## Introduction

## Purpose To investigate electromagnetism in the form of electromagnetic induction.

**Background Information**

Electromagnetic induction involves electricity and magnetism and can be produced in two main ways: a) passing electricity through a wire induces a magnetic field around the wire; and 2) moving a magnet through a coil of wire induces an electric current in the wire. Generators are electromagnetic devices that produce electricity using electromagnetic induction.

**Materials** PHET Simulation or video link: <http://somup.com/cbeobfRt3> .

**Procedures**: Use the Phet Simulator: Faraday’s Electromagnetic Lab and complete each part.

 1. <https://phet.colorado.edu/en/simulation/legacy/faraday>

 2. Click “download” the simulation.

## PART I Bar Magnet

# 1. Draw or take a screen shot of the magnetic field lines around a typical bar magnet [LABEL your drawing].

2. Move the compass around the bar magnet. Which end of the tiny magnets point to the N and which point to the S? What would be the magnetism of each color of the tiny magnets?

## PART II Pick Up Coil

1. Move the bar magnet all the way through the coil from left to right. Then, reverse the direction from right to left. Record the direction of the electrons (dots) inside the coil as each end of the magnet passes through.

2. Record what happens to the light as you pass the entire magnet through the coil.

3. Record what happens to the light as you pass the entire magnet through the coil quickly versus slowly. When is the bulb brightest and most dim?

**PART III Electromagnet**

1. Draw or take a screen shot of the electromagnet and label the parts (battery, coil, electric current, magnetic field lines).

2. Notice that the battery shows 10 v (volts) to the right. Shift that lever to the left and observe the electric current and tiny magnets. What happens?

3. Why do you think this is called an electromagnet?

## PART IV Generator

1. Turn the faucet on by moving the lever to the right. Explain what produces the electric current.

2. Is this direct current (always in one direction) or alternating current (changing direction)?

3. The lights in our house run on alternating current. Why don’t they blink off and on?

## ANSWERS

## PART I Bar Magnet

# 1. Draw the magnetic field lines around a typical bar magnet [LABEL your drawing].



2. Move the compass around the bar magnet. Which end of the tiny magnets point to the N and which point to the S? What would be the magnetism of each color of the tiny magnets?

 ***The white end of the tiny magnets point to the N, meaning it must be SOUTH. The red end of the tiny magnets point to the S, meaning it must be NORTH.***

## PART II Pick Up Coil

1. Move the bar magnet all the way through the coil from left to right. Then, reverse the direction from right to left. Record the direction of the electrons (dots) inside the coil as each end of the magnet passes through.

 ***As the N end passes through, the electrons in the coil flow counterclockwise.***

 ***As the S end passes through, the electrons in the coil flow clockwise.***

2. Record what happens to the light as you pass the entire magnet through the coil.

 ***The bulb goes on and off.***

 ***This is known as AC or alternating current.***

3. Record what happens to the light as you pass the entire magnet through the coil quickly versus slowly. When is the bulb brightest and most dim?

 ***The bulb is brightest as the magnet passes through quickly and most dim when it passes through slowly.***

## PART III Electromagnet

1. Draw the electromagnet and label the parts (battery, coil, electric current, magnetic field lines).

##

2. Notice that the battery shows 10 v (volts) to the right. Shift that lever to the left and observe the electric current and tiny magnets. What happens?

 ***The electric current and the tiny magnets REVERSE direction.***

3. Why do you think this is called an electromagnet?

 ***The electricity from the battery produces a magnetic field so that both electricity and magnetism are present.***

## PART IV Generator

1. Turn the faucet on by moving the lever to the right. Explain what produces the electric current.

 ***The water turns a “turbine” (wheel) connected to a magnet. The magnet influences the electromagnet producing a current.***

2. Is this direct current (always in one direction) or alternating current (changing direction)?

 ***alternating current … constantly changing direction***

3. The lights in our house run on alternating current. Why don’t they blink off and on?

 ***The lights in our homes blink on and off 120 times per second so our eyes do not notice.***