Name: _____

Period: _____

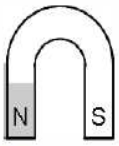
Magnets

4.6

Magnet Basics

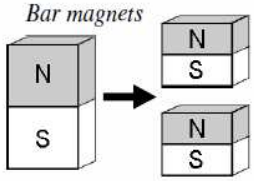
A magnet is anything that can attract or repel another magnet.

Horseshoe magnet



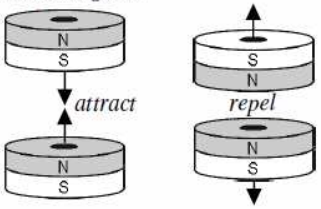
1) All magnets have two poles: a north and a south.

Bar magnets



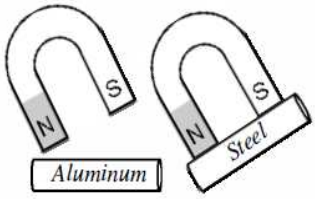
2) You can't separate a N pole from a S pole (you just make smaller magnets).

Donut magnets



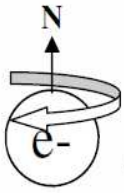
Opposite attract *Likes repel*

3) Magnets exert magnetic forces of attraction and repulsion.

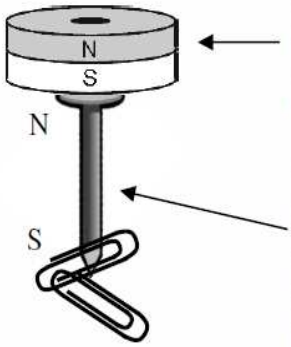


4) Magnets only attract ferrous metals: Iron, Cobalt, and Nickel (steel is an alloy of mostly Iron and Nickel).

How do Magnets Work?



Moving or spinning electrons in atoms cause magnetism. If electrons are paired and spinning in opposite directions, the magnets cancel each other out. When a substance is magnetic many of the electrons are spinning in the same direction.



Permanent magnets do not lose their magnetism. Many of the electrons in a permanent magnet are spinning the same way and the all of the little electromagnets add up. Lodestone and Magnetite are the only two natural permanent magnetic materials.

Temporary magnets become magnets only when near a permanent magnet. The spinning electrons line up together when a magnet is near, but will eventually fall back after the magnet leaves. Only ferrous materials can become temporary magnets. Often bumping them (like dropping) can cause the electrons to fall back quickly.

Electromagnets

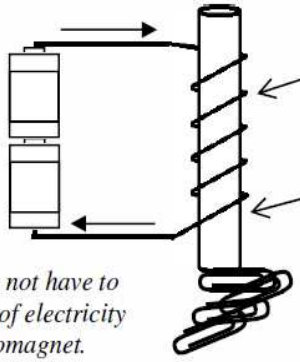
An electromagnet is a magnet made by moving electricity.

Electromagnets are particularly useful because they allow us to create forces that we can turn on and off at will.

A toaster holds the toast down with an electromagnet. When the electricity turns off, the electromagnet releases the toast.

Ways to strengthen an electromagnet:

1) More electricity (more current thru more batteries, etc).



2) More coils (the easiest way to add electricity).

3) Add a ferrous core, especially iron, which becomes a temporary magnet.

An electromagnet does not have to have a core: any loops of electricity will make an electromagnet.

Generators and Motors

Moving electricity creates magnetic fields. Moving magnets make electricity. Because electricity and magnetism are linked we can make motors and generators.

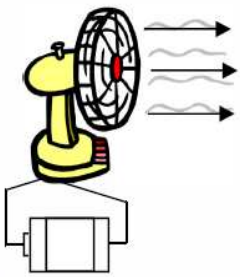
Generators generate electricity.

Something turns the generator (does work) causing magnets to move, which creates electricity. Dams, cars, and power plants all produce electricity in this way.

Work in (air): electricity out.

Motors use electricity.

Electricity causes magnetic forces thru electromagnets. The electromagnets cause the object to turn (do work).



Electricity in: work out (moving air).

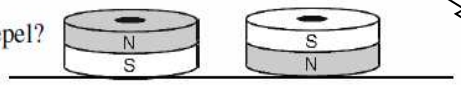
Motor or Generator?

It could be either one, depending on how it is used. Any motor can create electricity and any generator will turn if electricity is applied.

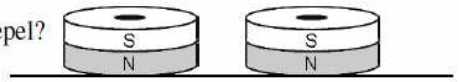
All sections marked with a ⚡ are considered essential concepts and must be completed to receive full credit on WS.

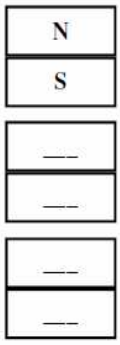
1. Permanent magnet	A. Turns when electricity is turned on.
2. Temporary magnet	B. Becomes a magnet near a magnet, then loses its magnetism when moved away.
3. Motor	C. Becomes a magnet when electricity moves in wire coils.
4. Generator	D. Uses work to make electricity.
5. Core	E. Does not lose its magnetism: lodestone and magnetite are only natural types.
6. Electro-magnet	F. Center of the electromagnet coils.

Attract or repel?

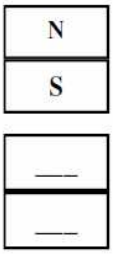


Attract or repel?





If the three magnets are ***attracting*** each other, label N and S on the second magnet.

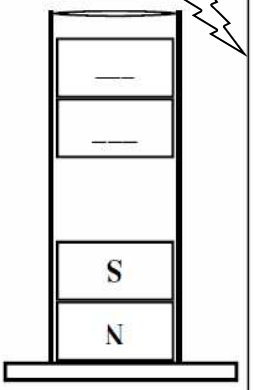


If the two magnets are ***repelling*** each other, label N and S on the second magnet.

*The diagram show **magnetic levitation (Maglev).** The top bar magnet is suspended (floating) above the bottom magnet while in a graduated cylinder to keep it from falling to the side.*

1) Two keep the upper magnet levitated, are they attracting or repelling each other?

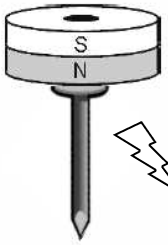
2) Label N and S on the upper magnet.



1) Label the north and south poles of the nail magnet.

2) Will the nail stay a magnet when removed from the bar magnet?

3) Is the nail a temporary or permanent magnet?



True or false (and why):
"A magnet will pick up any piece of metal."

As a magnet gets closer to another magnet, does the magnetic force increase or decrease?

What makes a magnet on the atomic level?

Draw a simple electromagnet:

Name three ways you could increase the strength of an electromagnet:

Motor, Generator, or Both?

_____Creates electricity.
_____Has loops of wire in it.
_____Creates motion.
_____Is turned by a force.
_____Can make electricity.

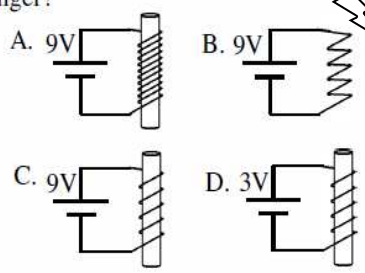
____ Used in a hydroelectric dam.
____ Used in open or close windows in a car.
____ Turns when electricity is applied to it.

____ *Work* → ☐ → *Electricity*

____ *Electricity* → ☐ → *Work*

Which electromagnet is stronger?

A or B?
B or C?
C or D?
A or C?
A or D?



Which is the strongest of the four?