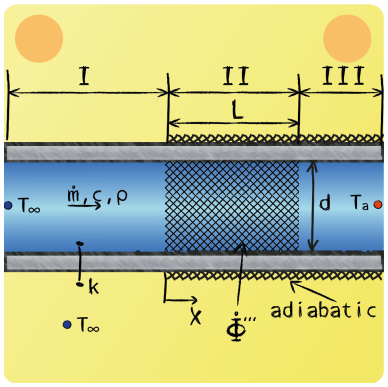
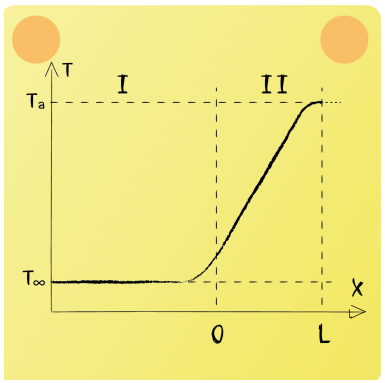
Lecture 7 Question 5.1

Water flows through a long tube which has adiabatic walls from a certain location $x = 0$. The area upstream of $x = 0$ is named region I. Between the point $x = 0$, and $x = L$ (region II) a very fine-meshed, electrically heated grid is located in the flow. Well ahead of the grid, the flow has the ambient temperature T_∞ and downstream of the grid, the temperature T_a.
Sketch the temperature profiles of the water in the pipe with consideration of the diffusive heat transport





Diffusive heat transport (=conduction) should be considered. Therefore, some heat will be transferred in the opposite direction to the flow. And thus, just a before region II, the flow temperature start to rise from T_∞ and some heat will be transferred to the environment.

Just before the end of region II, the temperature should already have reached T_a, with a zero slope gradient at the end.