Name: _____ Period: ____Date: _____

AP Physics 2

Lab #5-3: Magnetic Induction – Part 1

I. *In the first part of this activity, we will use the simulation at **bit.ly/fdaylaw** to examine the relationship between wires, magnetic fields, and induced emf (Ɛ). Use the "right-hand" rule, Faraday's Law and Lenz's Law to answer the questions below as completely as possible.*

1. Describe what happens to the lightbulb in the simulation when you drag the red and blue bar magnet (N S) into the coil of wire in each of the ways listed below. Using Faraday's Law, explain why for each.

   a. Slowly insert the bar magnet north end first halfway into the coil of wire and stop.

   b. Slowly insert the bar magnet north end first halfway into the coil of wire and then pull it out again.

   c. Slowly drag the bar magnet north end first all the way through the coil from the right side of the screen to the left.

   d. Repeat steps a & b, but move the magnet more quickly.

   e. Flip the magnet with the big green button so that the south end goes first and then repeat steps a, b & c.

2. Check the white box next to "Field Lines" to display the magnetic (*B*) field lines. Activate the voltmeter by checking the white box next to the word "Voltmeter". In these steps, you will click the big green button repeatedly so that the bar magnet rotates. Describe what happens to the lightbulb and the voltmeter for each of the following scenarios and explain why, using Faraday's Law:

   a. Flip the magnet back and forth while it is near, but not inside, the coil.

   b. Flip the magnet back and forth while it is inside the coil.

3. Reset the simulation with the small orange button in the lower right corner. Activate the voltmeter again. Describe what happens to the lightbulb and the voltmeter for each of the following scenarios and explain why, using the "right-hand" rule, Faraday's Law and Lenz's Law:

a. Slowly insert the bar magnet north end first halfway into the coil of wire and stop. What kind of emf is induced? Why?

b. Quickly insert the bar magnet north end first halfway into the coil of wire and stop. What kind of emf is induced? Why?

c. Flip the magnet with the big green button so that the south end goes first and then repeat steps a & b. How are the results similar? How are they different? Why?

4. Add a second coil of wire by clicking the light purple button that shows two coils at the bottom of the page. Perform the following steps and, for each, use Faraday's Law to explain what happens and why:

   a. Insert the bar magnet north end first halfway into the top coil of wire and then pull it out again. Do the same for the bottom coil of wire. Describe what happens to the light bulb for each coil. How are the results similar? How are they different? Why?

   b. Repeat step a, but instead observe what happens to the voltmeter. How are the results similar? How are they different? Why?

   c. Place the magnet in the top coil of wire and then click the big green button repeatedly so that the bar magnet rotates. Do the same for the bottom coil of wire. Describe what happens to the light bulb for each coil. How are the results similar? How are they different? Why?

   d. Repeat step a, but instead observe what happens to the voltmeter. How are the results similar? How are they different? Why?

5. Describe Faraday's Law in your own words, using an example from the results of this simulation.

6. Describe Lenz's Law in your own words, using an example from the results of this simulation.

7. Based on the results of this simulation and using terms such as "wire", "coil", "magnet", "magnetic field", "emf", "current" and "induced", explain how magnets and coils of wire can be used to generate electricity.