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Magnetism and Induction

Abstract:
The purpose of this lab was to explore the properties of magnetism and magnetic induction. In part one, we are asked to place a magnet at the center of a sheet of polar graph paper. We then placed a compass at the outermost edge of the circle, and then drew vector lines in the opposite direction of the compass needle for 30 degree increments around the circle. The second part of the lab asked us to estimate the induction of a current we are creating from moving a magnet in and out of a coil. The final part of the lab required us to find the amplitude corresponding to different frequencies. We performed five different trials using a frequency range of 200 Hz to 1000 Hz. We then set up the oscilloscope, observed the volts/DIV and recorded our findings. After all of our data was collected, we then utilized the equation (# of DIV's)*(Volts/DIV)= volts, and then divide that number (known as peak-to peak voltage) by two. Once our calculations were complete, we then went on to create a graph of voltage vs. frequency to demonstrate our results.

Post-Lab Questions:

1. The definition of a magnetic flux is a measure of strength within a magnetic field over a given area which is perpendicular to it, which is then equal to the product of that area and the density of the magnetic flux through it. The two quantities that a magnetic flux depends on are direction and intensity.

2. The setting for the two frequency knobs on the function generator would have to be set to 0.5 Hz and 10^4 Hz for it to give a signal with a frequency of 5000 Hz.

3. On the oscilloscope vertical axis represents voltage, and the horizontal axis represents time.
T=1sec/DIV*10DIV
T=10 seconds
1/10=.1Hz
The minimum frequency of a waveform that could be fully displayed on the screen is **.1Hz.**

4. (Number of DIV's) * (Volts/DIV) = Volts → 8*2= **16 volts**

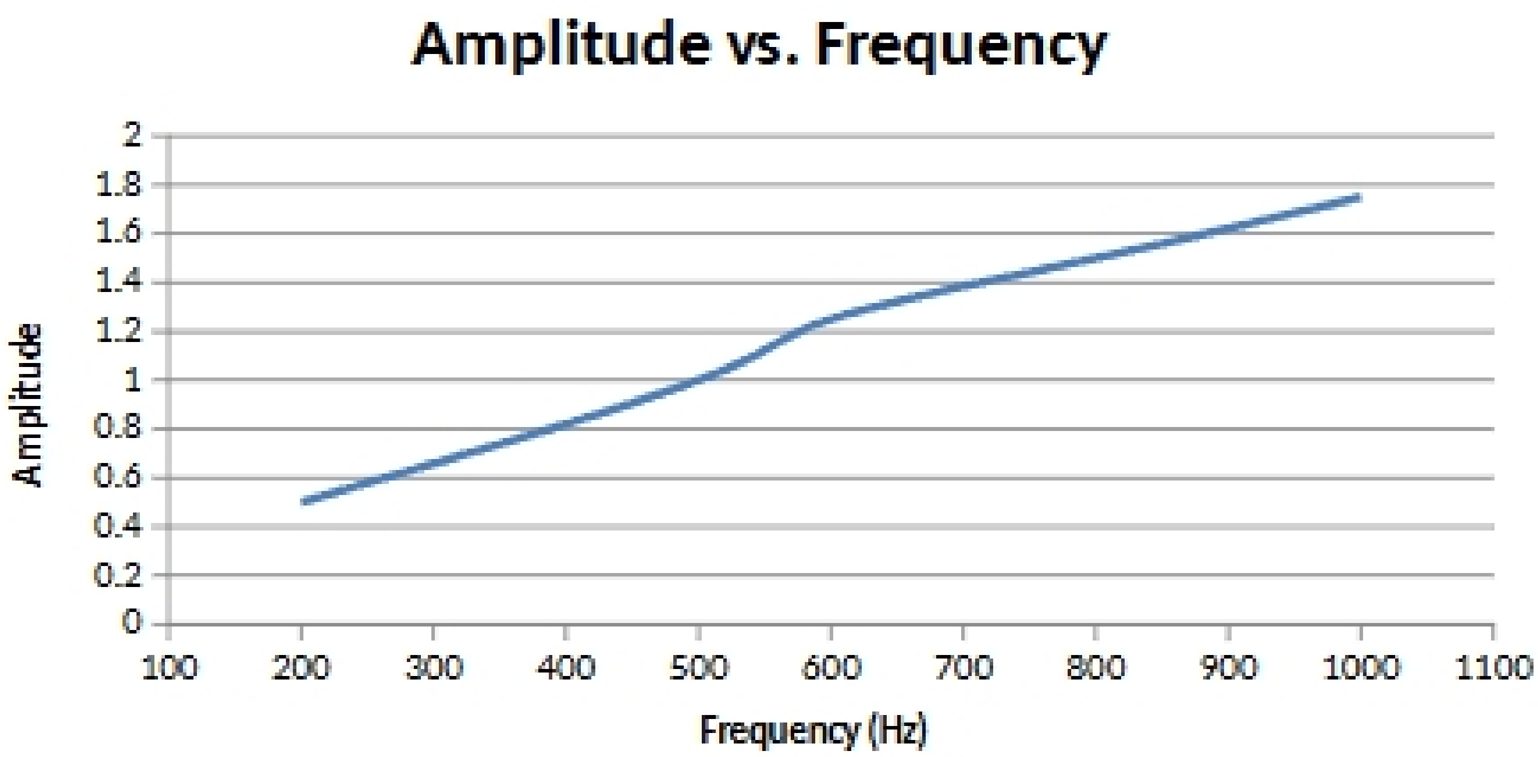
5. Yes the field is uniform at 0 degrees and 180 degrees. Field map is attached.

6. The maximum current found was 8 µA. The current was present as long as there was a change in the magnetic flux. The rate of change of the magnetic flux (how fast and frequency of motion) was what affected the amplitude of the induction.

7. The definition of an AM radio is the method of transmitting audio, visual and other types of information using a radio wave. The signal which is relevant is superimposed onto a radio-frequency carrier wave. This frequency of the carrier wave then remains unchanged, but it is the amplitude that is varied in accordance with the amplitude AM (amplitude modulation). The definition of an FM

radio is the method of transmitting information through a radio-frequency carrier wave. This frequency of the carrier wave is varied in accordance with the amplitude and polarity of the signal input, while this time the amplitude remains unchanged. (FM- frequency modulation). AM and FM radios are both the same kind of radio wave, but they are modulated differently. FM has a strong advantage over AM radio because it is less likely to have fluctuations in signals, because it is able to ignore the fluctuations and produces less static. We used both types of radio waves in this lab, AM waves because the amplitude was changing and FM waves because we also changed the frequency.

8.



Voltage and frequency are directly proportional, as one increases the other increases as well. I would expect this because of the formula $\mathcal{E}=|\Delta\Phi/\Delta t|$. Voltage is proportional to the rate of change of the magnetic flux which is proportional to the frequency, meaning the voltage and frequency are proportional to each other.

Conclusion:

In this lab we explored the properties of magnetism and magnetic induction. In the first part of this lab we were asked to place a magnet at the center of a piece of polar graph paper. We then placed a compass at the outermost edge and drew vector lines in order to create a field map. The second part of the lab asked us to estimate the induction of a current which we created by moving a magnet into and out of a coil. We observed that when the north pole of the magnet was inserted, the needle moved to the right (+ direction), and when the south pole was inserted, the needle moved to the left (- direction). Our estimation of the maximum induced current was 8 µA. For the third part of the lab, we were asked to find the amplitude for corresponding frequencies. We performed five trials with frequencies ranging from 200 Hz to 1000 Hz. We then observed the volts/DIV on the oscilloscope and recorded our findings. After we had collected all of our data we utilized the equation: (number of DIV's)*(Volts/DIV)= volts, and then divided that number (also known as peak-to peak voltage) by two to get the amplitude. Once we had completed our calculations we were able to create a graph of amplitude vs. frequency, which we found to be linear (what we expected) because they are proportional to one another.