

Name _____ Date _____

Partners _____

Magnetic Forces: Lab #7
M.L. West

Objective: to learn about magnets and their connection to DC electricity.

Equipment:

Background: Magnetism has been known for thousands of years, but understood for only 150 years or so. It turns out to be intimately related to electric currents.

Procedure:

NOTE: PLEASE KEEP MAGNETS AWAY FROM COMPUTERS AND FLOPPY DISKS!

1. Permanent magnets

a) Compasses

In this room with no windows, which way is north? _____

One end of a compass needle points toward the north magnetic pole of the Earth. We often assume that our buildings are oriented north/south as well. We will test this assumption by aligning a compass with the floor tiles which are aligned with the room walls and the whole building.

Put the small compass on the floor along a tile border and notice the direction it points. Measure the angle between the tile edge (presumably this building's north direction) and magnetic north. It is roughly _____ degrees.

Comment:

True north (Earth's rotation axis) is about _____ degrees (East, West) of magnetic north as seen from New Jersey. The building is then about _____ degrees from true north.

b) Since you now know which end of the compass (the north-seeking end is what color _____) points toward the Earth's north pole, you can use the small compass to determine the north-seeking (N) pole of a permanent bar magnet. (What do the two north-seeking poles do to each other?)

Mark this end of the bar magnet with a rubber band. Mark another permanent bar magnet's north-seeking pole with a rubber band also. Please do not write anything on the magnets!

Hold one bar magnet in your hand. Please be careful to hold the magnets and not drop them as some of them are brittle and might break. Bring the north pole toward the north pole of another bar magnet. Describe what happens:

Try one south pole approaching another south pole. Describe what happens:

Try one south pole approaching a north pole. Describe what happens:

Conclusions:

c) Bar Magnet

Place the magnet on a piece of white paper on the table. Place the clear plastic lid on top of it. Place the baggie on the lid. Spread out the iron filings inside their baggie and use them to visualize the magnetic lines of force, and sketch them for a bar magnet: Be careful to keep the filings inside the bag. They make a mess if they escape!

Use the magnet viewing card to visualize the north and south poles of a bar magnet. With this card the poles appear (dark, light) and the regions between the poles appear (dark, light).

Sketch:

d) Horseshoe magnet

Use the iron filings inside their baggie to visualize the magnetic lines of force, and sketch them for a horseshoe magnet:

Use the magnet viewing card to visualize the north and south poles of a horseshoe magnet.

Sketch:

e) Disk magnet

Use the iron filings inside their baggie to visualize the magnetic lines of force, and sketch them for a disk magnet:

Use the magnet viewing card to visualize the north and south poles of a disk magnet.

Sketch:

f) Flat flexible magnet

Use the iron filings inside their baggie to visualize the magnetic lines of force, and sketch them for a flexible flat refrigerator magnet:

Use the magnet viewing card to visualize the north and south poles of a flexible flat refrigerator magnet. Sketch:

Try several different refrigerator magnets:

Comment:

g) Picking things up

Spread your paper clips on the table. Try to pick up some paper clips with a magnet.

Your strongest magnet (_____) picked up _____ paper clips.

Your strongest magnet's other end picked up _____ paper clips.

Could your strongest magnet pick up brass fasteners? _____

Could your strongest magnet pick up aluminum foil? _____

Could your strongest magnet pick up copper wire? _____

Could your strongest magnet pick up any coins? _____

Comment:

2. Electromagnets

a) Hold your large nail over the paper clips.

If it is not a magnet it should pick up _____ paper clips. Did it?

b) Leaving a tail of about 10 centimeters, wrap the wire around the nail near the tip, then wrap it around the nail as many times as possible (_____), leaving a long tail.

Connect the ends of the wire to a battery (_____ volts)

Try to pick up the paper clips. Your nail picked up _____ clips.

Try to pick up brass fasteners. Your nail picked up _____ fasteners.

Comment:

c) Connect your electromagnet nail's wires to a 3 volt battery combination.

Now it can pick up _____ paper clips.

What happens when you disconnect the wires from the battery while the nail is holding some paper clips?

Did your nail get hot? Be careful!

d) Place the small compass near the flat coil. Connect the coil to a 3 volt battery combination. Describe how the compass acts when the electrical connection is made:

What happens when you reverse the electrical leads?

Does an electromagnet have a north and a south pole?

e) How many paper clips can the flat coil pick up or hold on to? _____

Insert your other large nail into the central hole of the flat coil. Now how many paper clips can it pick up or hold on to? _____

Comment:

3. Blockers of magnetism:

Experiment with various materials (paper, cloth, plastic, metal foil, soda can, water, etc.) to see if anything can block the effect of your strongest magnet at the same separation.

Conclusion:

How does this topic apply to your life?

Try the Rattle Rox.

What is a cow magnet?