Calculating the value of unknown resistor

Objective of the experiment:

1- Finding the value of unknown resistor using known resistor.
2- Examine the effect of the resistance value on the electrical current in the circuit.
3- Learn how the galvanometer work.

Theory:

If we have the electrical circuit shown below:

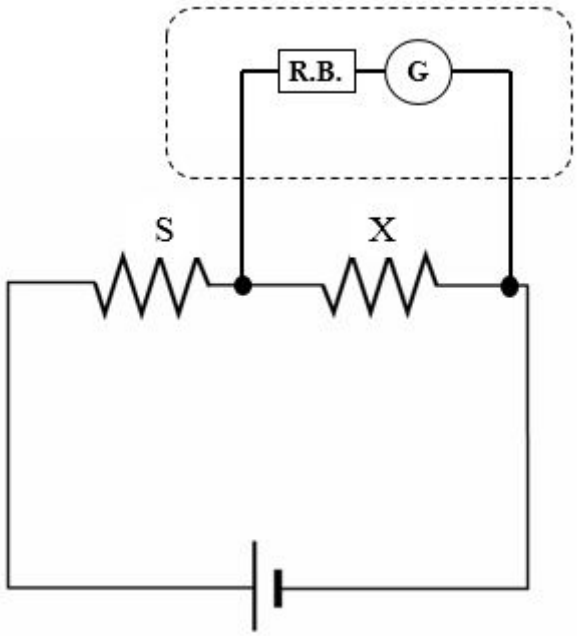

Figure 1. Experiment circuit.

The potential difference across the unknown resistor would be: $V = I \times R_X$.

And the potential difference across the known resistor would be: $V = I \times R_S$.

In both cases, the current passing through the galvanometer is proportional to the potential difference across it:

$$\mathbf{I_x \alpha \theta_1}$$

$$\mathbf{I_S \alpha \theta_2}$$

Where $\boldsymbol{\theta_1}$ and $\boldsymbol{\theta_2}$ are the galvanometer reading across the known and unknown resistor. By substitution above equations we get:

$$\frac{\mathbf{X}}{\mathbf{S}} = \frac{\boldsymbol{\theta_1}}{\boldsymbol{\theta_2}} \quad \Longrightarrow \quad \boldsymbol{X = S\,\frac{\theta_1}{\theta_2}}$$

The value of unknown resistor X can be calculated from the last equation from the average of several readings of galvanometer for each case.

Instruments:

- DC power supply.
- Galvanometer.
- Resistor box R.B.
- Unknown resistor $\boldsymbol{R_X}$.
- Known fixed resistor $\boldsymbol{R_S}$.
- Connection wires.

Methods:

1. Connect the circuit as shown in Figure 1.
2. Connect high resistance from resistor box in series with galvanometer to avoid the current effect passing through galvanometer.
3. Set the voltage form DC power supply at 10 volts.
4. Record the galvanometer reading $\boldsymbol{\theta_1}$ (the galvanometer and resistor box in parallel with **X**).
5. Transfer the galvanometer and resistor box to be in parallel with **S** and record the galvanometer reading $\boldsymbol{\theta_2}$.
6. Change the resistance form resistor box and record $\boldsymbol{\theta_1}$ and $\boldsymbol{\theta_2}$.
7. Repeat the previous step several times and record $\boldsymbol{\theta_1}$ and $\boldsymbol{\theta_2}$ for each resistance form resistor box.
8. Write down your reading in the table below:

No.	R.B (Ω)	θ_1 (mA)	θ_2 (mA)
1			
2			
3			
4			
5			

9. Draw a graph of $\boldsymbol{\theta_1}$ on x-axis and $\boldsymbol{\theta_2}$ on y-axis.
10. Find the slope value from the graph, its value is ($slope = \frac{\Delta\theta 1}{\Delta\theta 2}$)
11. Calculate the value of unknown resistor from:

$$\mathbf{X = S * slope}$$

Discussion:

Q1) Define electrical resistance!

Q2) Define resistivity! And on what it depends?

Q3) why material have resistance?

Q4) Two resistor (R_1 and R_2=2Ω) in series, connected to 12V DC source with 2A current. Calculate:

a) The unknown resistor R_1. b) The voltage across each resistor.