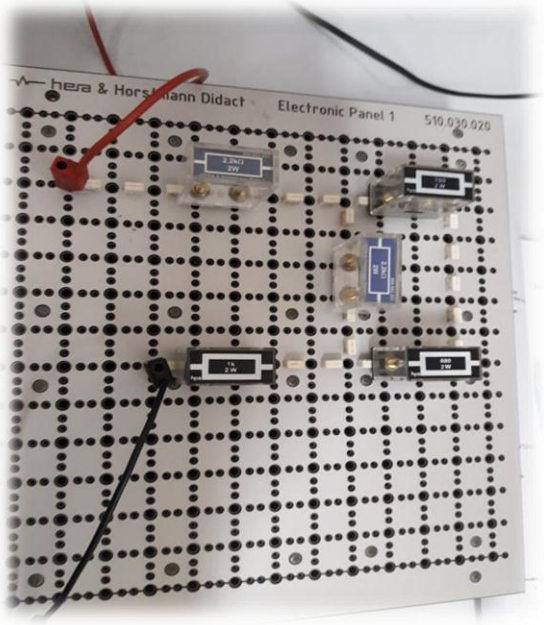
Introduction

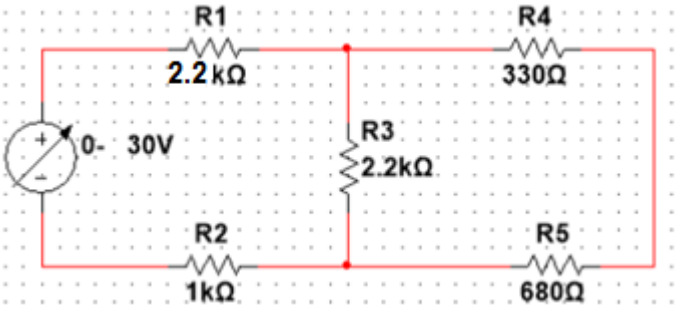
In this experiment we studied the effect of more than one voltage source in a net work, how to find a method of simplifying a network in order to obtain the current in one particular branch of the network.

❖Procedure

Part One (Kirchhoff's law)

1. **we Connected the circuit as shown.**



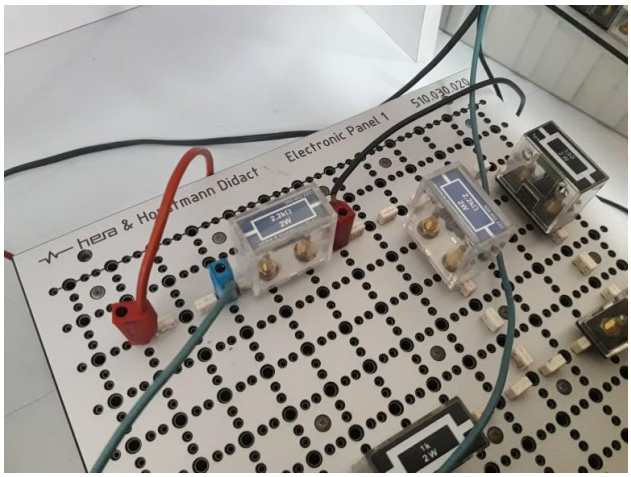


2. **we measure the voltage and current across the resistors .(see table 1)**

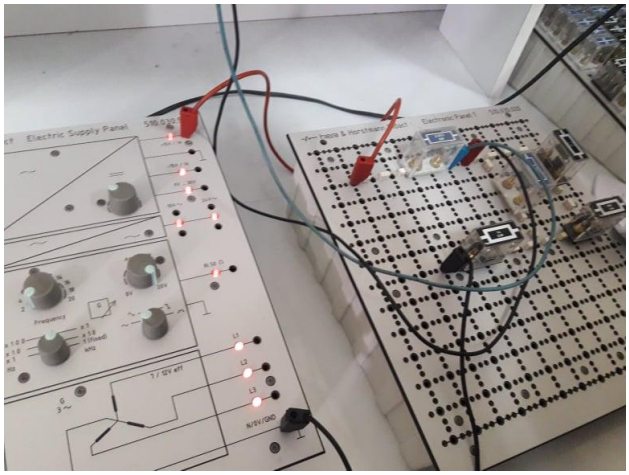
Resistance	Voltage(v)	Current(mA)	Calculated R
R1	8.46	3.86	2.19 kΩ
R2	3.91	3.85	1.01kΩ
R3	2.65	1.2	2.2kΩ
R4	0.868	2.63	330 Ω
R5	1.69	2.63	642.5 Ω

Table 1

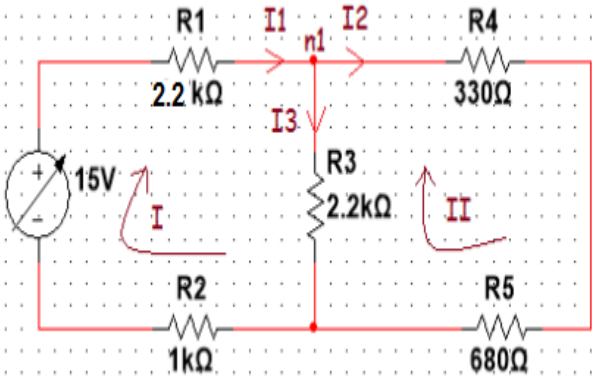
Measuring V1



Measuring I1



❖ TO find the current and the voltage theoretically.



❖SOLUTION

- ✓ **n1(KCL): I1=I2+I3… (1)**

- ✓ **Loop I(KVL):**
  - 15+(I1*R1)+(I3*R3)+(I1*R2)=0
  -15 +3200*I1+2200*I3=0…(2)
- ✓ **Loop II(KVL):**
  1010*I2-2200*I3=0…(3)

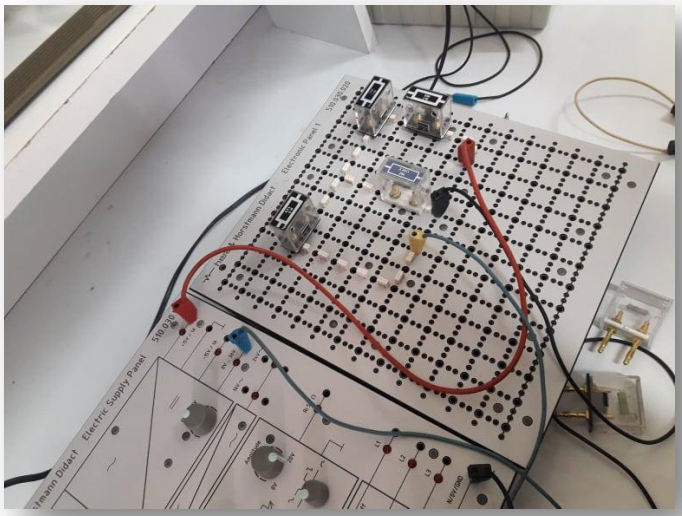
Solve eq.for I1,I2 and, I3.we get that
I1= 3.85 mA=IR1=IR2
I2=2.6mA=IR4=IR5
I3= 1.213 mA=IR3

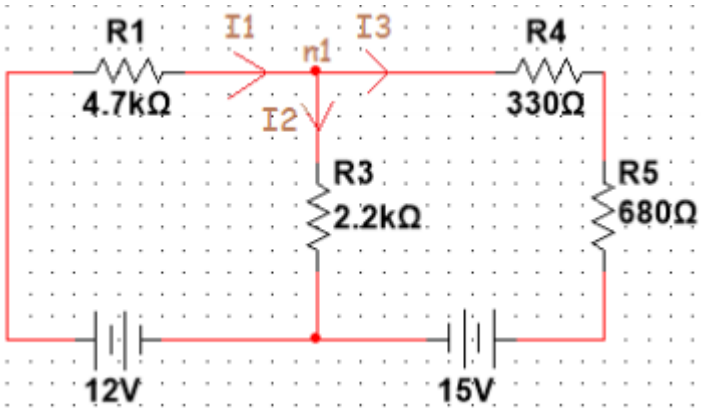
Resistance	Current(theoretically)mA	Voltage(theoretically) v V=R*I
R1=2.2kΩ	3.85	8.47
R2=1kΩ	3.85	3.85
R3=2.2kΩ	1.213	2.66
R4=330Ω	2.6	0.8788
R5=680Ω	2.6	1.768

(and that what we get experimentally).

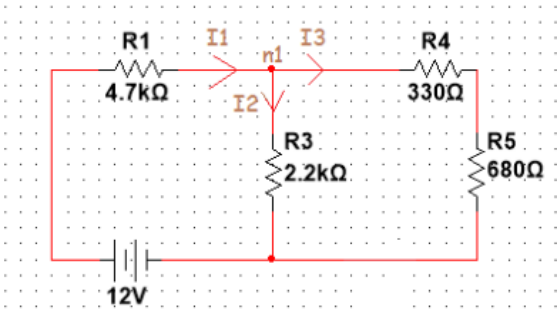
❖Part Two (Superposition Theorem)

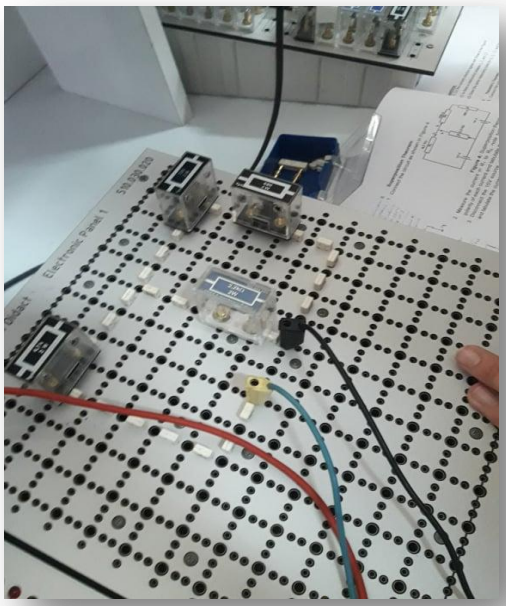
1. **Connect the circuit as shown.**



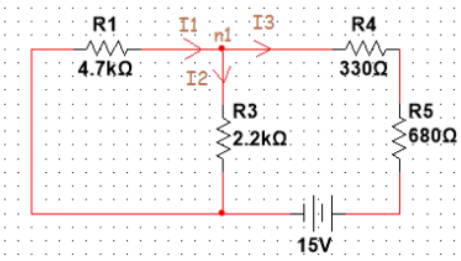


2. **We measure the current.**
3. **Disconnect the 15V source (Kill 15V source) ,as shown and we measure the current as shown**





4. **we Connect the 15V source and disconnect the 12V source source as shown and measure the current.**

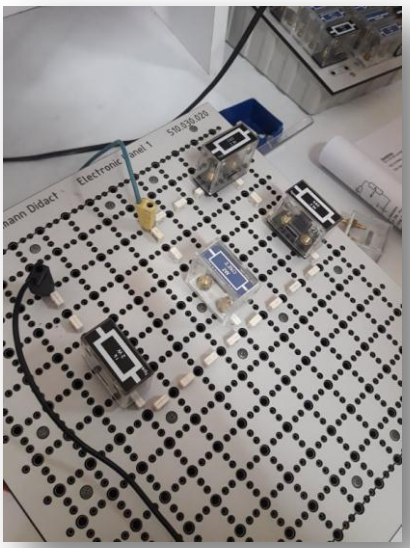


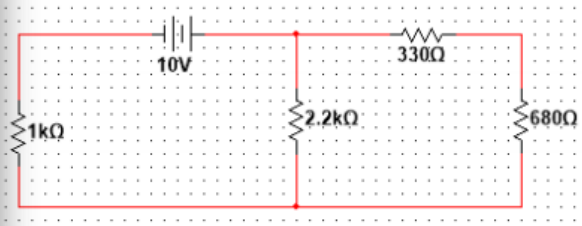
I measure(mA)	Current(mA)		Current(mA)		Current (mA)	I sup	Current (mA)	I calc	Current (mA)
I1	0.29	I1`	2.21	I1``	-1.92	I1	0.29	I1	0.31
I2	4.79	I2`	0.68	I2``	4.09	I2	4.77	I2	4.7732
I3	-4.5	I3`	1.51	I3``	-6.02	I3	-4.51	I3	-4.451

- ✓ **Do the currents direction agrees with those in the Fig**
- **No, we see for Ex. that we have a Negative Sign in I3 (that mean I3 in the opposite Direction).**
- ✓ **Is there a relationship between I1,I1` and I1``?**
- **Yes, I1=I1`+I1``…… 0.29=2.21+-1.92**
- ✓ **Dose the same relationship holds for(I2,I2`,I2``)and for (I3,I3`,I3``)**
- **Yes**
- **I3=I3`+I3`` ……. -4.5=1.51+-6.02(and so on I2).**

❖Part three (Thevenin's Theorem)

1. We Connect the circuit as shown.





2.We measure the current in the 680 Ohm resistors.(we get I=4.01 mA).

3.We Remove the 680Ohm resistor, and measure the voltage.(we get that Vo.c=6.85 volt=Vth)

4. We remove the voltage source, and we connecting test voltage source between x,y ,measure the total current by applying 2,4,6 and 8 and calculate Rth. (see result in Table 2)

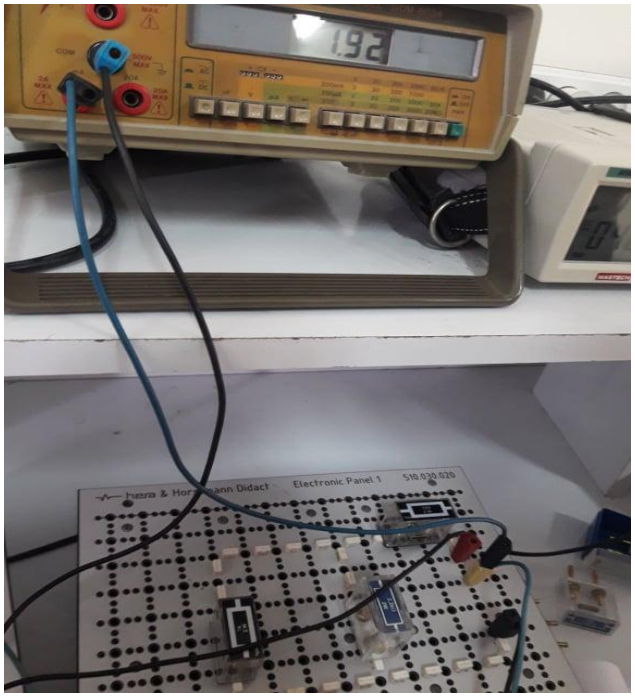


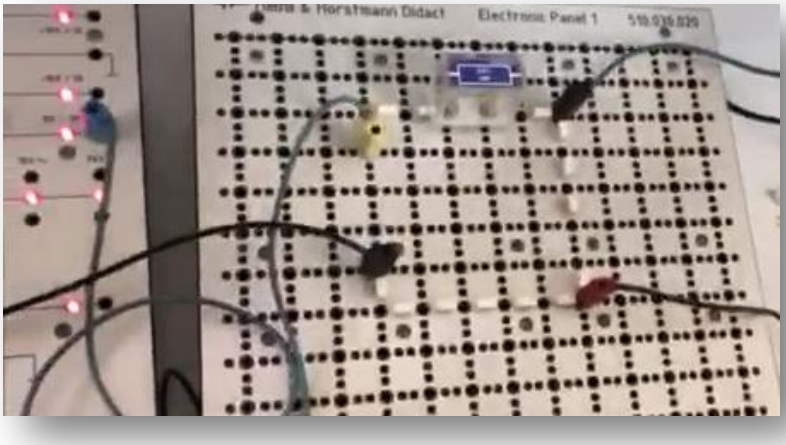
Table 2

V	2	4	6	8
I mA	1.92	3.89	5.81	7.78
R	1041	1028.2	1032.7	1028.2
Rth=sum R\4=1032.5Ω (it's close to 1KΩ.so it's Logical)				

5. **We find the current through 680**Ω(by applying kirchoff's laws), **we get that I=4.04 mA,and we get by measuring I= 4.01mA(so the two values almost equal)**
   Or I 680= Vth\Rl+Rth=4.001 mA
6. **We find Ith**
   - ✓ **Rth=Vo.c\I s.c**
     1032.5=6.85\I s.c
     I s.c= 6.634 mA=I th

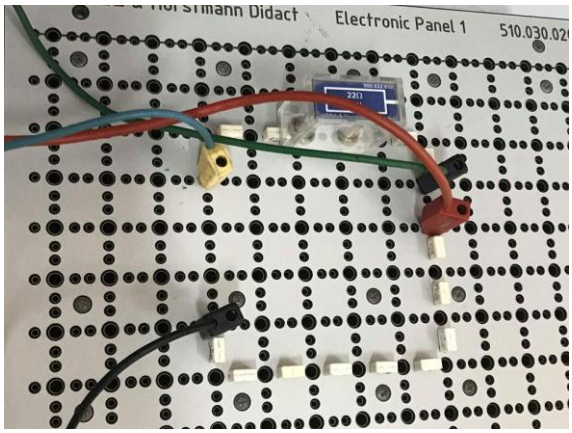
❖Part four(Voltage Source)

1. **We Connect the circuit as shown and measure V o.c**



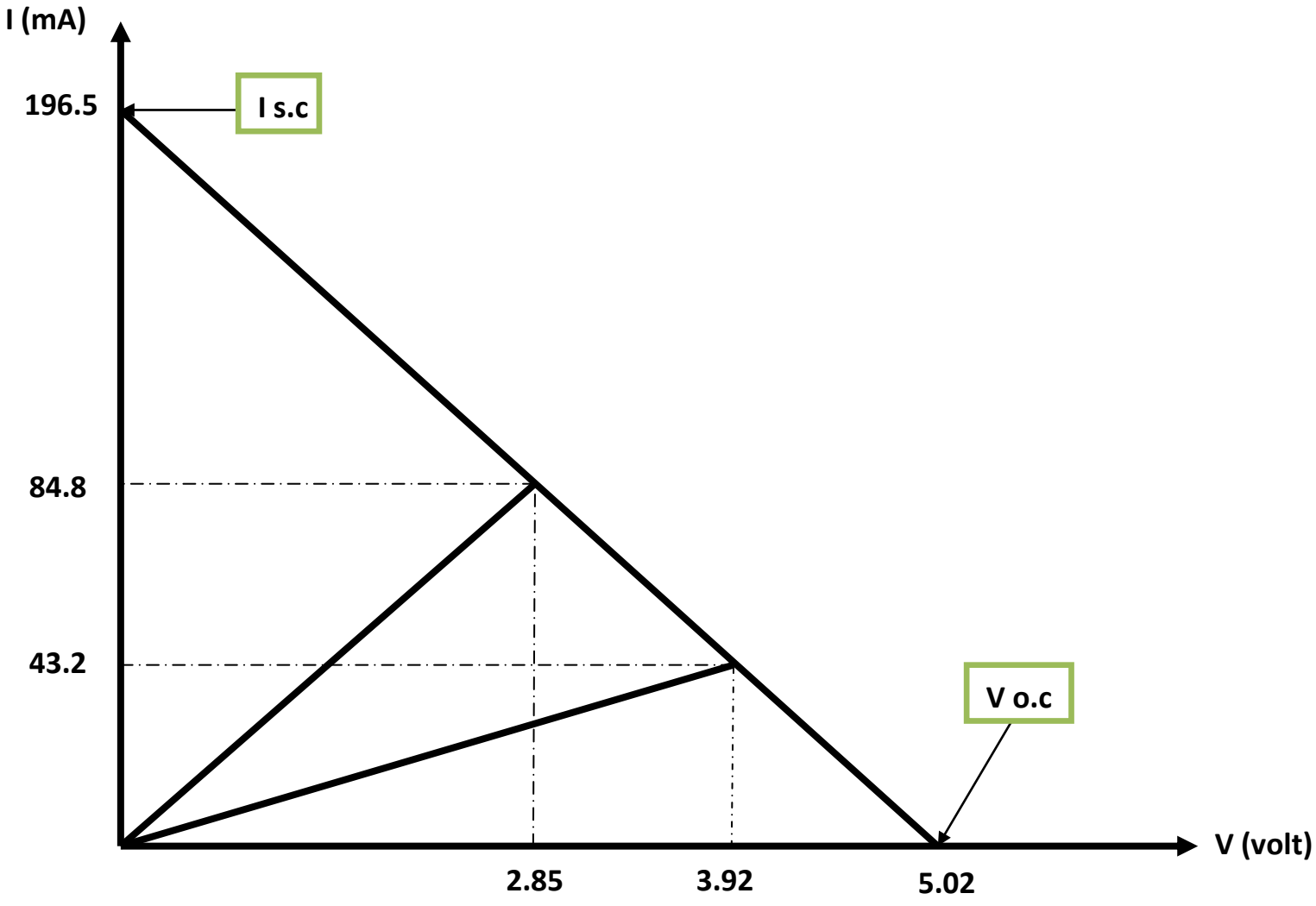
2. **We connect a 100 Ω&33 Ω,and we measure V12 and IL**

3. **We disconnect Rl and connect ammeter to the point 12 then measure I s.c**



	100 Ω	33 Ω	open
V o.c volt	3.92	2.85	5.02
I s.c mA	43.2	84.8	196.5

Max power = Vth^2\4 RL
= 2.85 ^2\4*33=0.0615 watt



Characteristic curve

❖Conclusion

At this experiment we learnt the network theorems Kirchhoff's law(KVL&KCL) , We also applied and ensures of superposition theorem by putting two voltage sources separately and compute the current of each one and add them to result the final current that will be if both of the sources are in the circuit. We also verified thevenin's theorem and found the equivalent circuit consisting of: V_{th} and R_{th} and measured them by several methods.