C $\quad V = \frac{1}{C}\int I \cdot dt \quad I = C \cdot \frac{dV}{dt} \quad P = CV \cdot \frac{dV}{dt} \quad W = \frac{1}{2}CV^2.$

KCL (Kirchoff's Current Law) :-

KCL states that the sum of currents entering into the node is equal to the sum of the currents leaving from that node.

(or).

The algebraic sum of all the currents at a particular node or junction is equal to zero.

$I_3 = \frac{V}{3} =$

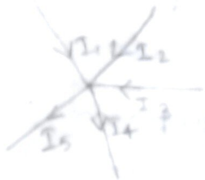
$I_1 + I_2 + I$

I_T

Current divis

$I = 0F$

$I_1 =$

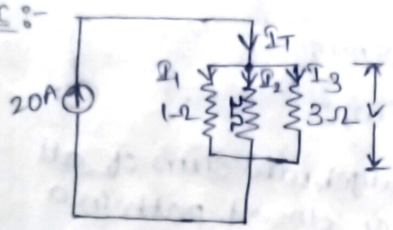


1

$$I_1 + I_2 + I_3 = I_4 + I_5.$$

$$I_1 + I_2 + I_3 - I_4 - I_5 = 0.$$

Ex :-



$$I_T = I_1 + I_2 + I_3$$

$$20 = \frac{V}{1} + \frac{V}{2} + \frac{V}{3}$$

$$20 = V\left[1 + \frac{1}{2} + \frac{1}{3}\right]$$

$$20 = V\left[\frac{6+3+2}{6}\right]$$

$$20 = V\left[\frac{11}{6}\right]$$

$$V = \frac{20 \times 6}{11} = \frac{120}{11} = 10.9 \text{ volt}$$

$$I_1 = \frac{V}{1} = \frac{10.9}{1} = 10.9 \text{ Amp}$$

$$I_2 = \frac{V}{2} = \frac{10.9}{2} = 5.45 \text{ Amp}$$

$$I_3 = \frac{V}{3} = \frac{10.9}{3} = 3.63 \text{ Amp}$$

$$I_1 + I_2 + I_3 = 10.9 + 5.45 + 3.63$$

$$= 19.98 \text{ Amp}$$

$$I_T \simeq I_1 + I_2 + I_3.$$

Current division rule :-

$$I = \frac{\text{opposite resistance}}{\text{Total resistance}} \times \text{total current}$$

$$I_1 = \frac{2 \parallel 3}{(2 \parallel 3) + 1} \times 20 = \frac{\left(\frac{2 \times 3}{2+3}\right)}{\left(\frac{2 \times 3}{2+3}\right) + 1} \times 20$$

$$= 10.9 \text{ Amp}.$$

$$I_2 = \frac{(1 \| 3)}{(4 \| 3) + 2} \times 20 = 5.4\ \text{Amp}$$

$$\begin{array}{r} 10.9 \\ 5.4 \\ 3.6 \\ \hline 19.9 \end{array}$$

$$I_3 = \frac{(1 \| 2)}{(1 \| 2) + 3} \times 20 = 3.6\ \text{Amp}.$$

$$I_T = I_1 + I_2 + I_3 = 10.9 + 5.4 + 3.6$$

$$= 19.9\ \text{Amp}$$

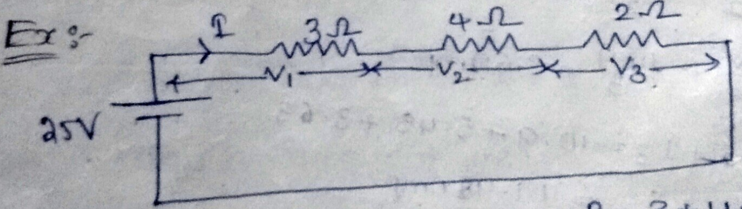
KVL (Kirchoff's Voltage Law) :-

KVL states that the algebraic sum of all branch voltages around any closed path in a circuit at any instant of time is equal to zero.

(or)

The ~~va~~total voltage is equal to the sum of voltage drops at individual resistance elements. KVL is also called as conservation of energy.

Ex:-



$$R = 3 + 4 + 2$$
$$= 9\Omega$$

$$V_T = V_1 + V_2 + V_3.$$

$$\boxed{V_T = IR} = 2.77\ \text{Amp}.$$

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

$$I = \frac{25}{9} = 2.77\ \text{Amp}$$

$$V_1 = IR_1$$

$$V_2 = IR_2$$

$$V_3 = IR_3.$$

$V_1 = 2.77 \times 3$

$= 8.31\,V$

$V_2 = 2.77 \times 4$

$= 11.08\,V$

$V_3 = 2.77 \times 2$

$= 5.54\,V$

$V_T = V_1 + V_2 + V_3$

$= 8.31 + 11.08 + 5.54$

$= 24.93$

$25 \simeq 24.93$

By using voltage division rule :-

$$\frac{\text{Same resistance}}{\text{total resistance}} \times \text{total voltage}$$

$V_1 = \frac{3}{9} \times 25 = 8.33\,V$

$V_2 = \frac{4}{9} \times 25 = 11.11\,V$

$V_3 = \frac{2}{9} \times 25 = 5.55\,V$

$V_T = V_1 + V_2 + V_3 = 24.99$

$25 \simeq 24.99$

iii) Linear and Non-linear

iv) Lumped and distributed.

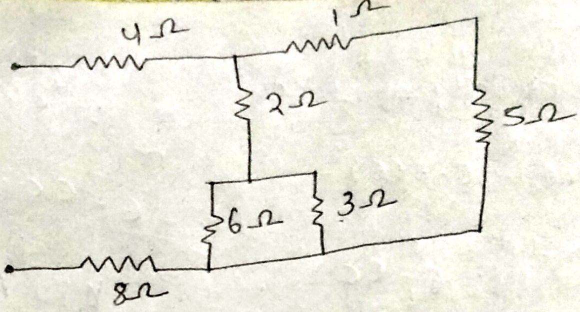
i) Active and passive :-

Energy socurces(V and I) are active elements capable of delevering power to some external device.

Passive elements are those which are capable only of receiving power. Inductors and capacitors are capable of storing a finite amount of energy and return it later to an external element.

ii) Bilateral and Unilateral :-

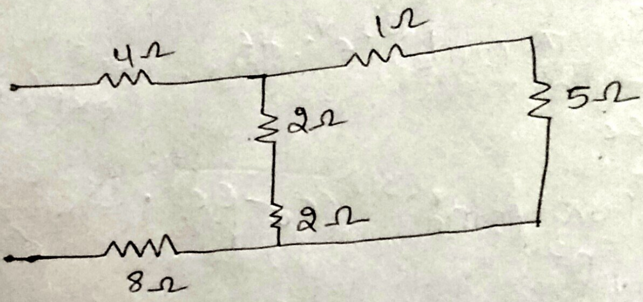
the bilateral elements voltage and current ... for current flowing in

1) 

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

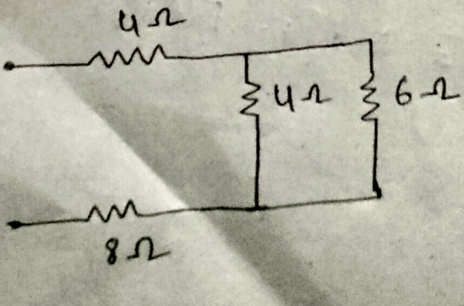
$P = VI$

$$Req_1 = \frac{6 \times 3}{6+3} = \frac{18}{9} = 2\Omega.$$

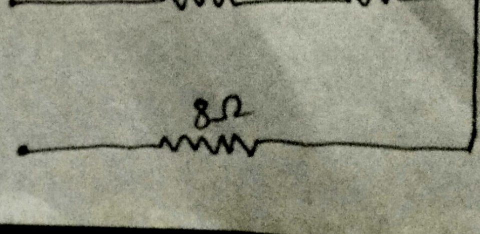


$$Req_2 = 2 + 2 = 4\Omega$$

$$Req_3 = 5 + 1 = 6\Omega$$



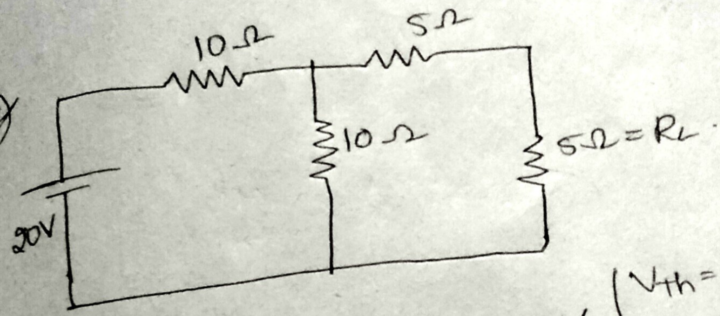
$$Req_4 = \frac{4 \times 6}{4+6} = \frac{24}{10} = 2.4\Omega$$



$Req_5 = 4 + 2.4 + 8$

$= 14.4\Omega$.

$\therefore \boxed{Req = 14.4\Omega}$



$V_{Th} = \frac{10}{20} \times 20 = 10V$ $\left(V_{Th} = \frac{10}{10+10} \times 20\right)$

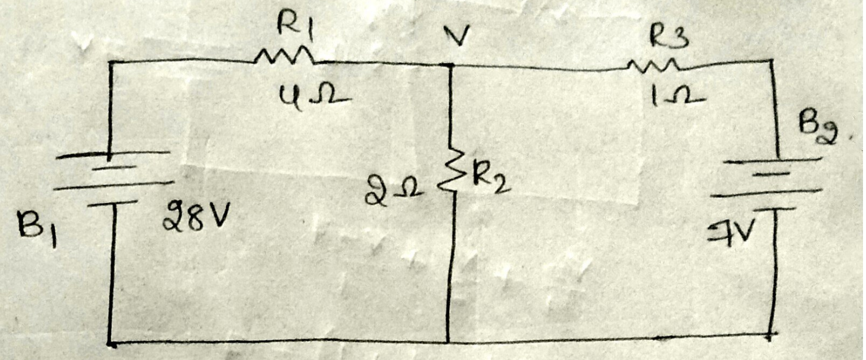
$R_{Th} = (10 \| 10) + 5$ $\left(R_{Th} = (10 \| 10) + 5\right)$.

$= \frac{100}{20} + 5$ $\left(I_L = \frac{V_{Th}}{R_{Th} + R_L}\right)$

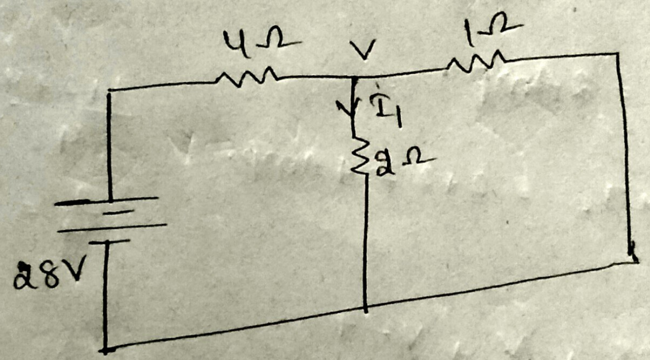
$= 10\Omega$

$I = \frac{10}{10+5} = \frac{10}{15} = 0.66$ Amp.

(Mesh Analysis :-) x



case(i) :-



$$= \frac{V-28}{4} + \frac{V}{2} + \frac{V}{1}$$

$$= V\left[\frac{1}{4} + \frac{1}{2} + 1\right] = 7$$

$$= V\left[0.25 + 0.5 + 1\right] = 7$$

$$\Rightarrow V\left[1.75\right] = 7$$

$$V = \frac{7}{1.75} = 4.$$

$$I_1 = \frac{4}{2} = \underline{\underline{2\,Amp}}.$$

$\frac{1}{4} + \frac{1}{2}$

$\frac{2+4}{8}$

$= \frac{6}{8} + 1$

$= \frac{6+8}{8}$

$= \frac{14}{8}$

$= \frac{7 \times 8}{14}$

$\frac{2+4}{8}$

$\frac{6}{8} + 1$

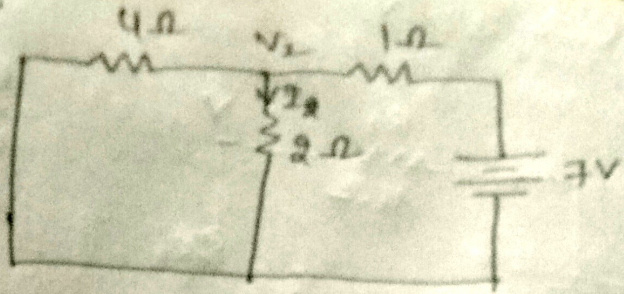
$\frac{6+8}{8}$

$\frac{14}{8}$.

$\frac{14}{8} = 7$

$\frac{\cancel{7} \times 8^{4}}{\cancel{14}_{2}}$

case (ii) :-



$$\frac{V}{4} + \frac{V}{2} + \frac{V-7}{1}$$

$$V\left[\frac{1}{4} + \frac{1}{2} + 1\right) = 7$$

$$V = 4$$

$$I_2 = \frac{4}{2} = 2\ \text{Amp}.$$

$$\frac{1+2+4}{4}$$

$$I = I_1 + I_2 = 2 + 2 = 4\ \text{Amp}.$$

$$\frac{7}{4} = 7$$

case (iii) :-

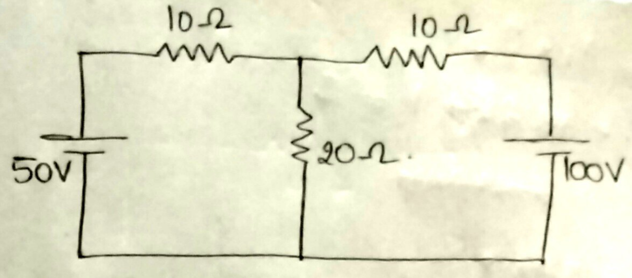
$$\frac{V-28}{4} + \frac{V}{2} + V - 7$$

$$V\left[\frac{1}{4} + \frac{1}{2} + 1\right] = 14$$

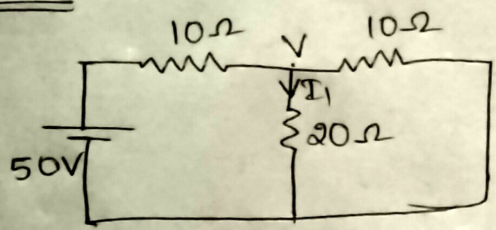
$$V\left(\frac{14}{8}\right) = 14$$

$$V = 8$$

$$\frac{\cancel{8}4}{\cancel{2}}.$$



case(i):-



$$\frac{V-50}{10}+\frac{V}{20}+\frac{V}{10}$$

$$V\left[\frac{1}{10}+\frac{1}{20}+\frac{1}{10}\right]=5$$

$$V\left[0.1+0.05+0.1\right]=5$$

$$V\left[0.25\right]=5 \Rightarrow V=\frac{5}{0.25}=20$$

$$I_1=\frac{20}{20}=1\,\text{Amp.}$$

case (ii):-

$$\frac{V}{10}+\frac{V}{20}+\frac{V-100}{10}$$

$$V\left[\frac{1}{10}+\frac{1}{10}+\frac{1}{20}\right]=10$$

$$V\left[0.25\right]=10 \Rightarrow 40.$$

$$I_2=\frac{40}{20}$$

$$I_2=2\,\text{Amp.}$$

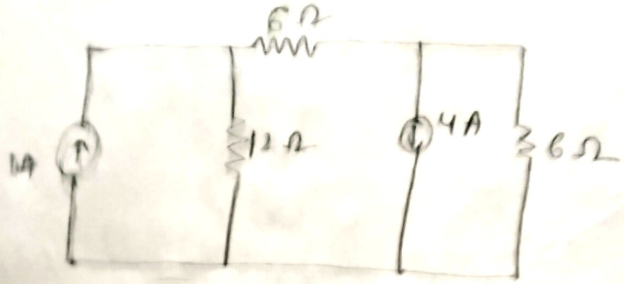
$I = I_1 + I_2$

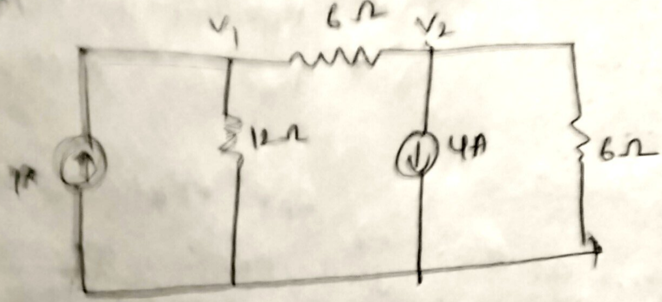
$= 2 + 1 = 3$

~~= 3 Amp.~~

$I = 3$ Amp

problem :





for ~~case~~ Node (1) :- $-1+\frac{V_1}{12}+\frac{V_1-V_2}{6}=0$

$$-12+V_1+2V_1-2V_2=0$$

$$3V_1-2V_2=12 \quad \text{— (1)}$$

for node 2 :- $4+\frac{V_2-V_1}{6}+\frac{V_2}{6}=0$

$$24+V_2-V_1+V_2=0$$

$$24+2V_2-V_1=0$$

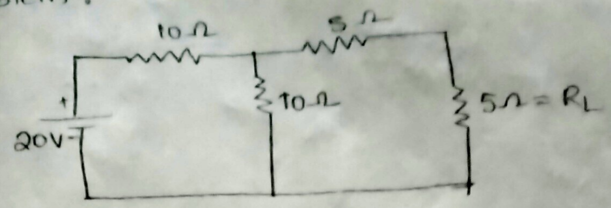
$$V_1-2V_2=24 \quad \text{— (2)}$$

by solving eq^ns (1) & (2)

$V_1=-6V$, ~~$V_2=18V$~~

$V_2=-15\ V$.

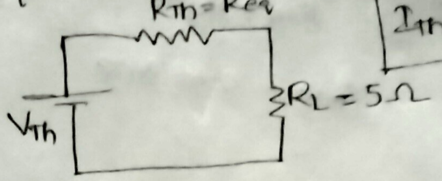
problem :-

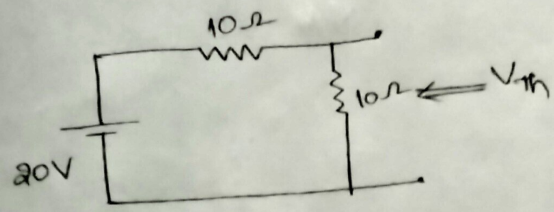


Thevenin's Theorem.

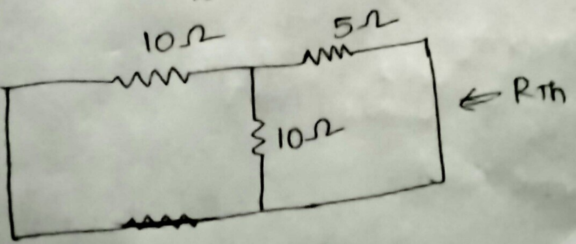
~~Eq~~ ~~its~~ equivalent resistance is —

$$\boxed{I_{Th} = \frac{V_{Th}}{R_{Th}+R_L}}$$





$$V_{Th} = \frac{10}{10+10} \times 20 = \frac{10}{20} \times 20 = 10\,\text{Volts}$$



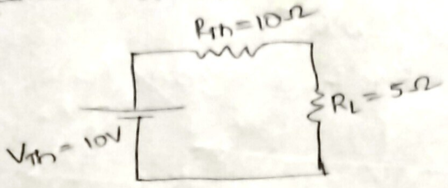
$$R_{Th} = (10 \parallel 10) + 5$$

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

$$= \frac{100}{20} + 5$$

$$R_{Th} = 5 + 5 = 10\Omega$$

equivalent resistance is —



$V_{th} = 10$

$R_{th} = 15$

$R_L = 5$

$\frac{10}{20} = 0.5$

$$I_{th} = \frac{V_{th}}{R_{th} + R_L} = \frac{10}{10+5} = \frac{10}{15} = 0.66 \text{ Amp}$$

$I_{th} = 0.66$ Amp

Bits:-

V_{th}

1) B
2) D
3) C
4) A
5) C
6) Infinity.
7) $\frac{1}{L_1} + \frac{1}{L_2} = \frac{L_1 L_2}{L_1 + L_2} = L_{eq}$
8) magnetic field
9) Farad
10) power calculation.
11) A
12) C
13) A
14) B

15) C
16)
17)
18)
19
20

$V_{th} = 10$

$R_{th} = 15$

$R_L = 5$

$\frac{10}{20} = 0.5$

$\frac{10}{15} = 0.66$ Amp

15) C

16) electrical field

17) power calculation.

18) Henry

19) short circuit

20) Linear bilateral Network.