

Electricity and magnetism

An even simpler motor

The force on a conductor in a magnetic field

You will need....

- ✓ 1.5 V cell
- ✓ Steel screw
- ✓ Neodymium magnet
- ✓ Piece of wire

Background:

A current carrying conductor experiences a force in a magnetic field.

$$\text{Force} = BIL$$

where B is the magnetic flux density, I is the current and L is the length of conductor within the field (Lorentz Force Law)

Follow these steps:

1. Place the screw between the magnet and the negative terminal of the cell.
2. Connect one end of the wire to the positive terminal of the cell.
3. Complete the circuit by brushing the other end of the wire against the magnet.
4. Observe what happens.

Safety note

- ! The circuit as described has little resistance and the electric current may be large.
- ! It is therefore not advisable to use batteries with low internal resistance such as or NiMH.

So what happened?

The screw and magnet rotate.

In this instance the magnet is part of the electric circuit. The horizontal current from the edge to the centre is in a vertical magnetic field and experiences a force perpendicular to both.

What next?

1. Invert the magnet and repeat.
2. Invert the battery and repeat.
3. Insert a lamp (1.5 – 2.5 V, 0.5 – 1.0 A) on the connecting wire.

