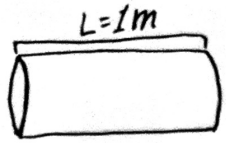
Conduction, Convection, or Radiation

$k_{Al} = 400 \frac{W}{m \cdot K}$

1)



$T_H = 600K$

fire

ice

$T_c = 273K$

$$\frac{Q}{\Delta t} = \frac{kA}{L}\Delta T = \frac{\left(400 \frac{W}{m \cdot K}\right)\left(0.5 \times 10^{-4} m^2\right)}{1m}(600K - 273K)$$

($\frac{Q}{\Delta t}$: rate of energy transfer)

$$\rightarrow \boxed{\frac{Q}{\Delta t} = 6.54\ W}$$

$A = 0.5\ cm^2 = 0.5\ (cm)(cm) \times \frac{10^{-2} m}{1\ cm} \times \frac{10^{-2} m}{1\ cm}$

$$\rightarrow \boxed{A = 0.5 \times 10^{-4} m^2}$$

2.) Radiation: $\frac{Q_{net}}{\Delta t} = \varepsilon \sigma A (T_1^4 - T_2^4)$

b/c blackbody

$\sigma = 5.67 \times 10^{-8} \frac{W}{m^2 K^4}$, $\varepsilon = 1$

$A = 0.5 \times 10^{-4} m^2$

$T_{Cu} = 450K$

$T_{Room} = 300K$

$$\rightarrow \frac{Q_{net}}{\Delta t} = (1)\left(5.67 \times 10^{-8} \frac{W}{m^2 K^4}\right)\left(0.5 \times 10^{-4} m^2\right)\left((450K)^4 - (300K)^4\right)$$

$$\rightarrow \frac{Q_{net}}{\Delta t} = 0.093\ W$$

3.) Jimmy is correct. Convection (placing a fan in front of the oven door) transfers thermal energy more quickly than radiation.