Quiz 9/21/04

① a.) $q''_B = q''_C$

There is no generation in (B) and (C) (You can tell this by the linear temp profile).

An energy balance at (3) shows that what leaves (B) goes to (C)

① (b) q_A increases with distance. The temperature becomes steeper throughout (A). This is probably due to generation

① (c) $q''_A\big|_{③} = q''_B\big|_{②}$ At this interface there is no generation, so it follows that it is the same reason as (a)

① (d) $q''_B = q''_C$ (from a.))

$$-K_B \frac{\partial T}{\partial x}\Big|_B = -K_C \frac{\partial T}{\partial x}\Big|_C$$

$$\frac{\partial T}{\partial x}\Big|_B < \frac{\partial T}{\partial x}\Big|_C \quad \therefore K_B > K_C$$

(Also the largest temp drop is typically the lowest conductance, or the highest resistance)

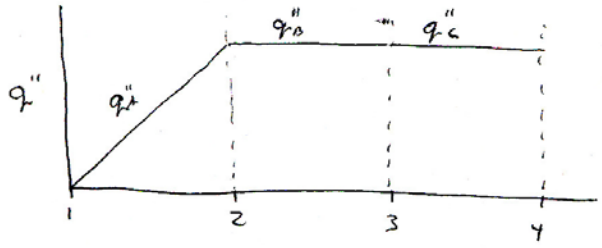
① e.) Here we have to look at the approach to ②. [Part (c)]

At the interface, we can say $q''_A\big|_{②} = q''_B\big|_{②}$

$$-K_A \frac{\partial T}{\partial x}\Big|_{②,A} = -K_B \frac{\partial T}{\partial x}\Big|_{②,B}$$

$$\frac{\partial T}{\partial x}\Big|_{②A} > \frac{\partial T}{\partial x}\Big|_{②,B} \quad \therefore \quad K_A < K_B$$

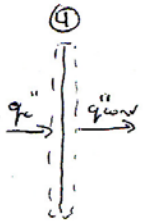
(3) f.)



(1) g.) At pt. ①, $\left.\frac{dT}{dx}\right|_0 = 0$. This implies there is no heat transfer $\left[q'' = -k\frac{dT}{dx} = -k(0) = 0\right]$.

This could be a strong thermal insulator (adiabatic condition) or the line of symmetry for the system.

(2) h.)



Energy Balance at ④

$E_{in} - E_{out} + E_{gen} = E_{stor}$

$q''_{cond} = q''_{conv}$

$$\boxed{-k_c \left.\frac{dT}{dx}\right|_4 = h\left(T_4 - T_\infty\right)}$$