PART I: MAGNETIC FORCE:
Enter your observations into the incomplete sketch below: Indicate the motion of the spot (which is the
direction of the magnetic force). Fill in the text describing the direction of the electron beam and hence
the electric current. Label the magnetic north (N) and south (S) poles of the bar magnet and draw
arrows indicating the direction of the magnetic field (which is tangential to the field lines drawn) from
the right-hand-rule for the magnetic force. In particular indicate the direction of the field at the location
of the electron beam.

The direction of the electron beam is __________________ the plane of this worksheet.

The direction of the electric current is_______________ the plane of this worksheet.
PART II A. INDUCTION USING A BAR MAGNET:

Record your connections on the right hand side of the incomplete sketch given below. Choose the correct sketch of the coil winding by drawing the wire connections to the galvanometer.

Which direction did the galvanometer needle move when the bar magnet was inserted into the coil?
_____________________________________________________________________________

Which direction did the galvanometer needle move when the bar magnet was removed from the coil?
_____________________________________________________________________________

What happened to the induced current (i.e., the needle deflection) when the magnet motion ceased?
_____________________________________________________________________________

When inserting or withdrawing the bar magnet with a fast motion is the deflection of the needle larger or smaller than with a slow motion of the bar magnet?
_____________________________________________________________________________

What is the name of the law that explains the last two observations? Write the formula for this law.
_____________________________________________________________________________
PART IIB. INDUCTION USING AN ELECTROMAGNET:

Make the **wire connections** reflecting your setup in the incomplete sketch below. Choose the coil with the **correct winding** for your setup and **label** the **north pole** of the **small coil** after you have determined it using the **right-hand-rule** for the magnetic field in a current carrying coil, your wire connections and coil winding.

With the small coil inserted into the large coil:

Which direction did the needle go when the DC power was turned on?

__________________________________________________

Which direction did the needle go when the DC power was turned off?

__________________________________________________

In both cases what happened to the induced current (i.e., the needle deflection) after a short while when the applied voltage was held constant?

__________________________________________________
PART III. INDUCTION USING ALTERNATING CURRENT (AC) POWER:

In the incomplete sketch below record your wire connections for both coils, i.e. The small coil connected to the AC generator and to oscilloscope CH1, the large coil to oscilloscope CH2.

Graph the two voltage traces observed on the oscilloscope screen below. Specify the VOLTS/DIV and TIME/DIV scale for both CH1 and CH2. Also label and record the peak to peak amplitude and the period of the signal.

Assuming the two coils act like an ideal transformer (100% efficiency), use the ratio of the voltages across the coils to calculate the ratio \( N_2 / N_1 \): the number of turns in the large coil \( N_2 \) divided by the number of turns in the small coil \( N_1 \); see SV8, Ch. 21.7 and manipulate Eq. (21.22) to get \( N_2 / N_1 = \Delta V_2 / \Delta V_1 \).