Name : Ms Rodsy Tahmid

ID : 20101021

Course Code: Cse250

Experiment No : 3

Experiment Name:

Verification of KCL & KVL

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Ans: 3.1

(1) Objective:

This experiment is intended to verify Kirchhoff's voltage law (KVL) with the help of Series circuits.

(2) ~~Appearature~~ Apparatus:

~~↳ DC power supplies~~ ↳ One DC Ammeter (0-1A)

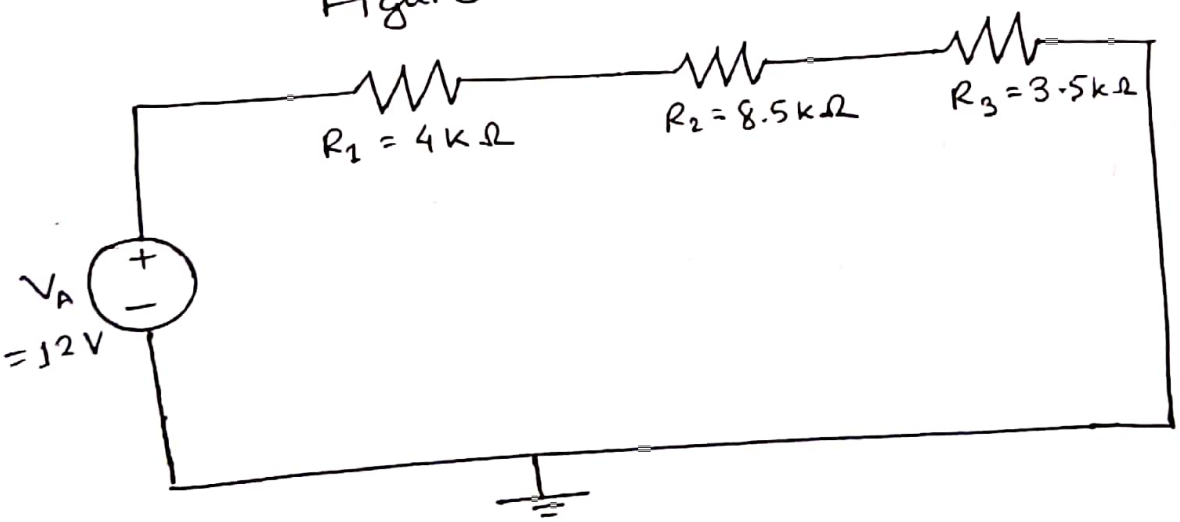
↳ One multimeter

~~↳ Resistors~~ ↳ Three Resistors

~~↳ Ground / Facthing~~ ↳ One DC power supply

(3) Circuit / Block / System Diagram:

Figure-1: KVL verification.



$V_1 = 12 - 9 = 3\ V$

$V_2 = 9 - 2.625 = 6.375\ V$

$V_3 = 2.625 - 0 = 2.625\ V$

$V_1 + V_2 + V_3 = 3 + 6.375 + 2.625\ V$

$= 12\ V$

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3.1

(4) Result / Analysis:

(i) $V_1 = 12 - 9 = 3$

$V_2 = 9 - 2.625 = 6.375$

$V_3 = 2.625 - 0 = 2.625$

(ii) Done in PSpice.

(iii) KVL Verification:

Observation	R_1 (kΩ)	R_2 (kΩ)	R_3 (kΩ)	V_A (V)	V_1 (V)	V_2 (V)	V_3 (V)
Simulation	4	8.5	3.5	12	3	6.375	2.625
Theoretical	4	8.5	3.5	12	3	6.375	2.625

$V_1 + V_2 + V_3$ (V)
12
12

(i) Theoretical:

$R = 4 + 8.5 + 3.5 = 16\,k\Omega = 16 \times 10^3\,\Omega$

$I = \frac{V}{R} = \frac{12}{16 \times 10^3} = 7.5 \times 10^{-4}\,A.$

$V_1 = IR_1 = (7.5 \times 10^{-4})(4 \times 10^3) = 3$

$V_2 = IR_2 = (7.5 \times 10^{-4})(8.5 \times 10^3) = 6.375$

$V_3 = IR_3 = (7.5 \times 10^{-4})(3.5 \times 10^3) = 2.625$

$V_1 + V_2 + V_3 = 3 + 6.375 + 2.625 = 12$

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(5) Questions & Answers:

(Q1) What does KVL predict about the circuit?

Ans: $V_A = V_1 + V_2 + V_3$

(Q2) Does your calculation of $V_1 + V_2 + V_3$ matches the value of V_A?

Ans: Matches exactly.

(6) Discussion:

All the results are exactly the same both in Simulation and theory which does not usually happen in practical (applied Physics).

Ground / Earthing is done in Simulation in Pspice for both the figures as it is necessary. (otherwise Pspice wouldn't work).

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Ans: 3.2

(1) Objective:

This experiment is intended to verify Kirchhoff's current law (KCL) with the help of a ~~samp~~ simple parallel circuit.

(2) Apparatus:

↳ One DC Ammeter (0-1A)

↳ Three Resistors

↳ One multimeter

↳ One DC power

(3) no. done later.

(4) Result / Analysis:

(i) $V = IR \Rightarrow I = \frac{V}{R}$.

$I = \frac{V_A}{R}$.

~~R =~~ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{R_p} = \frac{R_2R_3 + R_1R_3 + R_1R_2}{R_1 + R_2 + R_3}$

$R_p = \frac{R_1 + R_2 + R_3}{R_2R_3 + R_1R_3 + R_1R_2}$

$= \frac{4 + 8.5 + 5.5}{(8.5 \times 5.5) + (4 \times 5.5) + (4 \times 8.5)}$

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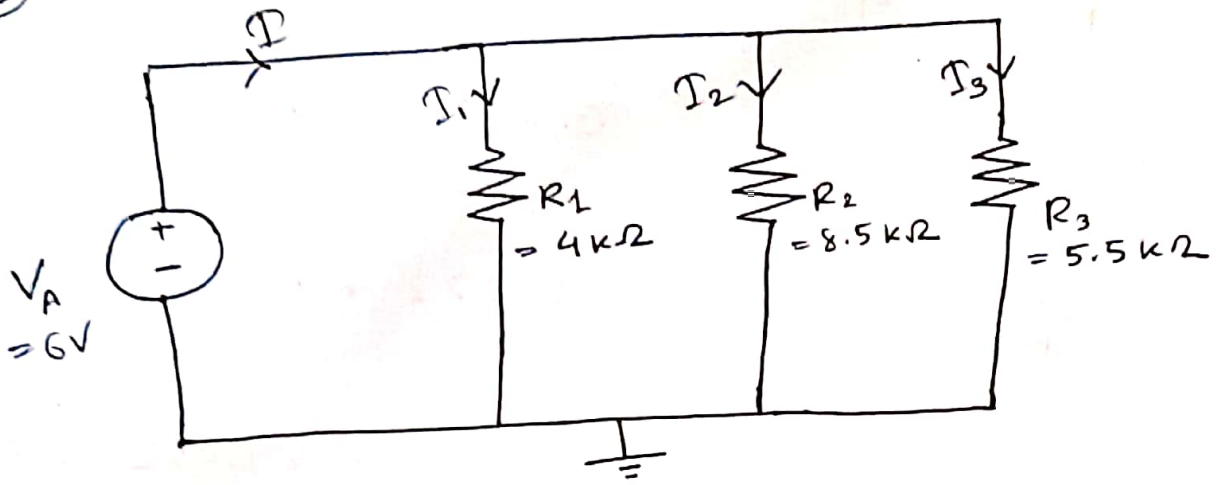
3.2 Circuit / Block / System Diagram:

Figure :- 2: KCL Verification.



- $I = 3.297$ mA

$I_2 = 1.500$ mA

$I_3 = 0.70588$ mA

$I_1 + I_2 + I_3 = 1.5 + 0.70588 + 1.091$

$= 3.29688$

- 4i) → continuation.

~~$R_p = 0.17518$~~

$$\frac{1}{R_p} = \frac{1}{4} + \frac{1}{8.5} + \frac{1}{5.5}$$

$$\frac{1}{R_p} = \frac{411}{748} \Rightarrow R_p = \frac{748}{411} = 1.8199 \approx 1.82\ k\Omega$$

$$\therefore I = \frac{V_A}{R_p} = \frac{6\ V}{1.82\ k\Omega} = 3.2967\ mA$$

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→ cont.

3.2

4.i)

$$I_1 = \frac{V}{R_1} = \frac{6}{4} = 1.5 \text{ mA}$$

$$I_2 = \frac{V}{R_2} = \frac{6}{8.5} = 0.70588 \text{ mA}$$

$$I_3 = \frac{V}{R_3} = \frac{6}{5.5} = 1.091 \text{ mA}$$

$$I_1 + I_2 + I_3 = 1.5 + 0.70588 + 1.091 \text{ mA}$$

$$= 3.29688 \text{ mA}$$

(ii) Done in PSpice.

(iii) KCL verification:

Observation	R_1 (kΩ)	R_2 (kΩ)	R_3 (kΩ)	I (mA)	I_1 (mA)	I_2 (mA)	I_3 (mA)
Simulation	4	8.5	5.5	3.297	1.5	0.70588	1.091
Theoretical	4	8.5	5.5	3.2967	1.5	0.70588	1.091

$I_1 + I_2 + I_3$ (mA)
3.29688
3.29688

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3.2 ⇒ KCL

(5) Questions & Answers :

Q1) What does KCL predict about the circuit?

Ans: $I = I_1 + I_2 + I_3$.

Q2) Does your calculation of $I_1 + I_2 + I_3$ matches the value of I?

Ans: Close enough.

(6) Discussion :

Due to change in decimal places, i.e three decimal places taken in simulation ~~and~~ whereas four decimal places taken in theoretical value, precision is not obtained, i.e, the results are close enough but ~~not exactly~~ does not match exactly.

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