

Magnetism

Magnetism is a force that acts at a distance due to a magnetic field. This field is caused by moving electrically charged particles or is inherent in magnetic objects such as a magnet. A magnet is an object that exhibits a strong magnetic field and will attract materials like iron to it. Magnets have two poles, called the north (N) and south (S) poles. Two magnets will be attracted by their opposite poles, and each will repel the like pole of the other magnet. Magnetism has many uses in modern life.

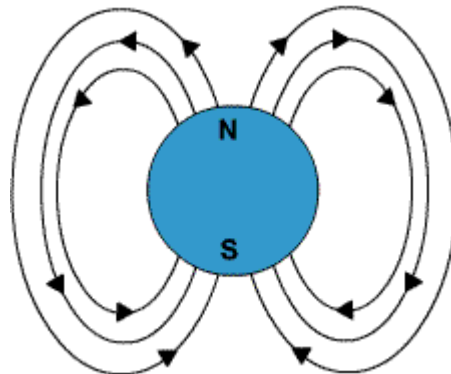
Questions you may have include:

- What is a magnetic field?
- What are magnets?
- How is magnetism used?

Magnetic field

A magnetic field consists of imaginary lines of flux coming from moving or spinning electrically charged particles. Examples include the spin of a proton and the motion of electrons through a wire in an electric circuit.

What a magnetic field actually consists of is somewhat of a mystery, but we do know it is a special property of space.



Magnetic field or lines of flux of a moving charged particle

Names of poles

The lines of magnetic flux flow from one end of the object to the other. By convention, we call one end of a magnetic object the N or North-seeking pole and the other the S or South-seeking pole, as related to the Earth's North and South magnetic poles. The magnetic flux is defined as moving from N to S.

Magnets

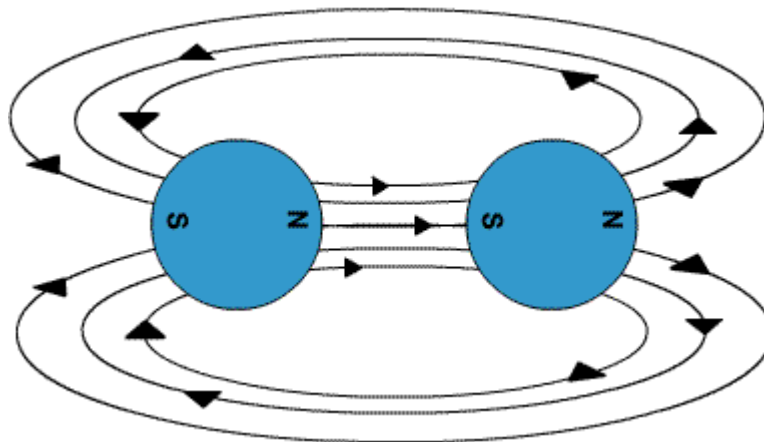
Although individual particles such as electrons can have magnetic fields, larger objects such as a piece of iron can also have a magnetic field, as a sum of the fields of its particles. If a larger object exhibits a sufficiently great magnetic field, it is called a magnet.

Magnetic force

The magnetic field of an object can create a magnetic force on other objects with magnetic fields. That force is what we call magnetism.

Attraction

When two magnets or magnetic objects are close to each other, there is a force that attracts the poles together.



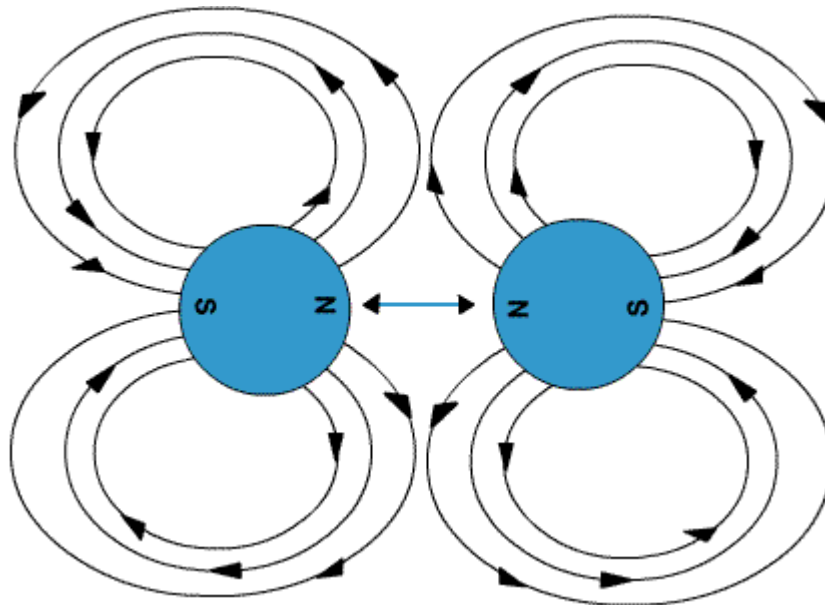
Force attracts N to S

Magnets also strongly attract ferromagnetic materials such as iron, nickel and cobalt.

(See [Magnetic Materials](#) for more information.)

Repulsion

When two magnetic objects have like poles facing each other, the magnetic force pushes them apart.



Force pushes magnetic objects apart

Summary

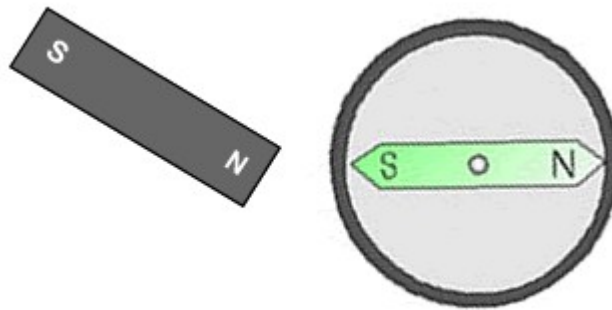
Magnetism is a force that acts at a distance and is caused by a magnetic field. The magnetic force strongly attracts an opposite pole of another magnet and repels a like pole. The magnetic field is both similar and different than an electric field.

Compass

A compass is simply a thin magnet or magnetized iron needle balanced on a pivot. It can be used to detect small magnetic fields. The needle will rotate to point toward the opposite pole of a magnet. It can be very sensitive to small magnetic fields.

Using a compass to show the magnetic field

When you bring a compass near an item suspected of being magnetized or having a magnetic field, the compass will turn and point toward the appropriate pole of the object.



Compass needle attracted to magnet's N pole

A famous experiment showed that a wire with DC electric current running through it created a magnetic field. When the electricity was turned on, a nearby compass moved to indicate a magnetic field was present.

Earth is a huge magnet

The compass was used to discover that the Earth is a huge magnet. The North-seeking pole of the compass needle will always point toward the Earth's North magnetic pole.

Iron filings

By spreading fine iron filings or dust on a piece of paper laid on top of a magnet, you can see the outline of the magnetic lines of force or the magnetic field. The picture below



Iron filings and compasses show the shape and direction of the magnetic field

This experiment also shows that magnetism will act through many materials, such as paper. Would the experiment work if a sheet of iron were used to sprinkle the filings? What about aluminum foil?