

Electromagnetic Induction

Many electrical or electronic devices rely on a principle called *electromagnetic induction* in order to function. The term refers to electricity being produced in a conductor by a changing magnetic field. To understand it better, it helps to go back in time.

This phenomenon was first observed by Michael Faraday in 1831 and, realizing that this was an important discovery, he carried out a number of experiments to determine exactly what was happening. He noticed that:

- When the magnetic flux linking a conductor changes then an electromotive force is induced in the conductor.
- The magnitude of the emf induced in the inductor is proportional to the rate of change of the flux linkage.

The above relates to one of Faraday's laws. In simple terms, it means that if a conductor is moved within a magnetic field then the force it experiences causes an electric current to flow through that conductor. Likewise, the faster the change in the magnetic field then the greater the emf produced.

The important thing to remember is that the electromotive force will only be produced in the conductor as long as the magnetic field is changing – therefore, no change, no current flow!

Other experiments

Michael Faraday was not the only one to have observed the phenomenon. Working independently, the American scientist Joseph Henry also discovered electromagnetic induction at about the same time as Faraday. In recognition, the *henry* (symbol H) is now the SI unit of inductance.

Many others quickly followed with further work in this field. In 1834, the German scientist Emil Lenz put forward what became known as *Lenz's law*. He stated that:

- The direction of an induced electromotive force is always such as to oppose the change producing it.

Apart from the production of electricity in a conductor, he also noted the existence of a mechanical force opposing the motion. As you will learn later, these laws are put to good use in a generator to produce electricity, and a motor to produce movement.



A conductor is the term given to a material whose electrons will move easily from one atom to another.



A typical conductor is a length of copper wire.