❖ Introduction

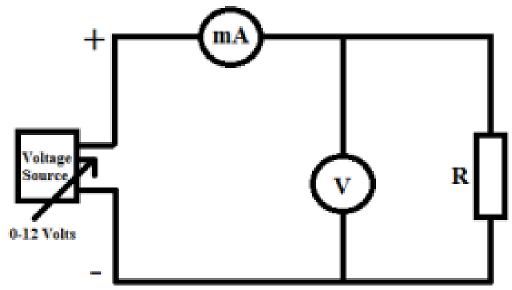
The objectives of this experiment are:

- ✓ To investigate the various applications of ohm's law.
- ✓ To investigate series and parallel resistive circuits.
- ✓ To investigate the voltage divider principle by using Variable resistance.

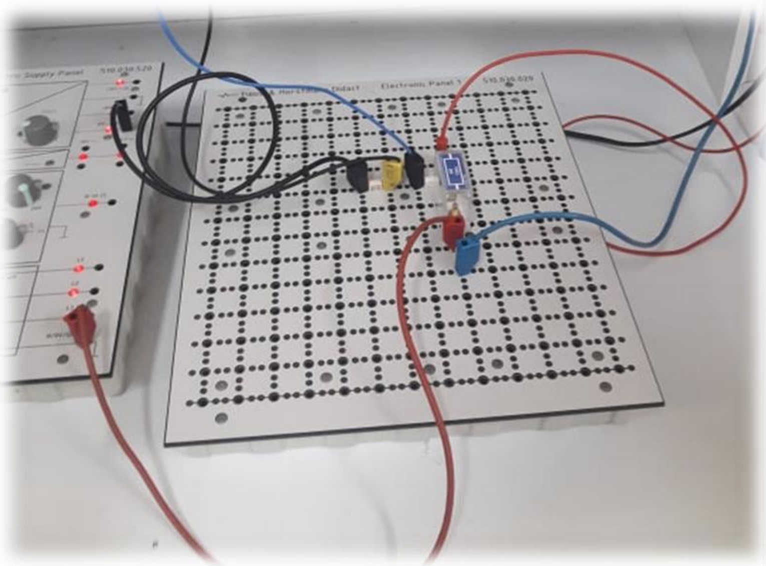
❖ Procedure

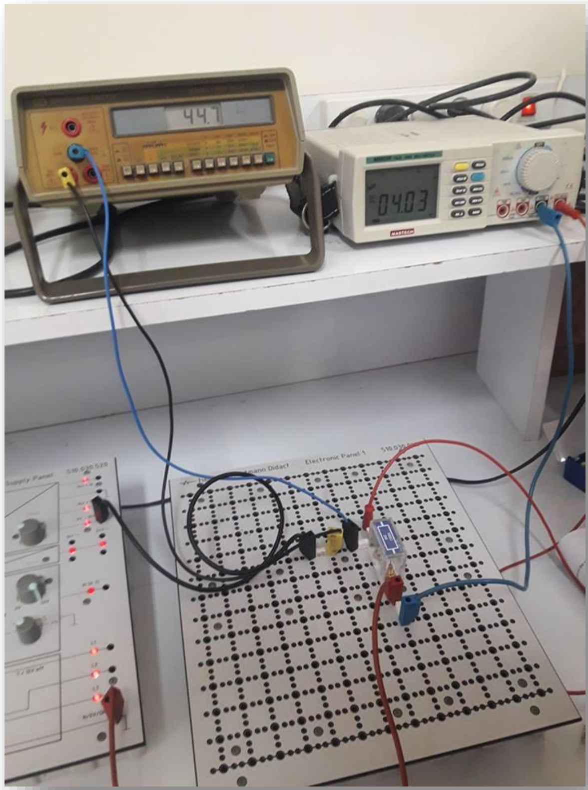
Part one(Ohm's Law)

1.we Set up the circuit as shown down.



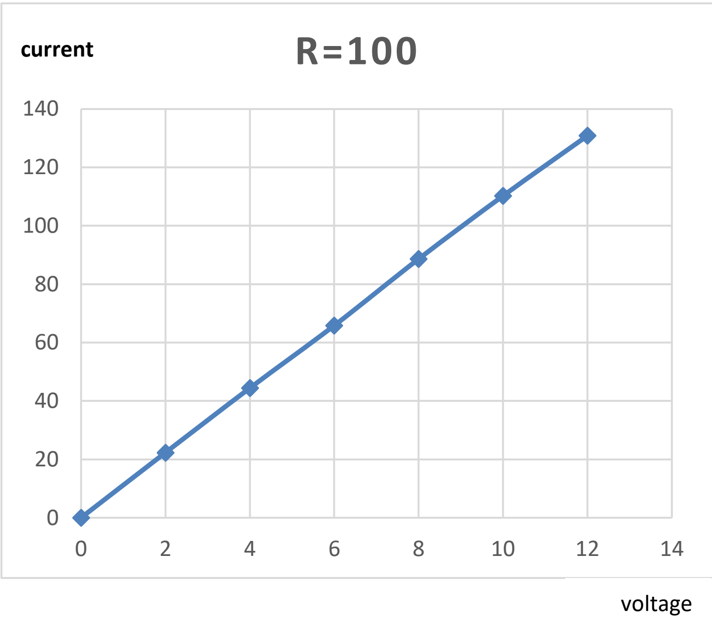
2.We measure the currents at certain resistance for certain voltage values(see Table 1).

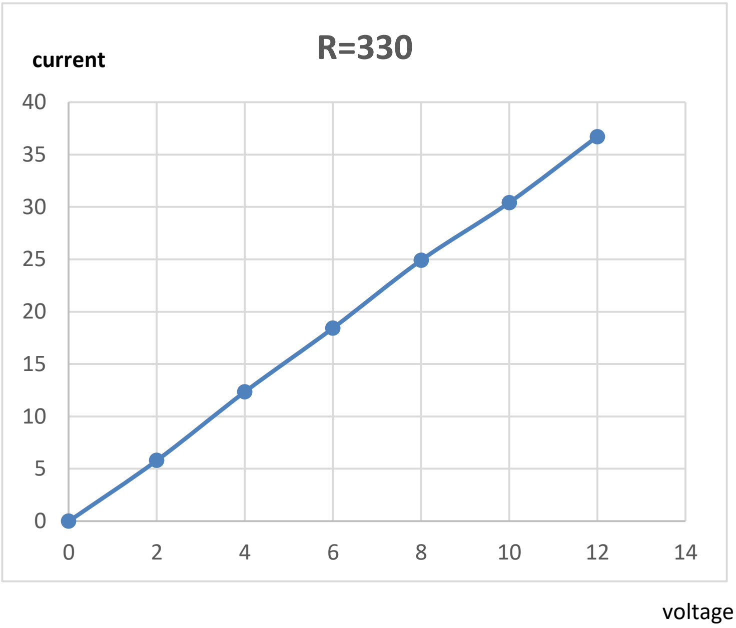


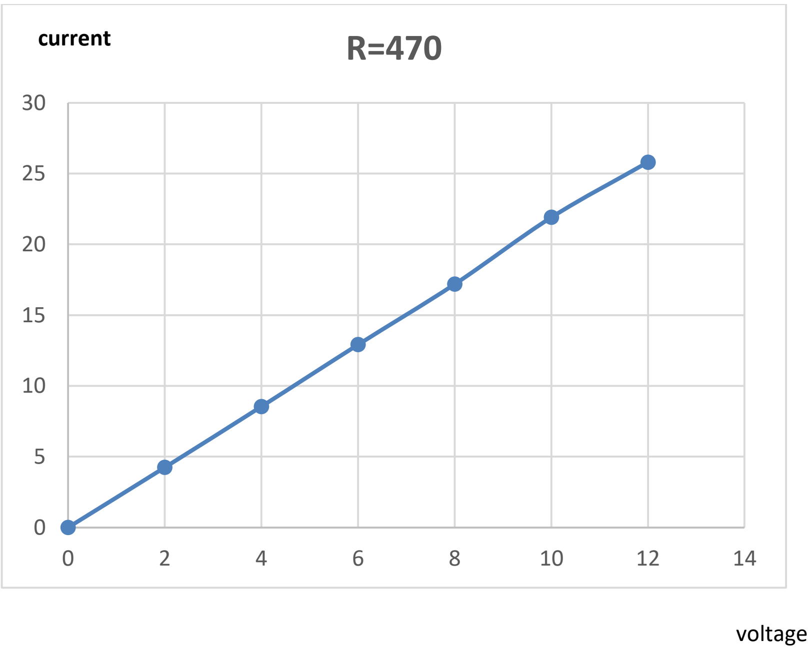


V		0	2	4	6	8	10	12
R=100Ω	I(mA)	0	22.3	44.4	65.8	88.6	110.2	130.8
	P(mW)	0	44.6	177.6	394.8	708.8	1102	1569.6
	R(Ω)	100	89.68	90.09	91.18	90.29	90.74	91.74
R=330Ω	I(mA)	0	5.8	12.35	18.43	24.9	30.4	36.7
	P(mW)	0	11.6	49.4	110.58	199.2	304	440.4
	R(Ω)	330	344.8	323.88	325.5	321.28	328.9	326.9
R=470Ω	I(mA)	0	4.24	8.54	12.91	17.18	21.9	25.8
	P(mW)	0	8.48	34.16	77.46	137.44	219	309.6
	R(Ω)	470	471.6	468.3	464.7	465.6	456.6	465.1

Table 1



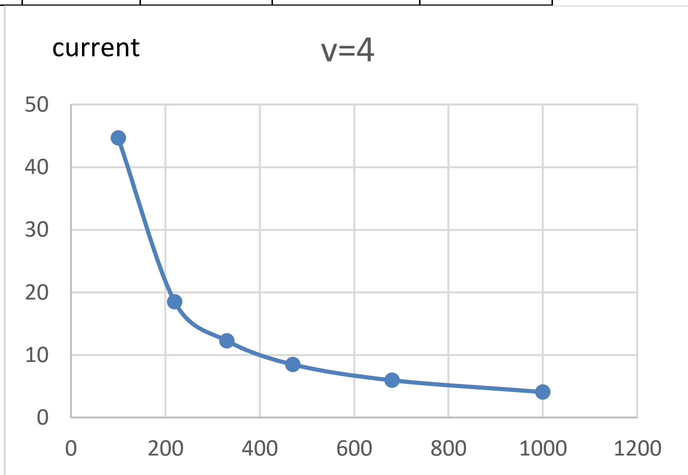


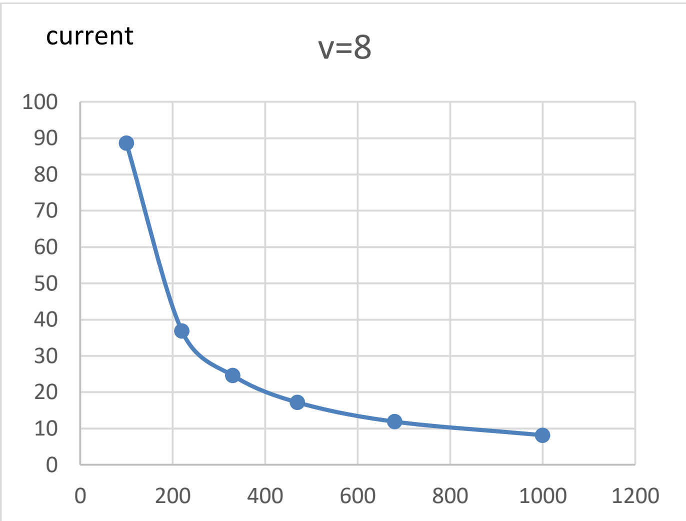


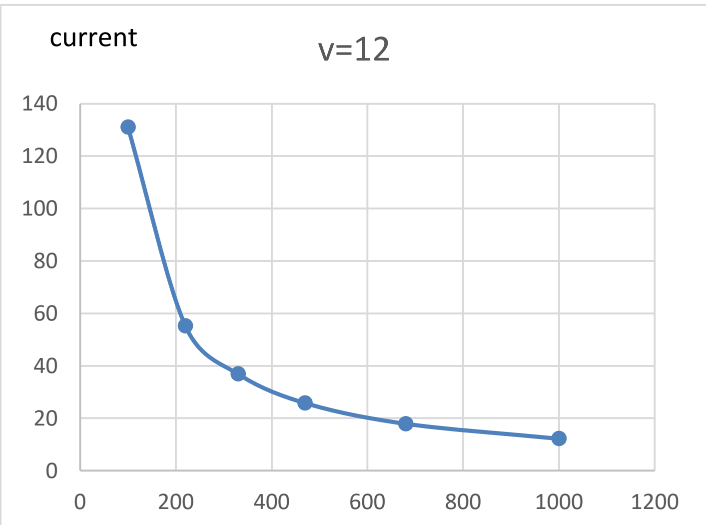
3.we Find the currents for the rest of resistor at voltages 4, 8 and 12 voltages (see Table 2).

Table 2

R Ω	100	220	330	470	680	1000
I(mA)at 4 v	44.7	18.5	12.3	8.5	5.98	4.1
I(mA)at 8 v	88.6	36.9	24.6	17.2	11.9	8.18
I(mA)at 12 v	131	55.2	36.9	25.8	17.9	12.2



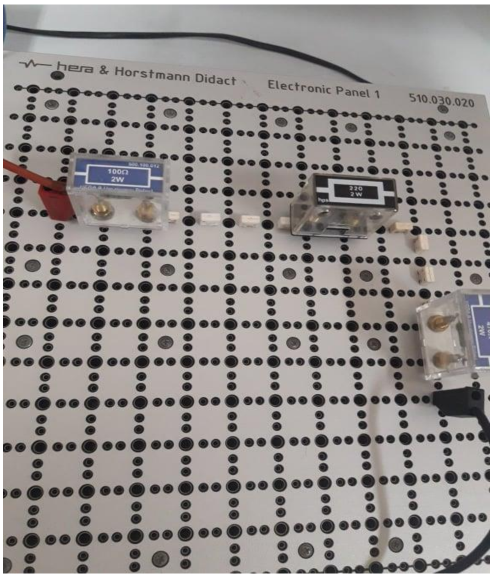


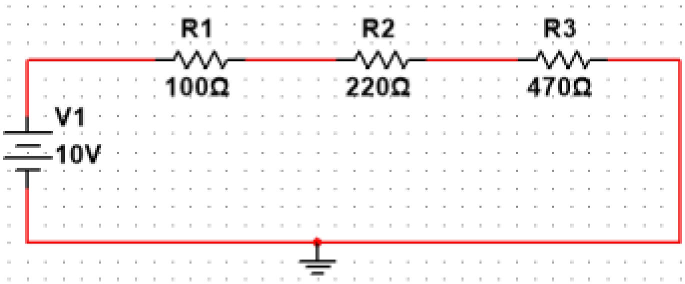


Part Two(series and parallel connection)

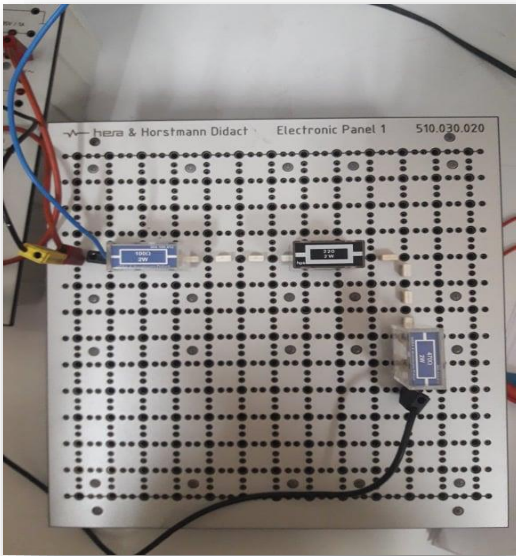
❖ **Series connection**

1. we Set up the circuit of series connection as follows.





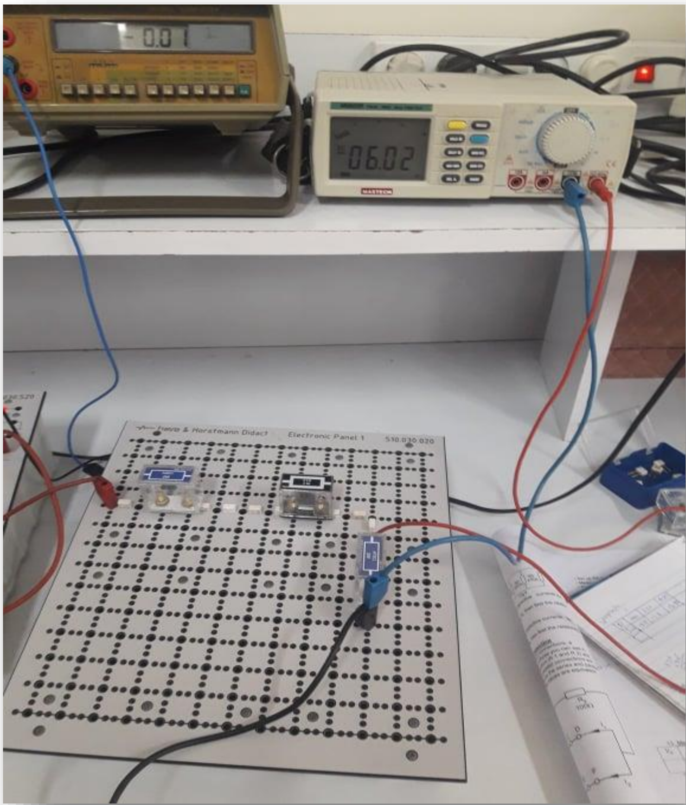
2. we Connect the ammeter inseries with the circuit andmeasure the current.(see table 3)



RΩ	100	220	470
I(mA)	12.8	12.8	12.78

Table 3

3.we Connect the voltmeter oneach resistor and measure their voltages and we calculatethe value of resistanceof each resistor from the values of current and voltage.(see table 4)



R Ω	100	220	470
V(volt)	1.162	2.82	6.02
R(calculated)Ω	90.7	220.3	470.1

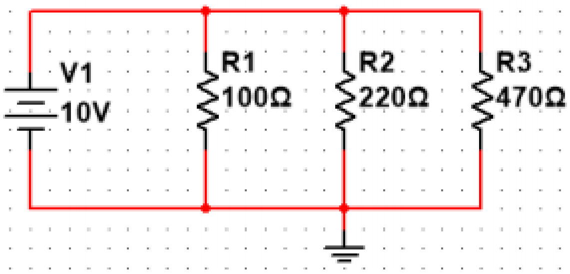
Table 4

The total resistance=the sum of voltages/current=(1.162+2.82+6.02)/12.8=781.4Ω

- ✓ **R total=90.7+220.3+470.1=781.1Ω**
- ✓ **Req=R1+R2+R3+...**

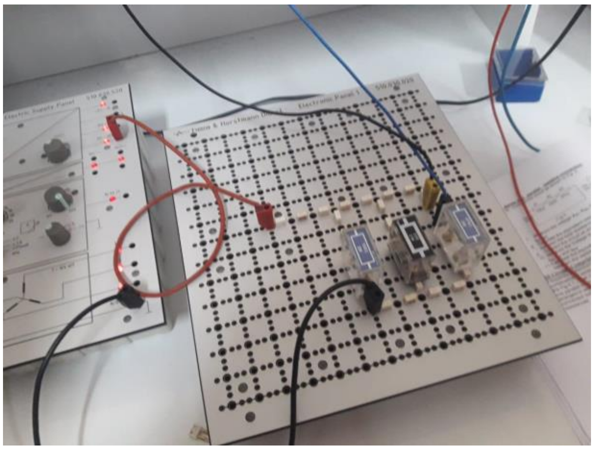
❖ parallel connection

1.we Set up the circuit of parallel connection .



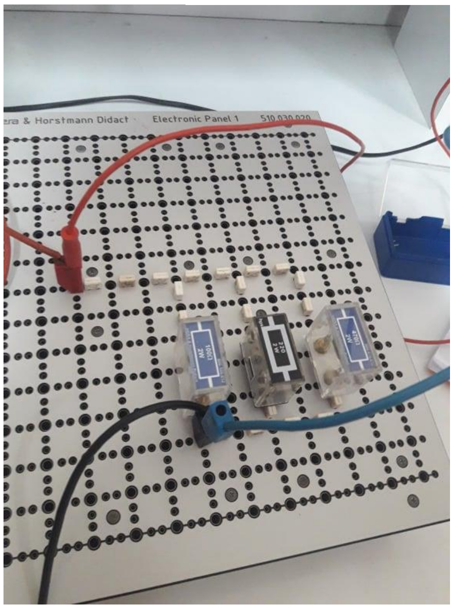
2. we Connect the ammeter in series with the source to find Itotal , then connect it inseries with each resistor to find theircurrents.

3. Measure the value of resistors from the values of voltages and currents and find a relationship between parallel circuit components.



Measuring resistance current

Measuring Total voltage



RΩ	100	220	470
V volt	9.98	9.72	9.96
I mA	108.3	44.7	21.2
Calculated R	92.1	217.4	469.8

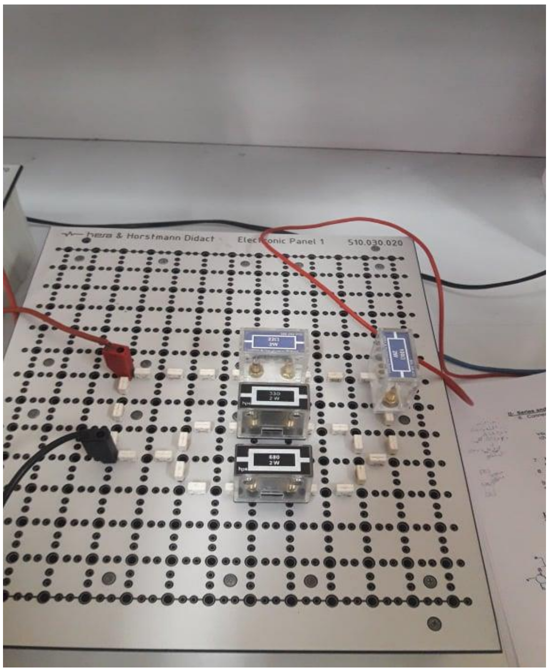
I total=171.1 mA

- ✓ The total resistance=the voltage / the sum of thecurrents=10/(108+44.7+21.2)=57.4ohm.
- ✓ 1/Req=1/R1+1/R2+1/R3+...
- ✓ Req=1/(1/92.1+1/217.4+1/469.8)=41.65ohm.

❖ Series and Parallel

1. We set up the circuit as shown.

2. We measure the partial currents at the measuring points.(see table5)



Partial current and total current(mA)		
Measuring points		
A-B	C-D	E-F
29.9	9.7	20

Table 5

3. We measure the partial voltages at the resistors R1,R2,R3 and R4.(see table6)

Partial voltages(v)			
UR1	UR2	UR3	UR4
.654	2.714	6.62	6.63

Table 6

- ☒ Mathematically

  R eq=344.1Ω

  I total=29mA

  VR1=29*22=638mV

  vR2=29*100=2900mV

  v(for parallel)=6.44 volt=VR3=VR4

- ☒ By Measuring

  V total=9.988 volt

  I total=29.9

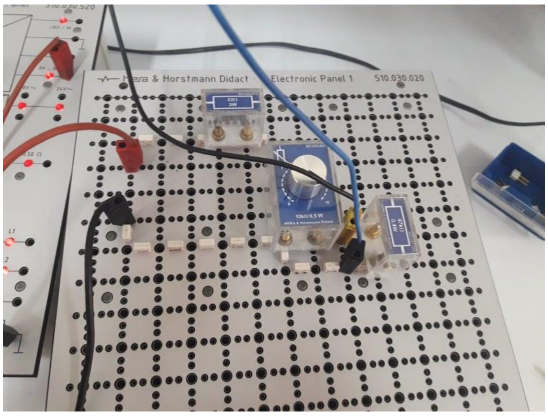
  - ✓ R eq=9.988\29.9mA=334.046 Ω(while mathematically its =344.1 Ω)

Part 3(voltage divider)

1. we Connect the circuit as shown down.

2. we Measure the voltage V2 at each of the potentiometer positions (α=0 to 10)

without R3 and thenwith R3.(see table6)



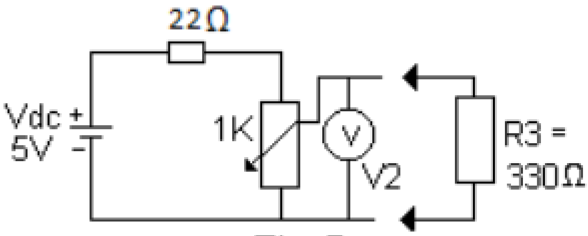
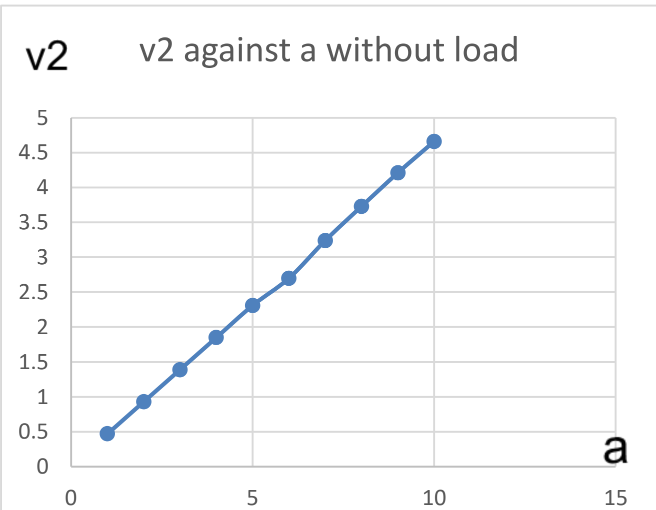
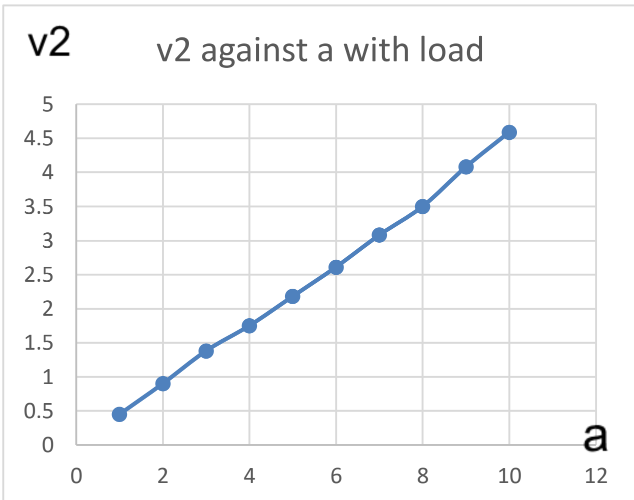


Fig-5

Table 6

A	1	2	3	4	5	6	7	8	9	10
V2 (R3 not conn.)	0.47	0.93	1.39	1.85	2.31	2.7	3.24	3.73	4.21	4.66
V2 (R3 conn.)	0.45	0.9	1.38	1.75	2.18	2.61	3.08	3.5	4.08	4.59





- ✓ **Describe the shape of curves.**

The curve that represents V2 without load resistant is rising smoothly applying the voltage division between the potentiometer resistors while the curve representing V2 against α with a load resistor R3 the voltages changed and are rising very slowly due to current branching between the potentiometer resistor and R3.

- ✓ **Without load, find R2 when α=3 (from the graph and calculation).**
  - ☒ **From the graph and measured : when α=3, V2=1.5 volts.**
    I total = 5\10022=.0004989A
    R2=1.5\.004989=3006.6Ω

  - ☒ **By calculation**
    I total=5\3002=.001654 A
    V R2=(3000\3022)*5=4.96 volt
    R2= V\I= 4.96\.001654=3000 Ω

- ✓ **The value of V2 when the potentiometer is at position 5 with R3=4.7K Ω**

R total=(4.7*5\4.7+5)22. =24.42 Ω

I total=.2A

V2= 1.985volt

❖ Conclusion

By the end of this experiment, we were able to identify the ohm's law. We also applied the principle of series and parallel connections of circuits. Moreover, we worked with a variable resistance potentiometer to apply voltage divider.