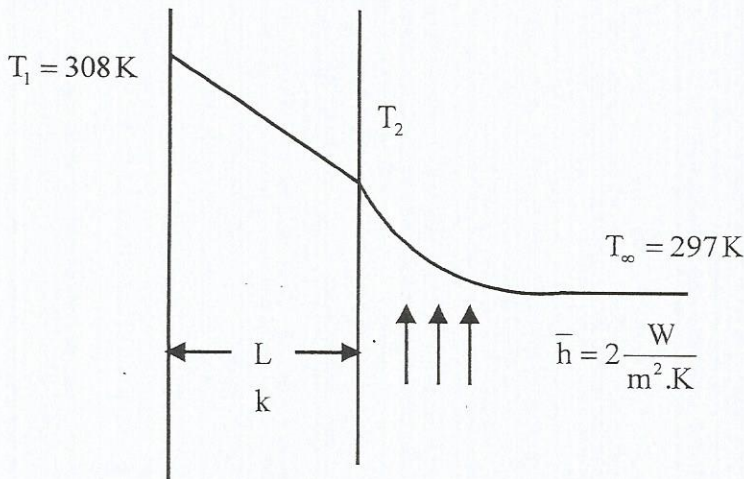


Cankaya University  
Faculty of Engineering  
Mechanical Engineering Department  
ME 313 Heat Transfer  
Fall 2017  
Quiz # 1

Consider the flat plate shown in the figure. There is convection on the right side of the plate. System is operating under steady state conditions. Numerical data is given in the figure. Determine the unknown temperature.



$k = 240 \text{ W/m.K}$   
 $L = 10 \text{ cm}$

here  $k$  is very high  
 $\bar{h}$  is very low

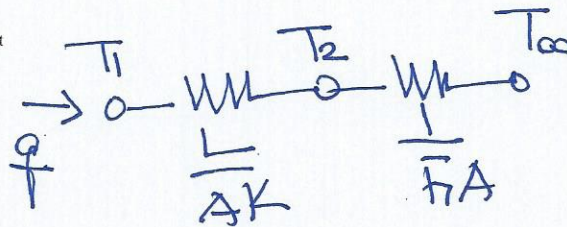
Equations:

$$q'' = -k \frac{dT}{dx}$$

$$q_c'' = \bar{h}(T_w - T_\infty)$$

$$\dot{E}_{in} - \dot{E}_{out} + \dot{E}_g = \dot{E}_{st}$$

$$\dot{E}_{st} = \rho c V \frac{dT}{dt}$$



$$q = \frac{T_1 - T_\infty}{\frac{L}{Ak} + \frac{1}{hA}}$$

let  $A = 1 \text{ m}^2$

$$q = \frac{308 - 297}{\frac{0.1}{240} + \frac{1}{2}} = \frac{11}{0.0004166 + 0.5}$$

$$= 21.9816 \text{ W}$$

$$q = (T_1 - T_2) / \left(\frac{L}{Ak}\right) \Rightarrow T_2 = T_1 - \frac{L}{Ak} q$$

$$T_2 = 308 - \frac{0.1}{240} (21.9816) = 307.99 \text{ K}$$