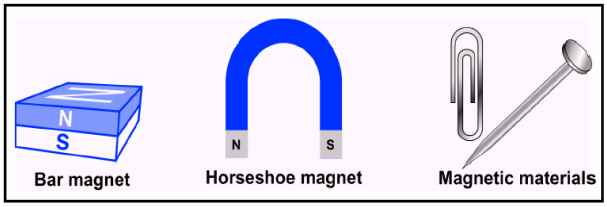
Name: _____

Period: _____

Magnetism

What is a Magnet?

A magnet is something that can attract metal or another magnet. A magnet can also repel another magnet.



Properties of magnets:

- Magnets have two opposite poles: north and south.
- If divided, each part of a magnet will also have a north and south pole (you can never make an un-paired pole)
- Magnets exert forces on other magnets, called "Magnetic forces"
- Opposite poles attract (North attracts South) Like poles repel (North repels North, etc)

Permanent and Temporary Magnets

Iron makes the best temporary magnets.
Only lodestone and magnetite are permanent magnets.

Permanent magnet – a magnet that retains its magnetism and does not need to be "recharged." *Lodestone* and *magnetite* are the only two permanent magnetic substances.

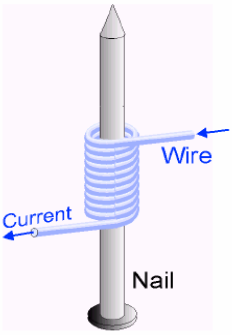
Temporary magnet – a magnet that occurs when near a permanent magnet, but loses its magnetism away from the permanent magnet; many metals can be temporary magnets.

Electromagnets

Electromagnet—a magnet made from electricity. When electricity moves it causes magnetism.

Best use of an electromagnet— we can turn it on and off. Toasters, doorbells: any job needing a force on command needs an electromagnet.

A simple electromagnet



Strengthening an electromagnet –

Increase electricity
– more batteries or stronger battery;

Increase number of coils
– actually adds electricity, too.

Add iron to the core (center of electromagnet)
- the iron amplifies the electromagnetic field.

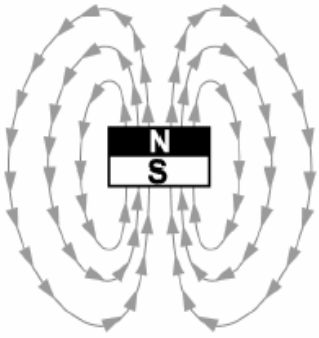
Second best use of an electromagnet
—we can control how much force we need by increasing or decreasing the electricity.

How do Magnets Work?

Spinning electrons cause magnetism.

Permanent magnets—all of the electrons in an atom are spinning the same way and the little electromagnets add up.

Temporary magnets— the electrons can switch to spin in the same way when near a magnet, but will fall back after the magnet leaves.



Any magnet will reach inside the magnetic field (the arrows)

The arrows show the direction a North pole would move in the magnetic field.

Magnetic Fields

Magnetic Field—the area in which a magnet or piece of metal feels the force of another magnet.

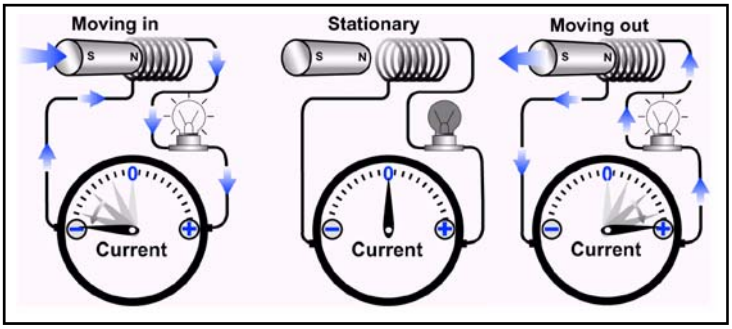
Rules for magnetic fields—
- drawn from North pole to South pole;
- closer or more arrows = stronger field.
- any magnet will react in a magnetic field.
- every magnet creates a magnetic field.

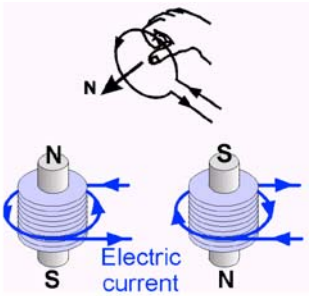
The magnet of a compass reacts to the Earth's magnetic field to point to ***magnetic north*** (in Canada), not ***true north*** (the North Pole).

Magnetic Induction

You "induce vomiting" when someone drinks poison – you <u>force</u> them to vomit.

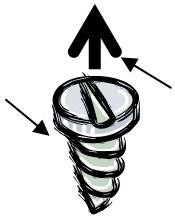
Magnetic induction is the forcing of electric current by moving a magnet through wire loops.





Right-hand rule:
To find the north pole of an electromagnet, simply wrap your right hand fingers in the direction of the electric current (from + to -). Your thumb will point in the direction of the electromagnet's *north pole.*

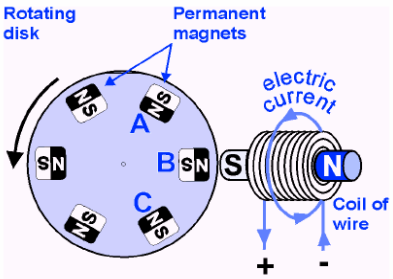
Another way that might help you with this right hand rule: if you turn a screw counterclockwise it will move up (out of its hole) - that's why counterclockwise is positive.



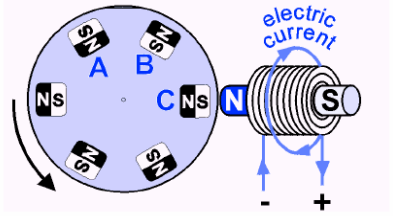
Turn a screw counterclockwise and it moves up - the positive direction.

Generators versus Motors

A motor and a generator are the same device in reverse. One can be used as the other.



Motor—makes work from electricity (stored work). Electricity makes electromagnets which push against permanent magnets to cause the motor to move.
Electricity In - Work Out.



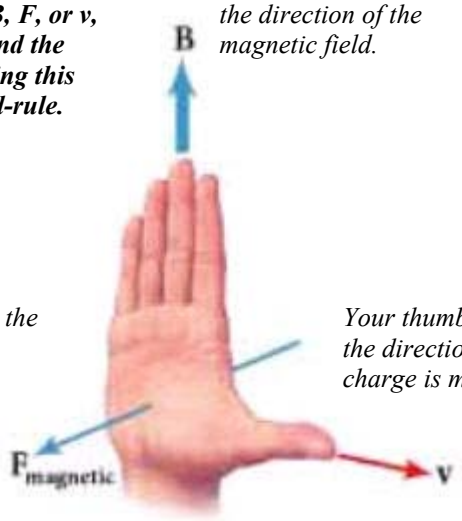
Generator—generates electricity from work (a force and distance). Moving magnets make electricity from magnetic induction. Generators usually move in circles.
Work In - Electricity Out.

Motor or Generator? Depends on if electricity is going in or out.

Second Right-hand rule:

If you are given two of these three: B, F, or v, you can find the third by using this right-hand-rule.

Your fingers are in the direction of the magnetic field.



Your palm is in the direction of the magnetic force.

Your thumb is in the direction the charge is moving.

Page #	Equation
	$F_{magnetic} = qvB$
see notes	$emf = -N\frac{\Delta[AB(\cos\theta)]}{\Delta t}$

B	Teslas (T)	Magnetic field strength	Strength of the magnetic field
q	Coulombs (C)	charge	Amount of charge moving in the mag field
N	No units	# of loops	The negative is not a part of N
A	m^2	area	Area of the loop of wire
emf	volts	Induced voltage	Voltage produced by a changing magnetic field