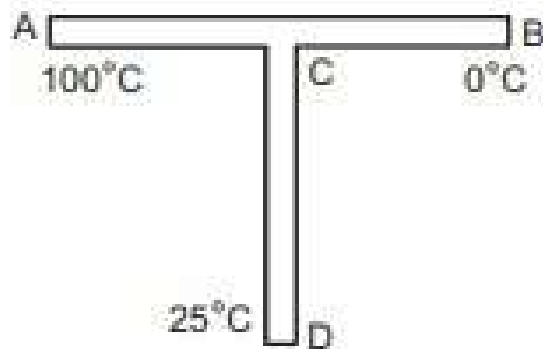


A rod  $CD$  of thermal resistance  $5.0 \text{ K W}^{-1}$  is joined at the middle of an identical rod  $AB$  as shown in figure. The ends  $A$ ,  $B$  and  $D$  are maintained at  $100^\circ\text{C}$ ,  $0^\circ\text{C}$  and  $25^\circ\text{C}$  respectively. Find the heat current in  $CD$ .



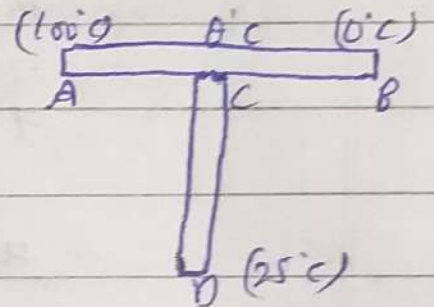
Let the temperature at junction (i.e. at 'C') be  $\theta$ .

Then,

$$\left(\text{Heat current}\right)_{AC} = \left(\text{Heat current}\right)_{CB} + \left(\text{Heat current}\right)_{CD}$$

$$\Rightarrow \left(\frac{\Delta T}{R}\right)_{AC} = \left(\frac{\Delta T}{R}\right)_{CB} + \left(\frac{\Delta T}{R}\right)_{CD}$$

$$\Rightarrow \left(\frac{100 - \theta}{2.5}\right) = \left(\frac{\theta - 0}{2.5}\right) + \left(\frac{\theta - 25}{5.0}\right)$$



$$\Rightarrow \boxed{\theta = 45^\circ\text{C}}$$

$$\therefore \left(\text{Heat current}\right)_{CD} = \left(\frac{\theta - 25}{5.0}\right)$$

$$= \left(\frac{45 - 25}{5.0}\right)$$

$$\boxed{\left(\text{Heat current}\right)_{CD} = 4\text{W}}$$