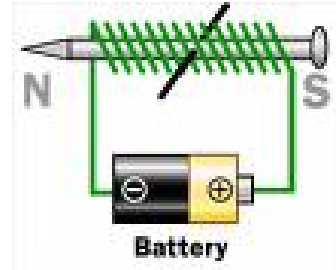


Part I:



1. Run the simulation on the website or go to <http://phet.colorado.edu>, and find Magnets and Electromagnets.
2. Move the compass slowly along a semicircular path above the bar magnet until you've put it on the opposite side of the bar magnet. Describe what happens to the compass needle.
3. What do you suppose the compass needles drawn all over the screen tell you?
4. How is the strength of the force/torque on the compass needle indicated?
5. What are the similarities between the compass needle (magnetism) and a test charge (electricity)?
6. Move the compass along a semicircular path below the bar magnet until you've put it on the opposite side of the bar magnet. Describe what happens to the compass needle.
7. How many complete rotations does the compass needle make when the compass is moved once around the bar magnet?
8. Click "flip polarity" and repeat the steps above after you've let the compass stabilize.
9. Click on the electromagnet tab. Place the compass on the left side of the coil so that the compass center lies along the axis of the coil. (The y-component of the magnetic field is zero along the axis of the coil.)

MAGNETISM **(continued)**

10. Move the compass along a semicircular path above the coil until you've put it on the opposite side of the coil. Describe what happens to the compass needle.

11. Move the compass along a semicircular path below the coil until you've put it on the opposite side of the coil. Describe what happens to the compass needle.

12. How many complete rotations does the compass needle make when the compass is moved once around the coil?

13. Use the voltage slider to change the direction of the current and repeat the steps above for the coil after you've let the compass stabilize.

14. Based on your observations, summarize the similarities between the bar magnet and the coil.

15. What happens to the current in the coil when you set the voltage of the battery to zero?

16. What happens to the magnetic field around the coil when you set the voltage of the battery to zero?

MAGNETISM (continued)

17. Play with the voltage slider and describe what happens to the current in the coil and the magnetic field around the coil.
18. What is your guess as to the relationship between the current in the coil and the magnetic field?

Part II – Graphing relationships.

Field Strength vs. Position

1. Using the Electromagnet simulation, click on “Show Field Meter.”
2. Set the battery voltage to 10V where the positive is on the right of the battery.
3. Along the axis of the coil and at the center of each compass needle starting 5 to the left of the coil, record the value of B. Move one compass needle to the right and record the value of B. Repeat until you’ve completed the table below. NOTE: Be sure to take all of your values along the axis of the coil. You’ll know you’re on the axis because the y component of the magnetic field is zero along the axis.

Compass position (arbitrary units)	Magnetic Field Strength (fill in units)
-5	
-4	
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	

4. What happens to the value of magnetic field strength inside the coil?

MAGNETISM **(continued)**

5. Graph the compass position on the horizontal axis and magnetic field magnitude on the y axis. Print your graph. Make sure to label the axes and title the graph.

a. Is your graph symmetric?

6. Using your graph, what is the relationship between magnetic field strength and position? (Use the fit feature of graphical analysis to help you.)

Part III – Using the simulation to design an experiment.

Field Strength vs. Number of Coils

1. Design an experiment to test how field strength varies with the number of coils.
2. Collect data in a table and **graph your results.**

Field Strength vs. Current

3. Design an experiment to test how field strength varies with the Current. (Recall that voltage is directly proportional to current...Ohm's Law.)
4. Collect data in a table and **graph your results.**