1.) If 70J of energy is available for every 30C of charge. What is the voltage?

Sol:-

$$V = \frac{W}{Q}$$

$$V = \frac{70}{30} = 2.33 \text{ volts}$$

2.) 5C of charge flow passed through a given point in a wire in 2sec. How many Amperes of current is flowing?

Sol:-

$$I = \frac{Q}{T} = \frac{5C}{2sec} = 2.5A$$

3.) What is the power in watts, if energy is 50J, used in 2.5sec.

Sol:-

$$P = \frac{W}{T}$$

$$P = \frac{50J}{2.5sec}$$

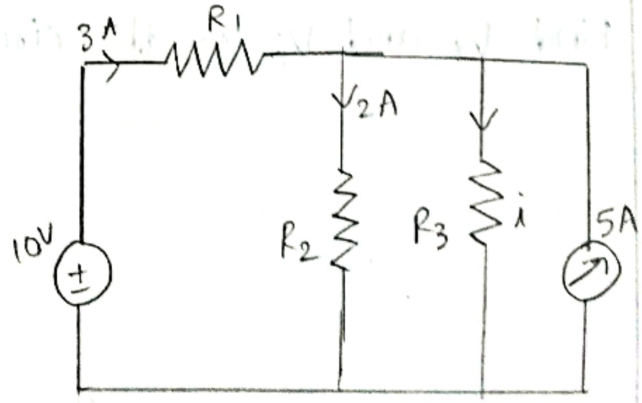
$$P = 20 \text{ watts.}$$

4.) Compute the current through resistor R_3. If it is known that voltage source supplies the current of 3A.

Sol:- Apply KCL at Node A

$$3 + 5 + 2 + i$$

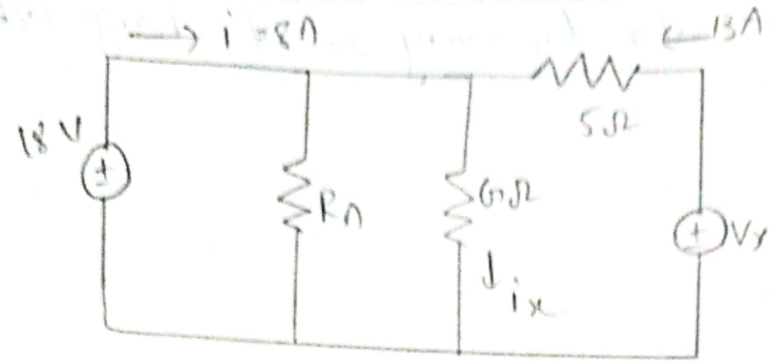
$$\boxed{i = 6A}$$



5.) Count the number of branches and notes in the given circuit, if $i_x = 3A$ & 18V source delivers 8A. what is the value of R_A.

Sol:- Number of branches = 5

Number of nodes = 3



Given; $i_x = 3A$

$V = 18V$

let 'i' be the current flowing through R_A.

(Assume to be leaving from the node).

By KCL;

At node 1

$$8A + 13 = i + i_x$$

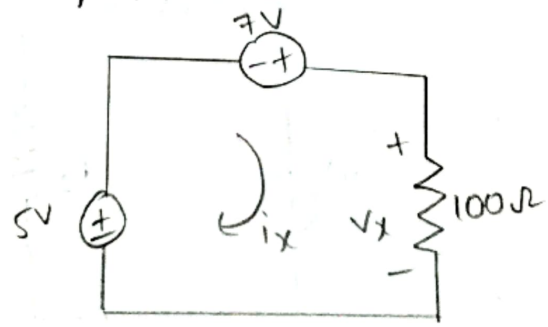
$$21 = i + i_x$$

$$i = 21 - 3$$

$$i = 18A$$

$$R_A = \frac{18}{i} = \frac{18}{18} = 1\Omega$$

6) Find V_x and V_i in the circuit.



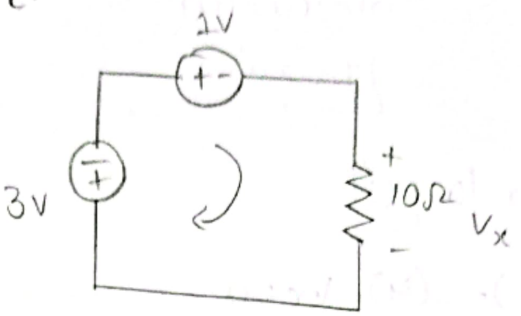
Sol:- $5V + 7V - V_x = 0$

$$\boxed{V_x = 12V}$$

$V = IR$

$$I = \frac{V}{R} \Rightarrow I = \frac{12}{100} \Rightarrow I = 0.12A$$

7) Find V_x and i_x in the circuit.



Sol:- $3+1 = V_x$

$V_x = -4V$

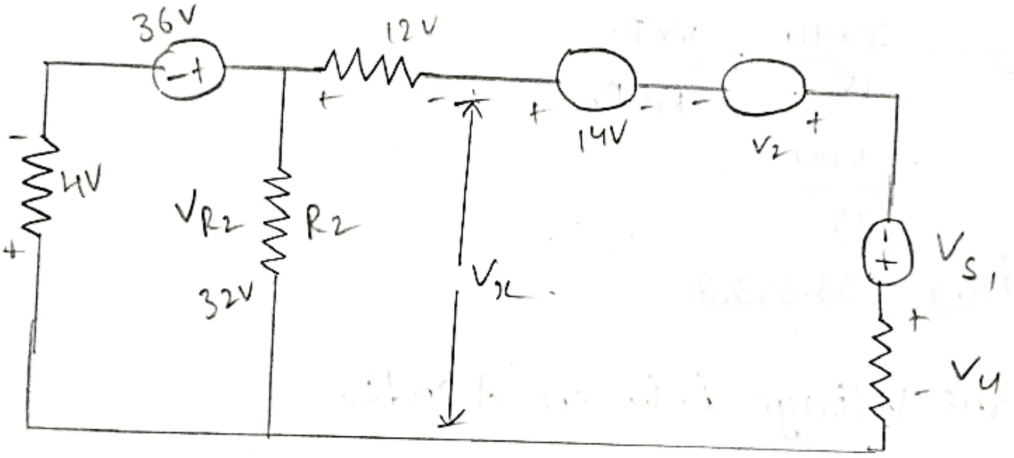
$V = IR$

$I = \frac{V}{R}$

$= \frac{-4}{10}$

$I = -0.4A$

8.) Find V_{R_2}, V_x in the circuit.



Sol:- Apply KVL in loop (1)

$-4+36-V_{R_2} = 0$

$32 = V_{R_2}$

$V = IR$

$V_{R_2} - 12V - 14V - V_x = 0$

$32 - 12 - 14 = V_x$

$V_x = 6V$

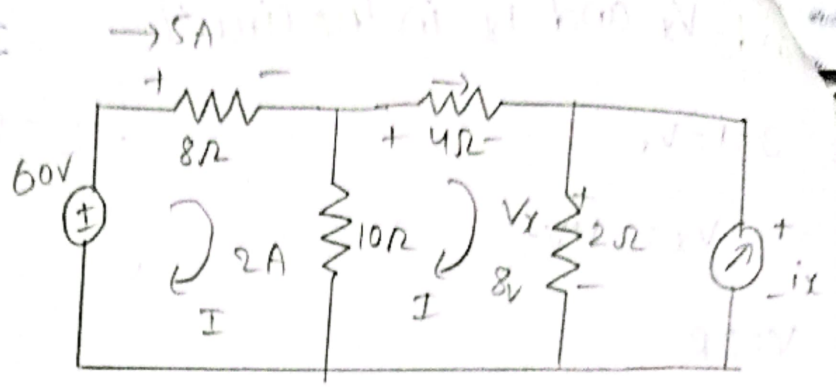
9.) Find V_x in the circuit.

Sol:- KVL for loop 1

$60V - 5(8) - 10I = 0$

$60 - 40 = 10I$

$\boxed{I = 2A}$



KVL for loop (2)

$10(2) - 3(4) - V_x = 0$

$20 - 12 = V_x$

$\boxed{V_x = 8V}$

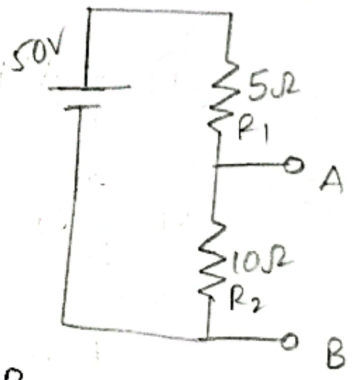
10.) Find the voltage across 10Ω Resistor.

Sol:-

$$R_{10\Omega} = \frac{50 \times 10}{15} = \frac{V_x R_2}{R_1 + R_2}$$

$$= \frac{500}{15}$$

$$R_{10\Omega} = 33.333\Omega$$



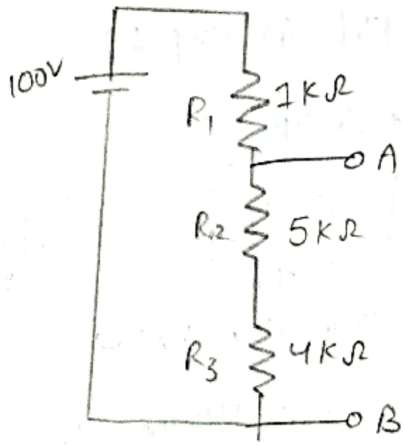
11.) Find the voltage between A and B.

Sol:-

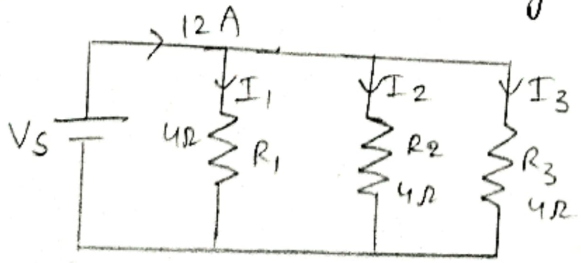
$$V_{AB} = \frac{V_x (R_2 + R_3)}{R_1 + R_2 + R_3}$$

$$= \frac{100 \times 9}{10}$$

$\boxed{V_{AB} = 90V}$



12.) Determine the current through each resistor in the circuit.



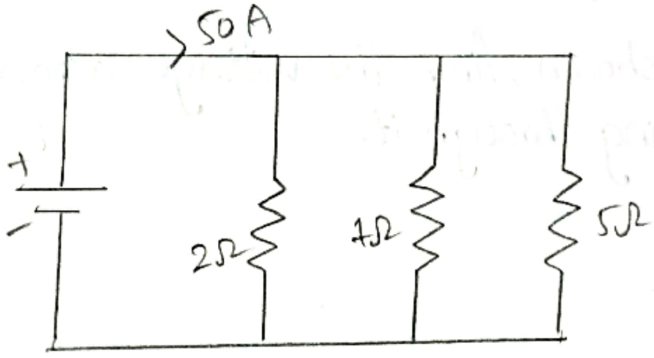
Sol:-

$$I_1 = \frac{I \cdot \frac{R_1 R_2}{R_2 + R_1}}{R_1 + R_T} = \frac{12 \times \frac{4 \times 4}{4+4}}{4+2} = \frac{24}{6} = 4A$$

$$I_2 = \frac{I \cdot \frac{R_2 R_3}{R_2 + R_3}}{R_2 + R_T} = 4A$$

$$I_3 = 4A$$

13.) Determine the currents in all the resistors in the given circuit.



Sol:-

$$R_{T_1} = \frac{R_2 \times R_3}{R_2 + R_3} = \frac{5}{6} = 0.833$$

$$R_{T_2} = \frac{R_1 \times R_3}{R_1 + R_3} = \frac{10}{7} = 1.429$$

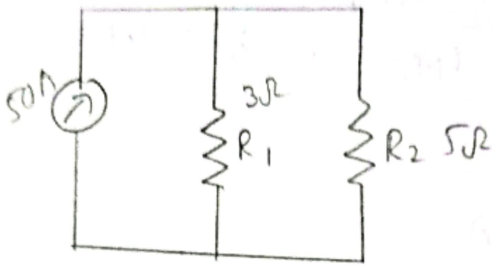
$$I_1 = \frac{50 \times 0.833}{2.833} = 14.702A$$

$$I_2 = \frac{50 \times 1.429}{1.1.429} = 29.42A$$

$$R_{T_3} = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{2}{3} = 0.67$$

$$I_3 = \frac{50 \times 0.67}{5.67} = \frac{335}{5.67} = 5.91A$$

14.) Determine the current in each Resistor in the given circuit.

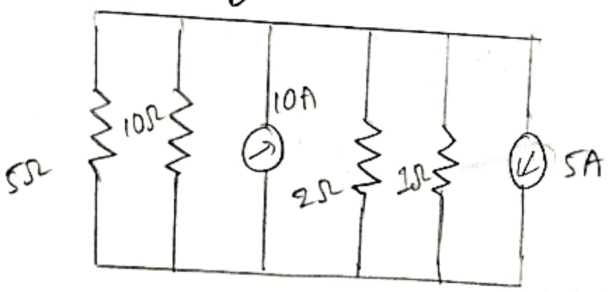


Sol:-

$$I_1 = \frac{I \times R_2}{R_1 + R_2} = \frac{50 \times 5}{8} = \frac{250}{8} = 31.25A$$

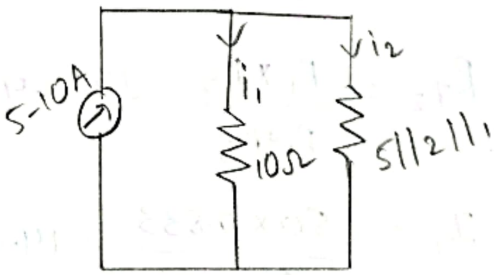
$$I_2 = \frac{50 \times 3}{8} = \frac{150}{8} = 18.75A$$

15.) For the circuit shown, find the voltage across 10Ω resistor & the current passing through it.



Sol:-

$$I_{10\Omega} = \frac{0.588 \times 5}{10.588}$$

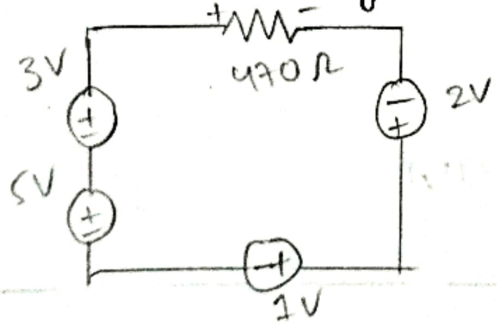


$$I_{10\Omega} = 0.278\,A$$

$$V_{10\Omega} = I_{10\Omega}(10\Omega)$$

$$V_{10\Omega} = 2.78V$$

16.) Find the current through 470Ω Resistor.



Let I be the current flowing in 470Ω Resistor.

$V = 5+3-470I+2-1$

$= 9-470I$

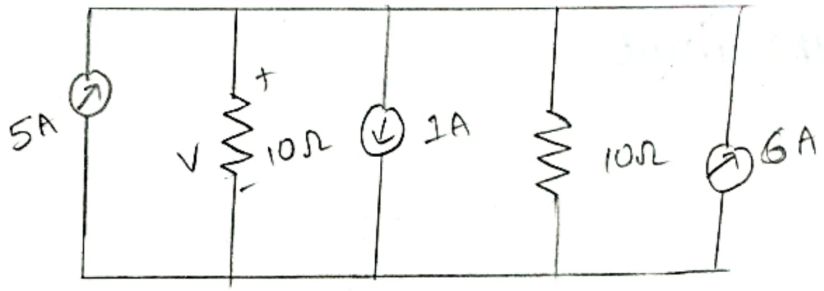
$9-470I=0$

$9=470I$

$I = 0.01915$

$I = 19.15mA$

17.) Determine 'V' in the circuit.

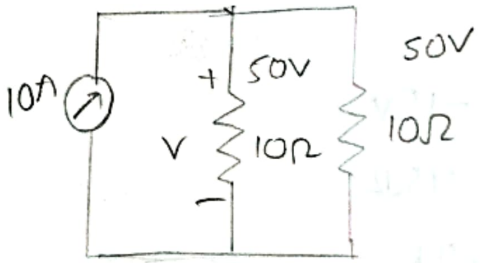


Sol:-

$I = 10\ A$

$I_{10\Omega} = \frac{10^5 \times 10}{20}$

$= 5A$

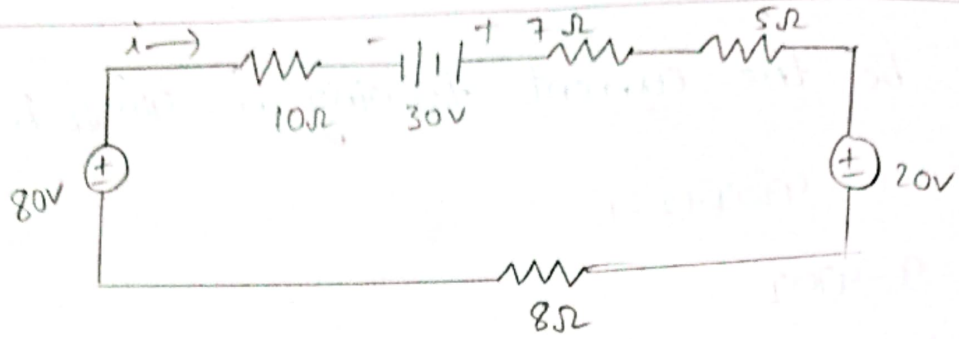


$V = IR$

$V = 5 \times 10$

$\boxed{V = 50V}$

18.) Find the current 'I' in the circuit & the power delivered by 80V source, use Resistance & source combinations.



V=90V

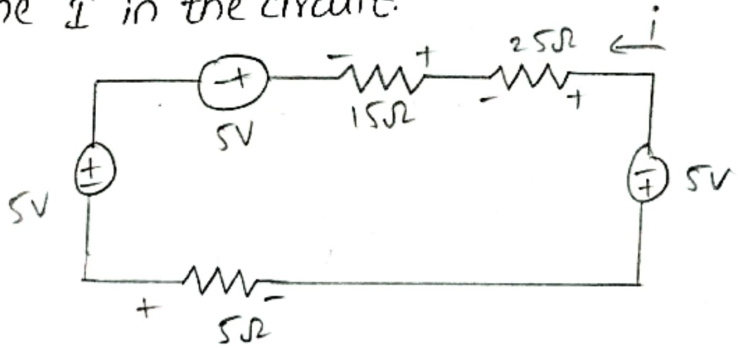
I=?

R=30Ω

$i = \frac{90}{30} = 3A$

$P_{(80V)} = Vi = 80(3) = 240$ watts.

19.) Determine 'I' in the circuit.



Sol:-

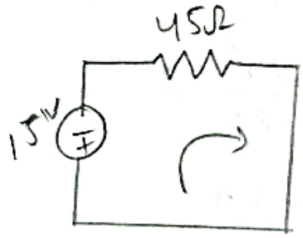
V=-15V

R=45Ω

V=IR

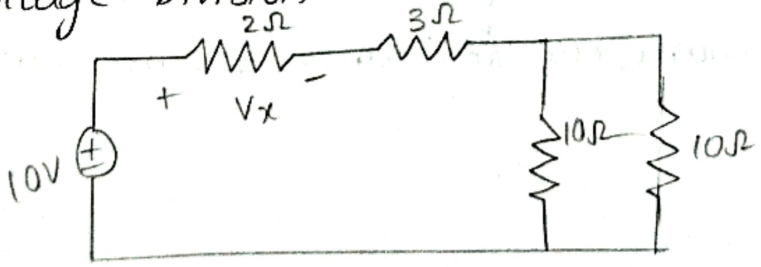
$I = \frac{-15}{45} = -0.3333$

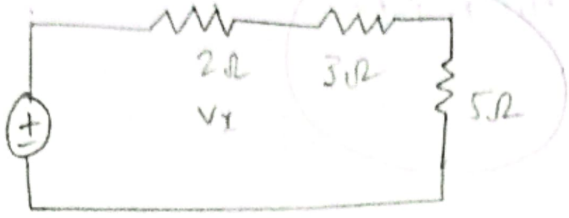
$\boxed{I = 0.3333}$



V=-15V

20.) Use voltage Division to determine V_x in the circuit.

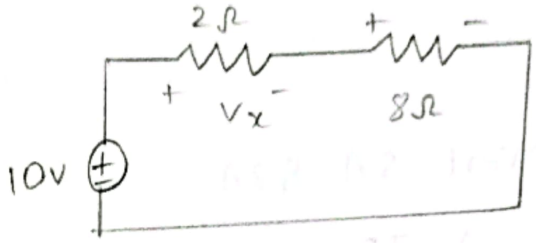




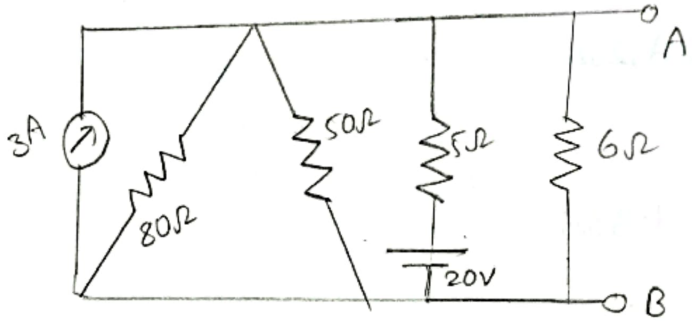
series

$$V_x = V_{2\Omega} = 10 \times \frac{2}{10}$$

$$\boxed{V_x = 2V}$$



21.) Replace the circuit with A & B with voltage source in series with a single resistor.



Sol:- Convert a series combination of 20V, 5V into an equalent circuit.

$$I = \frac{V}{R} = \frac{20}{5} = 4A$$

in parallel with 5Ω.

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

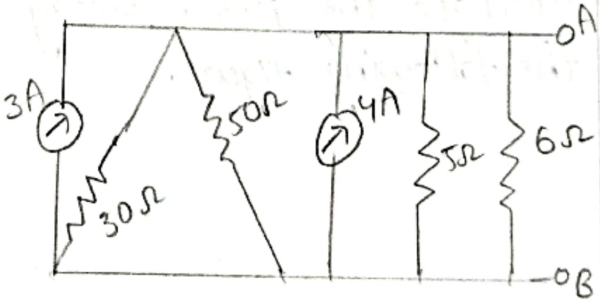
$$= \frac{1}{30} + \frac{1}{50} + \frac{1}{5} + \frac{1}{6}$$

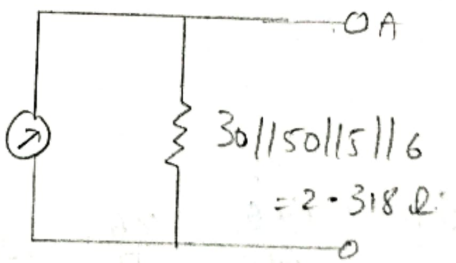
$$R_T = 2.380\Omega$$

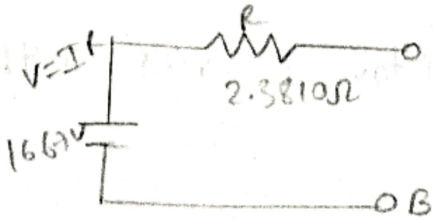
$$V = IR$$

$$= 7 \times 2.3810$$

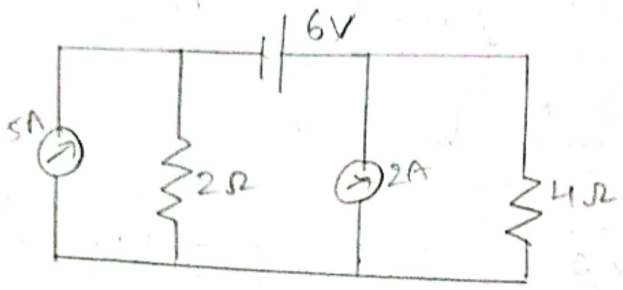
$$= 16.67V$$







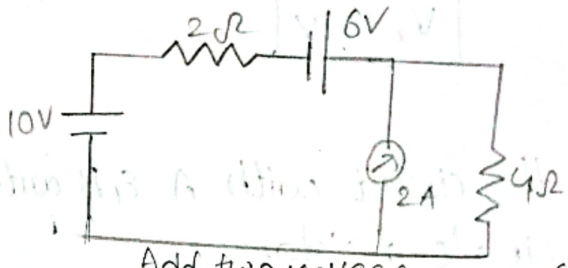
22) Find the current in 4Ω resistor.



Sol:- Convert 5A & 2A

$V = IR$

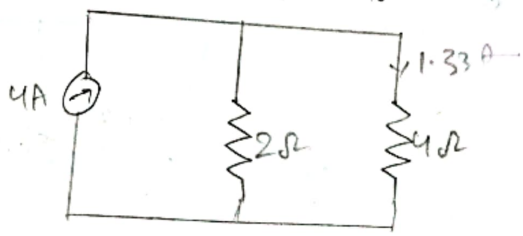
$= 5 \times 2 = 10V$



Add two voltage $= 4V$ & then convert.

Combine 4V & 2Ω

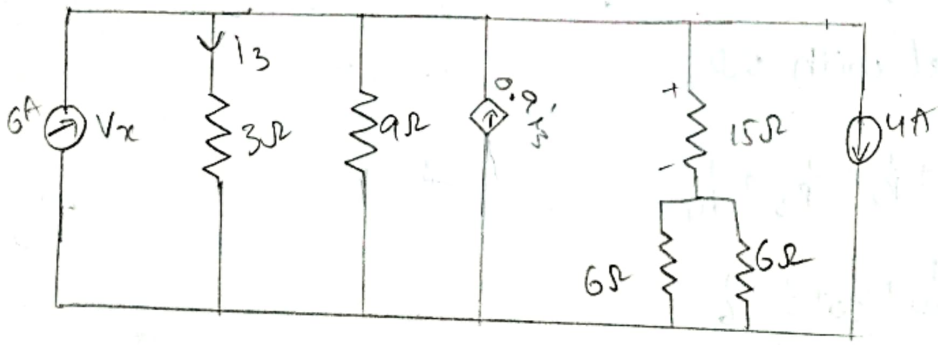
$I = \frac{V}{R} = 2A, 2\Omega$



$I_{R4\Omega} = 4 \times \frac{2}{6} = 1.33A$

$\boxed{I_{R4\Omega} = 1.33A}$

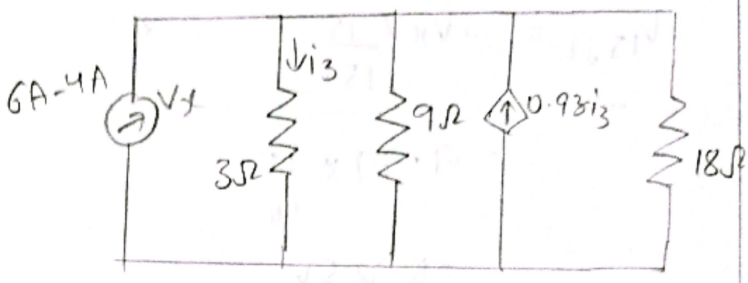
23) Calculate the power voltage source of the dependent source in the following figure.



Sol:- $6\Omega \| 6\Omega = \frac{6 \times 6}{6+6} = \frac{36}{12} = 3\Omega$

3Ω resistor is series with 15Ω. $\Rightarrow 3+15 = 18\Omega$.

$9 // 18 \Rightarrow \frac{9 \times 18}{9+18} = 6\Omega$



Apply KCL at node A

$$2 + 0.9i_3 = i_3 + \frac{V_x}{6}$$

From the circuit $V_x = IR$

$$= i_3 \times 3$$

$$= 3i_3$$

$$\Rightarrow 2 + 0.9i_3 = i_3 + \frac{3i_3}{6}$$

$$2 = i_3 + \frac{3i_3}{6} - 0.9i_3$$

$$i_3 = \frac{2}{6}$$

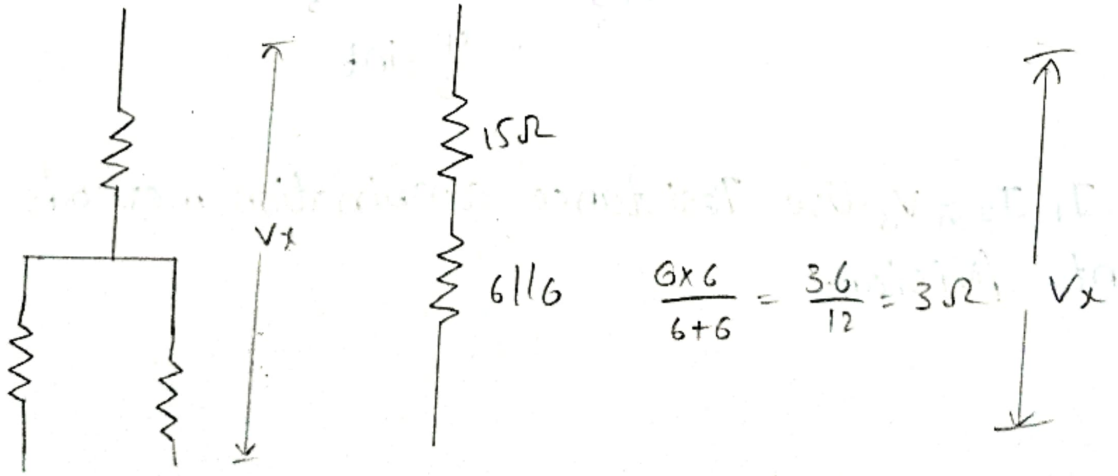
$$\boxed{i_3 = 3.33}$$

$$V_x = 3i_3 = 3 \times 3.33 = 9.99v$$

$$P = V.i = 9.99 \times 0.9 i_3 = 9.99 \times 0.9 \times 3.33$$

$$= 29.94003 \text{ watts}$$

24.) Calculate power dissipated in 15Ω Resistor.



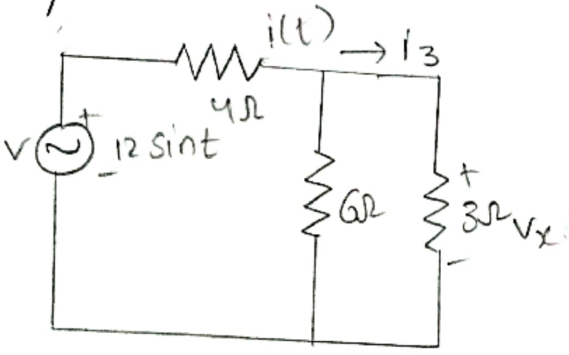
Sol:- $V_{15\Omega} = V_x \times \frac{15}{15+3}$

$= 9.99 \times \frac{15}{18}$

$= 8.325V$

$P_{15\Omega} = Vi = V \cdot \frac{V}{R} = \frac{V^2}{R} = \frac{(8.325)^2}{15} = 4.63 \text{ Watts.}$

25) Write an expression for the current through 3Ω resistor.



Sol:- $I = \frac{12 \sin t}{(6 \| 3) + 4}$

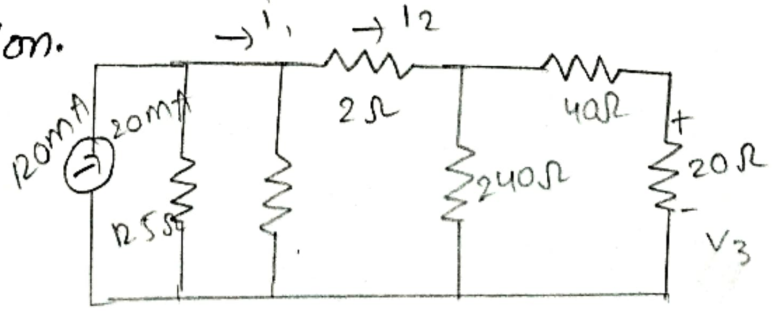
$I = 2 \sin t$

By using current division rule;

$i_{3\Omega} = 2\sin t \times \frac{6}{6+3} = 2 \sin t \times \frac{2}{3}$

$= \frac{4}{3} \sin t$

26) Find I_1, I_2 & V_3. Use Resistance combination methods & current division.

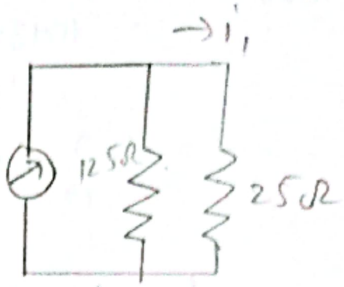


$i_1 \Rightarrow$ step (1) : $40+20 = 60\Omega$

(2) : $60 \| 240 = \frac{60 \times 240}{60+240}$

(3) : $48+2 = 50\Omega$

(4) : $50 \| 50 = \frac{50 \times 50}{50+50} = 25\Omega$



$$i_1 = 120mA \times \frac{125}{125+25}$$

$$\boxed{i_1 = 100mA}$$

$i_2 \Rightarrow$ step (1)

$$i_2 = 100mA \times \frac{50}{50+50}$$

$$= 50mA$$

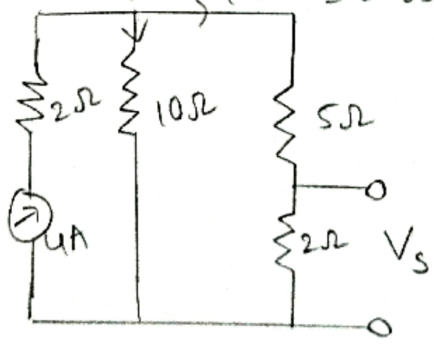
$V_3 \Rightarrow I_{20\Omega} \times (20\Omega)$

$$i_{20} = 50 \times \frac{240}{40+240+20}$$

$$= 50 \times \frac{240}{300} = 40mA$$

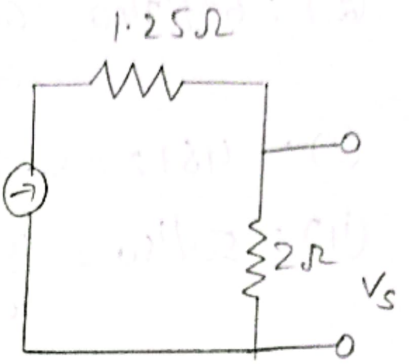
$$\Rightarrow V_3 = 40mA \times 20\Omega = 0.8V$$

27.) Determine the current in 10Ω Resistor. Find V_s in the circuit.



$$I_{10\Omega} = 4A \times \frac{7}{10+2+5}$$

$$= 4 \times \frac{7}{17} = 1.65A$$



$$R_{eq} = \frac{1}{2} + \frac{1}{10} + \frac{1}{5}$$

$$= \frac{10 \times 5 + 2 \times 5 + 2 \times 10}{2 \times 10 \times 5}$$

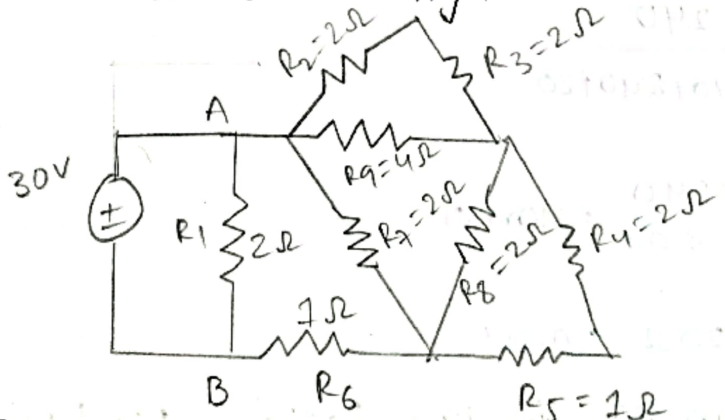
$$= \frac{50+10+20}{100} = 1.25$$

$V = IR$

$V = 4 \times 2$

$\boxed{V = 8\Omega}$

Q8.) Determine the current delivered by the source in the circuit shown in figure.

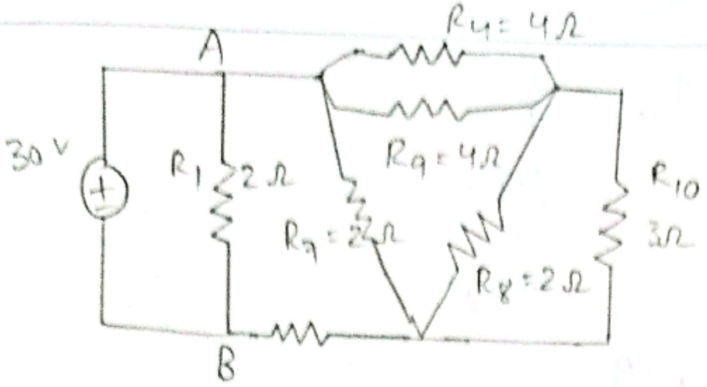


Soln (1) $R_5 R_4 \rightarrow$ series

$R_5 + R_4 = 3\Omega$

(2) R_2, $R_3 \rightarrow$ series

$R_2 + R_3 + 4\Omega$



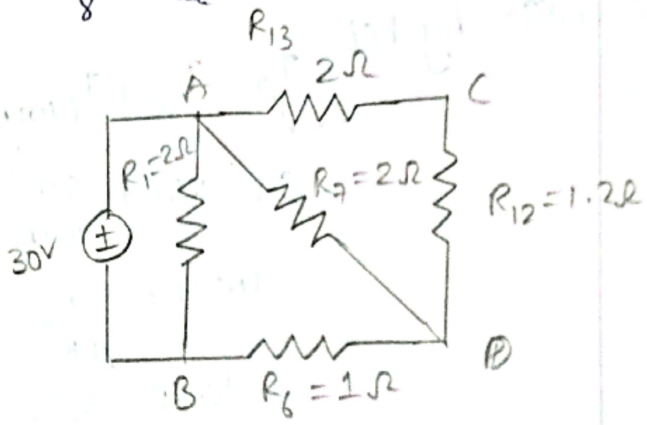
(3) R_8 & R_{10} (Parallel) $= \frac{2\times3}{2+3} = \frac{6}{5} = 1.2\Omega$

(4) R_9 & R_{11} (Parallel) $R_{13} = \frac{4\times4}{4+4} = \frac{16}{8} = 2\Omega$

(5) R_{13}, R_{12} (series)

$= 1.2 + 2$

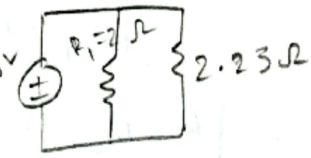
$= 3.2\Omega$

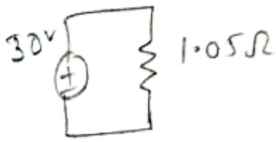


R_1, R_6 (series) $= 2+1 = 3\Omega$

(6) $3.2\Omega \,||\, R_7 = \frac{3.2\times2}{2+3.2} = 1.23\Omega$

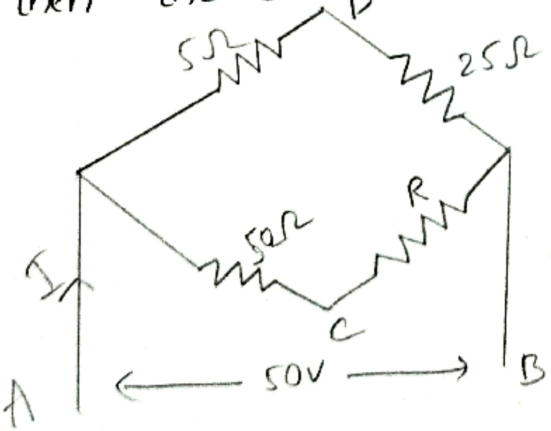
(7) $1.23 + R_6 = 1.23 + 1 = 2.23\Omega$





(8) $2.23 \,||\, 2 = \frac{2.23\times2}{2.23+2} = 1.05\Omega$

29.) Determine the value of Resistance R & current in each branch; then the total current taken by the circuit is 6A.



Sol:- The current in ABD $I_{30\Omega} = \frac{V}{R}$

$= \frac{50}{30}$

$= 1.66\,A$

The current in Branch ACB

$I_{(10+R)} = \frac{V}{R}$

$= \frac{50}{10+R}$

Sol:- by KCL $I_7 = I_{30} + I_{(10+R)}$

$6A = 1.66 + \frac{50}{10+R}$

$4.34 = \frac{50}{10+R}$

$10+R = \frac{50}{4.34}$

$R = \frac{50}{4.34} - 10$

$\boxed{R = 1.52\Omega}$

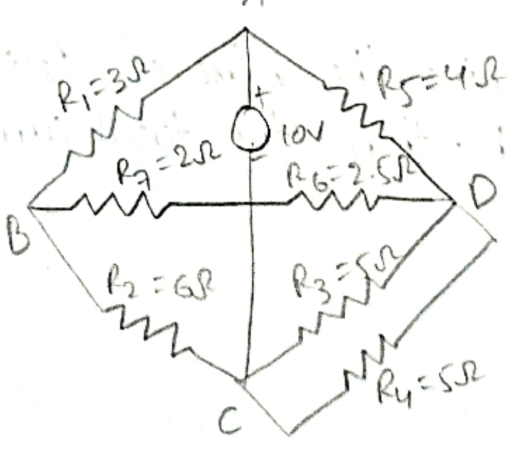
30) Find the power delivered by source in the circuit.

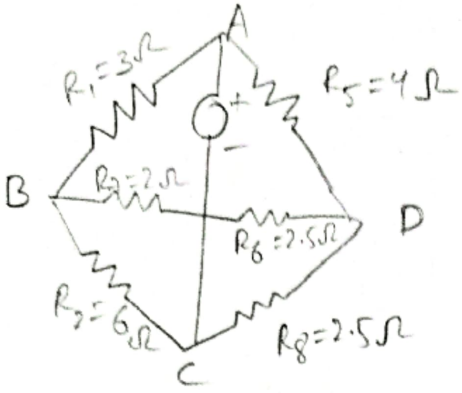
Sol:- $R_8 \Rightarrow R_3 \| R_4$

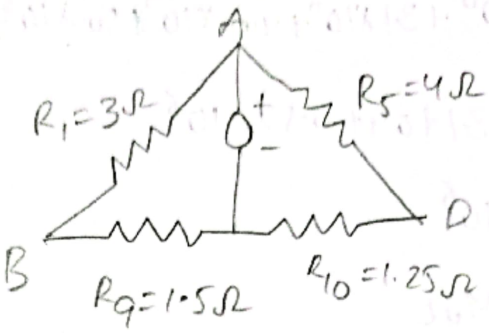
$= \frac{5\times5}{5+5} = 2.5\Omega$

$R_9 \Rightarrow R_7 \| R_2 = \frac{2\times6}{2+6} = 1.5\Omega$

$R_{10} \Rightarrow R_8 \| R_6 = \frac{2.5\times2.5}{2.5+2.5} = 1.25\Omega$







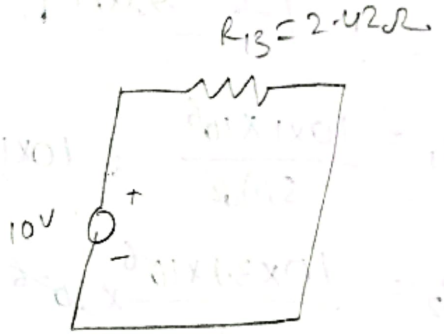
$R_{11} \Rightarrow R_9 \| R_1 = 1.5+3 = 4.5\Omega.$

$R_{12} \Rightarrow R_{10} \| R_5 = 4+1.25 = 5.25\Omega.$

$R_{13} \Rightarrow R_{11} \| R_{12} = \frac{4.5 \times 5.25}{4.5+5.25} = \frac{23.625}{9.75} = 2.42\Omega.$

$P = \frac{V^2}{R} = \frac{100}{2.42}$

$\boxed{P = 41.322 \text{ watts}}$



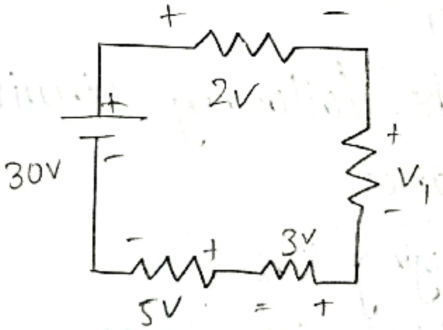
31.) Determine the unknown voltage drop V_1 in the following circuit.

Sol. By KCL;

$30 = -2 - V_1 - 3 - 5$

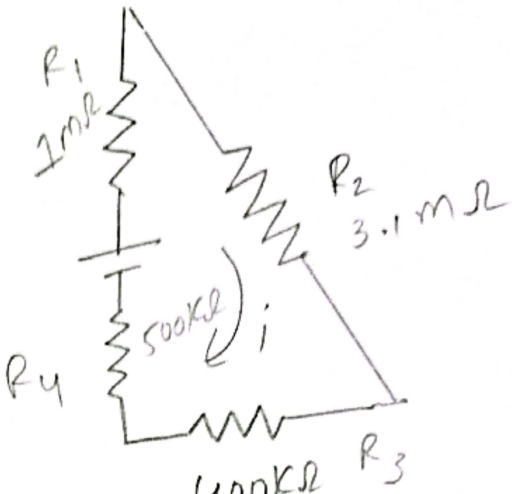
$V_1 = 30 + 10$

$\boxed{V_1 = 40V}$



32.) What is the current in the following circuit & determine voltage accross each resistor.

Sol:- let i be the current



$$R_{eq} = 1\times10^{6} + 3.1\times10^{6} + 400\times10^{3} + 500\times10^{3}$$

$$= (1+3.1+0.4+0.5)\times10^{6}$$

$$= 5\times10^{6}$$

$$R_{eq.} = 5M\Omega$$

$\Rightarrow V = IR$

$$I = \frac{V}{R} = \frac{10}{5}\times10^{-6}$$

$$= 0.2\times10^{-5}$$

$$\boxed{I = 2\mu A}.$$

$$V_{R_1} = \frac{10\times1\times10^{6}}{5M\Omega} = 10\times10^{6}\times0.2\times10^{-6} = 2V_{R_1}$$

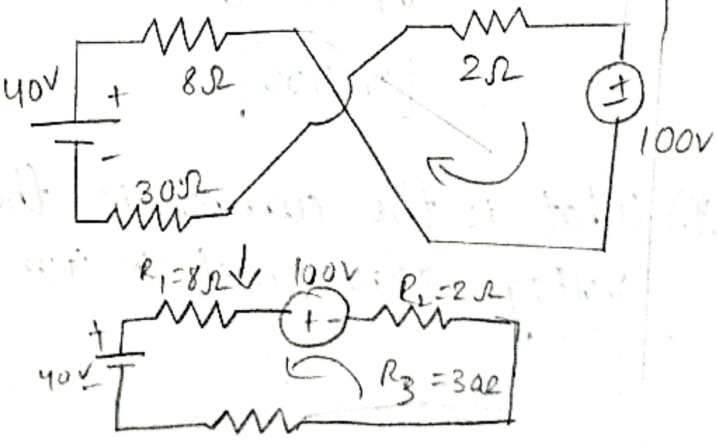
$$V_{R_2} = \frac{10\times3.1\times10^{6}}{5}\times10^{-6} = 31\times0.2 = 6.2V$$

$$V_{R_3} = 10\times0.4\times10^{6}\times10^{-6}\times0.2 = 0.8V$$

$$V_{R_4} = 10\times0.5\times10^{6}\times10^{-6}\times0.2 = 1V$$

33.) In the following circuit. find i & voltage across 13Ω Resistance.

Sol:- By Applying KVL



$$\Rightarrow 30i - 2i + 100 - 8i - 40 = 0$$

$$-40i = -60$$

$$\boxed{i = 1.5A}$$

By ohm's law; $V = IR$

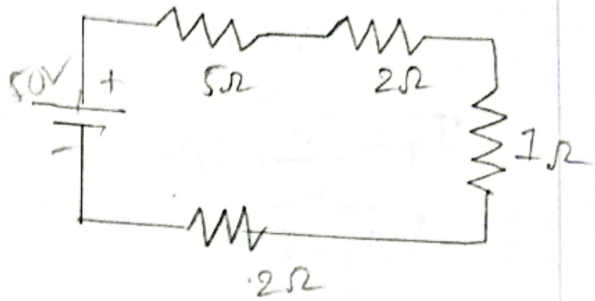
$$= 1.5\times30 = 45V$$

$$\boxed{V = 45V}.$$

i) Determine the total amount power in the circuit. Find the power absorbed by each resistor.

Sol:-

$$P_T = \frac{V_T^2}{Req} = \frac{50^2}{5+2+1+2}$$



$$= \frac{2500}{10} = 250 \text{ watts} \quad [\because P = Vi]$$

$P_{5\Omega} = 25 \times 5 = 1.25\,W$

$P_{2\Omega} = 4 \times 5 = 20\,W$

$P_{1\Omega} = 1 \times 5 = 5\,W$

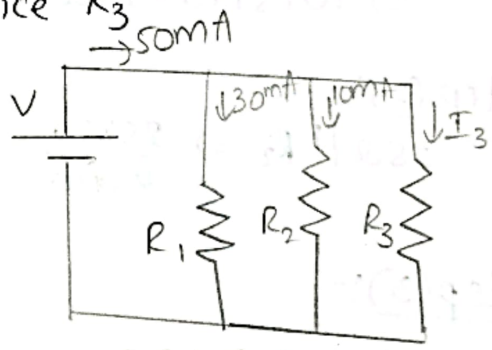
$P_{2\Omega} = 4 \times 5 = 20\,W$

35.) Determine current through resistance R_3

Sol:- By KCL;

$$50 = 30 + 10 + I_3$$

$$\boxed{I_3 = 10mA}$$



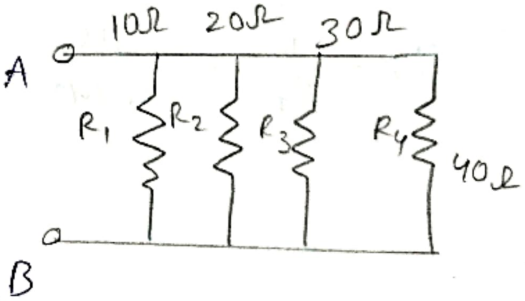
36.) Determine the parallel resistance blw. A & B of the circuit

Sol:-

$$\frac{1}{R_T} = \frac{1}{10} + \frac{1}{20} + \frac{1}{30} + \frac{1}{10}$$

$$\frac{1}{R_T} = 0.7$$

$$\boxed{R_T = 1.43}$$



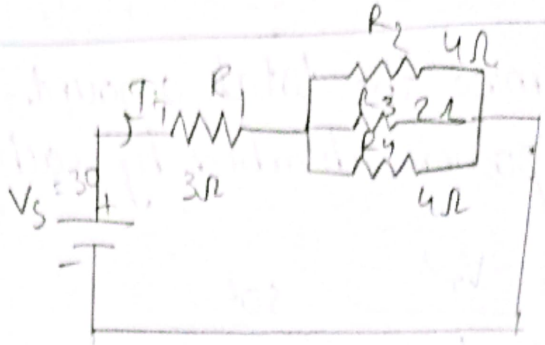
37.) Determine the current through Resistor R_3.

Sol:- $R_T = \frac{1}{4} + \frac{1}{2} + \frac{1}{4} + 5$

$= 1 + 5 = 6\Omega$

$I_T = \frac{30}{6} = 5A.$

$\boxed{I_T = 5A}$

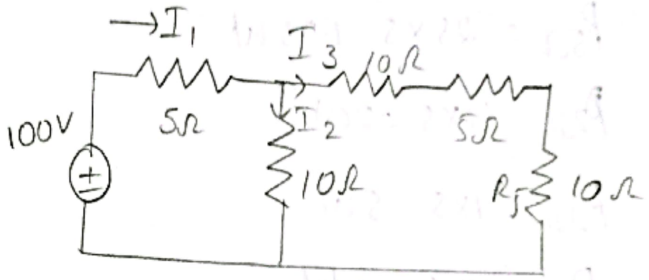


38) Find the current I_1, I_2, I_3.

Sol:- Step (1):-

R_3, R_4 & R_5 are in series

$\Rightarrow 10 + 5 + 10 = 25\Omega.$



step (2):-

$25\Omega \,||\, R_2 \Rightarrow \frac{25 \times 10}{25+10} = \frac{250}{35} = 7.142\Omega$

step (3):-

$R_T = 5 + 7.142\Omega.$

$= 12.142\Omega.$

$I_T = \frac{V}{R_T} = \frac{100}{12.142} = 8.237A. = I_1$

$I_2 = 8.237 \times \frac{10+10+5}{10+10+5+10} = 5.88A$

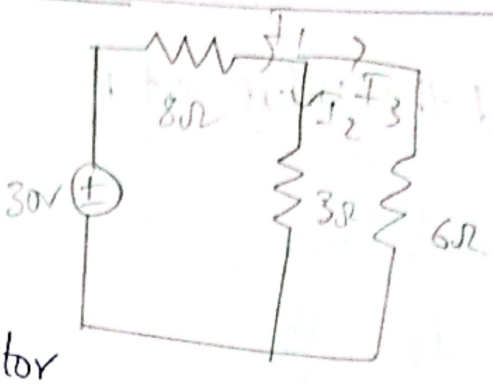
$I_3 = I_1 - I_2 = 2.36A.$

39.) Find the currents and voltages in the given circuit.

Sol:-

Step 1:- $3\Omega \| 6\Omega$

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



Step 2:- 8Ω is series with 2Ω resistor

$8+2 = 10\Omega$

$I_1 = \frac{30}{10} = 3A \quad \{\because I_1 = I_2 + I_3\}$

$I_2 = 3 \times \frac{6}{3+6} = 2A$

$I_3 = I_1 - I_2 = 1A$

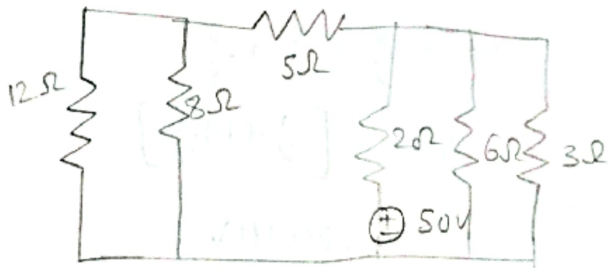
$V_{8\Omega} = IR = 3 \times 8 = 24V$

$V_{3\Omega} = 2 \times 3 = 6V$

$V_{6\Omega} = 1 \times 6 = 6V$

10) Find the current supplied by the source.

Soln Step 1:- $\frac{2 \times 8}{12+8} = 4.8\Omega$



$\frac{6 \times 3}{6+3} = \frac{18}{9} = 2\Omega$

Step 2:- $4.8 + 5 = 9.8\Omega$

$= \frac{9.8 \times 2}{9.8+2} = 1.661\Omega$

Step 3:- $2 + 1.661\Omega$

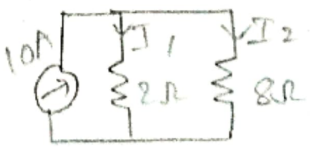
$= 3.661\Omega$

$I_T = \frac{50}{3.661} = 13.66A$

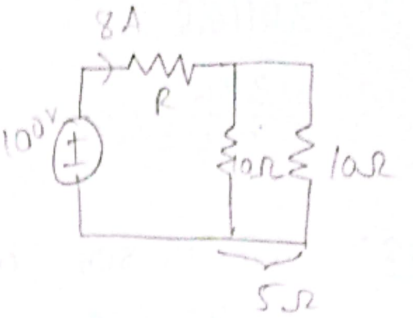
41) Find I_1 & I_2

Soln $I_1 = 10 \times \frac{8}{8+2} = 8A$

$I_2 = 10 \times \frac{2}{8+2} = 2A$



42) Find the value of R.



Sol: By Ohm's law;

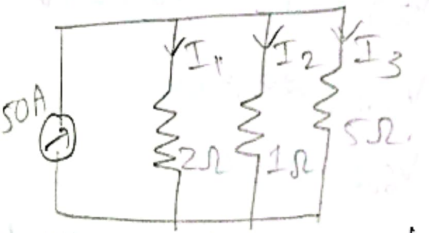
$$I_T = \frac{V_S}{R_{eq}}$$

$$8 = \frac{100}{R+5}$$

$$R+5\Omega = 12.5$$

$$R = 7.5\Omega$$

43) Determine the current in all ~~three~~ resistors in the circuit.



Sol: KCL;

$$50 = I_1 + I_2 + I_3$$

let us assume that at point A the voltage is 'V'.

$$50 = \frac{V}{2} + \frac{V}{1} + \frac{V}{5}$$

$$50 = V\left[\frac{1}{2} + 1 + \frac{1}{5}\right]$$

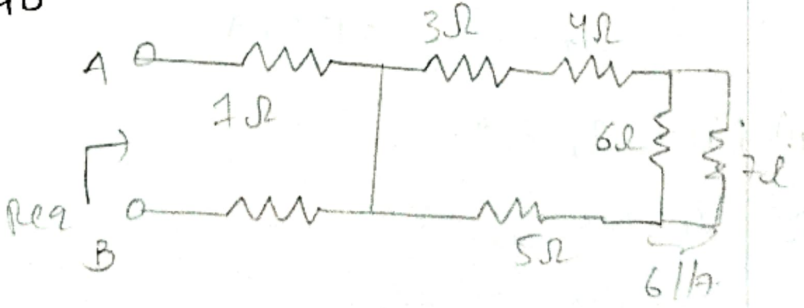
$$V = 29.41V$$

$$I_1 = I_{2\Omega} = \frac{V}{2} = \frac{29.41}{2} = 1.47A$$

$$I_2 = I_{1\Omega} = \frac{V}{1} = 29.411A$$

$$I_3 = I_{5\Omega} = \frac{V}{5} = \frac{29.411}{5} = 5.88A$$

44) Find R_{eq} between A & B

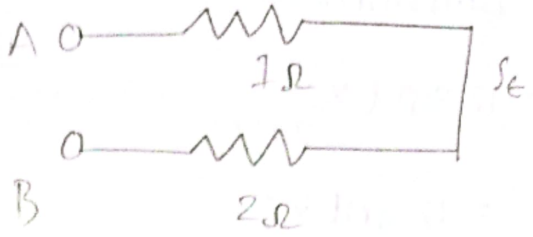


$R_3 = 6 \| 7 = \frac{6 \times 7}{6+7} = 3.23\Omega$

In series

$R_q = 3+4+5+3.23$

$= 15.23\Omega$

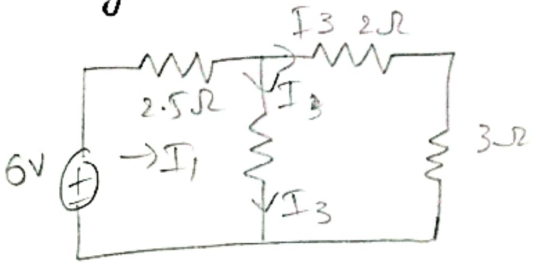


Because of short circuit the parallel resistance is to be neglected.

$R_{eq} = 1+2$

$R_{eq} = 3\Omega.$

15.) Find all branch currents & voltages across all resistors.



$R_T = 2.5+2.5 = 5\Omega.$

$I_T = \frac{10}{5} = 2A$

$I_3 = 2 \times \frac{5}{2+3+5} = 2 \times \frac{5}{10} = 1A$

A + 'A', KCL;

$I_1 = I_2 + I_3$

$I_2 = 1A$

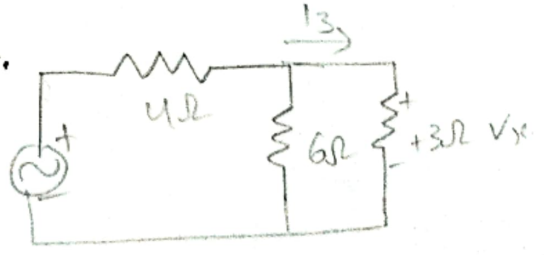
$V_{2.5\Omega} = I_1(2.5) = 2 \times 2.5 = 5V$

$V_{2\Omega} = I_2(2) = 1 \times 2 = 2V$

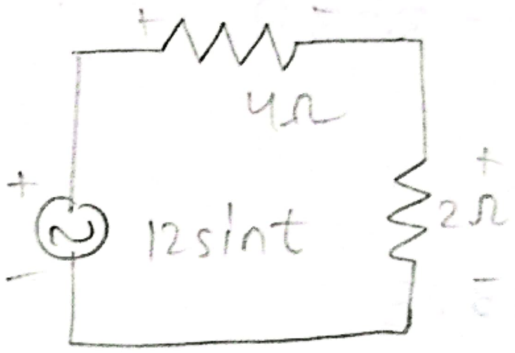
$V_{5\Omega} = I_3(5) = 1 \times 5 = 5V$

$V_{3\Omega} = I_3(3) = 1 \times 3 = 3V.$

46.) Determine V_x in the circuit.



Sol: Voltage Division rule



$$V_x = 12\sin t \times \frac{2}{2+4}$$

$$= 12\sin t \times \frac{2}{6}$$

$$V_x = 4\sin t \text{ volts.}$$