AP Physics C Name:
Magnetic Induction Lab Period:

Purpose

The goal of this lab is for you to make clear to me your quantitative *and* qualitative understanding of two of our four demonstrations that rely on the principle of magnetic induction.

Your Task

The four experiments are: the Ring Launcher, the Transformer, the Rebar Launcher, and the Tesla Coil. You must choose one of the Ring Launcher or Transformer, then one of the Rebar Launcher or Tesla Coil. For each of the experiments you choose, you are to individually write up a one-page explanation of the experiment that includes a discussion of Faraday's and Lenz's Laws. You may include diagrams and equations, but these will not be counted in the 'one page' requirement.

In addition to this one-page explanation, you are to answer the following questions on a second page:

Ring launcher and transformer

PLEASE EXERCISE CAUTION AS INSTRUCTED IN CLASS

- Identify all the solenoids in this experiment and make a rough calculation of the magnitude of the magnetic field within the solenoid (in Teslas). These experiments are driven by 120 Volts AC (VAC), so you will need to measure the resistance of the solenoid to determine the current.
- Determine the maximum and minimum magnetic fluxes that drive the experiment (in Webers)
- Determine the *emf* induced due to the rate of change of magnetic flux (in Volts)
- Discuss the 'turn ratio' of the experiment: the ratio of the number of turns in the "primary" coil to the number of turns in the "secondary" coil. Calculate the effect this has on the primary and secondary voltages.
- Calculate the amount of energy being transferred to the second coil. For the ring launcher, this can be done with a mechanics argument; for the transformer you probably won't be able to measure it directly.

Rebar launcher and Tesla Coil

DO NOT OPERATE EITHER OF THESE EXPERIMENTS WITHOUT MY DIRECT SUPERVISION

- For both of these experiments, there is a 'buildup' of energy followed by a discharge. Identify the storage locations for the buildup of energy. Why do these experiments benefit from an 'all at once' discharge of electrical energy?
- For the Tesla Coil, calculate the turn ratio for the primary and secondary windings (coils). If the black transformer outputs 6000 V, what do you think the voltage of the doorknob at the top should be?
- For the Rebar launcher: how should the initial position of the bar affect its subsequent motion? How would the experiment differ if the bar were made of aluminum rather than an iron alloy?