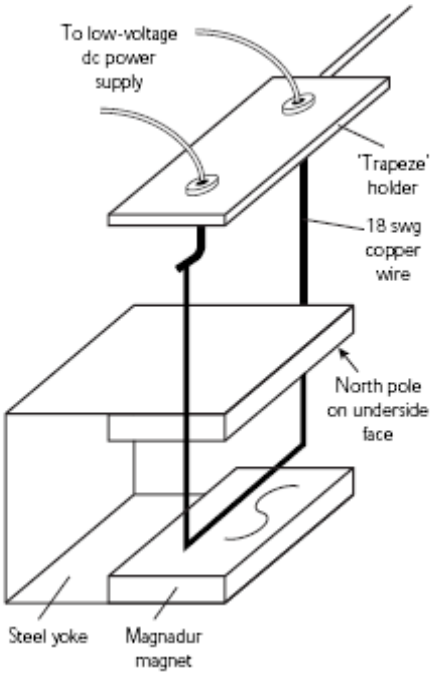
TAP 412-2: An electromagnetic force

Use the arrangement shown below to explore the force on a current-carrying conductor when it is inside a magnetic field.

You will need:

- ✓ trapeze holder
- ✓ 18 swg bare copper bent to make trapeze
- ✓ Magnadur magnets (2) (as from Westminster Electromagnetic kit)
- ✓ steel yoke
- ✓ low-voltage dc supply (e.g. Westminster pattern)
- ✓ leads



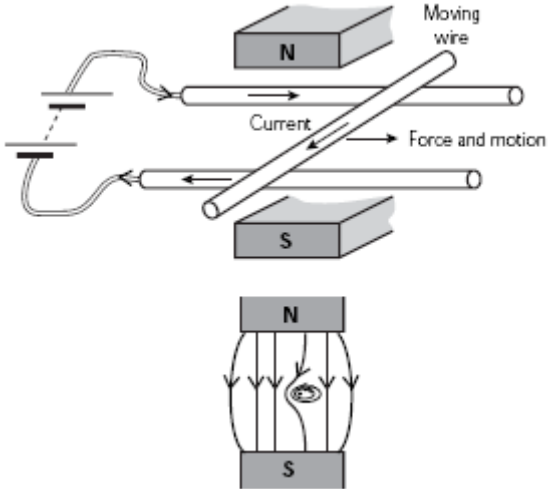
Identify the north and south poles of your magnet.

Switch on the current to the ‘trapeze’ wire and note how the ‘trapeze’ behaves.

- Repeat with the magnetic field alone reversed.
- Repeat with the electric current alone reversed.
- Repeat with both the magnetic field and the electric current reversed.

Practical advice

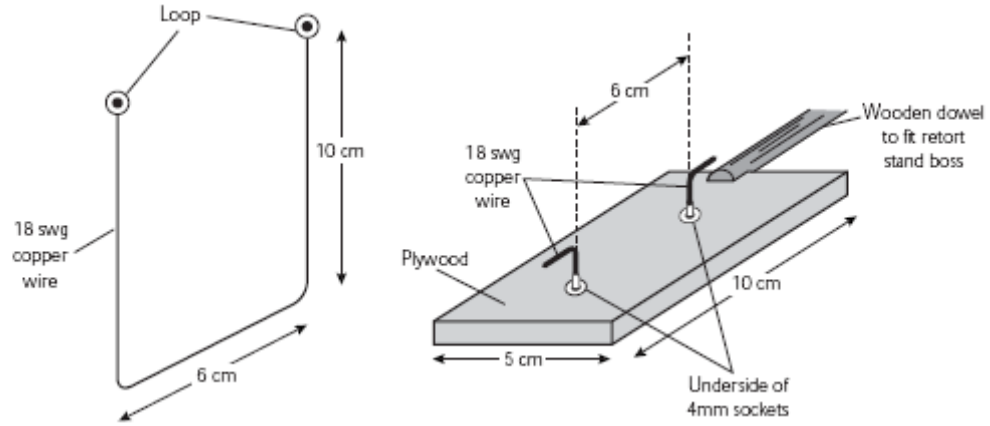
When considering the direction of the force, some students might appreciate an explanation in terms of a ‘catapult field’ (below) in which the interaction of the field of the permanent magnet with that of the current-carrying wire gives rise to an attraction on one side of the wire and a repulsion on the other. The resulting field-line pattern can be likened to a catapult – the wire is ‘kicked’ as it would be if the lines were pieces of stretched elastic. The direction is as described by Fleming’s left-hand rule.



The term ‘magnetic flux density’ will probably need some discussion, as it has connotations of flow.

Technician’s note

Trapeze and trapeze holder construction details:



Requirements:

- ✓ plywood 10 cm x 5 cm (DIY store),
- ✓ 18 swg bare copper wire (Philip Harris Y94804/7),
- ✓ 4 mm sockets white (2) (JPR 705-210),
- ✓ dowel rod 15 cm (DIY store),
- ✓ retort stand and boss

External reference

This activity is taken from Salters Horners Advanced Physics, section TRA, activity 9