Name: _____

Basic AC Lab - ELEC 105L

LAB #4b: DC Properties of Inductors – Exponential Rise and Fall

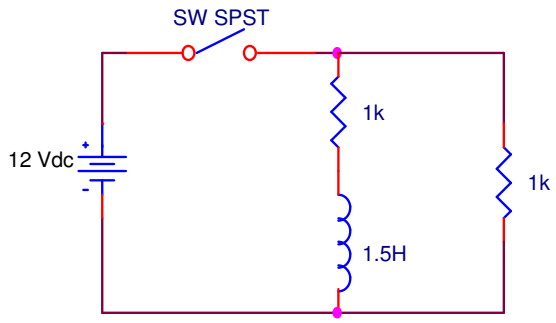
INTRODUCTION: The objective of this lab is to observe the DC behavior of an inductive circuit during charging and discharging. The principles to understand better are the exponential time constant **τ** and how the voltage and current change after a switch is closed or opened.

MATERIALS:

- 1 – 1.5 H inductor
- 2 – 1 kΩ resistors
- 1 SPST switch
- HP54603B Oscilloscope
- HP3631A DC Power Supply

PROCEDURE:

1. Build the following circuit using the large breadboard.



2. Calculate the time constant **τ** for this circuit. Set the time base on the scope so that 5**τ** will easily fit on the screen. Connect Ch. 1 of the scope across the inductor. Set the vertical scale so the voltage across the inductor should fit on the screen. Finally make sure the vertical coupling for Ch.1 is set to DC.

τ = _____ sec/div= _____ volts/div= _____

3. To see the voltage across the inductor, the scope trigger will need to be set properly. In the trigger section of the scope (far right) hit the **Source** button and set the trigger source to Ch.1. Now hit the **Mode** button and make sure Normal is the selected mode. Hit the **Slope/Coupling** button and make sure the slope is positive (⎍), and that the coupling is set to DC. Finally turn the **Level** knob until the trigger level is ~ 5V.

4. Close and open the switch a few times. There should be a clean decaying exponential trace across the screen when the switch closes. Make any adjustments necessary to get the entire trace on the screen, then save this trace to the computer * and include it with your lab report. On the following page quickly sketch the signal that appears on the screen.

* Instructions on how to save scope traces to the computer were given at the beginning of today's lab. If you missed it ask one of your lab mates to show you.

5. Looking at the trace on the scope how long did it take the voltage to decay to its steady state value? Does this agree with the prediction for 5τ?

6. What was the steady state value for the voltage? Why isn't it 0V?

7. The next experiment will be to capture the inductor voltage when the switch is opened. Change the trigger **Slope** to negative (⌐) and adjust the trigger **Level** to around –5V.

8. Open and close the switch a few times to observe the voltage of the inductor during discharge. Make any adjustments necessary to get the entire trace on the screen, then save the waveform to the computer for your lab report. Next to the charge waveform above quickly sketch the inductor discharge voltage waveform.

9. What was the time for the inductor to discharge? Why wasn't it the same as for the charge time?

10. What was the peak negative voltage that the inductor voltage went to during the discharge? Why wasn't it equal and opposite of the voltage during the charge?

11. For this circuit what would be an easy way to look at the waveform of the inductor current on the scope? Include this waveform in your lab report.