# Pre-Lab Information

**Purpose** Plan an investigation to explore the evidence that an electric current produces a magnetic field, and that a changing magnetic field produces an electric current.

**Time** Approximately 60 minutes

**Question** What evidence exists that an electric current produces a magnetic field, and what evidence exists that a changing magnetic field produces an electric current?

**Hypothesis** Develop two hypotheses to test the question.

**Summary** In Part I, you will design your own experiment to explore evidence that an electric current induces a magnetic field.

In Part II, you will design your own experiment to explore evidence that a changing magnetic field produces an electric current.

As you might guess, there are many different experiments you could design that can be used to demonstrate the same concepts or achieve the same results. A good experiment will be clearly laid out and concise, only containing the components necessary to test the hypotheses. Write the hypotheses in the space below.

**Hypothesis 1**

**Hypothesis 2**

# Safety

* Wear clothing that is appropriate for working in a lab environment.
* Behavior in the lab needs to be purposeful. Use caution when connecting the electric circuit to avoid risk of electric shock.
* Make sure you devise clear steps for building a circuit and collecting evidence before actually building it. If you have any questions about connecting components properly, be sure to ask your teacher.
* Always disconnect the circuit when not in use to prevent overheating and loss of charge.
* Handle magnets with care. Dropping magnets can decrease their strength over time.
* If using iron filings, wear safety goggles to avoid getting filings in the eyes.
* Do not bring magnets near computers, computer monitors, audio tapes, or other such magnetic devices. Strong magnets can destroy materials with magnetic properties.
* Report all accidents—no matter how big or small—to your teacher.

# Background Information

It is time to get you thinking about what type of evidence indicates the presence of a magnetic field and what type of evidence indicates the presence of an electric current. Your goal is to gain usable data with which you can evaluate the hypotheses you developed.

You may recall Oersted’s and Faraday’s experiments. Hans Oersted is credited with the discovery of electromagnetism, which is the generation of a magnetic field by an electric current. Michael Faraday discovered electromagnetic induction, which is the generation of an electric current in a closed circuit by a changing magnetic field.

# Lab Procedure

Here is an outline of the steps you should follow to plan your investigation for this lab. Later in the guide, you will have space to develop your ideas, collect data, analyze and discuss results, and draw conclusions.

1. **Determine the types of data you will gather and the tools of measurement you will use to collect the data.**

How will you gather data for your experiment? If gathering quantitative data, you may want to devise a table in which you can record your results in an organized manner. Also, consider how you will record any qualitative or descriptive data in addition to your numerical results. You should use a pencil to record data.

1. **Devise an experiment to examine the evidence that an electric current produces a magnetic field, and the evidence that a changing magnetic field produces an electric current.**

How can you arrange a circuit and determine the effect of an electric current on a magnetic field? How can you create a changing magnetic field and determine its effect on an electric current? Develop the main steps and describe how you will run the experiment. Your teacher will guide you on what materials are available for your experiment.

1. **Stop. Have your teacher sign off on Steps 1 and 2 before you continue the investigation.**
2. **Gather materials and set up your experiment.**

Now that you know what you will do, gather the necessary items. Besides the objects you will experiment with, make sure you have the necessary equipment to take measurements. If you are working with lab partners, make sure each person knows his or her role in running the experiment. Check your setup and make sure everything is in order before you proceed.

1. **Run your experiment.**

As you proceed with your experiment, make sure you record all the necessary data and, if working in groups, the role each student performed during the experiment. Make sure all elements of your experiment are complete. Remember to clean up when you are done!

1. **Use the High School Lab Report Guide to write your lab report.**

# Part I: Exploring the Evidence That an Electric Current Produces a Magnetic Field

1. **Determine the types of data you will gather and the tools of measurement you will use to collect the data.**

Make a list of the types of data you plan to collect. If gathering quantitative data, you may want to devise a table in which you can record your results in an organized manner.

1. **Devise an experiment to examine the evidence that an electric current produces a magnetic field.**

Write the steps of your experiment. Include a sketch of your experimental setup.

1. **Stop. Have your teacher sign off on Steps 1 and 2 before you continue the investigation.**
2. **Gather materials and set up your experiment.**

Gather the necessary items and equipment. If you are working with lab partners, make sure each person knows his or her role in running the experiment. Document the roles here.

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| --- | --- |
| **Student Name** | **Role** |
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1. **Run your experiment.**

Record your data and observations in the space below. Remember to clean up when you are done!

# Part II: Exploring the Evidence That a Changing Magnetic Field Produces an Electric Current

1. **Determine the types of data you will gather and the tools of measurement you will use to collect the data.**

Make a list of the types of data you plan to collect. If gathering quantitative data, you may want to devise a table in which you can record your results in an organized manner.

1. **Devise an experiment to examine the evidence that a changing magnetic field produces an electric current.**

Write the steps of your experiment. Include a sketch of your experimental setup.

1. **Stop. Have your teacher sign off on Steps 1 and 2 before you continue the investigation.**
2. **Gather materials and set up your experiment.**

Gather the necessary items and equipment. If you are working with lab partners, make sure each person knows his or her role in running the experiment. Document the roles here.

|  |  |
| --- | --- |
| **Student Name** | **Role** |
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1. **Run your experiment.**

Record your data and observations in the space below. Remember to clean up when you are done!

1. **Use the High School Lab Report Guide to write your lab report.**