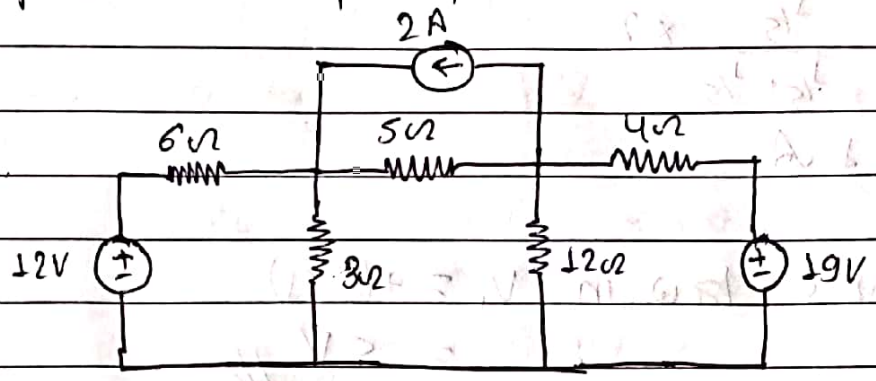
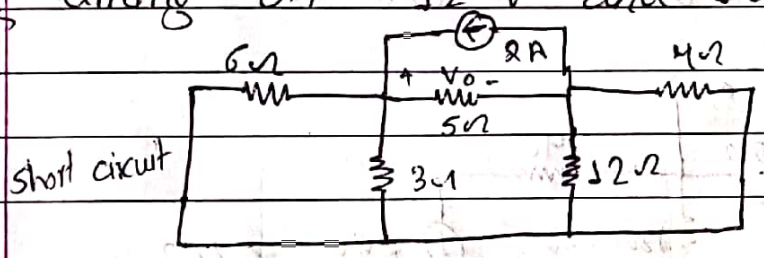
Date: .....

Page: 1

6) Determine V_o in the circuit below using the superposition principle



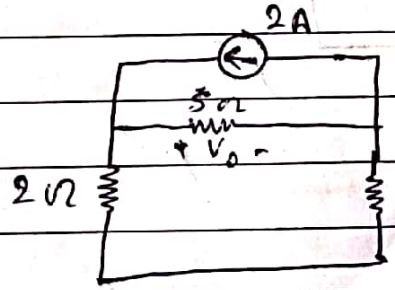
Case1 Turning off 12 V and 10 V



Now, $6\Omega // 3\Omega$ and $12\Omega // 4\Omega$

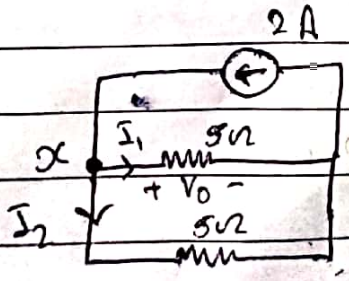
$R_{eq} = \frac{6 \times 3}{6+3}$ $\quad R_{eq} = \frac{12 \times 4}{12+4}$

$= 2\Omega$ $\quad = 3\Omega$



2Ω and 3Ω are in series,

$R_{eq} = 2 + 3 = 5\Omega$ #



At point x using current divider rule,

$$I_1 = \frac{1/5}{1/5 + 1/5} \times 2$$

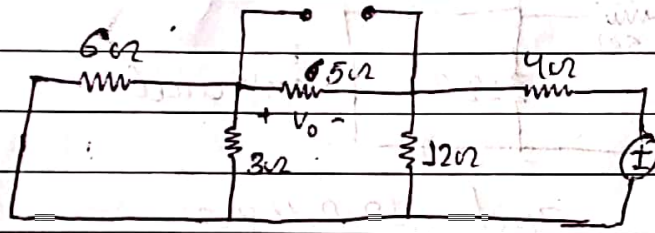
$$= 1\ A$$

Now,

Using ohm's law in $V_1 = +(5 \times 1)$

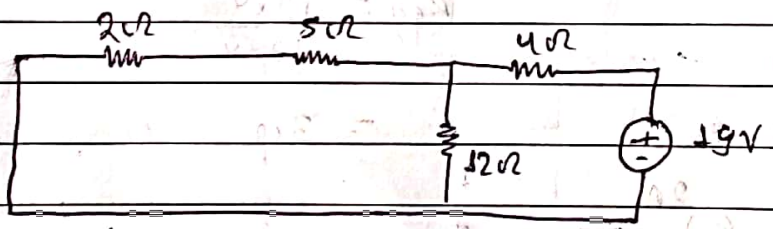
$$= 5\ V$$ //

Case 2) Consider 19 V, turn off 2A and 12 V



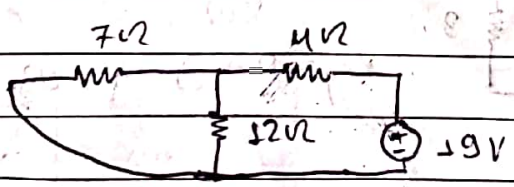
S.C

$6 \parallel 3 = \frac{6 \times 3}{6+3} = 2\Omega$



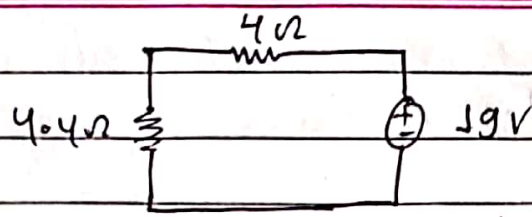
2Ω and 5Ω are in series,

$2 + 5 = 7\ \Omega$



7Ω and 12Ω are parallel,

$$R_{eq} = \frac{7 \times 12}{7 + 12} = 4.42\ \Omega$$

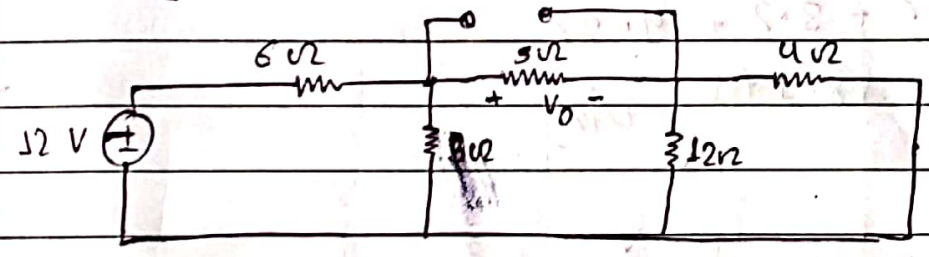


Using voltage divider rule,

$$V_{4.42} = \frac{4.42}{4 + 4.42} \times 19$$

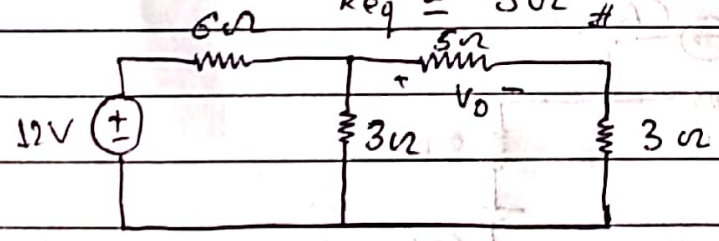
$$= 9.97\ V$$

Turning off 2A and 19 V



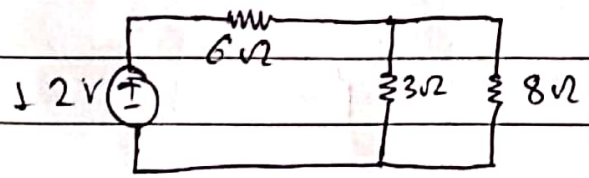
4Ω and 12Ω are in parallel so,

$R_{eq} = 3\Omega$ #

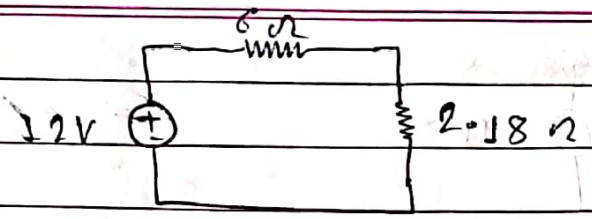


5Ω and 3Ω are in series so,

$R_{eq} = 5 + 3 = 8\Omega$



3Ω and 8Ω are in parallel



Using ~~Vol~~ V.D.R at,

$$V_{2.18} = \frac{2.18}{6 + 2.18} \times 12$$

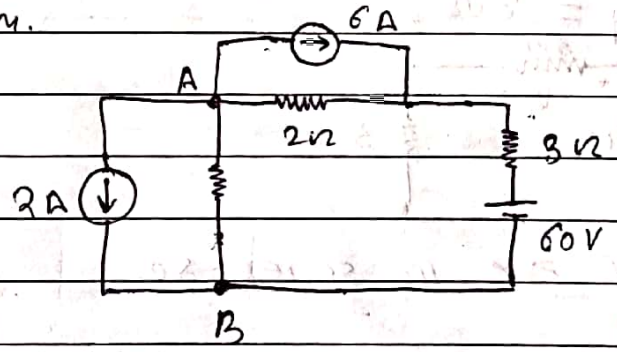
$$= 3.2\ V$$

Using S.T

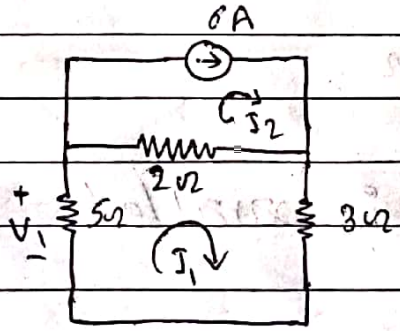
$$V_0 = 5 + 3.2 + 9.97$$

$$= 18.17\ V \quad \text{Ans.}$$

2) Find the voltage across 5 ohm using superposition Theorem.



Turn off 2A and 60V



$I_2 = 6A$

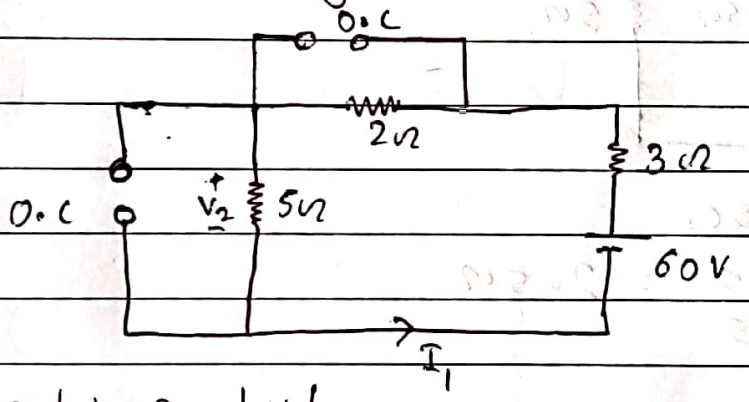
using KVL in mesh ①

$$-3I_1 - 2(I_1 - I_2) - V_1 = 0$$
$$V_1 + 2(I_1 + 6) + 3I_1 = 0$$
$$I_1 = -1.2\ A$$

Using ohms law,

$$V_1 = +I_1 \times 5$$
$$= -1.2 \times 5$$
$$= -6\ V$$

considering only 60 V and turn off 6A and 2A



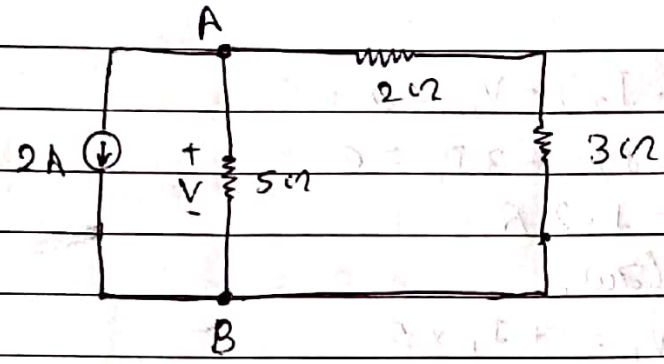
Applying KVL,

$$-5I + 60 - 3I - 2I = 0$$
$$-10I = -60$$
$$I = 6\ A$$

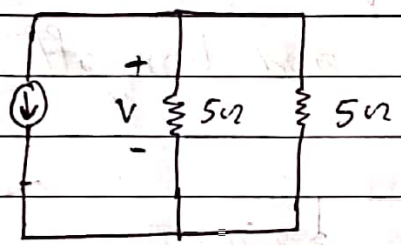
Using ohm's law,

$$V_1 = I \times 5\Omega$$
$$= 6 \times 5$$
$$= 30\ V$$

considering only 2A and turning off 6A and 60 V

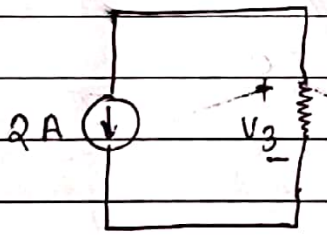


2Ω and 3Ω are in series, so,
$R_{eq} = 2+3 = 5\Omega$



$5\Omega \,//\, 5\Omega$ so,

$$R_{eq} = \frac{5 \times 5}{5+5} = 2.5\Omega$$



Now, $V_3 = -2.5 \times 2$
$= -5\ V$

Now, using superposition Theorem
$V = V_1 + V_2 + V_3$
$= -5 + 30 + -6$
$= 19\ V$ #