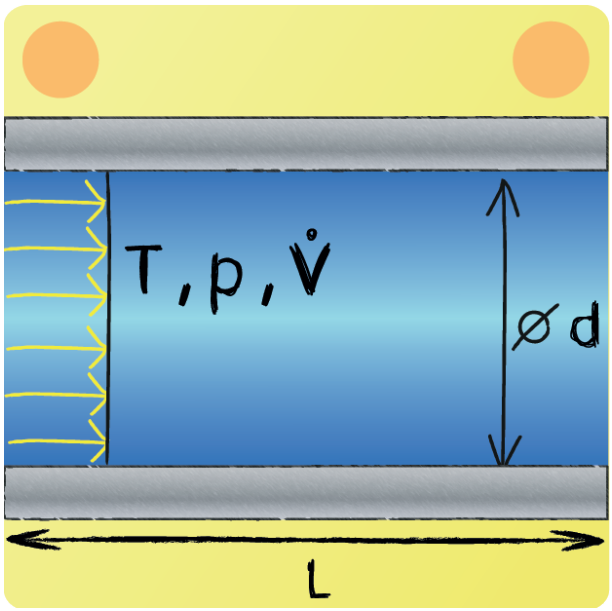
# Exam Preparation Convection 03




Air passes turbulently through a pipe (diameter $d$) for cooling purposes. How does the heat transfer coefficient change if the pressure $p$ is increased, while the temperature $T$ and the volume flow rate $\dot{V}$ remain constant? Pick the right relationship whether the numerical value of parameters will increase or decrease.

The heat transfer coefficient $\alpha$ is defined as:

$$\alpha = \frac{Nu \cdot \lambda}{D}$$

According to the problem set $\lambda$ and D are constant.

$$Nu = f(Re, Pr)$$

The Prandl-number stays constant, since according to the problem set the relevant physical properties are independent of pressure. For the Reynolds-number can be written:

$$Re = \frac{\rho \cdot u \cdot D}{\eta}$$

Since the volume flow rate is not changed, not only the diameter D and $\eta$ but also the velocity u stays constant. For air as ideal gas, it can be written:

$$p \cdot V = m \cdot R \cdot T \Rightarrow p = \rho \cdot R \cdot T$$

Therefore an increase in pressure results in an increase of the air density and consequently in an increase of the Reynolds-number.The growth of the Reynolds-number results in an increase of the Nusselt-number and therefore in an increase of the heat transfer coefficient.