

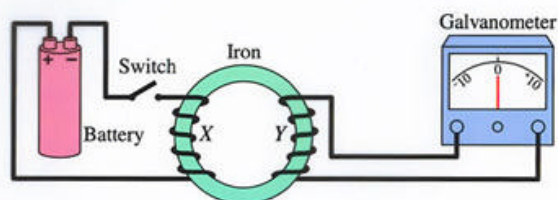
MND Physics

Electromagnetic Induction

Induced EMF is produced by a changing magnetic field.

KEYWORD: **Changing!**

It took Michael Faraday many years to discover this fact. He initially met with no success studying steady currents. Faraday used an apparatus much like this one:



It was through careful observation that he noticed a deflection in a galvanometer as he opened or closed the switch in the circuit. Faraday concluded that although a steady magnetic field produces no current, a CHANGING magnetic field can produce an electric current!

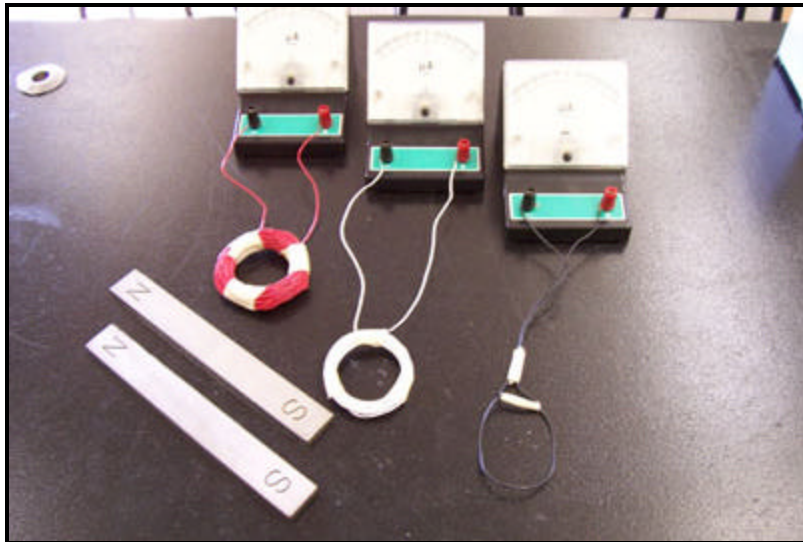
In this lab, you will investigate how the three components on the right hand side of the equation below, effect the production of electrical current represented by the left hand side of the equation (*emf* or electrical potential produces the electrical current). The magnetic field strength (B), the length of wire (l), and the rate of change of the magnetic field strength relative to the wire (v) are all variables you can control:

$$emf = Blv$$

(In order to simplify our above equation (and investigation), we assume the magnetic field remains perpendicular to the wire loop)

EQUIPMENT:

Galvanometers, 3 sizes of wire loops, 1 turn loop (BLACK WIRE), 25 turn loop (WHITE WIRE) 100 turn loop (RED WIRE), 2 bar magnets.



PROCEDURE:

You have been given that $\mathcal{E} = Blv$ (for a perpendicular B field). Using the above equipment, show experimentally that this relationship is, in fact, true.

Create a procedure to investigate the relative effects of B, l, and v on \mathcal{E} production. You are looking for RELATIVE changes and effects. Therefore, qualitative observations are acceptable; you are not expected to perform quantitative calculations. You must, however, submit convincing evidence that $\mathcal{E} = Blv$.

EXPERIMENT GUIDELINES

1. It will help your investigation to recall that an increase/decrease in magnitude of any variable on the right hand side of the equation should increase/decrease the magnitude of the left hand side of the equation, $\epsilon m\mathcal{F}$.
2. Keep 2 of the 3 variables constant while you investigate changes in the third variable.
3. There is actually a 4th variable in this investigation, the relative angle between the magnetic field and the wire loop! However, we can eliminate this variable if the magnetic field (the bar magnet) is always perpendicular to the wire loops.
4. Relative magnetic field strength (B) can be increased by adding a second magnet; make sure you line up the poles so that they face the same direction! Otherwise you will cancel the effect of the B field.
5. Make sure your investigation includes an examination of the effects of all three variables, B, I, and v on $\epsilon m\mathcal{F}$ strength.

DATA:

Create tables to record lab data.

ANALYSIS:

Calculate and discuss results. What conclusions can you make? Defend your answer.

QUESTIONS:

1. Transformers are found everywhere: in TV sets, computers, i-pods, on utility poles to supply power to our homes, and many other applications. A transformer is a device for increasing or decreasing an AC voltage. Why does a transformer operate only on alternating, not direct, current? Be specific.