#5 Experiment : Wheatstone Bridge

Name	
University ID	
Section	
Lab time	Day ( ), time from ( ) to ( )

Exp. 5: whetstones bridge	التجربة 5 (القنطرة المترية) قنطرة ويتستون المترية
Purpose of the exp. 1 - Use the Wheatstone Bridge to measure the unknown electrical resistance. 2 - Find the physical Properties of the unknown resistance wire. 3 - learn the structure and principles of the Wheatstone Bridge.	**أهداف التجربة**:- 1 - استخدام قنطرة ويتستون المترية لقياس قيمة مقاومة مجهولة 2 - إيجاد الخصائص الفيزيائية لسلك المقاومة المجهولة 3 - دراسة تركيب جسر ويتستون المتري والمبادئ المستخدمة للوصول للقوانين الرياضية.

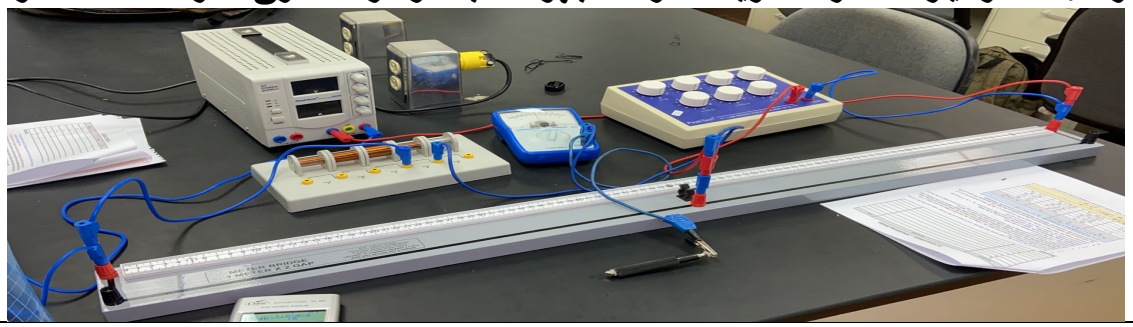
القوانين الرياضية (Equations)

$$R_x = R_s \frac{L_1}{L_2} \quad \text{..... equation (1)} \qquad A_x = \pi\ r^2 \quad \text{.....equation (2)}$$

$$\rho = R_x \frac{A_x}{L_x} \quad \text{.....equation (3)} \qquad \sigma = \frac{1}{\rho} \quad \text{.....equation(4)}$$

symbol	meaning	unit
R_x	**Unknown resistance of the wire** المقاومة المجهولة (للسلك) الملف	Ω
R_s	**resistance value of Resistance box** مقاومة صندوق المقاومات	Ω
L_1	**The length of the part of the wire of the vault opposite the unknown resistance** طول السلك (الجزء المقابل للمقاومة المجهولة)	m
L_2	**The length of the part of the wire opposite the box of resistors** الطول من السلك المقابل لصندوق المقاومات	m
L_x	**The length of the wire of with unknown resistance** طول سلك المقاومة المجهولة	m
A_x	**Wire's cross-sectional area unknown resistance** مساحة مقطع السلك الدائرية	m^2
r	**The radius of the unknown wire resistance** نصف قطر السلك المستخدم للمقاومة المجهولة	m
ρ	**Resistivity of the wire** المقاومة النوعية للسلك	$\Omega\,.m$
σ	**Electrical conductivity of the wire** الموصلية	$(\Omega\,.m)^{-1}$

الأدوات:-مصدر تيار، القنطرة المترية، مقاومة مجهولة ، جلفانومتر، صندوق مقاومات، أسلاك توصيل



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circuits

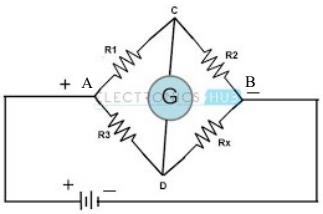

fig 1

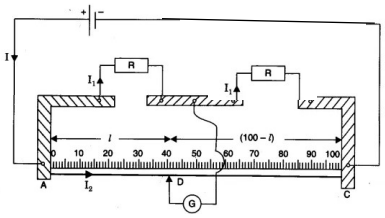

fig 2

Theory

The Wheatstone bridge is a circuit used to compare an unknown resistance with a known resistance. A Wheatstone Bridge is 4 resistors connected in the form of a square with galvanometer connected across one diagonal and a voltage source across the other, as shown in the circuit fig. When the Galvanometer indicates zero current, the bridge is balanced. under these conditions, the voltage drop from A to C must be the same as that from A to D. Similarly, the voltage drop from B to D must be the same as that from B to C.

$I_1R_1 = I_2R_3$ ….1 $I_1R_2 = I_2R_4$ ….2

By divided 1 by 2 $\frac{R_1}{R_2} = \frac{R_3}{R_4}$ ⟶ $\frac{R_1}{R_2} = \frac{\rho\frac{L_1}{A_x}}{\rho\frac{L_2}{A_x}}$

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

Procedure

1. We connect the circuit fig 2 and make sure that the volt switch is at the lowest value and that the current switch is at the highest value.
2. turn on the battery (voltage source) and place the voltage on the specified value not exceeding 1 volt.
3. Change the keys of the resistor-box to reach the required first value in the table and then move the slider on the ruler until the galvanometer index reaches zero) the touch of the shutter that gives the reading zero in the galvanometer is divided the length of the ruler into two parts L_1 and L_2.
4. Record of L_1 values (corresponding to the unknown resistance wire) and L_2 (corresponding to the known resistance - resistancebox-)
5. Repeat step 3 for the next resistances in the table.
6. Calculate using equation (1) R_x value at all the values of R_s in the table.
7. Find the average $\overline{R_x}$ readings. Then calculate the area of the wire section $A_x = \pi\ r^2$ from the suspended where the radius of the wire section is given.
8. Calculate using the lingering (1-3) the value of the resistivity $\rho = R_x \frac{A_x}{L_x}$. then conductivity $\sigma = \frac{1}{\rho}$
9. By reference to the tables of resistivity ρ in physics books or the Internet, determine the type of wire material used in the experiment Electrical resistivity and conductivity - Wikipedia .

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$r = 0.0762\ mm = 7.62 \times 10^{-5} m$ $A_x = \pi\ r^2 = \pi \times (7.62 \times 10^{-5})^2$ $= 1.8 \times 10^{-8} m^2$		L_x =20 m	
R_s	L_1	L_2	$R_x = R_s \frac{L_1}{L_2}$
50			
60			
70			
80			
90			
$\overline{R_x} =$			
$\rho = R_x \frac{A_x}{L_x} =$		$\sigma = \frac{1}{\rho} =$	

what is the material of the wire used as unknown resistance in this experiment?

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