

Name:

## Lab : Magnetic Fields

Answer all questions in the Procedure section directly on this handout.

Answer the questions ABCD at the end of the lab on a separate sheet and staple them to this sheet.

### Learning Goals

During this lab activity, you will learn to

- Predict the **direction** of the magnet field at different locations around a bar magnet and an electromagnet.
- Compare and contrast bar magnets and electromagnets.
- Identify the characteristics of electromagnets that are variable and what effects each variable has on the magnetic field's strength and direction.
- Relate magnetic field **strength** to *distance* quantitatively and qualitatively

### Procedure


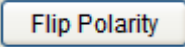
1. **Go To:** <http://phet.colorado.edu/en/simulation/faraday>

Either "Download" or "Run Now" to open the simulation


2. Complete the following tasks to help you investigate *Faraday's Electromagnet Lab*. These tasks will help you conduct appropriate experiments to answer the lab questions.

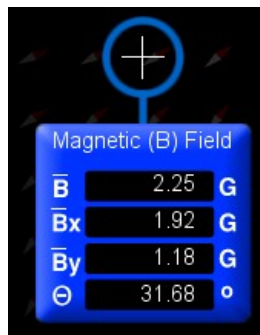
This procedure walks you through the **Bar Magnet** and **Electromagnet** tabs.

You will investigate the pickup coil, transformer, and generator tabs on your own.

- Click on the Bar Magnet tab. 
- Click on . Explain the **two** changes this causes in the simulation.
- Move compass to various locations around the bar magnet. Explain what orientation the needle takes with respect to the bar magnet.



- Select 'Show Field Meter'  . The image below will appear. The meter can be moved to various locations and indicates the magnetic field strength at the crosshairs. **Label:** Total magnetic field, y-component of the magnetic field, x-component of the magnetic field, angle and units in the following diagram.



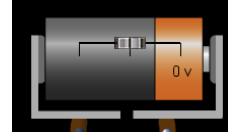
- You should be able to determine the **direction** of the magnetic field vector using the meter. **Draw** a vector to represent the direction of the magnetic field based on the values given on the above meter.

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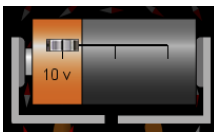
- Select  See Inside Magnet . Observe the orientation of the small compass needles. What direction does the field inside the magnet point?

Electromagnet

- Click on the Electromagnet tab.
- What is behaving like a magnet : The battery or The coils of current carrying wire ?
- Using the slider on the battery, change the voltage of the battery from 10V to 0V.

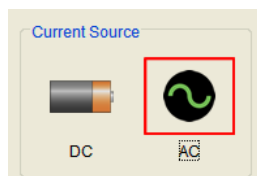


Then from 0V to '10V'.



**Record** above the changes you observe in the direction of the compass needle.

- Select AC as your current source.



**Observe** and **record** the changes in the compass needle.

3. **Design** and **execute** an experiment using the simulation that will allow you to understand the *direction* and *strength* of the magnetic field around

- (a) a bar magnet
- (b) an electromagnet

*You do not need to submit the procedure of your experiment, only your results.*

4. Investigate the other parts in the simulation, and observe how they relate to what we learned in class.

**Questions** Answer these on a separate sheet

- A. Using diagrams and a written explanation, explain the magnetic field **direction** and **strength** around a bar magnet, and an electromagnet.
- B. Explain the **similarities** and **differences** of a bar magnet and an electromagnet.
- C. Identify the characteristics of electromagnets that are variable (can be changed) and what effects each variable has on the magnetic field's strength and direction.
- D. Investigate the other parts of this simulation and describe what you observe/learn. How does the simulation relate to what we learned in class about changing magnetic fields and induced currents? Pay special attention to the Transformer and Generator tabs. They show you an example of what we learned in class on Tue 3/29