CSE250

CIRCUITS AND ELECTRONICS

EXPERIMENT NO. : 03

EXPERIMENT NAME : VERIFICATION OF KCL AND KVL

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SECTION: 07

1> Objective

- verify Kirchhoff's voltage law (KVL) with the help of series circuit
- verify Kirchhoff's current law (KCL) with the help of a simple parallel circuit

2> Apparatus

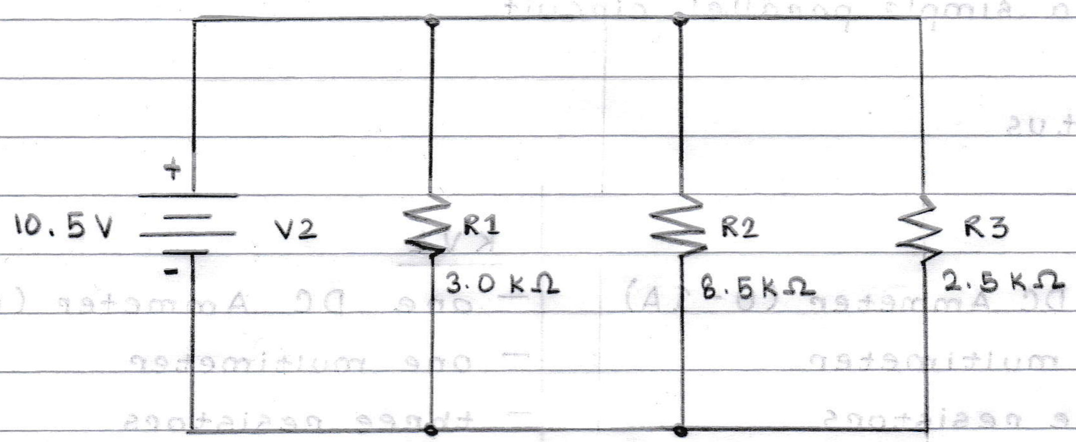
KCL	KVL
- one DC Ammeter (0 - 1A)	- one DC Ammeter (0 - 1A)
- one multimeter	- one multimeter
- three resistors	- three resistors
- one DC power supply	- one DC power supply

Proteus

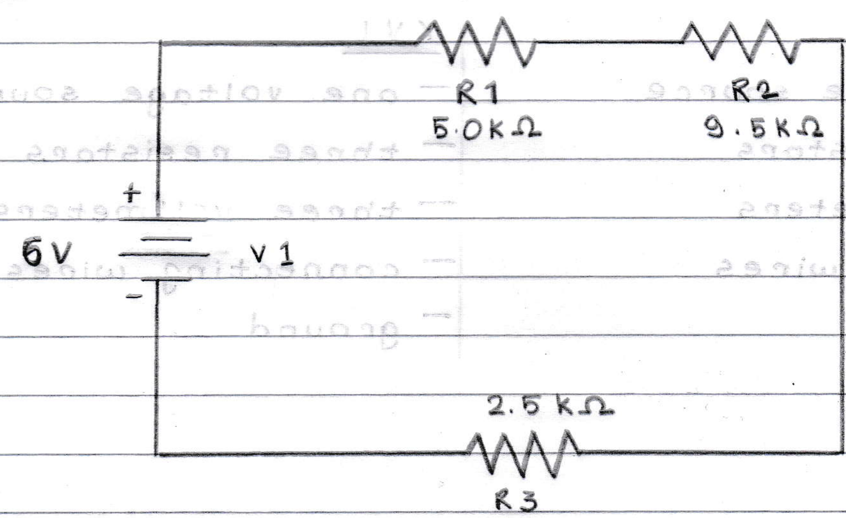
KCL	KVL
- one voltage source	- one voltage source
- three resistors	- three resistors
- three ammeters	- three voltmeters
- connecting wires	- connecting wires
- ground	- ground

3) Circuit / Block Diagram

KCL



KVL



4) Results / Analysis

KVL (Theoretical Observation)

$R_e = R_1 + R_2 + R_3$ $= (5 + 9.5 + 2.5)\ k\Omega$ $= 17\ k\Omega$	$R_1 = 5k\Omega$	$R_2 = 9.5\ k\Omega$	$R_3 = 2.5k\Omega$

$V_1 = \frac{R_1}{R_e} \times V$ $= \frac{5}{17} \times 6$ $= 1.765\ V$	$V_2 = \frac{R_2}{R_e} \times V$ $= \frac{9.5}{17} \times 6$ $= 3.353\ V$	$V_3 = \frac{R_3}{R_e} \times V$ $= \frac{2.5}{17} \times 6$ $= 0.882\ V$	$V = 6\ V$

KCL (Theoretical Observation)

$I_1 = \frac{V}{R_1}$ $= \frac{10.5}{3}$ $= 3.50 mA$	$I_2 = \frac{V}{R_2}$ $= \frac{10.5}{8.5}$ $= 1.235 mA$	$I_3 = \frac{V}{R_3}$ $= \frac{10.5}{2.5}$ $= 4.200 mA$

$\therefore I = I_1 + I_2 + I_3$

$= 3.500 + 1.235 + 4.200$

$= 8.935\ mA$

Table 1 : Verification of KVL

Observation	R_1 (kΩ)	R_2 (kΩ)	R_3 (kΩ)	V_A (V)	V_1 (V)	V_2 (V)	V_3 (V)	$V_1 + V_2 + V_3$ (V)
Simulation	5	9.5	2.5	6	1.76	3.35	0.88	5.99
Theoretical	5	9.5	2.5	6	1.76	3.35	0.88	5.99

Table 2 : Verification of KCL

Observation	R_1 (kΩ)	R_2 (kΩ)	R_3 (kΩ)	I (mA)	I_1 (mA)	I_2 (mA)	I_3 (mA)	$I_1 + I_2 + I_3$ (mA)
Simulation	3	8.5	2.5	8.94	3.50	1.24	4.20	8.94
Theoretical	3	8.5	2.5	8.94	3.50	1.24	4.20	8.94

5) Questions and ~~Ans~~ Answers

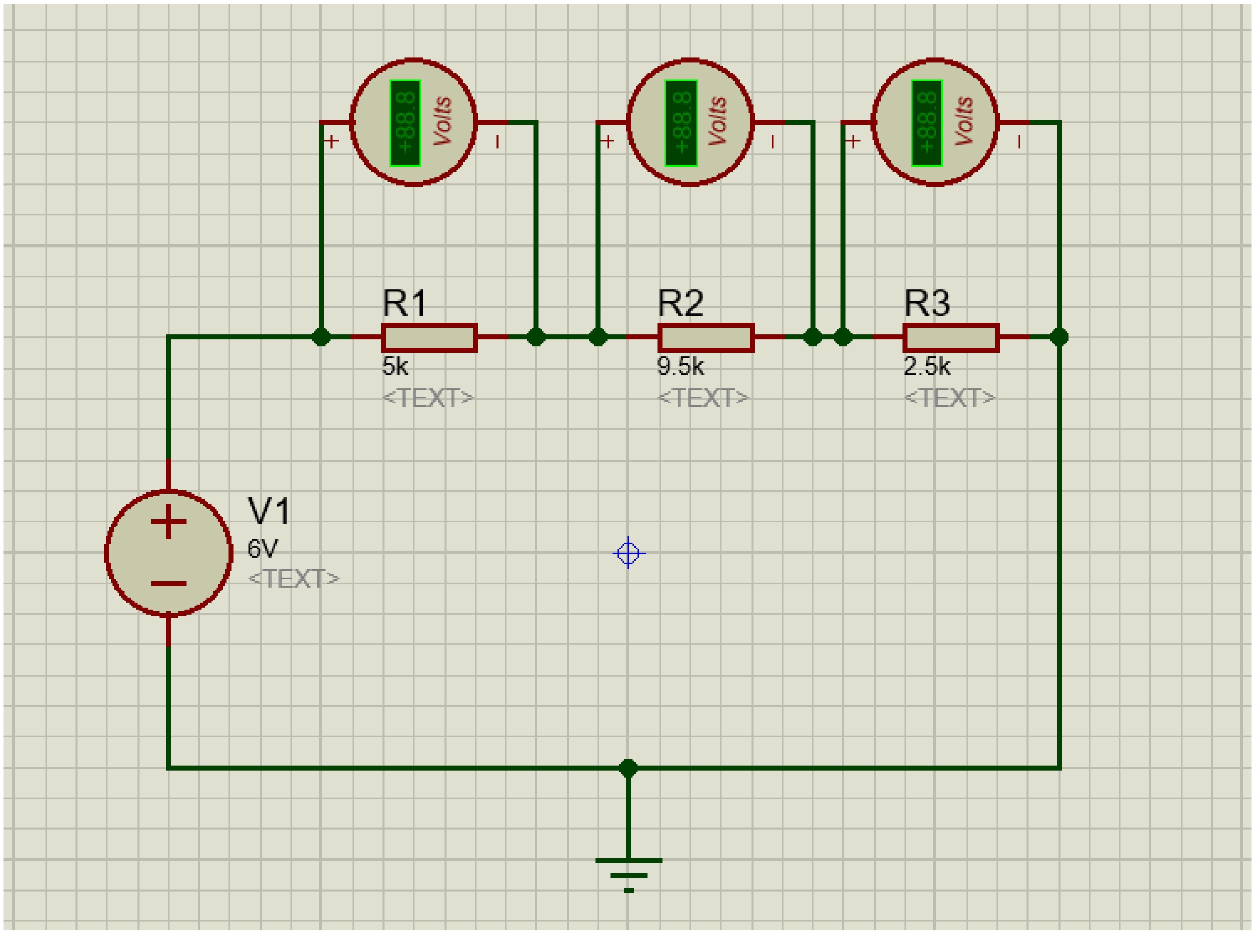
Q. State the rules of connecting voltmeters and ammeters in the circuit.

A. A voltmeter is connected in parallel to the component whereas an ammeter is connected in series to the component.

6) Discussion

In this experiment, we had verified Kirchhoff's voltage law (KVL) with the help of a series circuit and Kirchhoff's current law (KCL) with the help of a simple parallel circuit. Initially, we had to set up the provided circuits on Proteus using various components. After we are done constructing the circuit on Proteus, we run the simulation and obtain the different values to be tabulated in the tables. Then, we calculate the values of the tabulated variables theoretical using KCL and KVL component equations. Consequently, after we have obtained both the values of the simulation and theoretical observations and recorded the values in the respective tables of both the experiments, we can finally compare the results and prove the hypothesis. We can notice that both the tables have the same values in its ~~ox~~ theoretical and simulation observations. There is a slight, negligible discrepancy in Table 1 where $V_A \neq V_1 + V_2 + V_3$ as V_A is 6V whereas $V_1 + V_2 + V_3 = 5.99$ V. This discrepancy occurs due to the rounding off of decimal numbers and hence, it is negligible. In conclusion, as the rest of the results match perfectly, we have successfully proved KCL and KVL.

KVL



KCL