Honors Physics
2013-14

Faraday's Law and *EMF*

Name: _____

Purpose: *To investigate how a solenoid and a magnetic field work together to produce electric current.*

Part 1: Connect the solenoid to the Galvanometer so and investigate the following:

a. Move the magnet in and out of the solenoid and note your observations below.

The needle on the galvanometer deflects as the magnet is moved in and out of the solenoid

b. Place the magnet directly over (or along side) the opening in the solenoid and hold it in place for several seconds. Note your observations below:

Nothing happens, the needle on the galvanometer stays at zero.

c. Place the magnet inside the solenoid and hold it in place for several seconds. Note your observations below:

Nothing happens, the needle on the galvanometer stays at zero.

1. Based on your observations in a-c, the magnet must be _Moving_ in order to produce an electric current in the coil. This current is called an induced current.

2. Based on Ohm's Law, if there is a current in the coil, and the coil has some resistance, then not only are we producing current, we are also producing _Voltage_.

Part 2: *In this section you will investigate how the orientation of the magnetic field affects the direction of the current induced in the solenoid.*

d. Push the **north** end of the magnet into the solenoid and stop it near the center of the solenoid. Roughly record the maximum reading on the galvanometer, make sure to note whether or not the reading is positive or negative.

e. Pull the magnet from the solenoid with velocity similar to step 6 with the **north** end of the magnet directed into the solenoid. Roughly record the maximum reading on the galvanometer, make sure to note whether or not the reading is positive or negative.

3. What do you notice about the direction of the current in steps d and e when the field (magnet) goes into the solenoid vs. when it is removed from the solenoid?

The sign of the current is opposite if it is positive on the way in it is negative on the way out and vice versa. This implies that the current is changing direction.

4. Repeat steps d and e with the **south** end of the magnet oriented into the solenoid and note your observations.

The sign of the current is opposite if it is positive with the North on the way in it is negative with the south on the way in and vice versa.

Part 3: *In this section you will investigate how velocity of the magnetic affects the current induced in the solenoid.*

5. You should have noticed that the solenoid stops producing current shortly after the magnet enters the solenoid. Slowly move the magnet in and out of the solenoid wit a “slow”, “medium”, and “fast” velocities.

Velocity	Current
Small	smallest
Medium	medium
Large	largest

Note: By changing the velocity of the magnet, you are really changing the rate at which the magnetic field strength increases or decreases.

6. How does the rate of change of the magnetic field affect the current induced in the coil?

   The greater the rate of change of magnetic field results in a larger current and voltage.