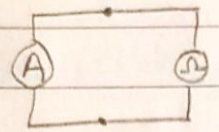
Date. 2020 / 01, 10

Lab 0: Ohms Law: Using a multimeter to perform voltage and current measurments on a resistor to find resistance via ohms law

Practice Circuts:

Measure resistance of the voltmeter

Measured Value: 0.1 KΩ

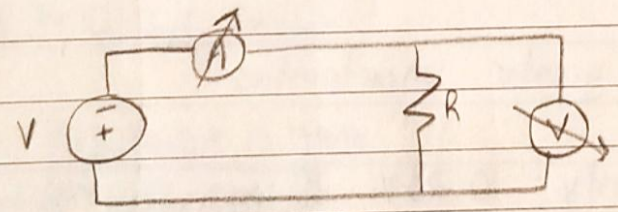


Measure resistance of the ammeter

Measured Value: 0.1KΩ

Start of Lab: Resistor Value on BreakBox: 470 ohms

	Voltage (V)	Accuracy (V) Uncertainty *	Persicion (V) Uncertainty	Current (mA)	Accuracy (mA) Uncertainty *	Persicion (mA) Uncertainty
1)	1.31	0.003	(0.01)	2.79	(0.02)	0.01
2)	3.50	0.009	(0.01)	7.44	(0.06)	0.01
3)	4.26	0.01	(0.01)	8.99	(0.07)	0.01
4)	5.00	0.01	(0.01)	10.52	(0.08)	0.01
5)	7.08	(0.02)	0.01	14.96	(0.1)	0.01



The following circut was wired

Circled values are greater Uncertainties

Reference Resistance Reading: 473Ω

Date. /

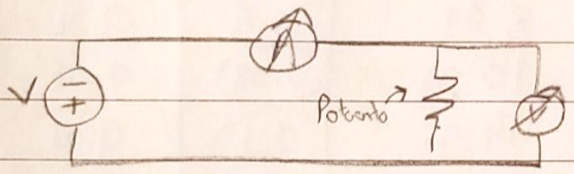
Manufactors Resistance Tolerance and Value (Bands)

Yellow	Blue	Brown	Gold
4	6	x10	± 5%

↳ 46 x10 = 460 Ohms ± 5%

Potentiometer Data: Referance Resistance Reading: 1290Ω

	Voltage (V)	* Accuracy uncertainty (V)	Percision uncertainty (V)	Current (mA)	* Accuracy uncertainty (mA)	Percision uncertainty (mA)
1)	2.91	0.007	(0.01)	2.26	(0.02)	0.01
2)	4.98	0.01	(0.01)	3.87	(0.03)	0.01
3)	6.20	(0.02)	0.01	4.84	(0.04)	0.01
4)	8.16	(0.02)	0.01	6.37	(0.05)	0.01
5)	12.39	(0.03)	0.01	9.69	(0.07)	0.01



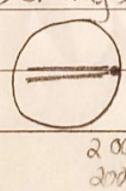
The following circuit was wired

Circled Values are greater uncertainties

* Accuracy Uncertainty: 0.25% of measured values (V)
* Accuracy Uncertainty: 0.75% of measured values (mA)

Multimeter Settings for both sets of measurments:

Top Dial:



Bottom Dial: DCV (For Voltmeter)
DCA (For Ammeter)

Date. /

Analysis

Resistor : Find R by using $R = \frac{V}{I}$

1) $R = \frac{1.31V \pm 0.01V}{2.79mA \pm 0.02mA}$

$R = \frac{1.31V \pm 0.01V}{2.79 \times 10^{-3}A \pm 0.01 \times 10^{-3}A}$

$R = \frac{1.31V \pm 0.76\%}{2.79 \times 10^{-3}A \pm 0.75\%}$

$R = 469.53\Omega \pm \sqrt{(0.75)^2 + (0.76)^2}$

$R = 469.53\Omega \pm 1.07\%$

$R = 469.53\Omega \pm 5.01\Omega$

$\boxed{R = 470\Omega \pm 5\Omega}$

For the remaining trials, we use the exact same method to determine R with uncertainties

2) $R = 470.43\Omega \pm 0.85\%$

$\boxed{R = 470\Omega \pm 4\Omega}$

3) $R = 473.86\Omega \pm 0.79\%$

$\boxed{R = 473\Omega \pm 4\Omega}$

4) $R = 492.60\Omega \pm 0.78\%$

$\boxed{R = 493\Omega \pm 4\Omega}$

5) $R = 473.26\Omega \pm 0.80\%$

$\boxed{R = 473\Omega \pm 4\Omega}$

Date. /

Potentiometer : Find R by using $R = \frac{V}{I}$

We use the exact same method as the resistor to determine R with uncertainties

1) $R = 1287.61\ \Omega \pm 0.82\%$

$\boxed{R = 1290\ \Omega \pm 10\ \Omega}$

2) $R = 1286.82\ \Omega \pm 0.78\%$

$\boxed{R = 1290\ \Omega \pm 10\ \Omega}$

3) $R = 1280.94\ \Omega \pm 0.67\%$

$\boxed{R = 1281\ \Omega \pm 9\ \Omega}$

4) $R = 1281.00\ \Omega \pm 0.79\%$

$\boxed{R = 1280\ \Omega \pm 10\ \Omega}$

5) $R = 1278.64\ \Omega \pm 0.79\%$

$\boxed{R = 1280\ \Omega \pm 10\ \Omega}$

Date. /

Average and Standard Deviation

$\bar{X}_{resistor} = (470 + 470 + 473 + 493 + 473)\ \frac{1}{5} = 475.80\,\Omega = 476\,\Omega$

$\bar{X}_{potentiometer} = (1290 + 1290 + 1281 + 1280 + 1280)\ \frac{1}{5} = 1284.20\,\Omega = 1280\,\Omega$

$S_{resistor} = ([(470 - 476)^2 + (470 - 476)^2 + (473 - 476)^2 + (493 - 476)^2 + (473 - 476)^2]/4)^{\frac{1}{2}}$

$= ([36 + 36 + 9 + 9 + 289]/4)^{1/2} \simeq 10.$

$S_{potentiometer} = ([(1290 - 1280)^2 + (1290 - 1280)^2 + (1281 - 1280)^2 + (1280 - 1280)^2 + (1280 - 1280)^2]/4)^{1/2}$

$= ([100 + 100 + 1 + 0 + 0]/4)^{1/2} \simeq 22$

$\sigma_{\bar{X}_{resistor}} = 10/\sqrt{5} \simeq 4$

$\sigma_{\bar{X}_{potentiometer}} = 22/\sqrt{5} \simeq 10$