Experiment name:

Verification of superposition principle.

Objective:

To verify experimentally the superposition theorem which is an analytical technique of determining currents in a circuit with more than one emf source.

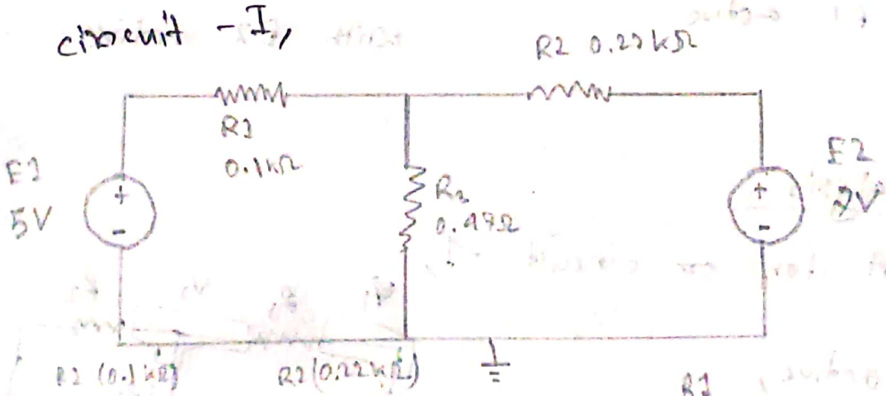
Apparatus:

i) Two DC power supplies.

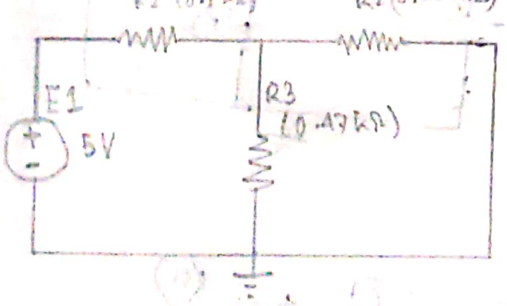
ii) One multimeter etc.

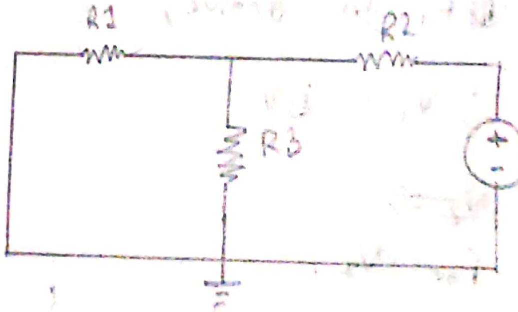
Circuit Diagram:

for circuit - I,



With both E1 and E2 active.

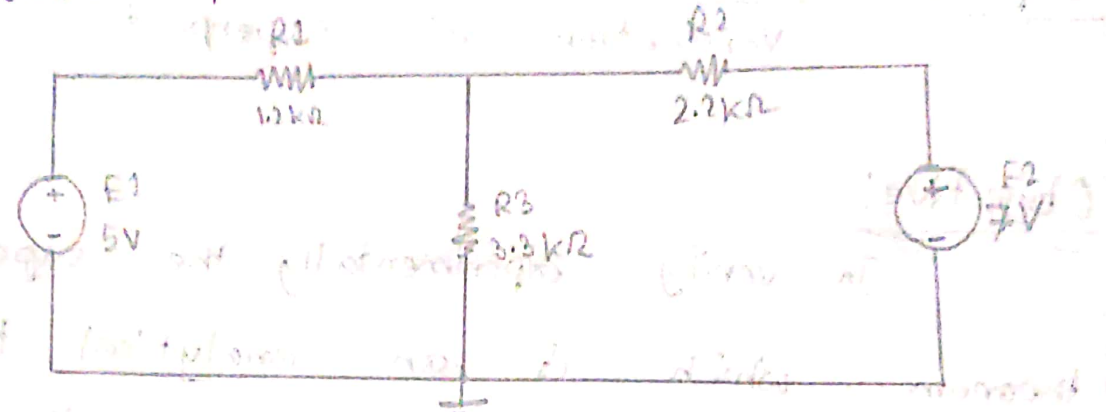




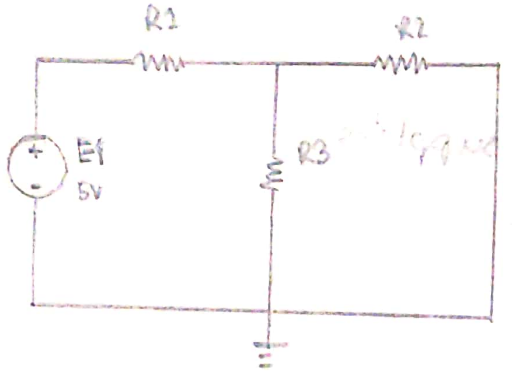
With E1 active,

With E2 active.

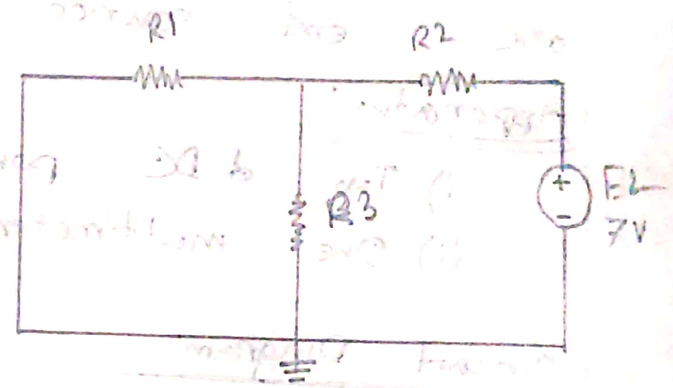
For circuit -2,



With both E1 and E2 active,



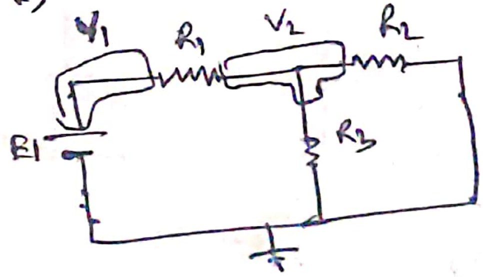
With E1 active



With E2 active.

Results/Analysis:

~~E1 is A~~ For circuit -1,



E1 is active,

$\therefore V_1 = 5V$

~~$V_2 \Rightarrow$~~

For V_2,

$$V_2\left(\frac{1}{0.1} + \frac{1}{0.22} + \frac{1}{0.47}\right) - \frac{V_1}{0.1} = 0 \quad \text{— (ii)}$$

Putting V_1 in ~~the~~ eq^n (ii),

$$V_2 \left(\frac{8620}{517} \right) = 50$$

or, $V_2 = \cancel{2.998}\ 2.999$

~~$I_3' =$~~

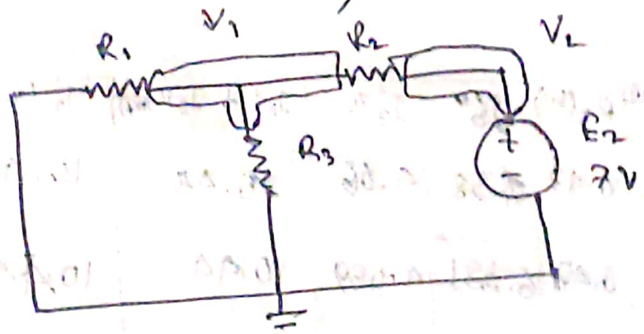
Here,

$$I_3' = \frac{V_2 - V_3}{R_3}$$

$$= \frac{V_2 - 0}{0.47}$$

$$= \frac{2.999}{0.47} = 6.38051 A$$

Again, E2 is active,



Here,

$V_2 = 7V$

For V_1,

$$V_1 \left(\frac{1}{0.1} + \frac{1}{0.22} + \frac{1}{0.47} \right) - \frac{V_2}{0.22} = 0$$

$$\text{or, } V_1 = \frac{517}{8620} \times \frac{7}{0.22} = 1.908 V$$

Now,

$$I_3'' = \frac{V_1 - V_3}{R_3}$$

$$= \frac{V_1 - 0}{0.47}$$

$$= 4.0596 \text{ A.}$$

According to superposition theorem,

$$\therefore I_3 = I_3' + I_3''$$

$$= 6.381 + 4.059$$

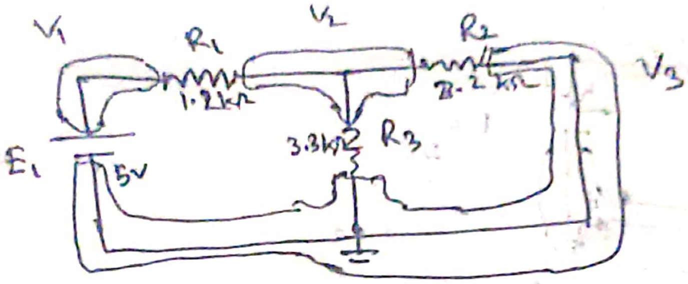
$$= 10.44 \text{ A}$$

Table !

Observation	R_1 (kΩ)	R_2 (kΩ)	R_3 (kΩ)	I_3'	I_3''	$I_3' + I_3''$ (mA)	I_3 (mA)
Simulation	0.1	0.22	0.47	6.38	4.06	10.44	10.44
Theoretical	0.1	0.22	0.47	6.381	4.059	10.44	10.44

For circuit-2,

①. Here, E_1 is active,



$V_1 = 5V$, $V_3 = 0$

For, V_2,

$$V_2\left(\frac{1}{1.2}+\frac{1}{2.2}+\frac{1}{3.3}\right)-\frac{V_1}{1.2}=0$$

$$V_2 = \frac{V_1}{1.2} \div \left(\frac{1}{1.2}+\frac{1}{2.2}+\frac{1}{3.3}\right)$$

$= \cancel{2.5757} \; \cancel{2.6}2.$

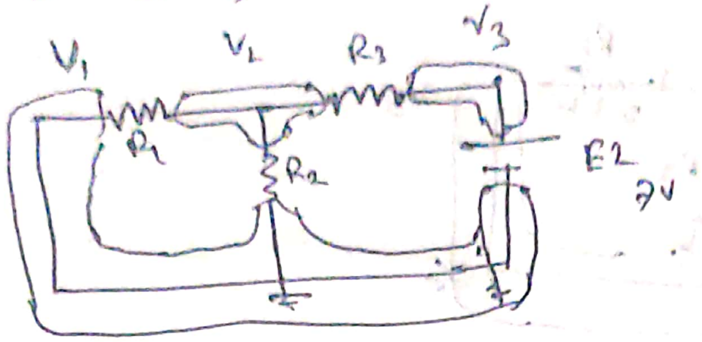
$= 2.61904$

Now,

$$I_3' = \frac{V_2 - V_3}{R_3} = \frac{2.619}{3.3} = 0.7936A.$$

Again,

E_2 is active,



Now,

$V_3 = 2V$, $V_1 = 0$

For. V_2,

$$V_2 \left(\frac{1}{1.2} + \frac{1}{2.2} + \frac{1}{3.3}\right) - \frac{V_3}{1.2} = 0$$

or, $$V_2 = \frac{V_3}{2.2} \div \left(\frac{1}{1.2} + \frac{1}{1.2} + \frac{1}{3.3}\right)$$

$= \cancel{3.6667V}\ 2$

Now,

$$I_3'' = \frac{V_2 - V_1}{R_3} = 0.606A$$

A/C superposition principle,

$I_3 = I_3' + I_3''$

$= 0.793 + 0.606$

$= \cancel{1.4A}\ 1.4A$

Observation	R_1 (kΩ)	R_2 (kΩ)	R_3 (kΩ)	I_3' (mA)	I_3'' (mA)	$I_3 = I_3' + I_3''$ (mA)	I_3 (mA)
Simulation	1.2	2.2	3.3	0.79	0.61	1.4	1.4
Theoretical	1.2	2.2	3.3	0.794	0.606	1.4	1.4

Discussion:

Here, we analyzed the ~~[illegible]~~ superoposition principle ~~by~~ by both theoretical and simulated calculation and found that both are equal. So, it can be called as the superposition theorem and it is a succesful experiment.