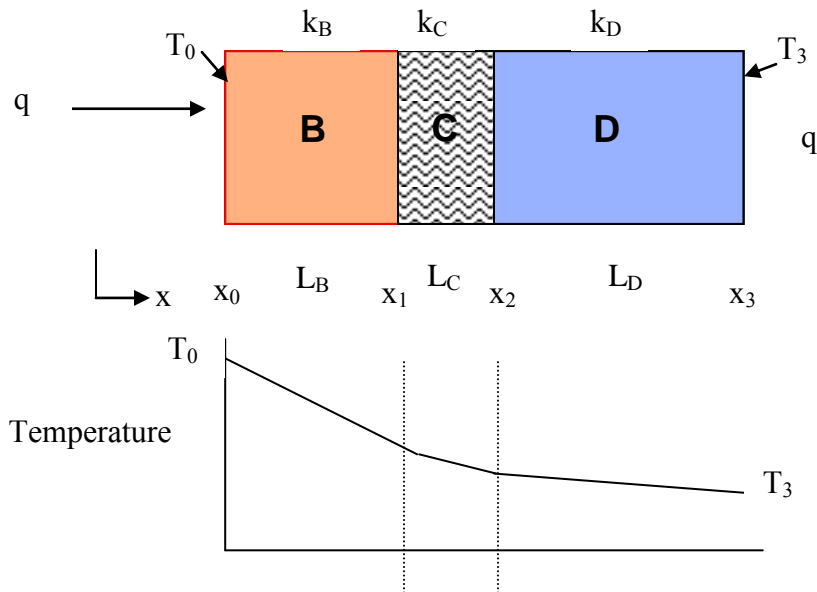


## HEAT CONDUCTION IN MULTILAYERED SYSTEMS

### COMPOSITE RECTANGULAR WALL (IN SERIES)



In a single layer, the rate of heat transfer is:

$$q = -kA \frac{dT}{dx}$$

Then

$$dT = -\frac{qdx}{kA}$$

or,

$$\Delta T = -\frac{q\Delta x}{kA}$$

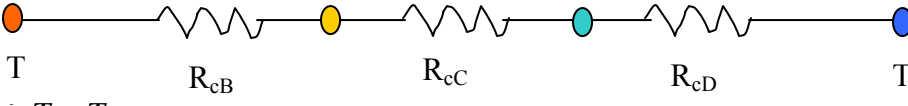
$$\Delta T_D = -\frac{qL_D}{k_D A}$$

$$\Delta T = \Delta T_B + \Delta T_C + \Delta T_D$$

$$T_0 - T_3 = -\frac{q}{A} \left( \frac{L_B}{k_B} + \frac{L_C}{k_C} + \frac{L_D}{k_D} \right)$$

In the preceding equation, for the conditions described in the figure where  $q$  is **positive** in the right direction and  $T_0 > T_3$ ,  $L_B$ ,  $L_C$  and  $L_D$  will be **negative** values, ( $x_0 - x_1$ ,  $x_1 - x_2$ , and  $x_2 - x_3$ ). Therefore,

**Using the Resistance Concept:**



The diagram shows a horizontal line representing a thermal circuit. It starts with an orange circle on the left labeled 'T'. This is followed by a zigzag line representing a thermal resistor labeled 'R<sub>cB</sub>'. This is followed by a yellow circle. This is followed by another zigzag line representing a thermal resistor labeled 'R<sub>cC</sub>'. This is followed by a cyan circle. This is followed by a third zigzag line representing a thermal resistor labeled 'R<sub>cD</sub>'. Finally, it ends with a blue circle on the right labeled 'T'.

$$q = \frac{T_0 - T_3}{R_{cB} + R_{cC} + R_{cD}}$$

$$R_{cD} = \frac{L_D}{k_D A}$$

and

$$q = \frac{T_0 - T_3}{\frac{L_B}{k_B A} + \frac{L_C}{k_C A} + \frac{L_D}{k_D A}}$$