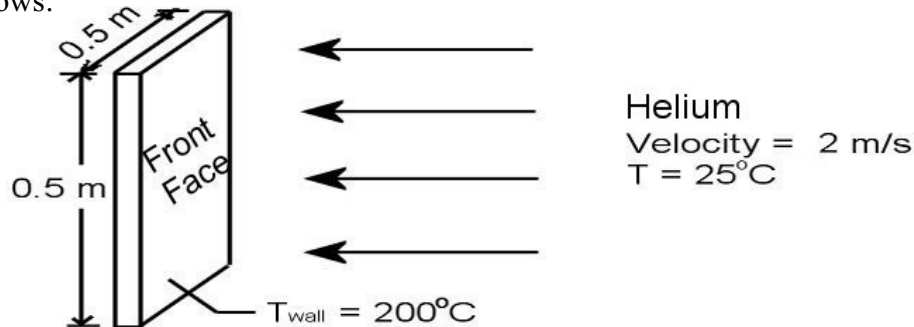


I. 50 points

Helium at 25°C and 1 atm flows perpendicular to a 0.5m square flat plate that is maintained at 200°C as follows:



A. 20 points

Find the heat transfer coefficient, h_{front} , in $\text{W/m}^2\text{-K}$ for the front face of the plate (the face turned toward the helium flow) assuming that forced convection dominates over natural convection.

B. 20 points

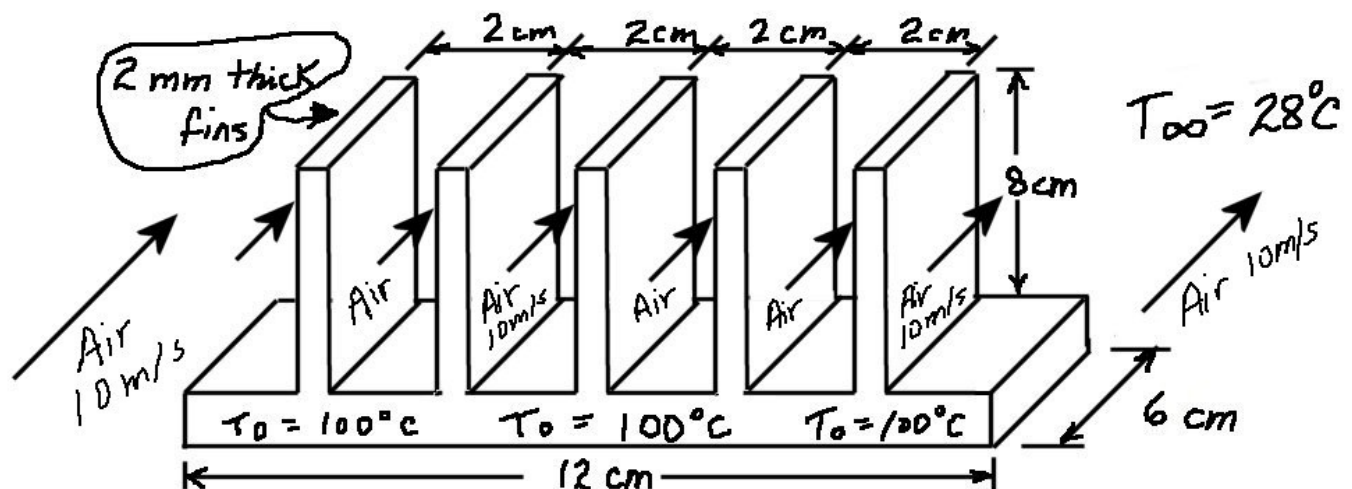
Find the heat transfer coefficient, h_{back} , in $\text{W/m}^2\text{-K}$ for the back face of the plate (the face turned away from the helium flow where flow is stagnant) assuming that natural convection dominates over forced convection.

C. 10 points

Find the total heat transfer rate to the surroundings.

II. 50 points

Air at 28°C and 1 atm is forced over the following heat sink made of 304 stainless steel using a fan such that the velocity of the air between and around the fins is 10 m/s. No heat is lost underneath the heat sink, and you may neglect heat transferred from the edges and ends of the fins. Estimate the total heat transfer rate to the



surroundings. Show your work!