



## Experiment No.4

### Kirchhoff's laws

#### Object

To verify Kirchhoff's voltage and current laws for simple DC circuits.

#### Theory

##### ❖ Kirchhoff's current law

States that the sum of the currents flowing into a junction or node is equal to the sum of the current 's flowing out of that junction.

$$\sum I_{leaving} = \sum I_{in}$$

Example

For node A  $I_{A1} + I_{A2} + I_{A3} = 0$

For node B  $I_{B1} + I_{B2} + I_{B3} = 0$

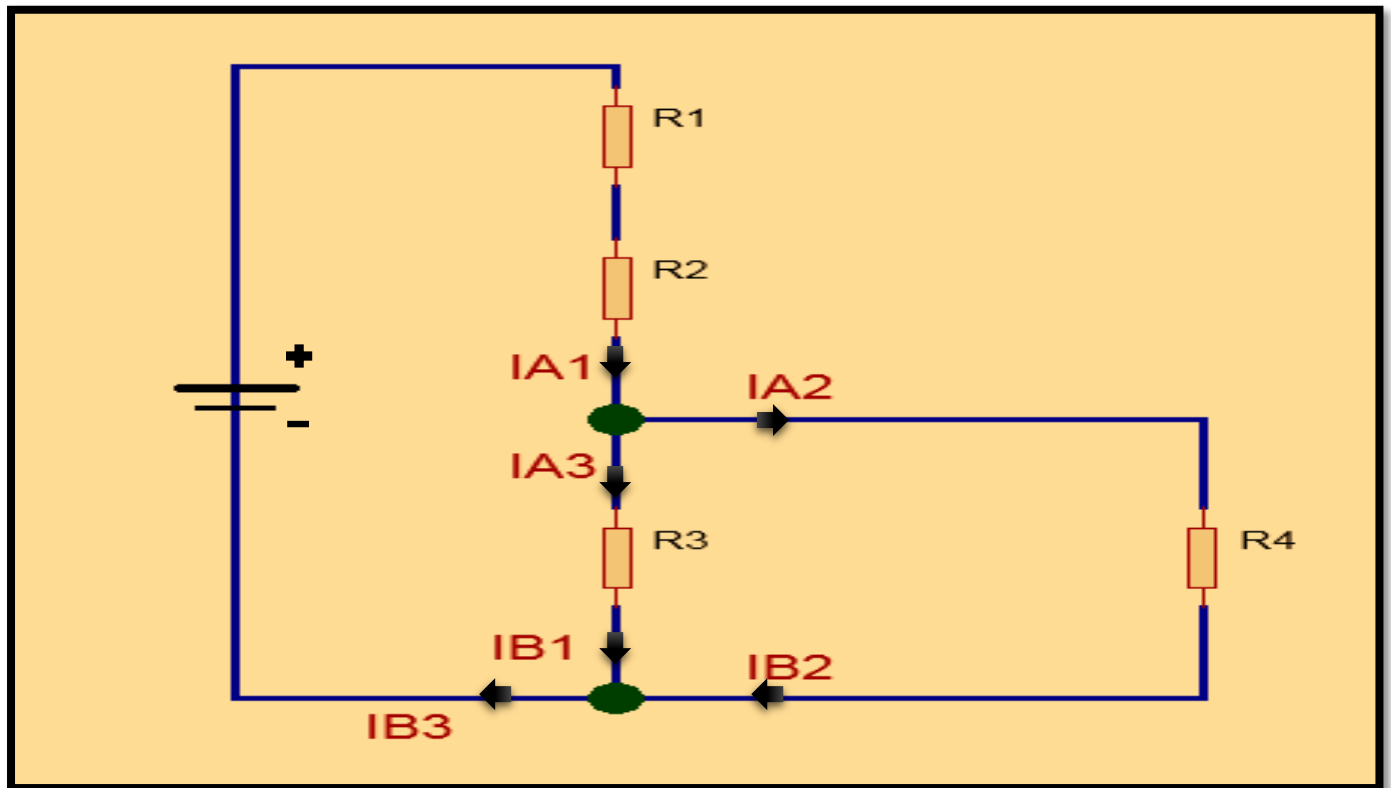


Fig.1 Setup to study the 1<sup>st</sup> Kirchhoff law

❖ **Kirchhoff's voltage law**

State that the algebraic sum at all voltages around path or loop is zero.

Example

The circuit shown in Fig.2. now with clockwise direction.

For Loop A

$$V_a + V_b + V_c + V_d = 0$$

For Loop B

$$V_e + V_d = 0$$

For Loop C

$$V_a + V_b + V_c + V_e = 0$$

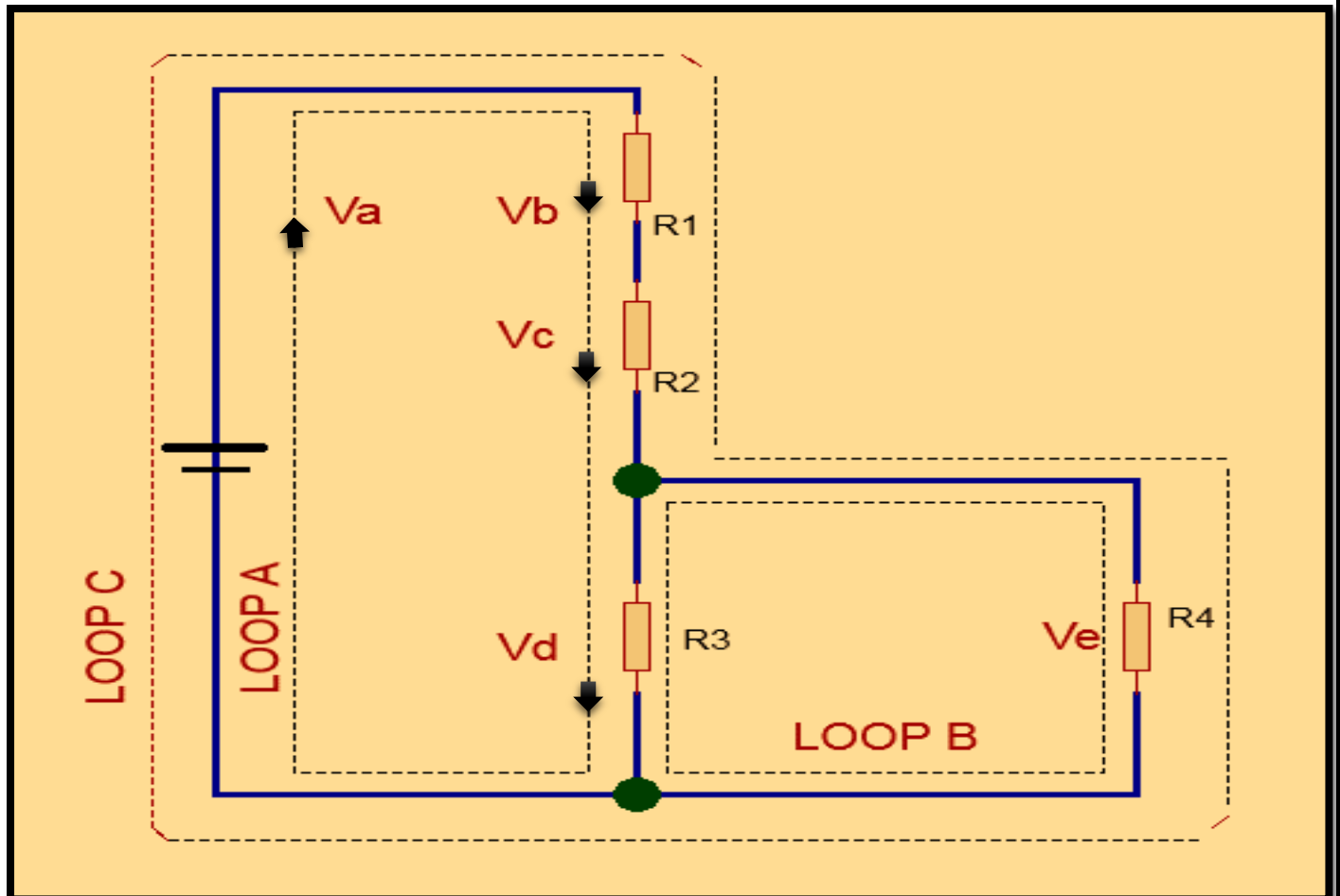


Fig.2 Circuit to study the 2<sup>st</sup> Kirchhoff law

### Procedure

1. Wire the circuit shown in Fig. 2, and adjust the power supply voltage at (15V)
2. Measure the voltage across each resistor, take in consideration the polarity across each resistor. Record your measured result in the Third column of table (1). Determine the sum of these measured voltages. In this stage Kirchhoff's voltage law should be stratified.

Parameter	Calculated	Measured	Error %
Source	15V	15V	.....



$V_b$			
$V_c$			
$V_d$			
<b>Total</b>			

Table.1

3. Wire the circuit shown in Fig.1 and adjust power supply voltage at (10V)
4. Measure the three branch currents. Record your measured results in the third column Table (2). In Kirchhoff's current law should be satisfied.

Parameter	Calculated	Measured	Error %
$I_{A1}$			
$I_{A2}$			
$I_{A3}$			

### Discussion

1. In your own words, state Kirchhoff's Voltage and Current law?
2. For the circuit shown in Fig.3. If  $I_1=18.4\text{mA}$  and  $I_4 =2.65\text{mA}$ , then  $I_2$  is:  
 a. 5.3mA    b. 13.1mA    c. 7.8mA    d. 18.2mA
3. If other resistors values are used for the circuit of Fig.2 in loop A, so that:  
 $V_b=0.54\text{V}$  and  $V_d=3.58\text{V}$ , Then  $V_c$  should be:  
 a. 1016V    b. 10.88V    c. 107V    d. 4.74V
4. Determine the branch current in the network of Fig.4. When The value of each resistance is one ohm.

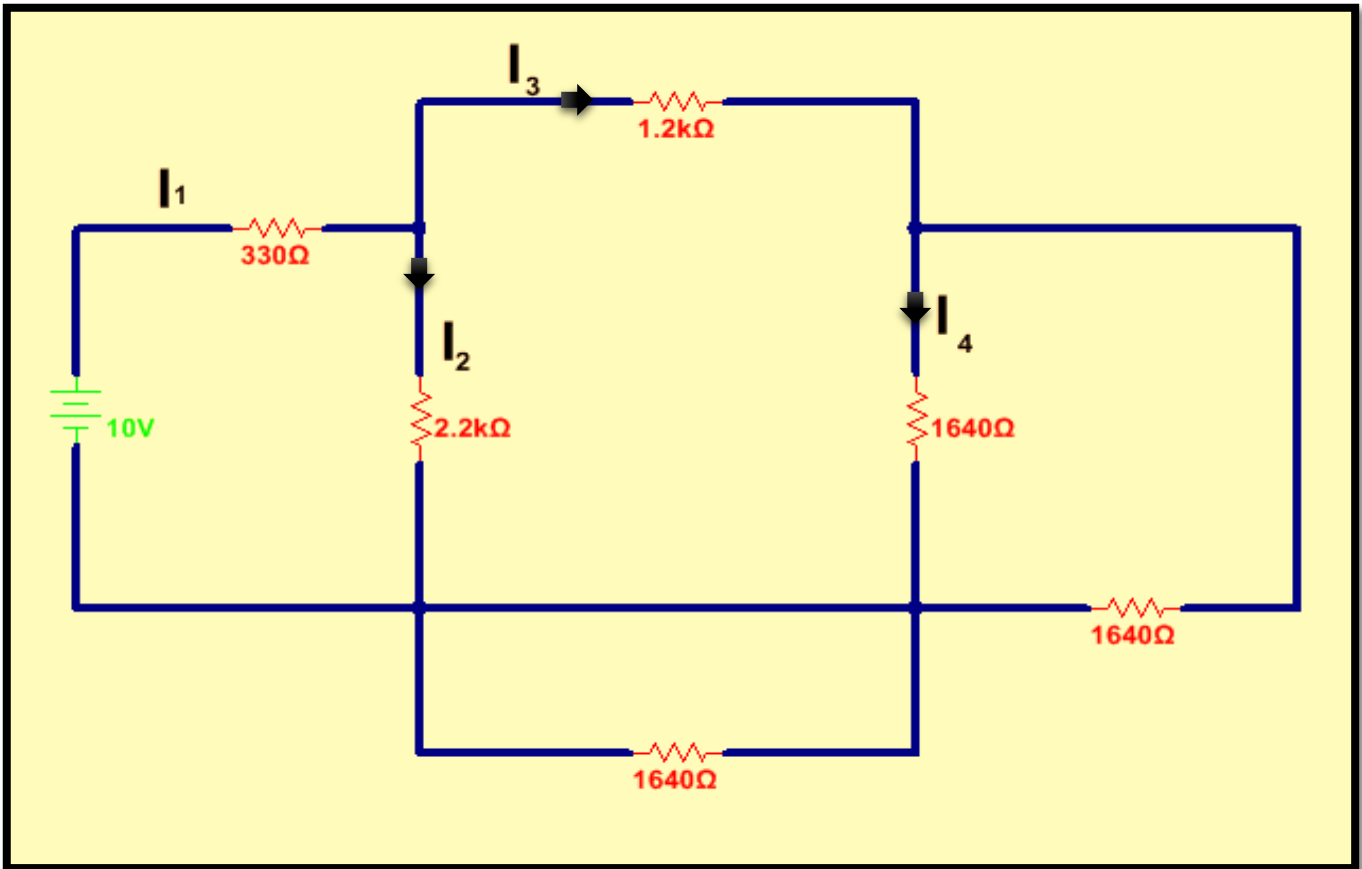


Fig.3

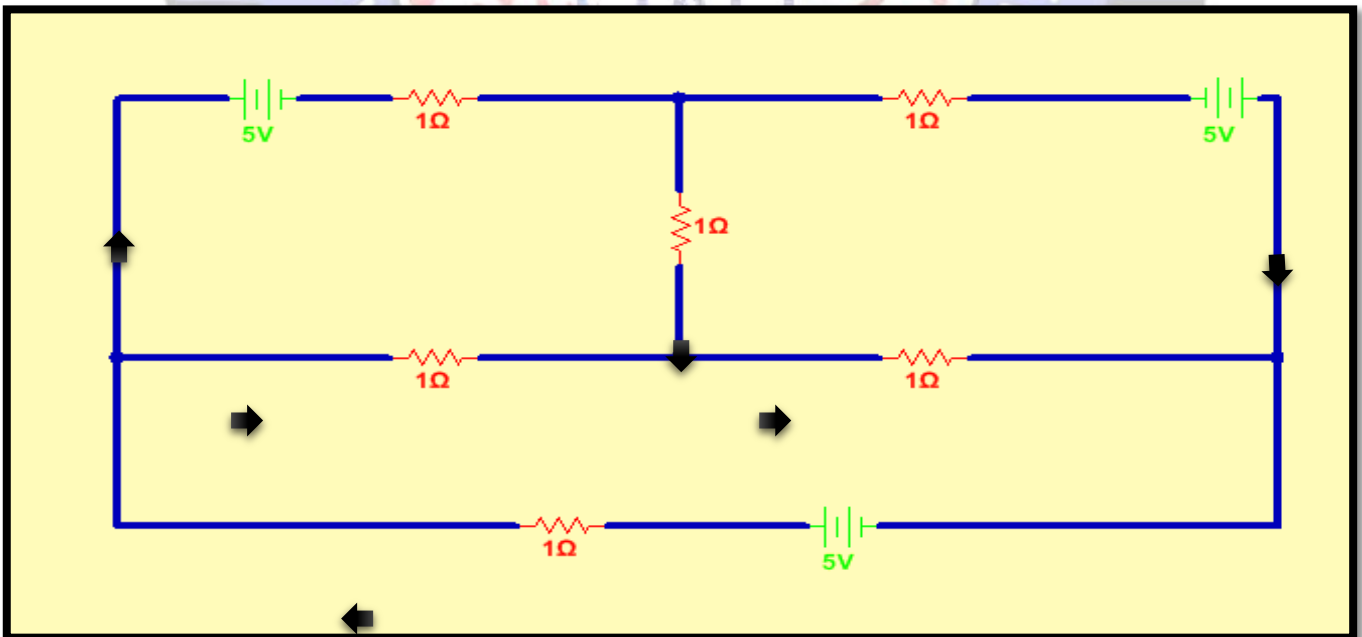


Fig.4