Pre-Lab Report

Lab section:

Name & Surname:

Table #:

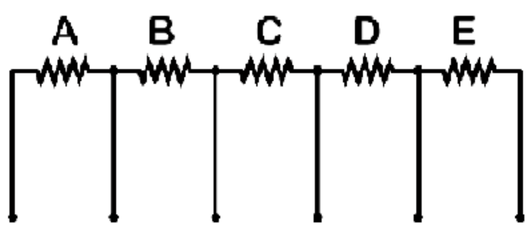
***Before the Lab* complete this page YOURSELF! Hand it in *in the first 5 min*. of the session PERSONALLY!**

You MUST justify your answers and show all steps. NO COPYCAT answers, or NO credits!

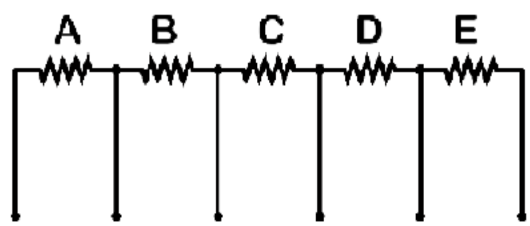
Please read the relevant presentation on PHYS LAB Website.

Q1. Connect three resistors B, C and D all together **a-** in series **b-** in parallel below. Show the direction of current flow using arrows:

Show series connection



Show parallel connection



Q2. Explain what happens when the galvanometer and the power supply are exchanged in a balanced Wheatstone bridge. What happens to balance then? Give a mathematical proof of it. (*Hint: Ignore the switch and rheostat on the bridge in the experiment. Draw the circuits before and after the exchange*)

(3rd Question is on the next page!)

Q3. Determine the uncertainty ΔR in the value of the unknown resistance if the uncertainty in determining the balance point on the slide-wire is ΔL. Consult to the introduction part of your Lab Book or you may search for "Error propagation". **Show your calculations below explicitly or no credits!**

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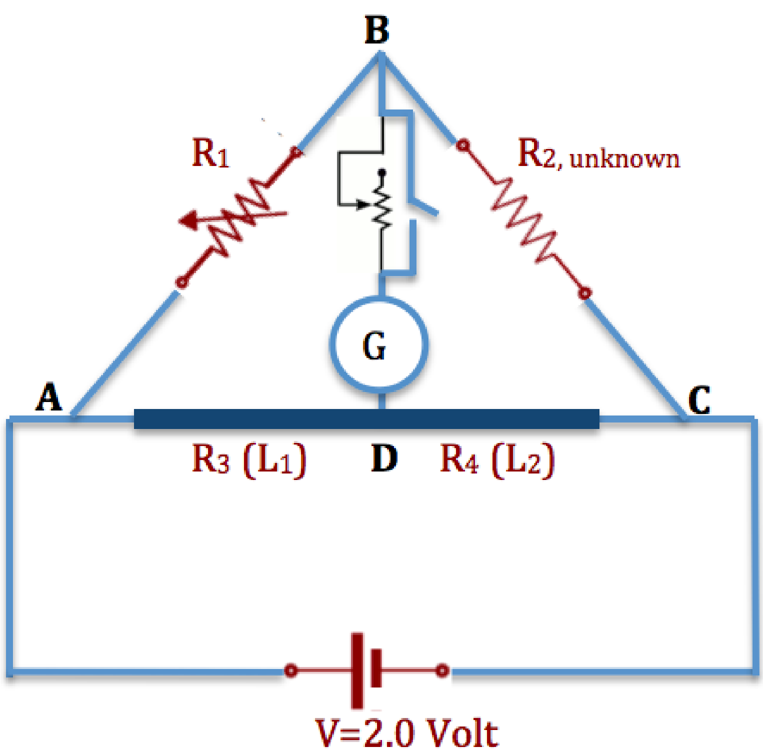
***Complete this report YOURSELF except DATA taking parts! Use a pencil for plots only and a pen for the rest!* Show your work clearly, NO COPYCAT analysis allowed, or NO credits!**

OBJECTIVE : To determine the resistance of various conductors and their series and parallel combinations using a slide-wire Wheatstone Bridge.

THEORY : In Wheatstone bridge there are two pairs of resistors connected in parallel. A galvanometer is connected between the points where individual resistors are connected together in each pair. To protect the galvanometer against excessive currents, a large resistance is connected in series with the galvanometer with the option to short it out using a switch. A low voltage power supply is connected across the points where each pair is connected in parallel to each other. In slide-wire Wheatstone Bridge case one pair of resistors is simply a wire and the galvanometer is connected to a point on the wire with the help of a sliding connection. The resistance ratio on this part of the circuit is simply the ratio of the lengths of the wire sections on each side of the sliding connection.



Assuming that the resistances in the wire part of the circuit are R1 and R2 and the other part are R3 and R4, let us further assume that the current passing through the wire part is I1 and the other part is I2. Then, adjusting the position of the sliding contact on the wire, the current through the galvanometer is brought to zero. This means that the potential differences across the resistances opposing each other in each pair will be equal:

$$I_1 R_1 = I_2 R_3$$

$$I_1 R_2 = I_2 R_4$$

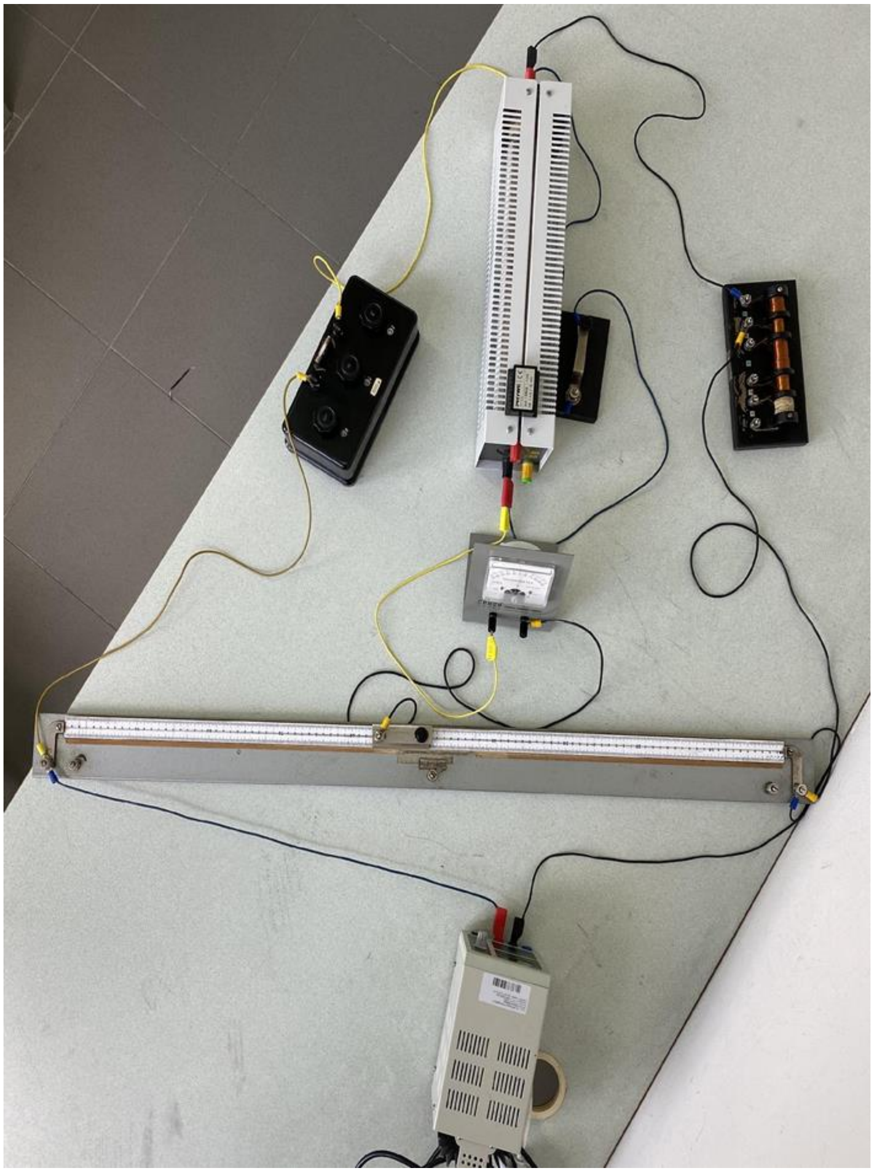
Dividing the first expression by the second one, we get

$$\frac{R_1}{R_2} = \frac{R_3}{R_4} = \frac{L_1}{L_2}$$

since the resistance of a wire is proportional to its length, cross section and its material. Both parts being part of the same wire, the ratio of the resistances is equal to the ratio of their lengths. Using such a bridge and a known resistance, for a 100.0 cm wire in the bridge, we can determine the value of an unknown resistance as:

$$R_x = \frac{(100.0 - L_1)}{L_1} R_1$$

APPARATUS : Slide-wire Wheatstone Bridge, galvanometer, resistance box, large resistance (rheostat), unknown resistance set, switch, a variable DC power supply.



PROCEDURE :

1. Set the power supply around 2.0 V.
2. Connect the circuit. Start with unknown resistance A. Set the resistance box to an appropriate value (generally 1 or 2 ohms) and move the contact key on the slide wire until bridge is balanced.
3. For the final precise adjustments close the switch and observe zero deflection on the galvanometer.
4. Note the point where the slide wire touches the contact key.
5. Repeat steps 2-3 & 4 for unknown resistances B and C.
6. Combine resistors A and C **in series** and place them into the bridge. Repeat steps 2-4.
7. Combine A and C **in parallel** and place them into the bridge. Determine the value of the combined resistance. Repeat steps 2-4 .
8. Calculate the value of the unknown resistances and their combinations in Table below.

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DATA-TAKING

Name of the Resistance*	R_1 ( ) (Resistance Box)	L_1** ( ) # of Significant Figures =	L_2 ( ) # of Significant Figures =
R_A			
R_B			
R_C			
R_{Series} (A and C)			
$R_{Parallel}$ (A and C)			

*** Ignore unknown resistances D and E! R_1 can be different for different unknown resistances.**

**** L_1 should be in the interval 10.0 cm < L_1 < 90.0 cm. Otherwise, change R_1 and retry!**

CALCULATIONS

Symbol	Calculations (show each step)	Result
R_A =	. . . .	
R_B =	. . . .	
R_C =	. . . .	
R_{Series} =	. . . .	
$R_{Parallel}$ =	. . . .	

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9. Calculate the expected values of R_{Series} and $R_{Parallel}$. You should use the formulae for equivalent resistance and the values calculated for R_A, R_B and R_C.
10. Compare R_{Series} and $R_{Parallel}$ with their expected values and calculate the percentage error. Take expected values as True Value.

CALCULATIONS

Symbol	Calculations (show each step)	Result
R_{Series} = *(expected)*	. . . .	. . . .
$R_{Parallel}$= *(expected)*	. . . .	. . . .

RESULTS

% Error for R_s : . . . .

% Error for $R_{//}$: . . . .

Consult to the resources for this experiment from PHYS LAB Website:

PHYL201 Intro | Presentation #2 | PHYL201 Lab Book