Answer on Question #41560, Physics, Other

Determine the quantity of heat conducted in thirty minutes through an iron plate 2.0 cm thick and 0:10m2 in area if the temperatures of the two sides are 0oC and 20oC. The coefficient of thermal conductivity of iron is 50.4 J/smC.

$9.1 \cdot 10^6 J$ $2.3 \cdot 10^6 J$ $4.1 \cdot 10^6 J$ $3.3 \cdot 10^6 J$

Solution

The area of an iron plate is $A = 0.10\ m^2$, thickness of an iron plate is $d = 2.0\ \text{cm} = 0.020\ \text{m}$, the temperatures of the two sides of an iron plate are $T_1 = 0℃$ and $T_2 = 20℃$, the coefficient of thermal conductivity of iron is $k = 50.4\ \frac{J}{sm℃}$, the time is $t = 30\ min = 1800\ s$.

According to Fourier's law the quantity of heat is

$$Q = k\frac{A\Delta T}{d} \cdot t = 50.4 \cdot \frac{0.10(20-0)}{0.020} \cdot 1800 = 9072000J = 9.1 \cdot 10^6 J.$$

Answer: $\mathbf{9.1 \cdot 10^6 J}$.