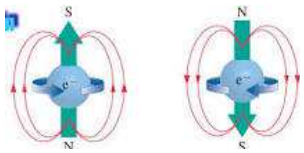
IS – 7 - Electromagnetism.

K6SQN

We are all familiar with those pieces of metal we call "Magnets". Magnets have "Poles" we call **"North"** and **"South".** An invisible force causes like poles to repel each other while opposite poles attract each other. This type of magnet is called a "Permanent Magnet".

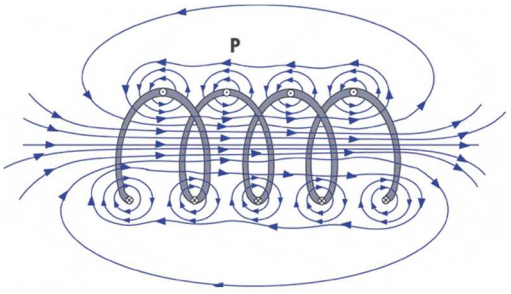


A basic fact in physics is that electrically charged particles, electrons in this discussion, create a magnetic field about them while in motion. Physicists have established that at the molecular level, electrons "spin" in one direction or another. This is a charged particle in motion. The result is a magnetic field around it. The polarity of the magnetic field is determined by the direction of spin. When many electrons in a material are spinning in the same direction those tiny magnetic fields, called "Electron Magnetic Moments" add to each other to extend the field outside of the material. This is so in materials which are "Ferromagnetic" such as Iron. In other materials, without that characteristic, the individual electron "spins" tend to be random and the combined fields are very weak to non-detectable.

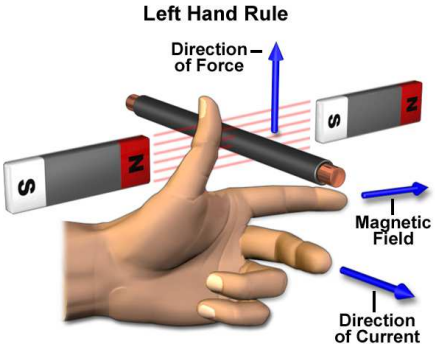
Magnetic fields are at the heart of electronics and radio. But, we create these magnetic fields electrically. That is, moving charged particles, also called "carriers", electrons, as an electric current, through or on a conductor we create a magnetic field around that conductor. The opposite is also true. The relative motion between a conductor and a magnetic field moves charged particles as an electric current in that conductor.

Creating a magnetic field with current: "The right hand rule" is a way visualize a magnetic field created by current flowing in a wire. It also shows the polarity of the magnetic field. Current flowing in the direction of your thumb**,** that is negative to positive, results in a magnetic field surrounding the wire in the direction of the fingers. The polarity of the magnetic field is from North Pole to South Pole.

Concentrating a magnetic field: A wire wound to form a coil allows each turn's magnetic field to combine with that of the others. This concentrates the field at the center (core) of the coil but also with the field surrounding the entire coil. This figure depicts an air core inductor. The magnetic field can be increased by inserting a permeable material such as iron or Ferrite at the center of the coil. An electromagnet is made in this fashion using iron as the coil's core.



Creating current with a magnetic field: Charged carriers move when subjected to a moving magnetic field.
(1) Current will flow in a conductor which is moving through a magnetic field. (2) A magnetic field moving past a conductor will cause a current in that conductor. "The left hand rule" illustrates this. When the wire moves through the field as shown, then the current in the wire moves in the direction shown. Reverse the field, or wire's direction of movement, reverses the direction of current.



Learning these concepts will help in a better understanding of inductive reactance, mutual inductance, Eddy currents, skin effect, antennae, transformers, generators, alternators and more.