Faraday's Law

Name: _____

Instructor: _____

Team Member 1	Team Member 4
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Instructions: Follow the steps on this worksheet, using your lab manual as a guide, unless directed to do otherwise by your lab instructor. Show at least one sample calculation for each step. Box final mathematical results. Do not forget the units.

1 Relative Motion

1.1 Data

1. Measure and record the diameter of the coil of wire and record the number of turns it has.

2. With the strip-chart recorder, re-sketch the voltage, $\mathcal{E}$, versus time plot. Label the axes properly and be careful about units.

1.2 Analysis

1. Change in Magnetic Flux. From your sketch of $\mathcal{E}(t)$, estimate the area under the curve of $\mathcal{E}(t)$, Area $= \int \mathcal{E}\,(t)\,dt = -\Delta\Phi$.

2. Use the coil's measurements and estimate of the change in magnetic Flux to compute the magnetic Field, B, for the permanent magnet.

2 Time-Varying Magnetic Field

Inside the Solenoid.

2.1 Data

1. Measure and record the actual value of the resistor.

2. Record the number of loops in the solenoid, then measure and record its length.

3. Record the number of loops in the pick-up coil, then measure and record its diameter.

4. Measure the peak-to-peak value and frequency of the voltage supplied to the circuit.

5. Measure the peak-to-peak value the voltage across the resistor.

6. Measure and record the amplitude, $\mathcal{E}_0$, of the voltage induced in the pick-up coil by the solenoid's changing magnetic.

2.2 Analysis

1. Use Ohm's Law to calculate the current across the resistor.

2. Use Kirchhoff's law to determine the current flowing through the solenoid.

3. Use Ampere's Law to obtain the theoretical value of the magnetic field, B, inside an ideal solenoid.

4. Use your measurements from the pick-up coil and Faraday's Law to determine the amplitude of the magnetic field, B_0, for the actual solenoid.

5. Compare the theoretical value of the magnetic field of the solenoid to the actual one.

Outside the Solenoid

2.3 Data

1. Follow the instructions in your manual regarding exploring the magnetic field outside the solenoid. Take notes and make a detailed sketch of what you find.

Analysis

1. Compare the ideal solenoid model to the your observations of the actual solenoid and discuss where the ideal model best represent the real solenoid.