

Magnetic Fields

History

- effects of magnetism have been known for thousands of years
- prior to 600 BCE it was known that **lodestone**, a type of ore containing iron, would attract small iron objects
- since lodestone was first found near a region called Magnesia, its effects came to be known as magnetism
- the Chinese were using magnets for navigation (as compasses) as early as 1500 AD
- modern magnets are usually made from various alloys of iron, nickel, cobalt, gadolinium, and other rare earths such as neodymium

Properties of Magnets

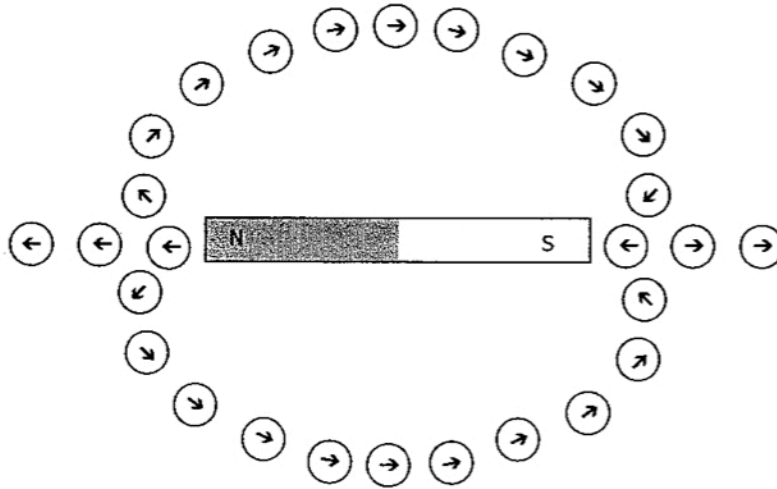
1. Magnets have **poles**.
 - the poles are regions near each end of a magnet which exhibit the strongest magnetic effects
2. A freely hanging magnet will align itself so one end points north, and the other south.
 - the pole that points north came to be called the **north magnetic pole**
 - the opposite end of the magnet is thus the **south magnetic pole**
3. The Law of Magnetic Poles.
 - magnets exert forces on each other
 - opposite poles attract each other
 - like poles repel each other
4. Magnets will attract some metals.
5. Magnetic poles always occur in pairs.
 - it is impossible to have a magnet that has only one pole
 - any attempt to separate the poles by cutting a magnet in half fails, because each half simply becomes a new magnet with its own north and south poles
6. Magnetic forces act at a distance.
 - thus, magnets create magnetic fields (just like gravitational or electric fields)

Definition

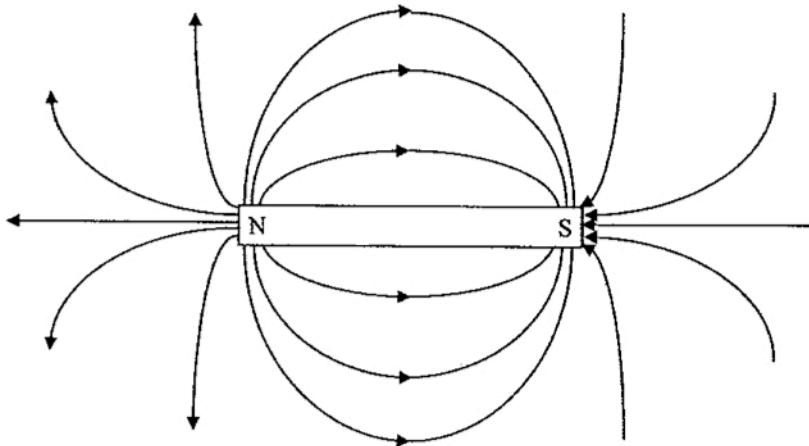
A magnetic field is the region surrounding a magnet in which another magnet will experience a magnetic force.

Visualizing Magnetic Fields

The appearance of a magnetic field can be determined using a couple of different methods. One is by using a number of small compasses to view the direction of the field at various points.



The field can then be drawn using magnetic field lines, in much the same way that we draw electric fields.



Another way to visualize magnetic field lines is by placing a sheet of paper over a magnet, or magnets, and sprinkling iron filings on the paper. The filings will arrange themselves along the magnetic field lines, thus revealing the pattern.

Properties of Magnetic Field Lines

1. Field lines begin at the north pole and end at the south pole.
2. The direction of the magnetic field is defined as the direction of the force that would be experienced by a north magnetic pole.
3. The direction of the magnetic field at any point is tangent to the magnetic field lines at that point.
4. The strength of the magnetic field is shown by the spacing of the field lines (closer together = stronger).
5. Magnetic field lines form complete loops.
6. Magnetic field lines actually pass through the magnet. Inside the magnet, the field lines point from the south pole to the north pole.