Student Revision Notes (age 14 – 16): Electromagnet Induction

When a magnet is moved into a coil of wire in a circuit an electric current is produced. The electric current has been induced, and the process is called **induction**. This way of making electricity using magnets was discovered by Michael Faraday in 1831 and this method is the basis of all dynamos used for making electricity today.

Connecting a wire to a sensitive meter and passing between the poles of a strong magnet is used to demonstrate this principle (see Figure 1).

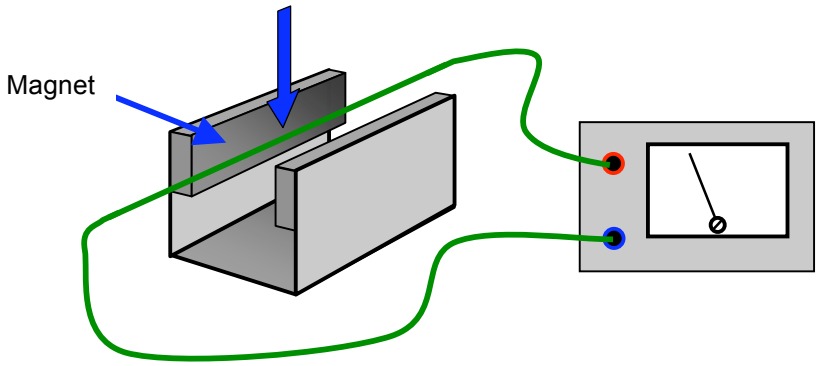

Figure 1

When using this arrangement the following observations are made:

- A current is only produced in the wire if it is moved up or down in the field cutting through the lines of the magnetic field.
- Side-to-side or end-to-end motion produces nothing and when the wire is held still in the field there is no reading i.e. no electric current.
- If the wire is moved upwards the flow of current is in the opposite direction to that when the wire is moved downwards.

If the arrangement is changed so that a coil of wire is used instead of just a straight piece (Figure 2), and a magnet moved through the coil, the following additional observations are made:

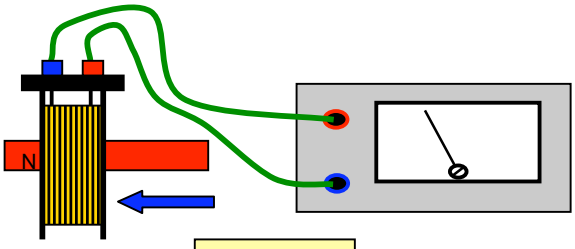

Figure 2

1. A current is produced when either the wire or magnet move (the wire must cut the magnetic field lines).
2. The faster the movement, the bigger the current.
3. Changing the direction of the movement changes the direction of the current,
4. The stronger the magnet, the bigger the current.
5. The more coils of wire, the bigger the current.

Numbers 3, 4 and 5 form the basis of Faraday's Law, which states that:

'The induced electromotive force in a closed loop equals the negative of the time rate of change of magnetic flux through the loop.'

This simply means that the induced current is proportional to the rate of change of the magnetic flux through a coil.

The German physicist Heinrich Lenz observed that the direction of the induced current in a conductor is always such as to oppose the motion which produced it. This is called Lenz's Law.

Linked Resources

www.twothirtyvolts.org:

Electromagnetic Induction (14-16) Student Quiz