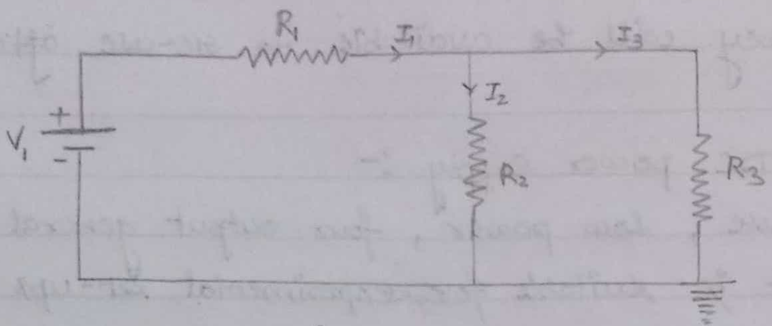
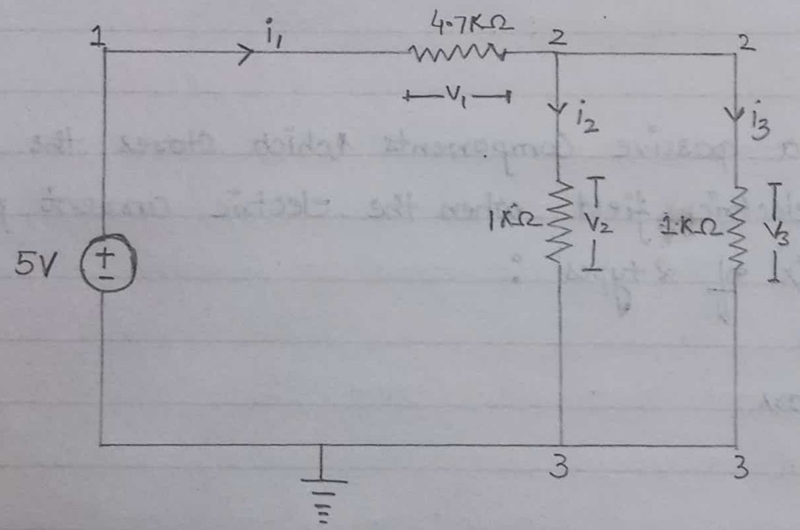


fig-1



(j) part

EXPERIMENT - 02

Aim :-

Verification of KVL & KCL using a given Circuit.

Apparatus Required :- (Multism live)

Multimeter (Digital), DC regulated power supply, bread board, Two 1kΩ resistors, one 4.7kΩ resistor

Theory :-

There are two types of Kirchoff's law :

(a) Kirchoff's Voltage law – KVL states that the algebraic sum of all the voltages encountered as one goes around complete loop is zero.

$$V_1 - R_1 I_1 - R_2 I_2 = 0 \quad \text{(as shown in Fig 1)}$$

$$R_2 I_2 - R_3 I_3 = 0$$

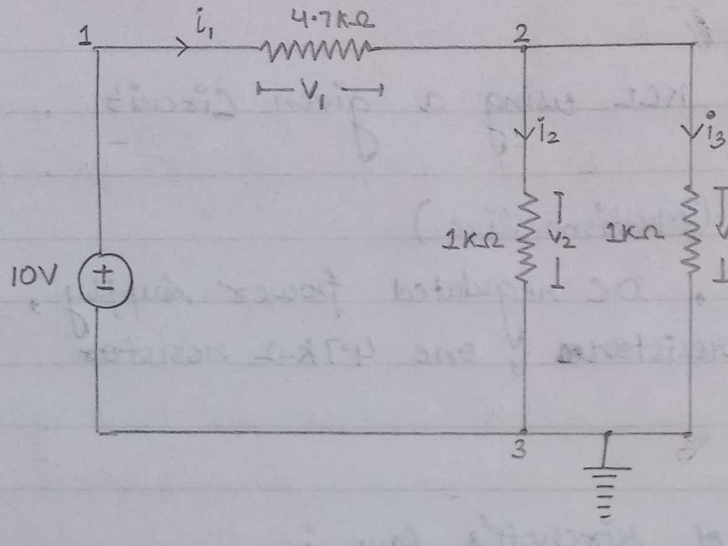
$$V_1 - R_1 I_1 - R_3 I_3 = 0$$

(b) Kirchoff's Current law – KCL States that the algebraic sum of current entering to the point of Node and Current leaving to that Node is equal to zero.

$$I_1 - I_2 - I_3 = 0 \quad \text{(as shown in Fig. 1)}$$

Observation Table :-

Measured current and potential :



(ii) part

Input Voltage V (volts)	Voltage across R_1 (V_1) V	Voltage across R_2 (mV) (V_2)	Voltage Across R_3 (mV) (V_3)	Current across R_1 (mA)	Current across R_2 (mA)	Current Across R_3 (mA)
5 V	4.526 V	0.480 mV	0.480 mV	0.961 mA	0.480 mA	0.480 mA
10 V	9.04 V	0.961 mV	0.961 mV	1.9231 mA	0.961 mA	0.961 mA

Calculation :-

(i) Calculation for 1st part :

$R_1 = 4.7 k\Omega$, $R_2 = R_3 = 1 k\Omega$

$4.7 i_1 + i_2 = 5 \quad \times 2$

$i_1 - 2i_2 = 0$ — ①

$9.4 i_1 + 2i_2 = 10$ — ②

+

$10.4 i_1 = 10 \rightarrow i_1 = 0.961 mA$ & $i_2 = 0.480 mA$

Voltage Across R_1 : $V_1 = i_1 R_1 = 4.5V$

Voltage Across R_2 : $V_2 = i_2 R_2 = 0.480 V$

Voltage Across R_3 : $V_3 = i_3 R_3 = 0.480 V$

At node 2 : $I_1 - I_2 - I_3 = 0$ hence, KCL is proved.

& Similarly, Total voltage (sum) $= 0$ hence, KVL is proved.

$(5 - V_1 - V_2) = 5 - 4.5 - 0.48 \cong 0$

(input voltage − Total sum of voltage drop) should be zero

(ii) Calculation for 2nd part :

$R_1 = 4.7 k\Omega$, $R_2 = R_3 = 1 k\Omega$

$4.7 i_1 + i_2 = 10 \quad \times 2$

$i_1 - 2i_2 = 0$ — (1)

$9.4 i + 2i_2 = 20$ — (2)

+

$i_1 = \frac{20}{10.4} = 1.92 mA$, $i_2 = 0.961 mA$

Voltage across R_1 : $V_1 = i_1 R_1 = 9.04 V$

voltage across R_2 : $V_2 = i_2 R_2 = 0.961 mV$

voltage across R_3 : $V_3 = i_3 R_3 = 0.961 mV$

At node 2 : $i_1 - i_2 - i_3 = 0$, KCL Proved

In first loop : $(V_1 + V_2 - 10)$ should be 0

$9.04 + 0.96 - 10 = 0$, hence, KVL Proved.

Result :-

(i) At node incoming current is found to be equal to outgoing current.

(ii) The total input voltage is found to be equal to the total voltage drop in the circuit.

Precaution :-

(i) All connection should be tight & correct.

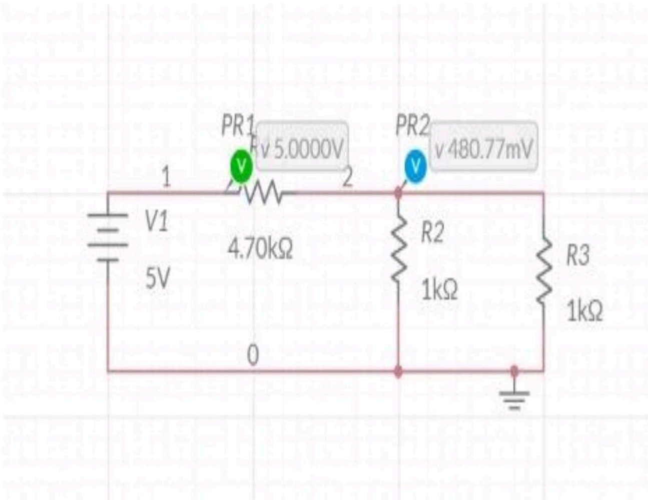
(ii) Switch off supply when not in use.

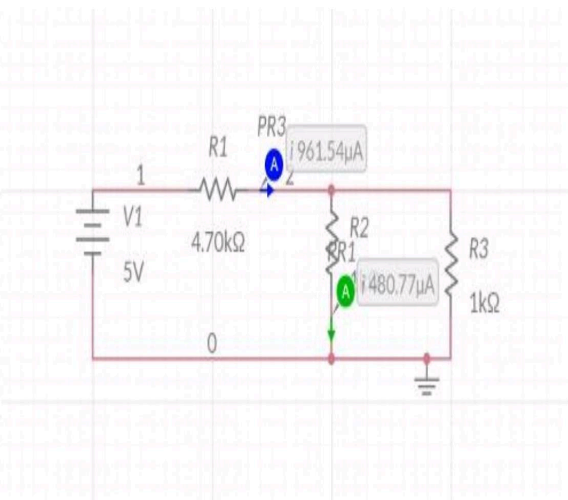
(iii) Reading should be taken carefully.

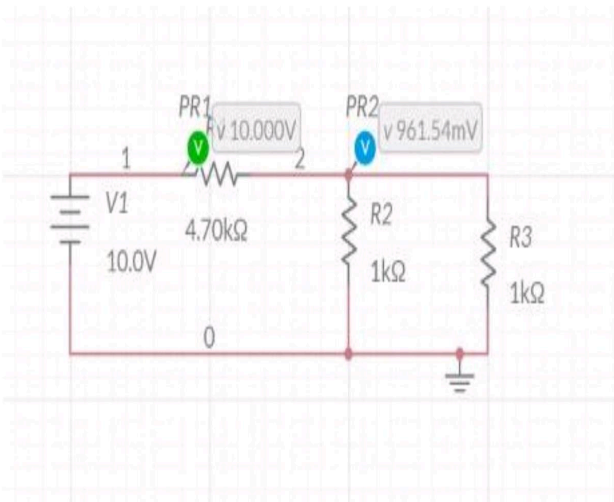
Learning Outcomes :-

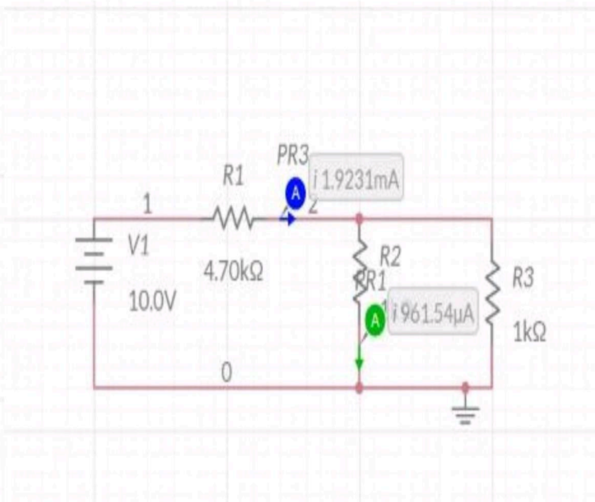
KCL & KVL are very important in solving the circuits where direct formula can't be applied.

Teacher's Signature: ____________


PR1
v 5.0000V
PR2
v 480.77mV
1
2
V1
5V
4.70kΩ
R2
1kΩ
R3
1kΩ
0


R1
PR3
i 961.54µA
1
2
V1
5V
4.70kΩ
R2
PR1
i 480.77µA
R3
1kΩ
0


PR1
v 10.000V
PR2
v 961.54mV
1
2
V1
10.0V
4.70kΩ
R2
1kΩ
R3
1kΩ
0


PR3
i 1.9231mA
R1
1
2
V1
10.0V
4.70kΩ
R2
PR1
i 961.54µA
R3
1kΩ
0