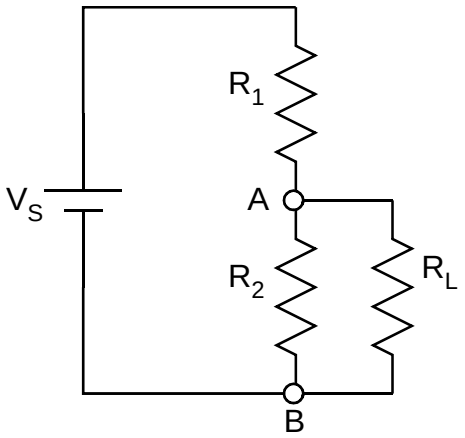
PH 411 Electronics

Problem Set 1
Due October 3rd 2024

PART I. Consider a potential divider shown below. Calculate the output potential of the divider (*i.e.* across the load resistor) as a function of the variable value R_L of the load resistance.

Please use a Kirchoff loop law analysis for your solution. Gingrich (Course referenc) solves this problem for you on page 11 by considering R_2 and R_L as parallel resistance (R_{2L}).
While also correct, please solve using Kirchoff's loops instead!



PART II. use a computer to plot your lab's result when

$$R_1 = 100\Omega \text{ and } R_2 = 100\Omega \text{ and } V_s = 5V$$

[Please plot analytically in a program of your choice or by generating pointwise in Excel].
Do not forget to label your axis, and then save this for use in your Lab #1 report.

PART III. *Let's get practical!* Suppose you added a red LED to the above setup.

a. What would happen if you connected the LED directly across V_s=5 V? Briefly why?

b. Red LEDs are designed to work best over a voltage drop of V_f= 1.8 to 2.1 V while drawing a current of I_f= 20 to 30 mA. Suppose the circuit load (R_L) is this red LED.

Will it turn on? Why or why not? [try it in lab]

c. Now suppose you remove R_2 entirely from the circuit in part b.
What will happen to your LED? (*try it!*) Is it wise to run the circuit this way long-term?
Calculate how you should change R_1 to compensate for the increased current across the LED.