1

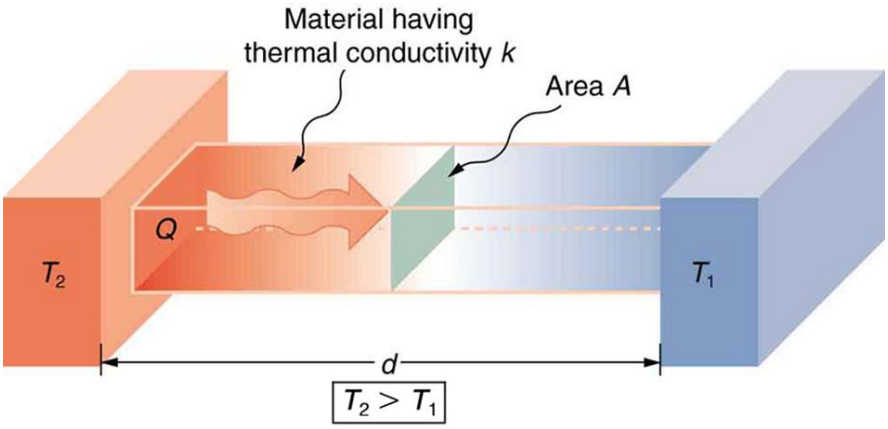

Fig. 1.1

Consider a conductor of uniform cross-section that is insulated so that no heat escapes from its surface except at the ends. Let the two ends of the conductor be maintained at temperatures T_2 and T_1 such that $T_2 > T_1$. Let its length be d and the cross-sectional area be A (see Fig. 1.1)

The rate of heat flow through the conductor is given by $\frac{Q}{t} = kA\frac{T_2 - T_1}{d}$ where k is known as the thermal conductivity of the material.

(a) Determine the S.I. base units of k.

S.I. base units of k = ……[2]

(b) Temperatures T_2 and T_1 are measured as (100 ± 2) °C and (20 ± 2) °C respectively. Calculate the fractional uncertainty in $\frac{Q}{t}$ assuming the uncertainties in k, A and d are negligible.

Fractional Uncertainty = ……. [3]

(c) A slab of a thermal conductor is 100 cm^2 in cross section and 2.0 cm thick. Its thermal conductivity is 0.10 in S.I. units. If the temperature difference between opposite faces of the slab is 100 ^0C, calculate the amount of thermal energy flowing through the slab in one day.

Energy = …… ……. J [3]

(d) Suggest why good electrical conductors are usually also good thermal conductors.

……

……

…… [2]

[Total: 10]