

Virtual Laboratory

Topic 10 – Magnetism

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Name _____

Section # _____

Date _____

Topic # _____

Magnetism Questionnaire

Answer the following questions based upon your reading.

1. What creates a magnetic field? _____

2. How are magnetic poles labeled?

Magnetic Poles are labeled _____ and _____ .

3. What is the magnetic polarity of the geographic North Pole of the Earth?

The geographic north end of the Earth is the _____ pole of a magnetic field.

A compass needle is a magnet—it's _____ end is marked NORTH.

4. Magnetic field is defined as going from the _____ end of a magnet to the _____ end.

5. What are the two factors that determine the strength of the magnetic field surrounding a magnet?

PHET Electromagnets:

a. Go to: http://phet.colorado.edu/simulations/sims.php?sim=Faradays_Electromagnetic_Lab.

Google **PHET Faraday's Lab**. Click the Play button and then **RUN NOW**. **At the top of the PHET page there are 5 tabs. Click on BAR MAGNET. Please answer all questions below using complete sentences. Utilize punctuation, capitalization, and proper grammar.**

6. Here you will find a compass and a bar magnet. What do the two have in common (and the question is not asking about color)?

7. Slowly move the compass around the bar magnet. What are your observations? Explain what you are witnessing.

8. Increase and decrease the strength of the bar magnet (use slider) and continue to slowly move the compass around the bar magnet. What effect does changing the magnet's field strength appear to have on the compass?

9. Place the compass next to the South Pole of the bar magnet and press the **Flip Polarity button**. What happens to the magnet and the compass? Explain.

10. Click **See Inside Magnet box**. What do you see? Explain what it means.

11. Click **Show Field Meter** and move the meter around. In what position outside of the magnet is the magnetic field greatest? Where is it weakest? (B represents the field strength. G is the abbreviation for the Gauss unit.)

Click the tab for **Electromagnet**. (Remember to answer questions using complete sentences.)

12. Notice that the electrons moving through the wire loops create a magnetic field. Slide the voltage bar inside the battery to the opposite end of the battery to switch the magnetic field. A) What happens to the magnetic field if the direction of current in the wire loop is reversed? B) What happens to the strength of the magnetic field as more electrons move (as current increases)? (Use the slider bar to increase voltage.)

A. _____

B. _____

13. Slide the voltage bar in the battery. When there is no voltage the electrons are still moving randomly though you can't see the random movement in this simulation. (Since the number of electrons moving in one direction is balanced by electrons moving the opposite direction, there is no net magnetic field.) There is no magnetic field because there is no net flow of electrons. **Predict** what you think will happen if a bar magnet approaches the coil of wire. Will the movement of electrons (in the coil) cause the magnetic field to increase, decrease, or stay the same? Will the movement of electrons producing the opposite magnetic field be encouraged or discouraged? Explain your reasoning. (You will refer to this answer later.) Just do the best you can. Don't do web searches looking for the right answer.)

Click the tab for **Pickup Coil**.

14. Slowly move the north end of the magnet towards the coil. What happens to the electrons in the wire as the field in the coil of wire from the north pole of the magnet increases in strength? What happens to the light bulb?

15. Slowly move the north end of the magnet away from the coil. What happens to the electrons in the wire as the field from the north pole of the magnet decreases in strength?

16. Slowly move the south end of the magnet towards the coil. What happens to the electrons in the wire as the field from the south pole of the magnet increases in strength? (Move the magnet to the other side of the coil of wire.)

17. Slowly move the south end of the magnet away from the coil. What happens to the electrons in the wire as the field from the south pole of the magnet decreases in strength?

18. Consider your prediction from question number 13. Example: A general rule for how a pickup coil will respond to a magnetic field might be:

Electrons in a pickup coil will move to minimize the disturbance in a changing magnetic field. They will tend to move so that the polarity of the coil is opposite the change in the field.

Explain, in your own words, what you think is happening to cause the electrons to move.

At the top of the page click the **Generator** tab.

19. Turn the faucet on by sliding the bar located on the faucet. _____

a. How does a generator use the effect you noticed in the pickup coil to generate electrical energy? _____

Increase the number of loops in the box on the right.

b. What effect does changing the number of coils (loops) have on the current? _____

c. What energy transformations are taking place? _____

d. Why does this generator make an alternating current? _____

MAGNETISM

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Name	Section #	Kit #	Topic #

Part A - Which Materials are Magnetic?

1.(2) Indicate by placing an Y or N for any magnetic materials found. Test with both ends of magnet.

Material	Magnetic (Y/N)	Material	Magnetic (Y/N)
Lead		Wood	
Steel		Rubber	
Plastic Shot		Candy Topping	
Colored Glass		Zinc	
Aluminum		Gravel	
Cobalt		Silver	
Copper		Magnesium	
Nickel		Tin	
Brass			

2. Using the above table list any magnetic materials found

Note: All of the materials that were attracted to the magnet are classified as ferromagnetic materials. All the others are classified as diamagnetic or paramagnetic.

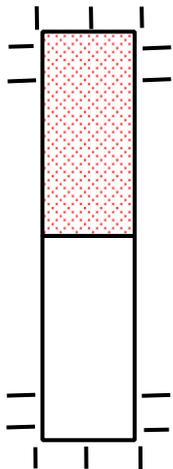
Part B – What is the Law of Magnetism? **Pre-lab Prep**

1. (4) Describe what happens when two like poles are brought together.
2. (5) Describe what happens when two unlike poles are brought together.
3. State the Law Of Magnetism.

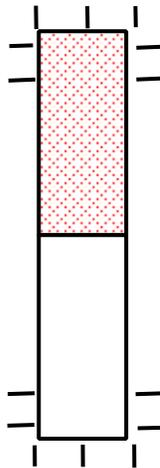
Part C - Magnetic Fields:
C 1 – Sketching Magnetic Fields

Note: Your lines of magnetic force will overlap between the sections. Use a different color for each section.

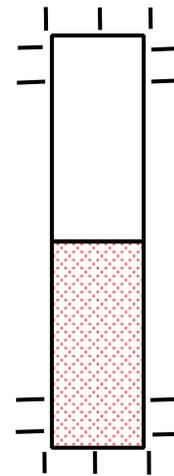
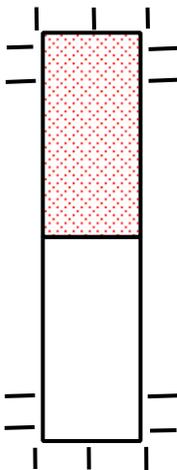
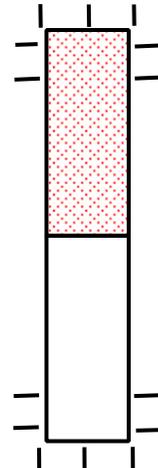
Single Magnet



Unlike Poles



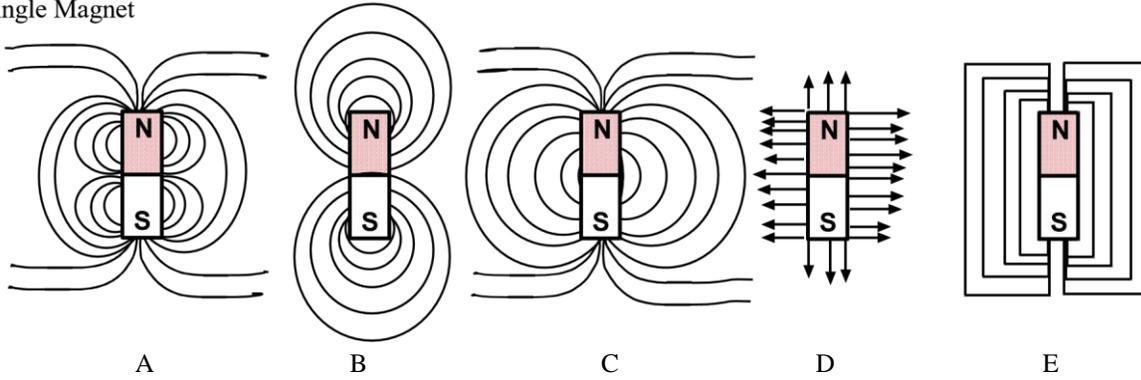
Like Poles



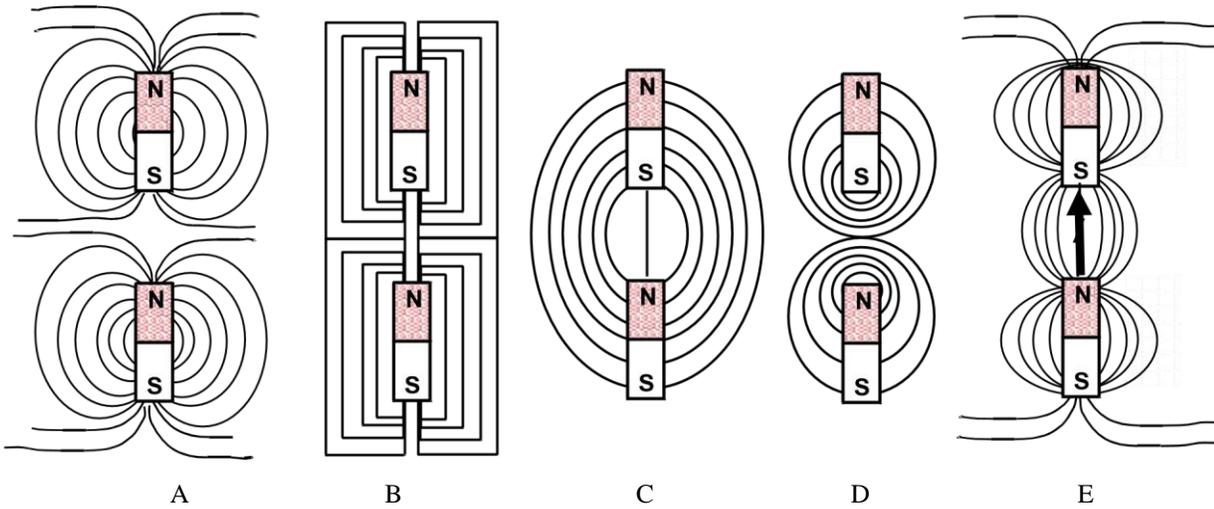
Summarize your findings concerning magnetic fields:

C2 – Selecting Magnetic Fields (Pre-Lab Prep)

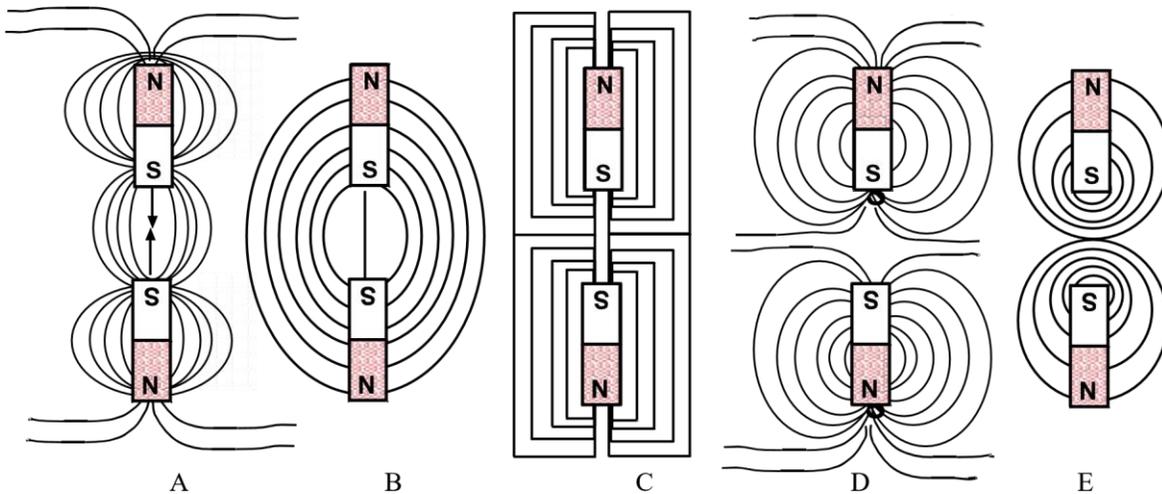
Single Magnet



Unlike Poles



Like Poles



Which is the correct drawing for: Single _____ Unlike Poles _____ Like Poles _____

Summarize your findings concerning magnetic fields. _____

Part D - What is the Effect of Electricity upon Magnetic Fields? Be careful of magnetic fields from power outlets, extra magnets, and laptops. These can affect your results.

Section 1 - What is The Effect of Electricity on the Production of Magnetism?

1. (2) Describe any movement of the compass needle
2. (3) Describe what happens when you place the wire on a piece of scrap paper and sprinkle a small amount of iron filings onto the wire with the electricity turned off while lifting up the wire.
3. (4) Describe what happens when you place the wire on a piece of scrap paper and sprinkle a small amount of iron filings onto the wire with the electricity turned on while lifting up the wire.
4. (5) What does your comparison suggest concerning a magnetic field near a Current Carrying Wire?

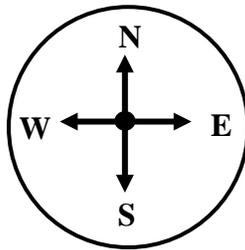
Section 2 – Observing the magnetic field around a current carrying wire. Draw the new positions of the compass needles on the drawing.



End View of Wire

Describe the magnetic field around the wire carrying an electric current

Part E - The Earth's magnetic field:



- 1.(4) What direction is the north pole of the magnet pointing? _____
- 2.(5) In which direction does the needle of the compass point? _____
- 3.(5) Does the needle point in the same direction when the compass is turned? _____
- 4.(6) Why are the poles of a magnet named North and South? _____
- 5.(7) If a bar magnet had the N and S markings rubbed off how could the North pole. and the South pole of the magnet be identified? _____

Part F - The effect of magnetism upon the production of electricity:

		Number of Wire Wraps			
		5	10	20	40
Galvanometer Reading					

How does magnetism affect the production of electricity: _____

Part G - Determining the strength of an electromagnet:

Trial	Turns	Observation	Iron	Aluminum	Wood
1	25	Compass (Yes or No)			
		Number of Staples			
2	50	Compass (Yes or No)			
		Number of Staples			
3	75	Compass (Yes or No)			
		Number of Staples			
4	100	Compass (Yes or No)			
		Number of Staples			

1.(10) Which core was the strongest? _____

2.(11) How does the number of turns of wire affect the strength of an electromagnet? _____

3.(12) Which combination of core and number of turns was the strongest? _____

Part H - The Electric Motor

1.(9) Explain how the motor works using the concepts in this topic. _____

2. Motor Certification (if appropriate have obtain your instructors initials) _____

Part I - Graphing the Earth's Magnetic Field Intensity Pre-lab prep

The Research Question: How has Earth's magnetic field intensity changed during the last 800 thousand years?

Your hypothesis: _____

Test your hypothesis: Go to the following website to obtain the data to plot on a graph of Intensity vs. Age (Before Present Day). **You will need to add the following data point that is not included on the table:** The age of the Earth is 0.0 representing *today*. The Earth's magnetic field strength intensity today is 11.5 units. <http://image.gsfc.nasa.gov/poetry/venus/Revstudent.html>

Scientists don't know for sure what the intensity level is that occurs when the Earth's magnetic poles reverse. but they are currently thinking it is around **2 intensity units or less**. For the purpose of addressing the questions below we will assume that the field reverses when the intensity is around 1.9 units or less. Use your graph to answer the following questions.

1. Identify the dependent variable. _____ 2.

Identify the independent variable. _____

3. Analyze the graph by answering the following questions.

a. How many times has the field changed directions in the last 800 thousand years? _____

b. How long ago was the magnetic field intensity least? _____ What was the intensity ? _____

c. How long ago was the magnetic field intensity greatest? _____ What was the intensity ? _____

4. How do your results compare to your hypothesis? _____ Explain _____

5. Use your graph to predict when the next reversal will occur. **Explain your reasoning.**

