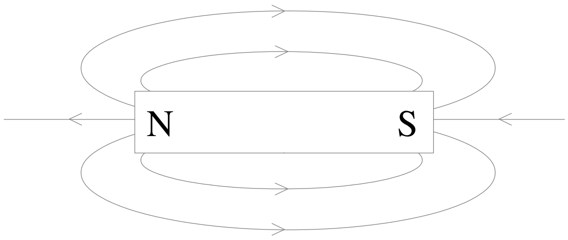
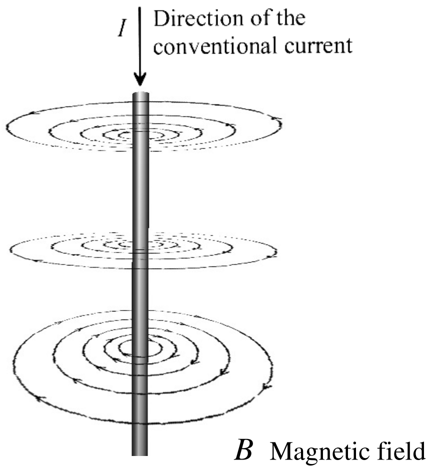
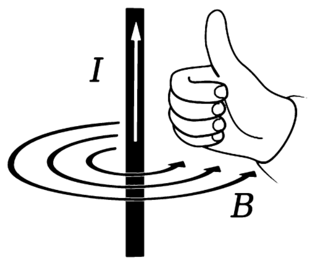
Magnetic Fields

Magnetic field lines show the force a test north pole would feel. Field lines therefore are away from north and towards south.

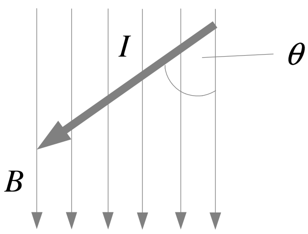


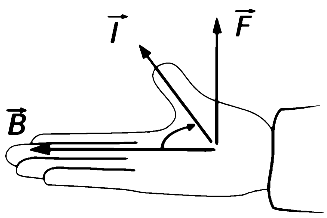
Moving charges (for example flowing through a wire) produce a magnetic field.
The direction of magnetic field produced by a current follows the right hand curl rule.





Moving charges (or current flowing in a wire) placed in another magnetic field experiences a force.
The direction of force on a current follows the right hand palm rule.





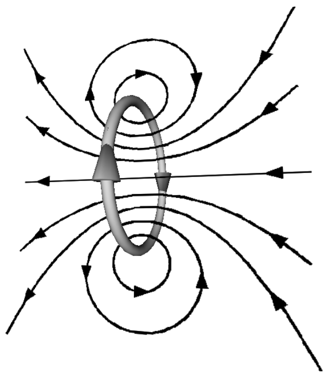
The magnitude of the force can be found with the formula:

$$F = I\,\Delta l\,B\sin\theta$$

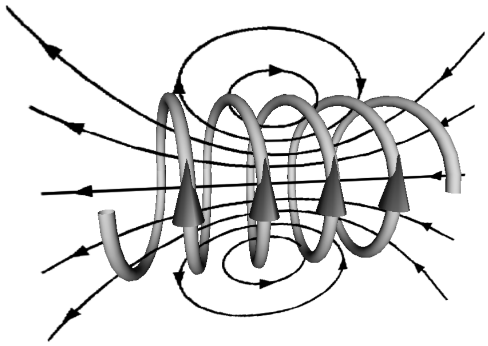
- force in N (newtons)
- current in A (amperes or amps) or Cs^{-1}
- length of wire in the field in m (metres)
- magnetic field strength in T (tesla)
- angle between wire and field in ° (degrees)

Loops and Electromagnets

A single loop of current-carrying wire will produce a magnetic field like this:



A coil or a number of loops will produce a magnetic field like this:



If this coil is wrapped around an iron core, the 'magnetic domains' in the iron line up with the magnetic field and act like tiny magnets, significantly increasing the strength of the magnetic field.

Electromagnetic Induction

Any relative movement of a charge in a magnetic field will produce a force.

Since it's relative movement, so if you move the field and leave the charge stationary, it will still experience a force.

This concept explains how generators work. In a generator, a coil of wire is spun around in a magnetic field, which pushes the electrons (produces a current) in the coil.
A motor is the opposite – a current is run through the coil which causes it to spin.

The production of electricity by relative movement of a magnetic field is called induction.