5.3 Resistivity

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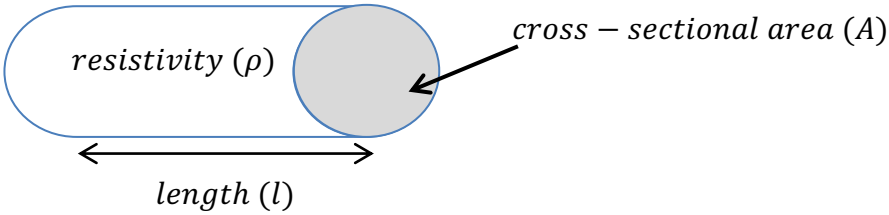
The resistance of a conductor depends on the length, the cross-sectional area and a property of the material called the resistivity (ρ). Resistivity is a bulk property of the material and is a constant (for a given temperature) for the material. For example, copper has a resistivity of $1.7 \times 10^{-8} \Omega m$ at room temperature.



(1) What effect do you think increasing the length has on resistance of the conductor?

(2) What effect do you think increasing the cross-sectional area has on the resistance of the conductor?

The resistance of the conductor is given by the following expression:

$$R = \frac{\rho l}{A}$$

(3) Rearrange this expression to find and expression for resistivity.

(4) Put in the units for resistance, length and area to work out a unit for resistivity. Confirm that it is the Ωm (as shown for copper at the top of the page).

(5) Do an internet search to find the resistivity of graphite, tungsten, glass and gold.

Note: To use the formula for resistance, lengths need to be in metres and areas need to be in metre squared. Students often find it difficult to convert areas from mm^2 to m^2 or from cm^2 to m^2.
(Remember that $1mm=1x10^{-3}m$, so $1mm^2= (1x10^{-3})^2=1x10^{-6}m^2$.)

(6) convert $1cm^2$ to a m^2