

## 5.2 - Thermal Conduction

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- (1999) What is the coefficient of thermal conductivity of a material?
- (1999) The temperature difference between the inside and outside of a room is  $25^{\circ}\text{C}$ . The room has a window of an area  $2\text{ m}^2$  and the thickness of the window material is  $2\text{ mm}$ . Calculate the heat flow through the window if the coefficient of thermal conductivity of the window material is  $0.5\text{ SI units}$ .
- (2000) Define the thermal conductivity of a material
- (2000) Give one major similarity and one major difference between heat conduction and wave propagation.
- (2000) Deep bore holes into the earth show that the temperature increases about  $1^{\circ}\text{C}$  for each  $30\text{ m}$  depth. How much heat flows out from the core of the earth each second for each square metre of surface area.
- (2007) Explain why in cold climates, windows of modern buildings are double glazed, ie: There are two pieces of glass with a small air space between them.
- (2010) A cylindrical element of  $1\text{ kW}$  electric fire  $1\text{ s}$   $30\text{ cm}$  long and  $1.0\text{ cm}$  in diameter. If the temperature of the surroundings is  $20^{\circ}\text{C}$ , estimate the working temperature of the element.
- (2013) Compare the law governing the conduction of heat and electricity pointing out the corresponding quantities in each case.
- (2013) A Lagged copper rod is uniformly heated by a passage of an electric current. Show by considering a small section  $dx$  that the temperature  $\theta$  varies with distance  $x$  along a rod in a way that,  $k\frac{d^2T}{dx^2} = -H$ , where  $k$  is a thermal conductivity and  $H$  is the rate of heat generation per unit volume.
- (2015) Define coefficient of thermal conductivity.
- (2015) Write down two characteristics of a perfectly lagged bar.
- (2015) A thin copper wall of a hot water tank having a total surface area of  $5.0\text{ m}^2$  contains  $0.8\text{ cm}^3$  of water at  $350\text{ K}$  and is lagged with a  $50\text{ mm}$  thick layer of a material of thermal conductivity  $4.0 \times 10^{-2}\text{ W/mK}$ . If the thickness of copper wall is neglected and the temperature of the outside surface is  $290\text{ K}$ ,
  - Calculate the electrical power supplied to an immersion heater.

- If the heater were switched off, how long would it take for the temperature of hot water to fall by 1 K?
- (2016) Identify two factors on which the coefficient of thermal conductivity of a material depend.
- (2016) A brass boiler of base area  $1.50 \times 10^{-1}$  and thickness 1.0 cm boils water at a rate of 6.0 kg/min when placed on a gas Stove. Estimate the temperature of the part of the flame in contact with the boiler.
- (2019) A closed metal vessel containing water at  $75^\circ\text{C}$  , has a surface area of  $0.5 \text{ m}^2$  and uniform thickness of 4.0 mm. If its outside temperature is  $15^\circ\text{C}$  , calculate the heat loss per minute by conduction.