Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

First Year (Semester I) B.Tech.

Basic Electrical and Electronics Engineering

Experiment No. : 03

Superposition Theorem

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Date of performance : 20/3/2021

Signature of teacher-in-charge : _____

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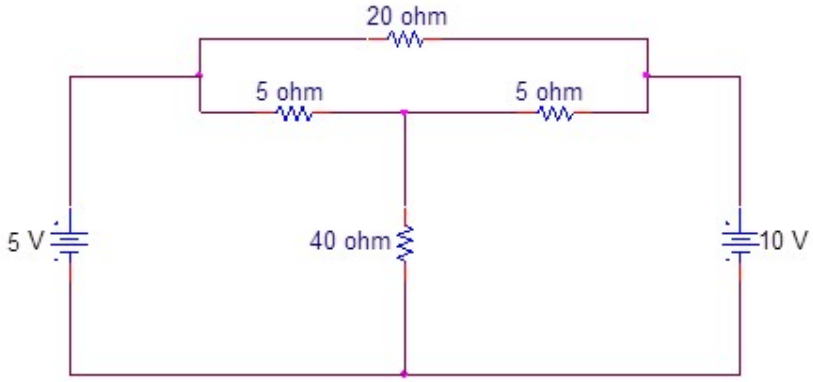
Aim:	To determine current and voltage value in a circuit using superposition theorem.
Apparatus :	Online simulation tools (Suggested Tinker cad)
Theortical Analysis:	 ***Fig. 1(a) Current across 40ohm resistor*** ***<u>Theoretical Calculations:</u>*** ***Current through 40ohm resistor***

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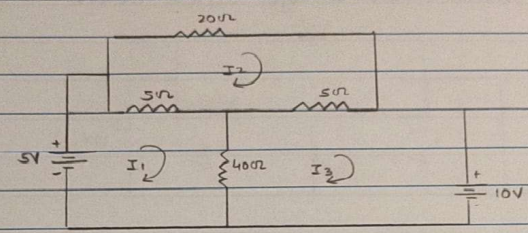
Fig 1(a): Current across 40Ω resistor



KVL in loop 1,

$5 - 45I_1 + 5I_2 + 40I_3 = 0$

$\therefore -9I_1 + I_2 + 8I_3 = -1 \quad -(i)$

KVL in loop 2,

$-30I_2 + 5I_1 + 5I_3 = 0$

$\therefore I_1 - 6I_2 + I_3 = 0 \quad -(2)$

KVL in loop 3,

$-45I_3 + 40I_1 + 5I_2 - 10 = 0$

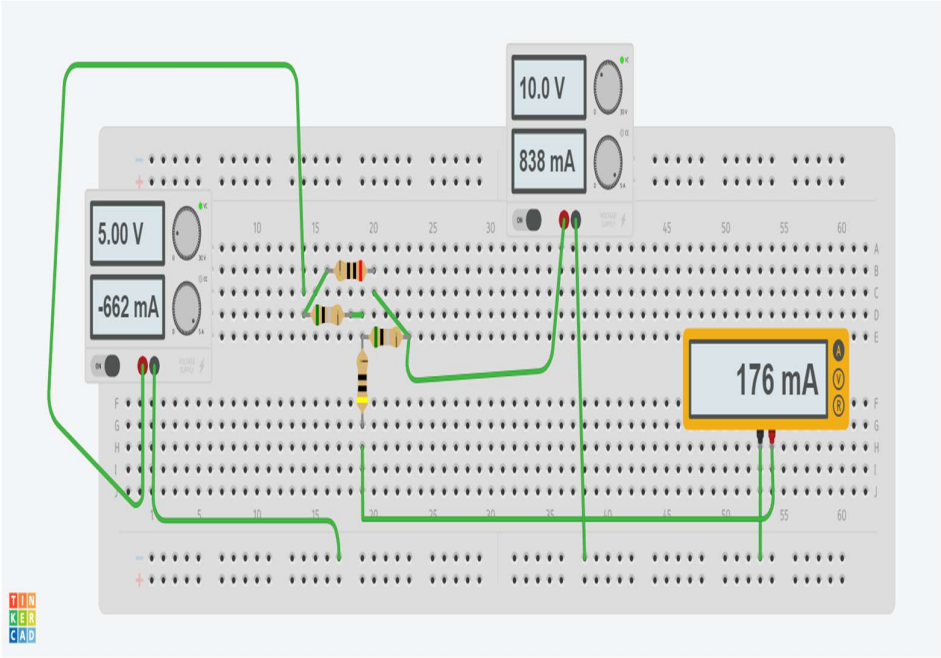
$8I_1 + I_2 - 9I_3 = 2 \quad -(3)$

On solving eq. (1), (ii) and (iii)

$I_1 = -0.662\ A$, $I_2 = -0.25\ A$, $I_3 = -0.838\ A$

$\therefore i_{40\Omega} = I_3 - I_1 = 0.838 - 0.662 = 0.176\ A$

$\therefore \boxed{I_{40\Omega} = 176\ mA}$



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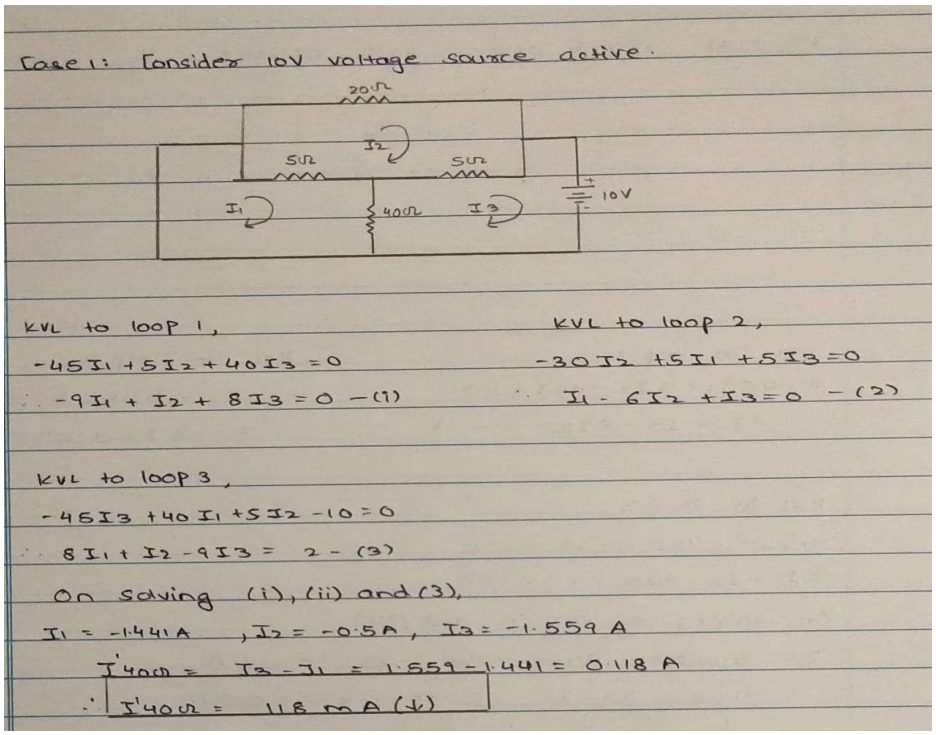
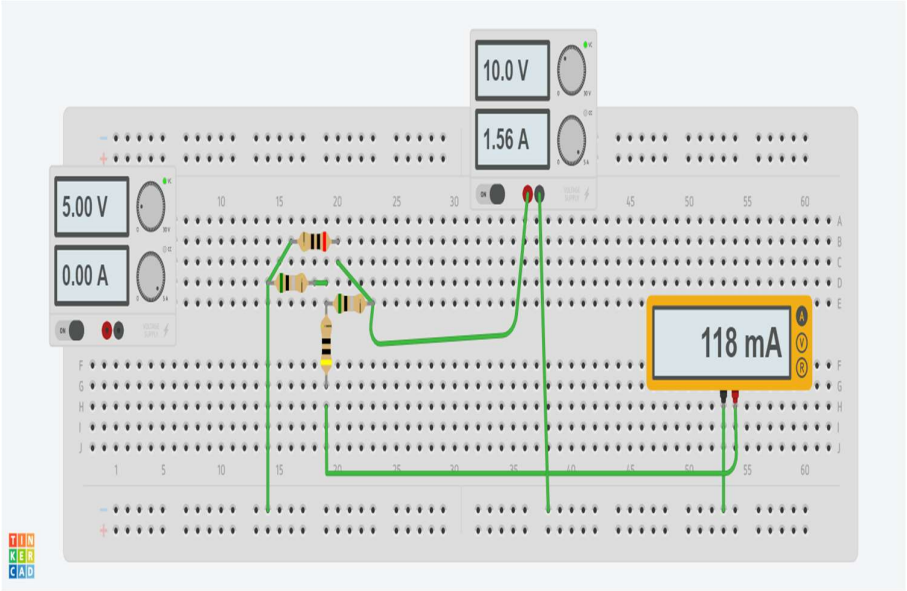
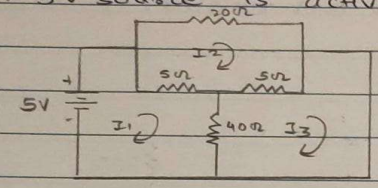




Case 2 : 5V source is active.



KVL in loop 1,

$-45I_1 + 5 + 5I_2 + 40I_3 = 0$

$-9I_1 + I_2 + 8I_3 = -1 \quad -(1)$

KVL in loop 2,

$-30I_2 + 5I_1 + 5I_3 = 0$

$\therefore I_1 - 6I_2 + I_3 = 0 \quad -(2)$

KVL in loop 3,

$-45I_3 + 40I_1 + 5I_2 = 0$

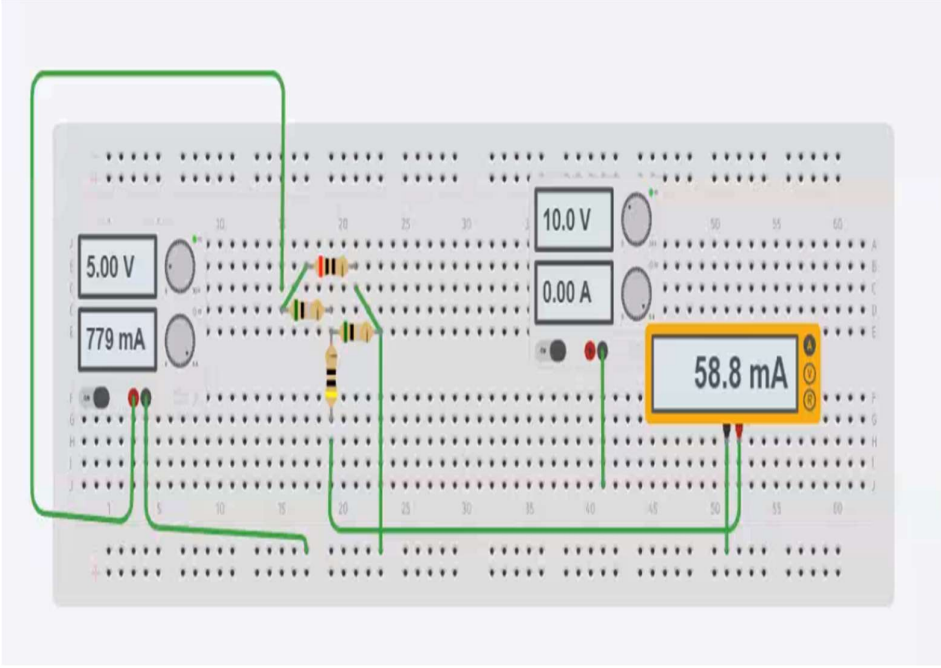
$8I_1 + I_2 - 9I_3 = 0 \quad -(3)$

Solving (1), (2) and (3),

$I_1 = 0.779\,A, \quad I_2 = 0.25\,A, \quad I_3 = 0.720\,A$

$I''_{40\Omega} = i_1 - i_3 = 0.059\,A$

$\therefore \boxed{I''_{40\Omega} = 59\,mA \downarrow}$



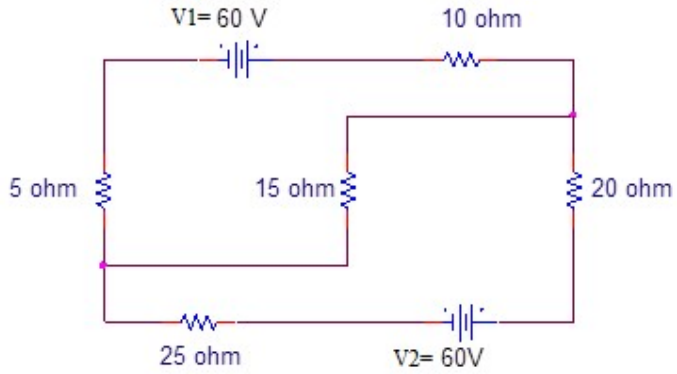
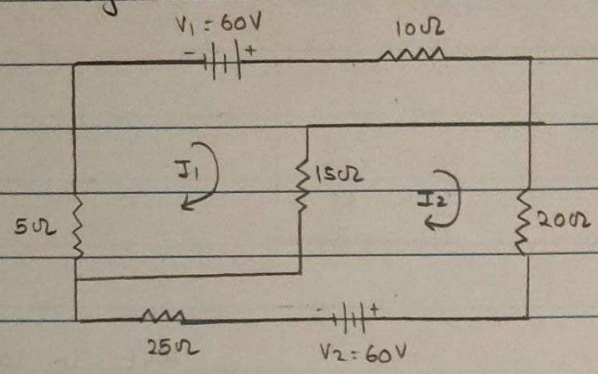


Fig. 1(b) Voltage across 15 ohm resistor

<u>Theoretical Calculations:</u>

Voltage across 15ohm resistor

Frg 1(b) Voltage across 15Ω resistor,



KVL in loop 1,

$-30I_1 + 15I_2 + 60 = 0$

$\therefore -2I_1 + I_2 + 4 = 0$

$\therefore 2I_1 - I_2 = 4 \quad -(i)$

KVL in loop 2,

$\therefore -60I_2 + 15I_1 - 60 = 0$

$\therefore -4I_2 + I_1 - 4 = 0$

$I_1 - 4I_2 = 4 \quad -(2)$

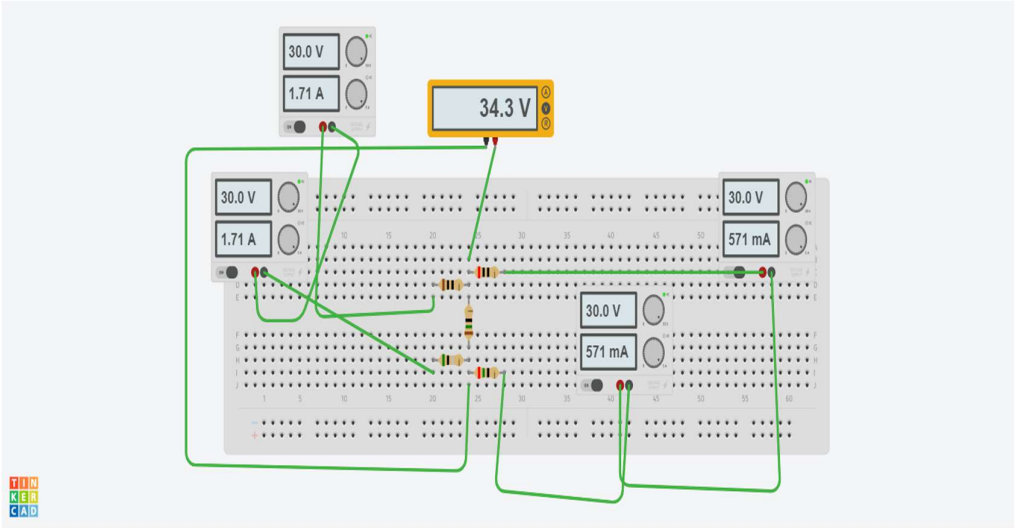
Solving (i) and (ii)

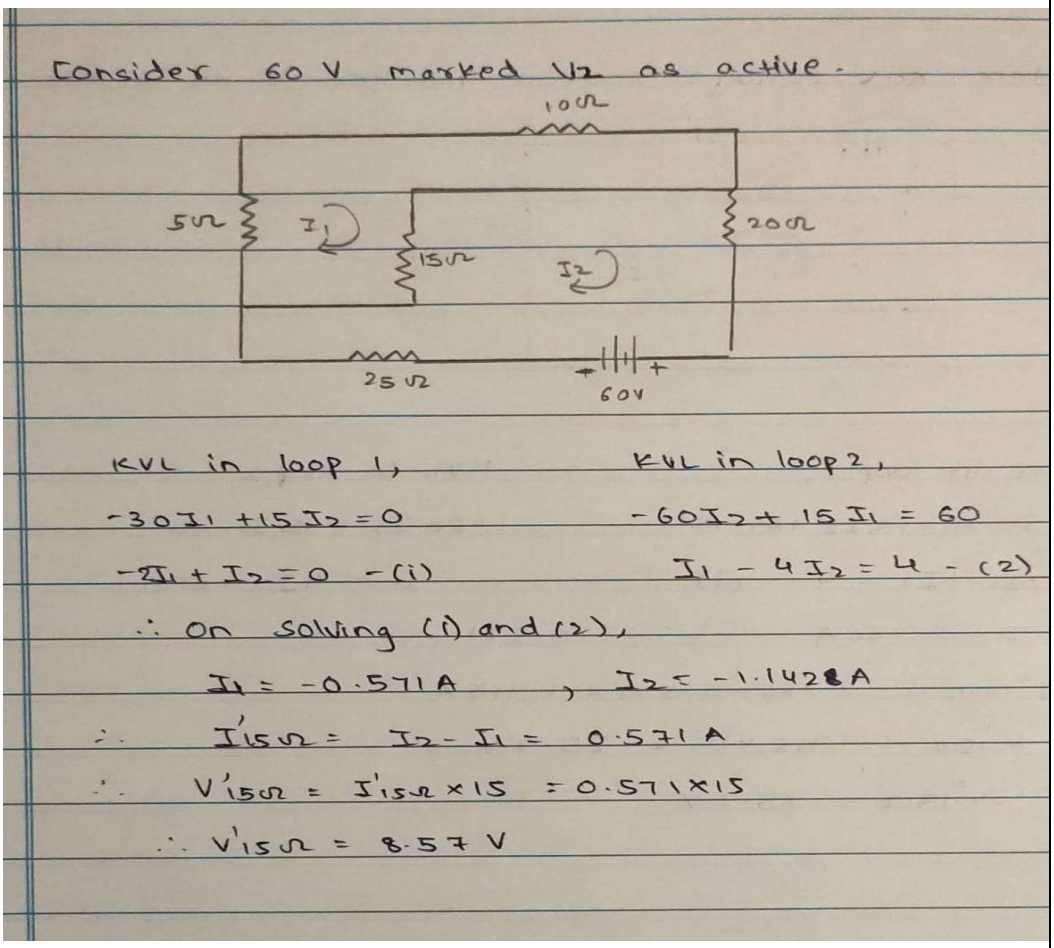
$\therefore I_1 = 1.714A \quad , \quad I_2 = -0.571A$

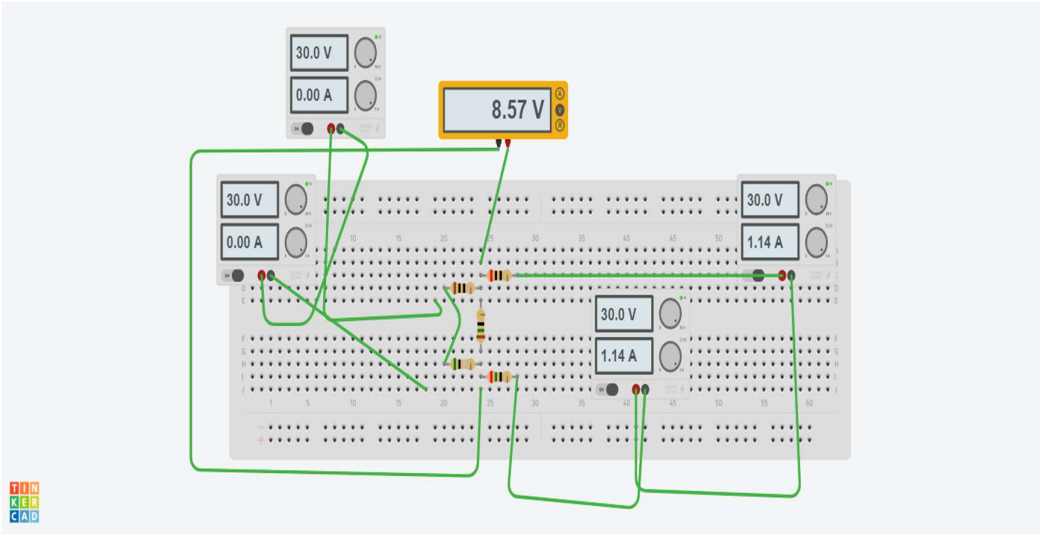
$\therefore I_{15\Omega} = i_1 - i_2 = 2.285A$

$V_{15\Omega} = I_{15\Omega} \cdot 15 = 34.3V$

$\therefore \boxed{V_{15\Omega} = 34.3V}$




Consider 60 V marked V2 as active.
10Ω
5Ω
I1
15Ω
I2
20Ω
25Ω
60V
KVL in loop 1,
-30I1 +15I2 = 0
-2I1 + I2 = 0 -(1)
KVL in loop 2,
-60I2 + 15I1 = 60
I1 - 4I2 = 4 -(2)
∴ on solving (1) and (2),
I1 = -0.571A , I2 = -1.142A
∴ I'15Ω = I2 - I1 = 0.571 A
∴ V'15Ω = I'15Ω × 15 = 0.571×15
∴ V'15Ω = 8.57 V


30.0 V
0.00 A
8.57 V
30.0 V
0.00 A
30.0 V
1.14 A
30.0 V
1.14 A
TIN KER CAD

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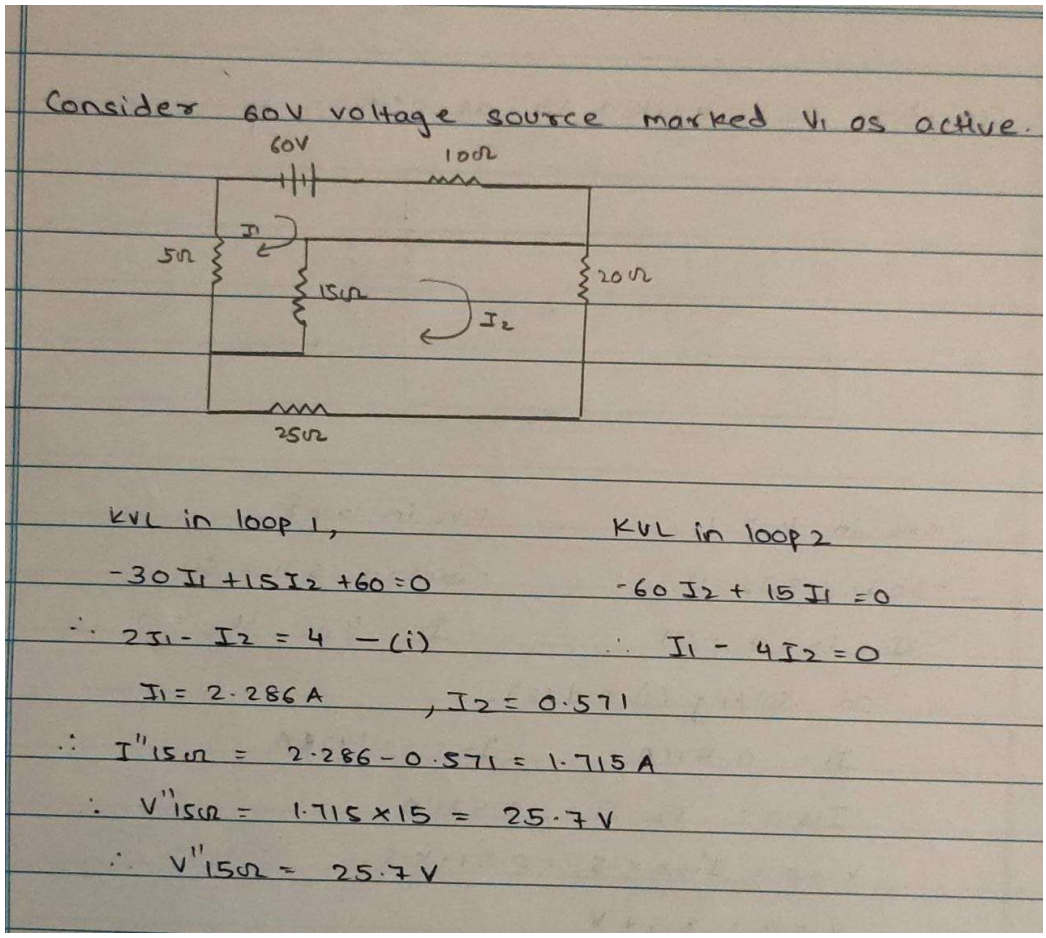

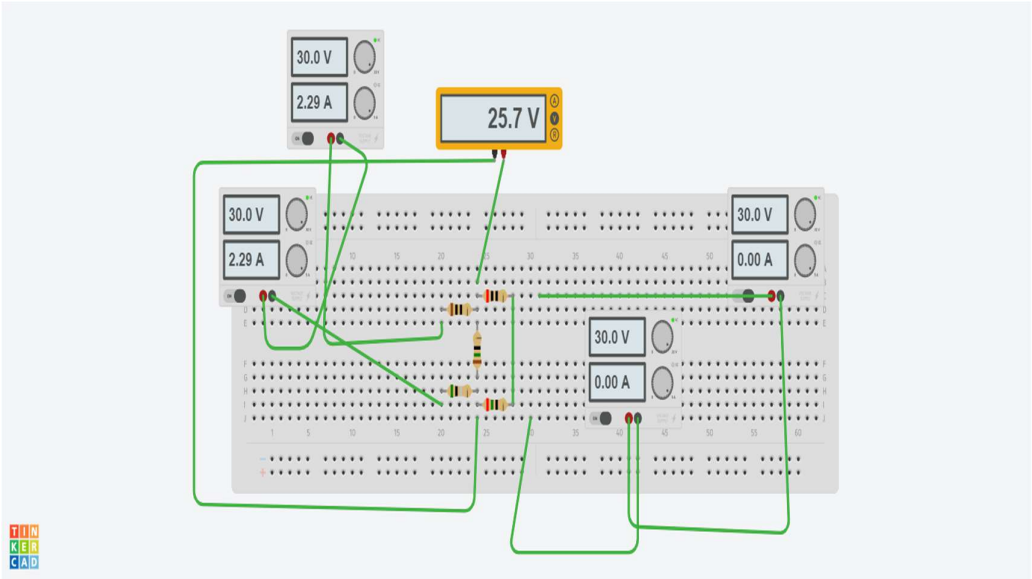

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	Active Voltage source	**Theoretical values, $I_{40\Omega}$**	**Practical values, $I_{40\Omega}$**
Observation Table	**When 5V active**	**59 mA**	**58.8mA =59mA**
	When 10V active	**118mA**	**118mA**

	Active Voltage source	**Theoretical values, $V_{15\Omega}$**	**Practical values, $V_{15\Omega}$**
Observation Table	**When V1 active**	**25.7 V**	**25.7 V**
	When V2 active	**8.57 V**	**8.57 V**

Conclusion:

- The Practical values have been attained by using online simulation tool Tinkercad.
- We used Superposition theorem to find the theoretical value of voltage and current.
- The theoretical and practical values are equal to each other.