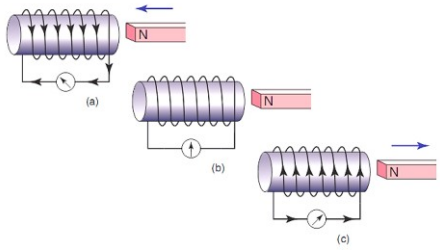
# ELECTRO–MAGNETIC INDUCTION [ E M I]

## What is Electro – Magnetic Induction?

1. **Induction** means to create. **Electromagnetic induction** means to create electricity. **Logically** if electricity can create magnetic effect or magnetism, then by reverse analogy by using magnetism we can electricity. It's true, first thought by **Sir Michael Faraday**.

## How to induce Electro–Magnetic Induction?

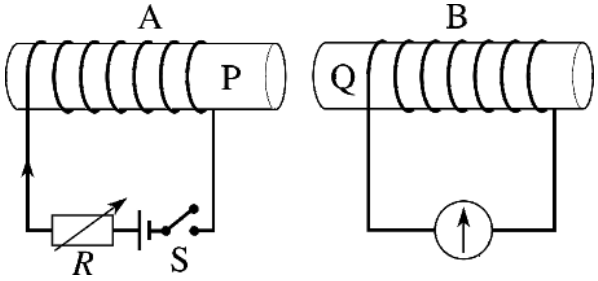
2. To induce current in a circuit, we require coils (solenoids), a bar magnet, some wires and a galvanometer [*see figure below*].




(i) we can induce current in a coil either **by moving it in a magnetic field** or **by changing the magnetic field around it**. It is convenient in most situations to move the coil in a magnetic field.

(ii) Case 1(**Coil and Bar Magnet**): When the coil and the magnet are both stationary, there is no deflection in the galvanometer. The motion of a magnet with respect to the coil produces an induced potential difference, which sets up an induced electric current in the circuit (above figure).

(iii) Case 2(**2 Coils but one coil acts as Bar Magnet**): Switch on the circuit. As soon as the **current in coil-1** reaches either a steady value or zero, the galvanometer in coil-2 shows no deflection. We conclude that a potential difference is induced in the coil-2 whenever the electric current through the coil–1 is changing (starting or stopping). Coil-1 is called the primary coil and coil-2 is called the secondary coil. As the current in the first coil changes, the magnetic field associated with it also changes. Thus, the magnetic field lines around the secondary coil also change. Hence **the change in magnetic field lines associated with the secondary coil is the cause of induced electric current in it**.




(iv) The process, by which a changing magnetic field in a conductor induces a current in another conductor, is called **electromagnetic induction**.

3. A **galvanometer** is an instrument that can **detect** the presence of a current in a circuit. The pointer remains at zero (the centre of the scale) for zero current flowing through it.

Galvanometer

## Flemings Right Hand Rule for EMI

4. The induced current is found to be the highest when the direction of motion of the coil is at right angles to the magnetic field.

5. We can use a simple rule to know the direction of the induced current. This simple rule is called **Fleming's right-hand rule** "**Stretch the thumb, forefinger and middle finger of right hand so that they are perpendicular to each other. If the forefinger indicates the direction of the magnetic field and the thumb shows the direction of motion of conductor, then the middle finger will show the direction of induced current.** "