# Additional Material for Faraday's Electromagnetic Lab PhET Simulation

**Faraday's law of induction** is a basic law of electromagnetism.

It predicts how a magnetic field will interact with an electric circuit to produce an induced electromotive force (EMF).

The magnitude of the induced emf in a circuit is equal to the rate of change of magnetic flux through the circuit.

Mathematically, the induced emf is given by:
$\mathcal{E} = -N \, d\Phi_B/dt$

Where N is the number of turns of wire and $\Phi_B$ is the magnetic flux through a single loop.

In **Field Meter**, **B** is a symbol for total magnetic field.

**B** has bar over it showing that it is a vector having magnitude and direction.

**G** is the cgs unit of measurement of magnetic flux density called Guass.

**Bx** and **By** stand for the x and y component direction of the magnetic field.

ø stands for angle of deflection.

A small coil which is inserted into a magnetic field to measure its field strength, or any variations in it.

Such a coil is connected to an indicating instrument, such as a ballistic galvanometer or a fluxmeter.

A pickup coil may also be utilized to examine the magnetic flux distribution of a magnetic field.

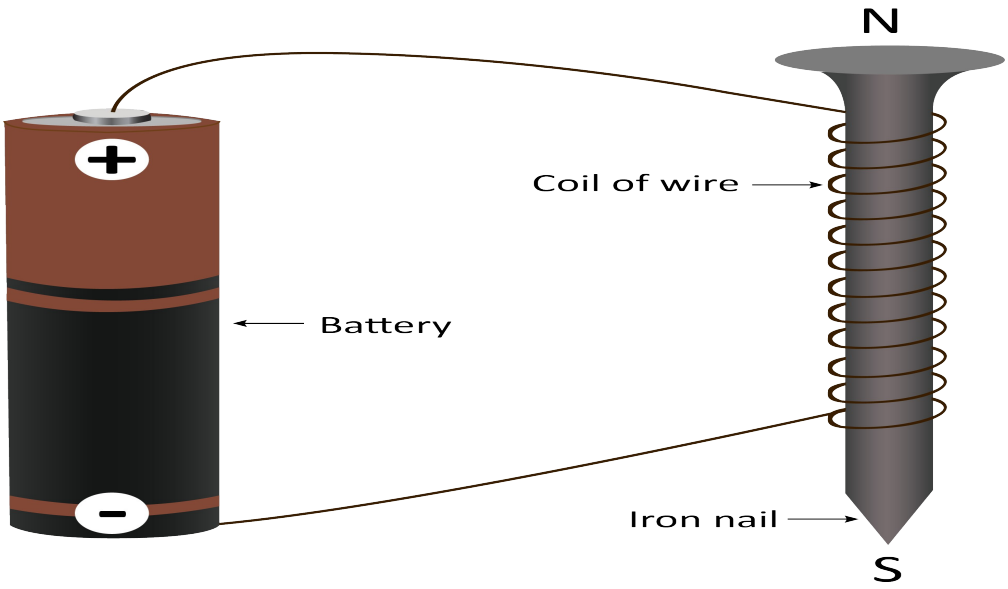
An electromagnetic coil is an electrical conductor such as a wire in the shape of a coil, spiral or helix.
Electromagnetic coils are used in,

- electrical engineering,
- In applications where electric currents interact with magnetic fields,
- In devices such as electric motors, generators, inductors, electromagnets, transformers, and sensor coils.

Electromagnet is a type of magnet in which magnetic field is produced by an electric current.

Electromagnets are widely used as components of other electrical devices such as motors, generators.

When an electric current is passed through a coil of wire wrapped around a metal core, very strong magnetic field is produced.




An electromagnet is made of a core of magnetic material wrapped around with a coil of insulated copper wire.
Electromagnets consists of an insulated wire wound into a coil.

An electromagnet requires a continuous supply of current to maintain the magnetic field.

Electromagnets are also employed in industry for picking up and moving heavy iron objects such as scrap iron and steel.

DC electromagnet is used in industry to pick up heavy objects, where constant magnetic field is required.

AC electromagnet used in an electrical motor requires constantly changing magnetic field.

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction.

A transformer changes a high-voltage supply into a low-voltage one, or vice versa.

Transformers are used to increase or decrease the alternating voltages in electric power applications.

A transformer that increases the voltage is called a **step-up transformer**.

In a step-up transformer primary coil has less number of loops than secondary coil.

A transformer that decreases the voltage is called a **step-down transformer**.

In a step-down transformer primary coil has more number of loops than secondary coil.

A generator (electrical) is a device that converts mechanical or chemical energy into electrical energy for use in an external circuit. It works on the principle of electromagnetic induction.

Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines and hand cranks.