

5.1.3 Resistance

Electrical resistance is a measure of the opposition to the flow of charges through a conductor. Materials with a big resistance strongly oppose the flow of charges, and so the current is reduced. Materials with a small resistance only weakly oppose the flow of charges and allow larger currents. Some materials are 'superconductors'. They have no resistance! Superconducting materials generally require very low temperatures to operate.



videos

Watch this animation to show how resistance arises:

<http://micro.magnet.fsu.edu/electromag/java/filamentresistance/index.html>

(1) ✎ Summarise what causes resistance in metal conductors.

(2) ✎ Why does resistance cause the material to heat up?

The unit for resistance is the ohm (Ω). The resistance of a component is the potential difference ($p.d.$) across the component divided by the current (I) flowing through the component:

$$R = \frac{p.d.}{I}$$

(3) ✎ Looking at this formula, what unit is an ohm equivalent to?

This formula is called 'ohm's law and is often written:

$$R = \frac{V}{I}$$

(4) ✎ Sketch the circuit symbols for a resistor and a variable resistor.

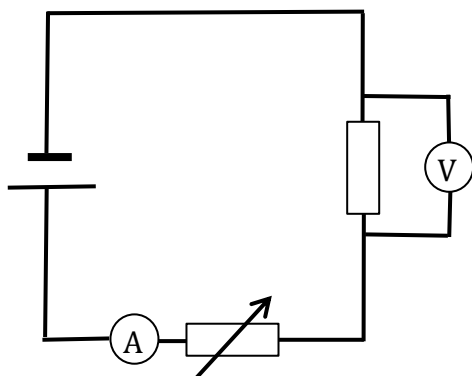
Resistors are used in circuits to reduce the flow of current. They obey ohm's law which states that: **"the current through a conductor is proportional to p.d. across it, provided the conditions do not change"**

(5) ✎ What is the main condition that could change?

Have a play with the following simulation:

<https://phet.colorado.edu/en/simulation/ohms-law>

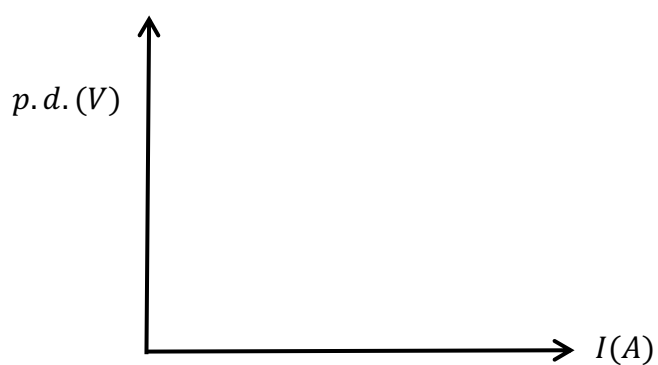
The characteristics of a resistor can be measured using the following circuit:



(6) Label the different circuit components.

(7) What would you do to investigate the characteristics of the resistor?

(8) Sketch the p.d. versus current graph you would get for this experiment.



(9) Indicate on the graph how you would obtain a value for the resistance of the resistor.