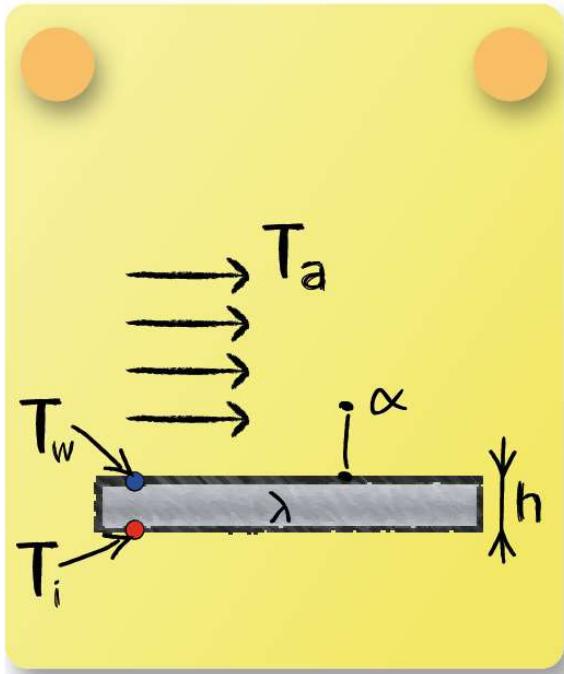


## Lecture 6 - Question 3



Air blows over a horizontal steel hot plate. The plate surface is maintained at a constant temperature. Determine the heat transfer coefficient  $\alpha$ . Take  $T_a = 20^\circ C$ ,  $h = 0.1 m$ ,  $T_w = 30^\circ C$ ,  $T_i = 100^\circ C$ ,  $\lambda = 2 W/mK$ .

In case of steady state heat transfer, the conductive and convective heat fluxes must equal each other in order to satisfy the energy conservation.

$$\dot{Q}_{cond} = \dot{Q}_{conv}$$

$$-\lambda \cdot A_s \cdot \frac{T_w - T_i}{h} = \alpha \cdot A_s \cdot (T_w - T_a)$$

Rewriting yields:

$$\alpha = -\lambda \cdot \frac{T_w - T_i}{h} \frac{1}{(T_w - T_a)}$$

Filling in the numerical values:

$$\alpha = -2 \cdot \frac{30 - 100}{0.1} \frac{1}{(30 - 20)} = 140 W/m^2 K$$

