Magnetism is a force that acts between certain objects called magnets. A magnet is a seemingly ordinary piece of metal, ceramic or rubber that is surrounded by an invisible field of force which affects any magnetic material brought within this invisible field. Legend has it that the first known magnets were discovered by the Greeks. These early magnets were made from naturally occurring magnetic rock called Magnetite and referred to as Lodestones.

The best known magnets today are pieces of magnetic metal that attract other kinds of metal. These magnets that keep their magnetism permanently are called ***permanent magnets****. Most permanent magnets are made of steel or mixtures of iron, nickel, cobalt and other substances. These materials are called magnetically hard because they can be magnetized only in strong magnetic fields.*

When a permanent magnet picks up an object, such as an iron nail, the nail becomes a ***temporary magnet****. But the nail will keep it's magnetism only so long as it is near a permanent magnet. Materials such as the iron in the nail are called magnetically soft because they can be magnetized in weak fields.*

A COMPASS

A compass is one of the oldest uses for a magnet. A compass needle is a bar magnet that points toward the earth's north magnetic pole. Scientists have explained the principle of magnetic fields so that we can understand why a compass works. But scientists do not know what produces the enormous electric currents deep within the earth that appear to be responsible for the earth's magnetic field.

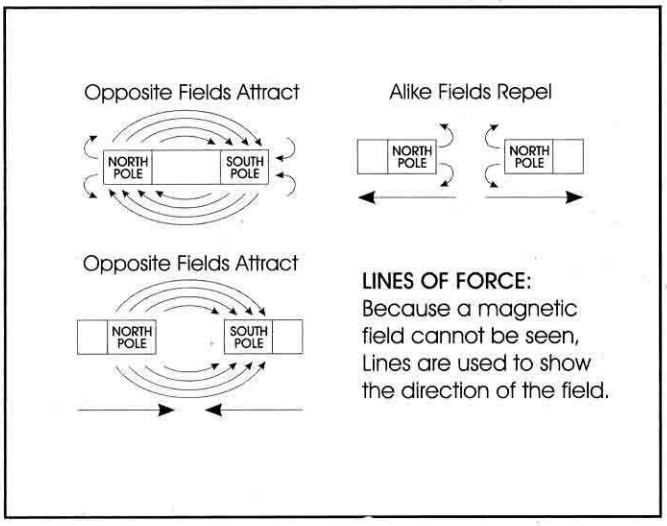
MAGNETIC FIELD

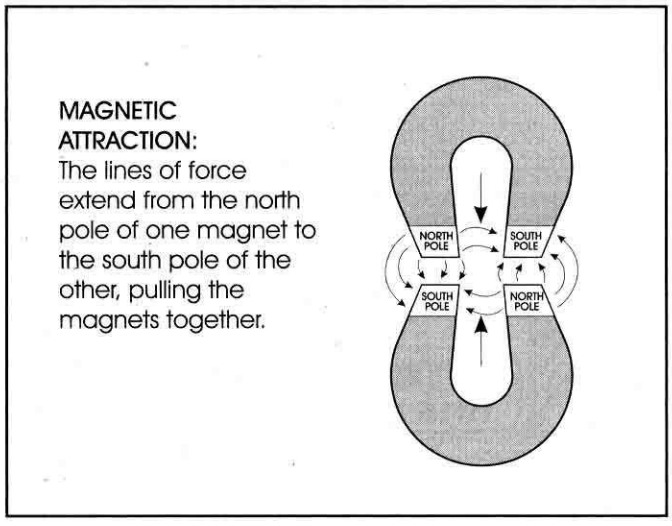
The action of magnets on each other, as well as on iron objects, is described in terms of its magnetic field. This magnetic field is caused by moving electrical charges. The electrical charge is caused by a disruption in the movement of the electrons around the nucleus of the atoms making up a magnetic material.

In most atoms, electrons spin in different directions and their magnetic fields cancel each other out. But, in atoms of magnetic materials the electrons spin in such a way that they do not cancel each other.

This action produces lines of force. The denser the lines of force, the stronger the magnet. The magnetic field is strongest at the poles, where the lines of force are the closest together. (See Fig. 1).

All magnets have two poles. When magnets are brought together, a north pole always attracts a south pole and is referred to as a magnetic attraction (See Fig. 2), while pairs of like poles repel each other.





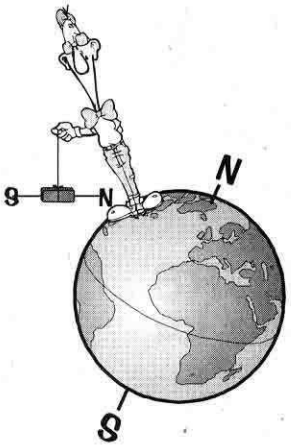
MAGNETIZATION

Magnets can be made in several ways:

1.) Moving a permanent magnet in one direction across a magnetic material.
2.) An electric current flowing through a coil of wire placed near a magnetic material.
3.) Hammering or tapping a magnetic material while it is in a magnetic field.

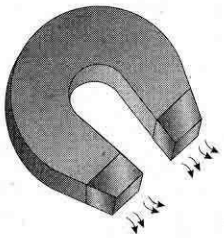
DIFFERENT SHAPES

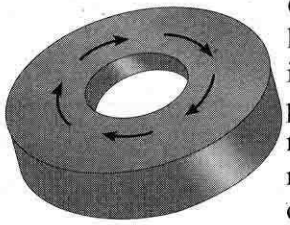
Magnets are made in many shapes and have their poles in different places.



Bar Magnets are the simplest permanent magnets. If you hold a bar magnet by a string tied around its center, one end will point towards the north. The other end will point towards the south. The poles are named by the direction they point. The north and south poles of the magnet point as they do because the earth's magnetic poles attract them. A common use for a bar magnet is as a door or cabinet catch. The magnetic powder used to store images and sounds on magnetic tapes and discs is composed of tiny bar magnets.

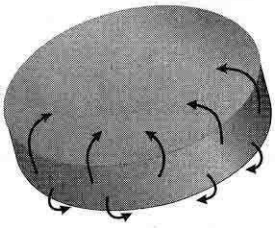
Horseshoe Magnets are bar magnets bent so that their poles are brought close together. This makes a stronger magnetic field.



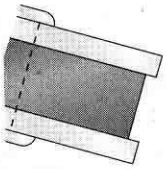


Circular (or Ring) Magnets look like a disc with a large hole in the center. They do not have poles. Instead, the magnetism moves around the inside of the magnet in one direction or the other.

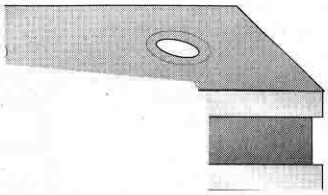
Magnets shaped like disks have one pole around the edge and the other pole in the center.



MAGNETIC ASSEMBLIES



Combining magnets with steel plates greatly increases the magnetic pull. A back plate will increase pull on the face of the magnet by approximately 50%.In the sandwich channel and disc assembly the magnet is recessed and the metal edge concentrates the magnetic force. These metal plates can increase the strength of rubber and ceramic magnets up to 32 times. For example, a 3/16 in. thick x 3/4 in. wide x 1 in. long rubber magnet has 4 oz. of pull. Sandwich the same magnet between steel plates and it will pull 8 pounds.



MAGNETIC MATERIALS

Some of the more common magnetic materials are the following:

1.) **Iron**
Easily magnetized.

2.) **Ceramic**
Made from barium and iron oxide powders, combined with the element oxygen. Ceramic is hard, strong, corrosion resistant and lighter than metal alloy magnets.

3.) **Rubber Magnets**
These are made by mixing magnetic powder with rubber compound, then molded and cut into shape. Rubber magnets can be easily cut, bent, twisted and flexed without energy loss, are lightweight and can be punched, stamped, drilled, bolted, riveted, glued and nailed. They are great for light holding jobs, won't scratch surfaces, and have a temperature range of -40 to +240 F. Rubber magnets are available as a block, bar, disc or strip.

4.) **Alnico**
It is a hard material with a high field strength.

5.) **Rare Earth Magnets**
Derive their name because of the difficulties encountered in the separating and refining of the raw elements. These magnets have exceptional resistance to demagnetization, outstanding temperature stability and power.