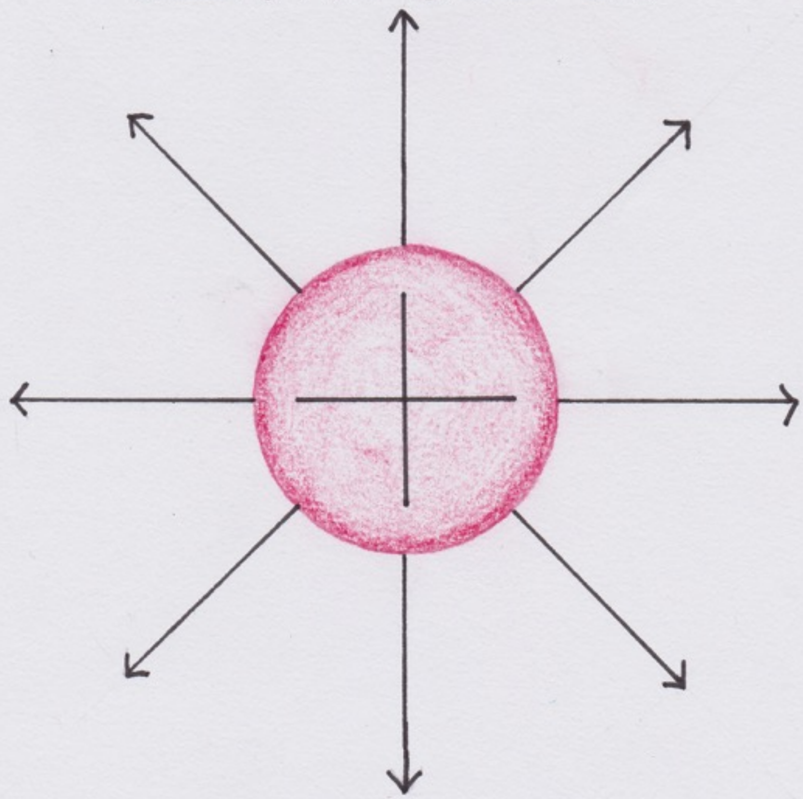
Physics

With Mr. Swarth



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11th Grade

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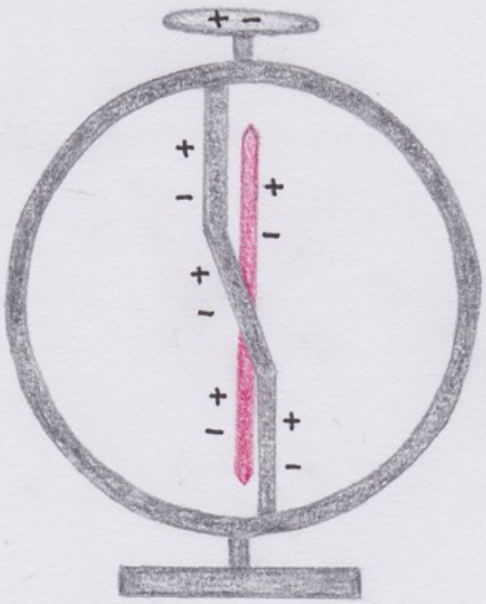
The Electroscope

1 No charged object is near the electroscope, so it is neutral.

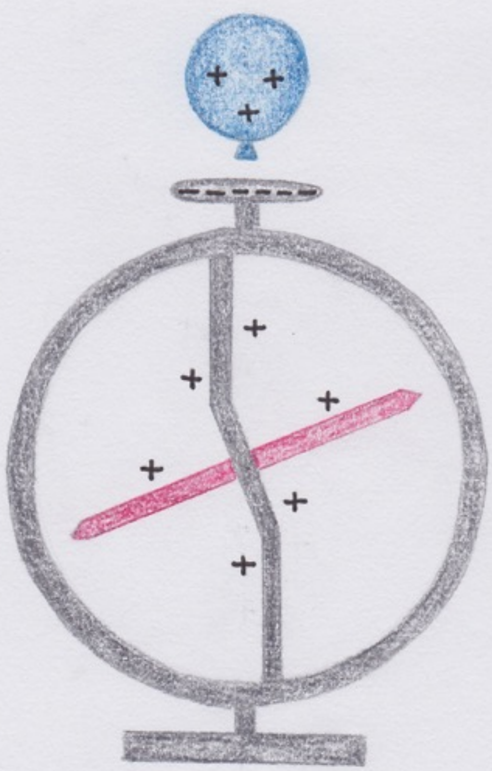
2 A positively charged balloon has been brought near the electroscope so the top of it becomes negatively charged and the bottom becomes positively charged. This redistribution of charge is called induction. Then the positively charged needle is repelled from the positively charged conductor.

3 A person touches the bottom of the electroscope, neutralizing the needle and conductor. This contact, which removes or adds electrons, is called conduction.

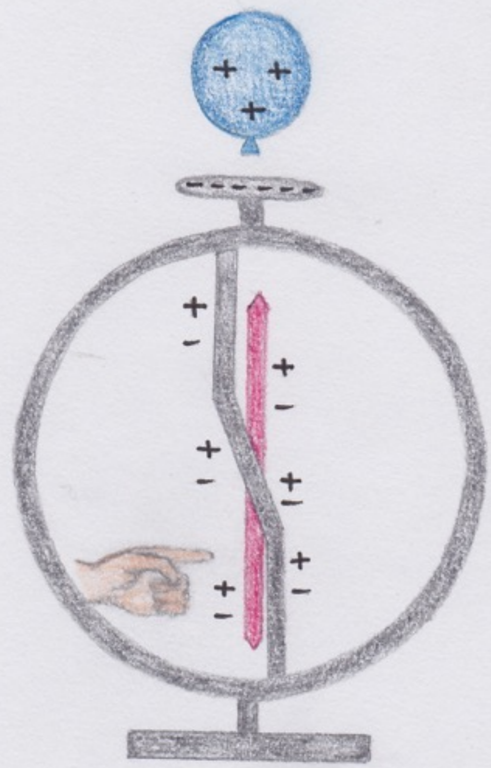
4 A person touches the bottom of the electroscope, neutralizing the needle and the conductor. Then the the balloon is removed, causing the negative charge to distribute down to the bottom of the electroscope. The negatively charged needle then repells from the negatively charged conductor This is another example of induction.



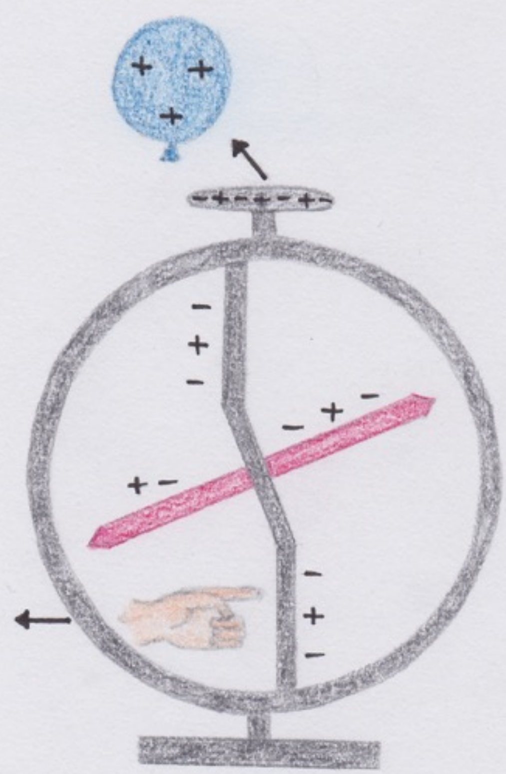
1 Neutral



2 Induction



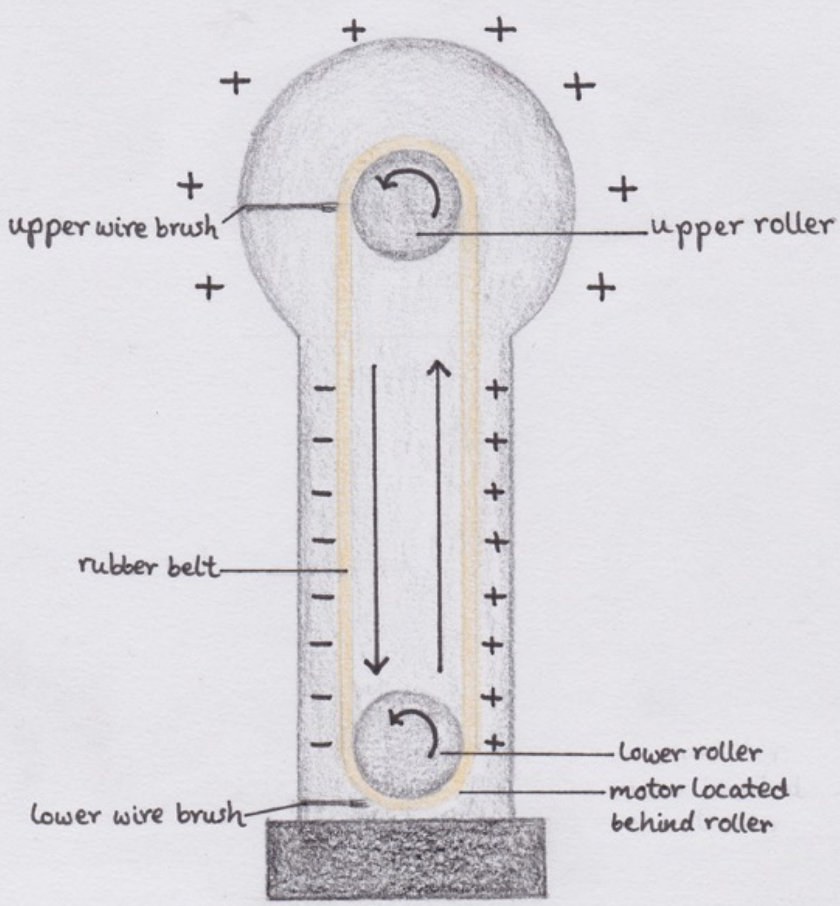
3 Conduction



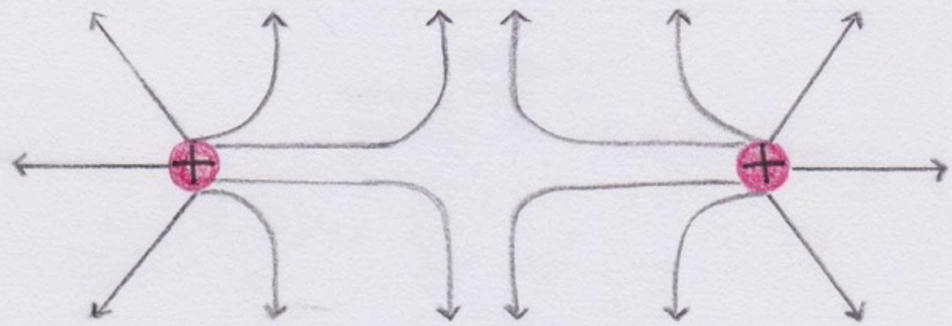
4 Induction

The Van de Graaff Generator

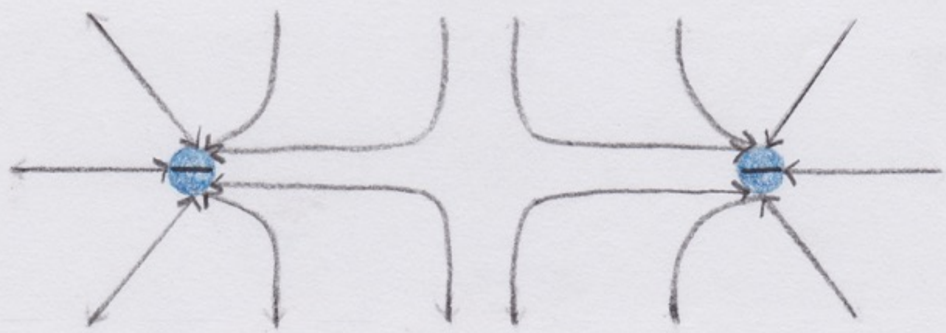
The Van de Graaff generator is an electrostatic machene that consists of a motor, a rubber belt, a dome, two rollers, and two wire brushes. The motor spins the lower roller, which in turn rotates the rubber belt. In a positively charged generator, the friction created by the movement of the rubber belt across the rollers causes electrons to be carried from the top of the dome, to the belt, and down to the bottom of the generator, where they are transferred onto the lower roller. This causes the dome's external surface to have a positive electric charge. (The top of the generator is a dome because a spherical surface holds charge better than any other shape.)
The Van de Graaff generator has very high electric potentials, and it produces very high voltage direct current electricity at low current levels.



Electric Fields



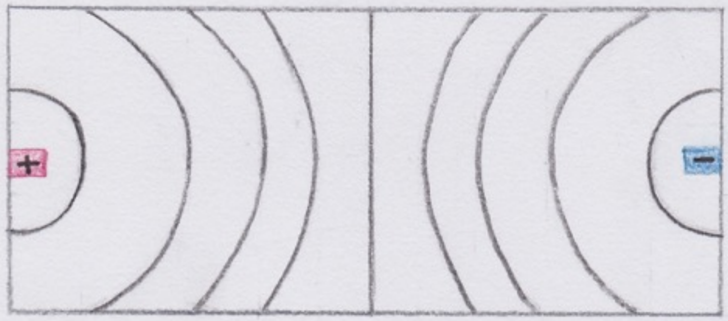
The electric field between two positively charged spheres.



The electric field between two negatively charged spheres.

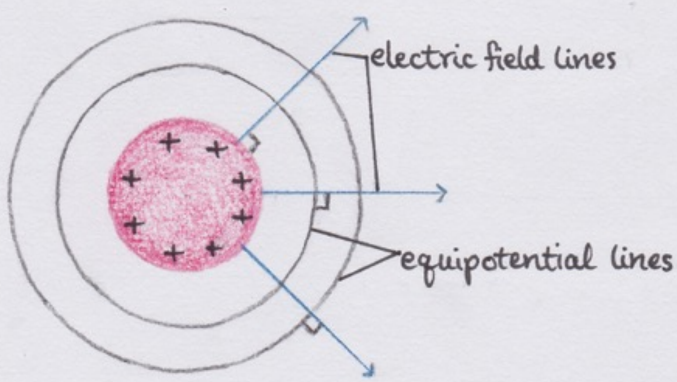
The electric field between a positively and negatively charged sphere.

Equipotential Lines



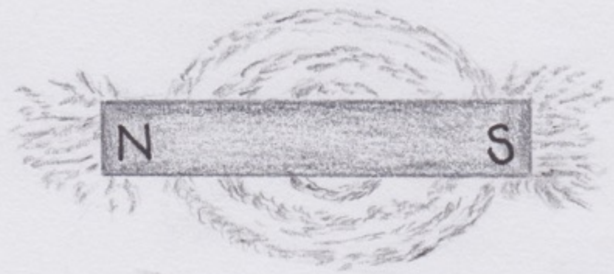
Equipotential lines between two charged spheres where there is no voltage difference.

Equipotential lines between two parallel charged plates where there is no voltage difference.



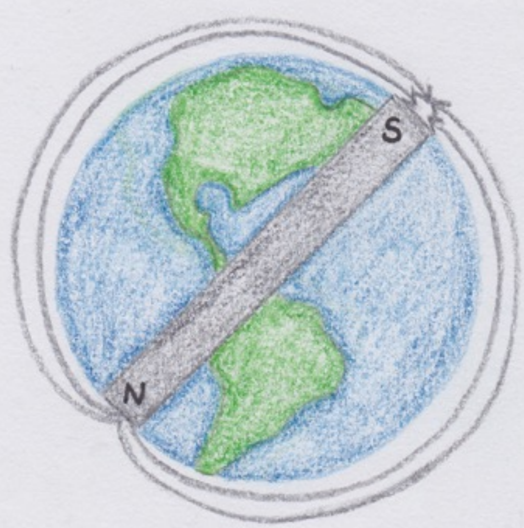
Electric field lines are perpendicular to equipotential lines.

Magnetic Fields



The magnetic field of a magnet

The magnetic field between the north poles of two magnets.

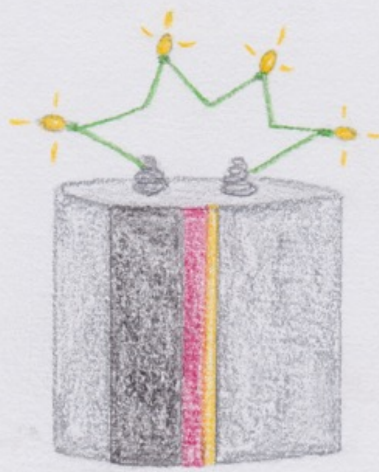


The Earth's magnetic south pole is at what we call the North Pole.

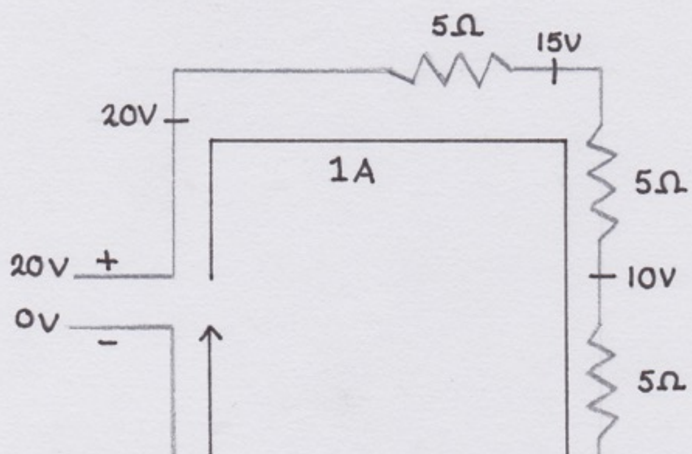
Ohm's Law and Electric Circuits

According to Ohm's Law, voltage is equal to the product of ampridge and resistance, which is written as $V = IR$. This formula can be used to solve for voltage, ampridge, or resistance in electric circuits.

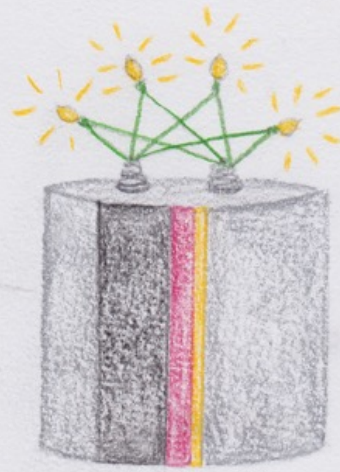
Series Circuits



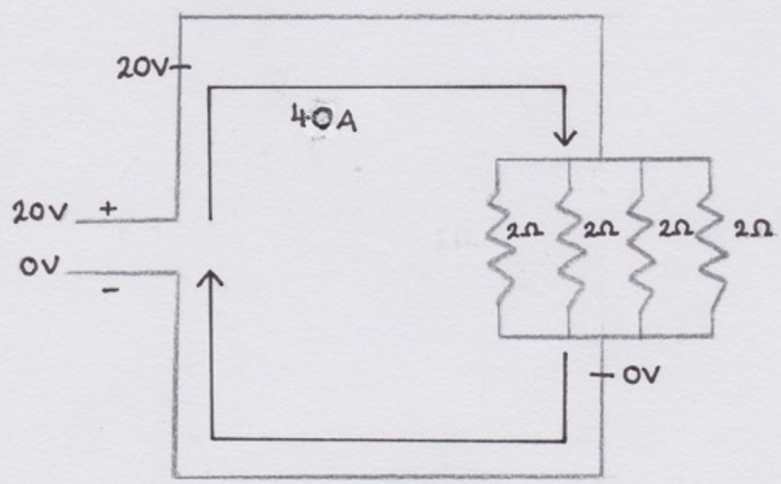
A series circuit has several resistances in a row. In a series circuit, the current is always constant. In the example below, the current of the circuit remains 1 amp.



Parallel Circuits



A parallel circuit has parallel resistors. In a parallel circuit, the voltage remains constant. In the example below, the voltage of the circuit remains 20 volts.



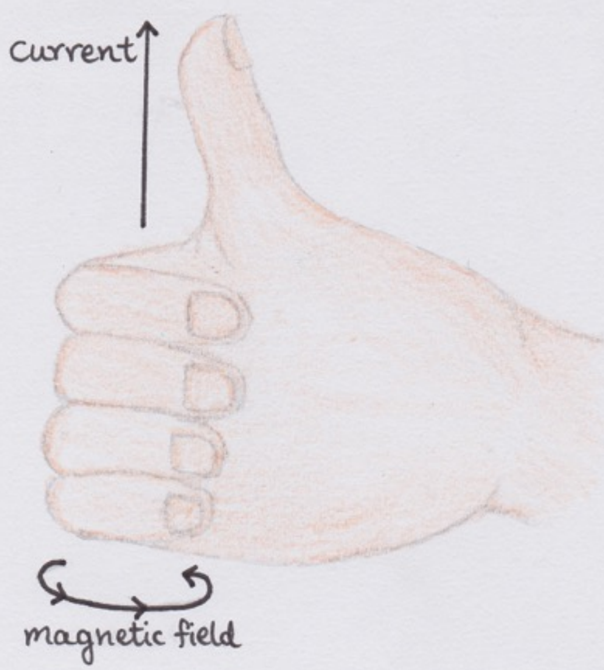
The Right Hand Rules

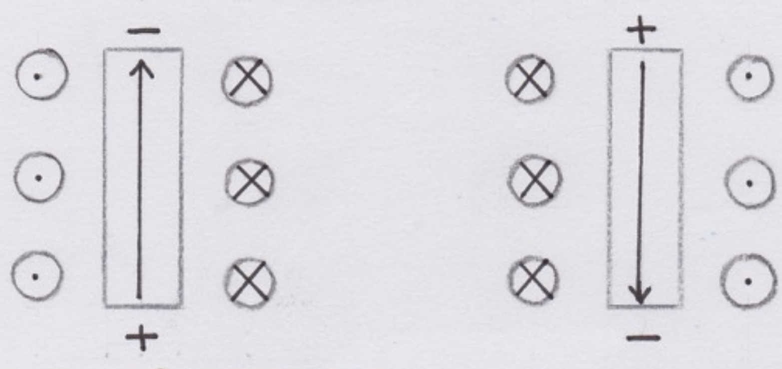
The First Right Hand Rule

There is a Right Hand Rule that is used to find the magnetic field around a wire that is carrying a current.

To make the correct hand gesture, make a fist with your right hand and put your thumb up as if you are making the "okay" gesture. Your thumb represents the current and your fingers represent the magnetic field.

To find the magnetic field around a wire that is carrying a current, point your thumb in the direction of the current in the wire. The direction in which your curled fingers point is the direction of the magnetic field.



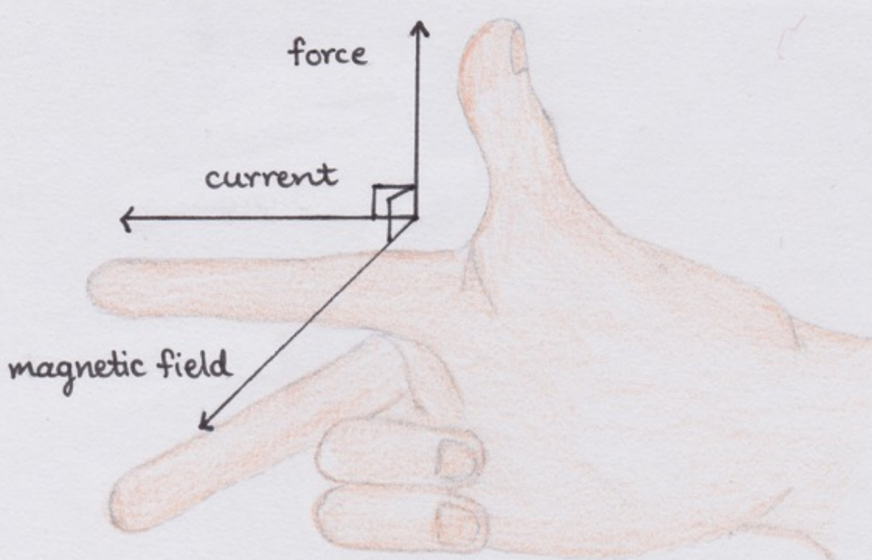


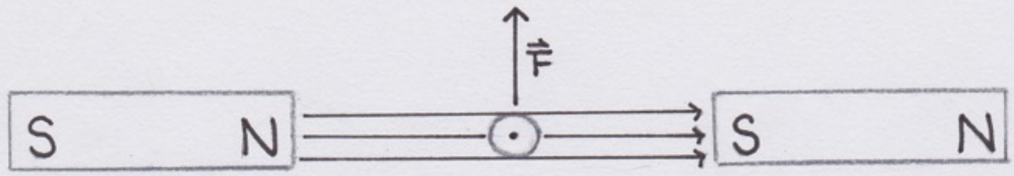
The Second Right Hand Rule

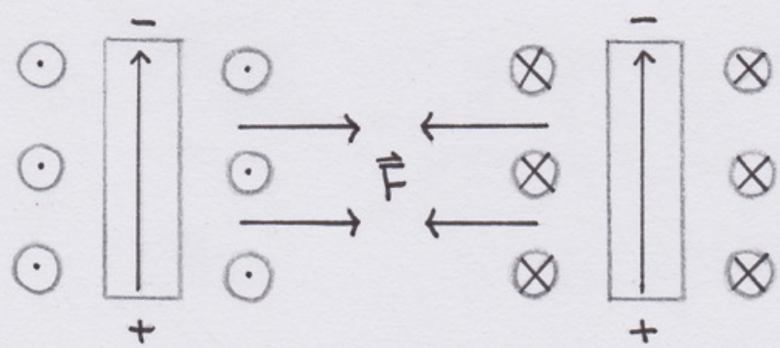
There is a second Right Hand Rule that is used to find the force on a wire that is carrying a current and has been placed in a magnetic field. Force, magnetic field, and current are all perpendicular to each other. Therefore, if you know the directions of two of the above, you can find the direction of the third.

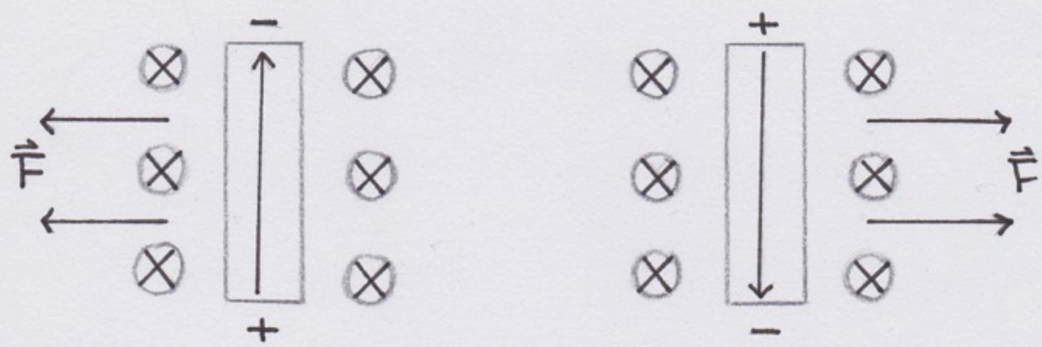
To make the correct hand gesture, point the pointer finger of your right hand out and point the thumb of your right hand up as if you are making a gun with your hand. Then stick your middle finger out as if you're about to pull the trigger of the gun, but straighten it out so that it is at a ninety-degree angle to both your pointer finger and thumb. Your pointer finger represents the current, your middle finger represents the magnetic field, and your thumb represents the force.

To find the force on a wire that is carrying a current and has been placed in a magnetic field, point your pointer finger in the direction of the current, and point your middle finger in the direction of the magnetic field. Your thumb will point in the direction of the force.

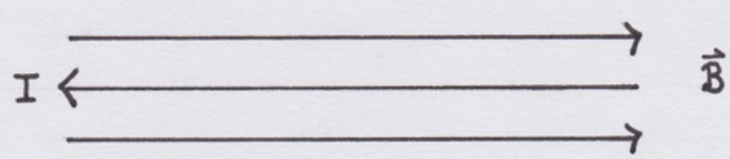








Because force, magnetic field, and current are all perpendicular to one another, in a scenario such as the one in the diagram below, no force is exerted.



Faraday's Law of Induction

According to Faraday's Law of Induction, a change in flux creates a current in an electric conductor. This principle is used in electric generators. In a generator, an electric conductor moves in a magnetic field, creating a voltage difference between the two ends of the conductor. This causes the electric charges in the conductor to flow, generating an electric current.