



9.3 Building an electric motor

Aim: To build an electric motor and, in doing so, understand how it works.

Equipment:

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| ■ 1 meter length of insulated wire | ■ 2 paper clips | ■ Scissors |
| ■ Cell | ■ 2 flat magnets | ■ 2 crocodile clips |
| ■ Adhesive tape | ■ Modelling clay | ■ 2 connecting cables |
| ■ Sandpaper | ■ Plastic straw | |

Theory

The electric motor operates on the principle of electromagnetism. A current-carrying wire produces a magnetic field. If this current carrying wire is placed inside an external magnetic field then, as a result of these two competing magnetic fields, a force will be generated.

This force will generate a turning effect if the wire is formed into a coil. To keep the coil rotating in the magnetic field a commutator is required. For commercial electric motors a split ring commutator is usually used (see page 212 in your textbook).

To build a simple electric motor it is sufficient to simply strip the insulation off one side of the wire such that when the wire rotates on its support, half the time it makes electrical contact and the other half there is an insulation layer between the contacts.

Method

- 1 Wrap the wire carefully around the cell about 10 times, without creating sharp bends in the wire, and leaving about 5cm of free length at either end.
- 2 Remove the wire from the cell with the free lengths coming out of either side of the loops and secure the loops tightly together with the adhesive tape, ensuring that the resulting coil is symmetrical about its rotation axis.

To check this, hold the coil by the free ends between your thumbs and first fingers and try to rotate it. If it does not rotate freely you will need to make some adjustments to the coil.

- 3 Place the coil on a flat surface and rub the insulation off only the last cm of the upper side of the free ends. This is the commutator.
- 4 Bend two paper clips into a 'p' shape. Push the paper clips into the modelling clay. Position them so that the commutator makes contact with the clip at either end.
- 5 Mount the magnets in some more modelling clay so that the north and south poles are facing each other and the coil can be mounted between them, rotating freely.
- 6 Make the electrical connections between the cell and base of the paper clips using the crocodile clips.
- 7 Give the coil a gentle push and watch it turn!
- 8 To keep the coil centered, cut some short lengths of plastic straw to fit between the paperclips and the coil.