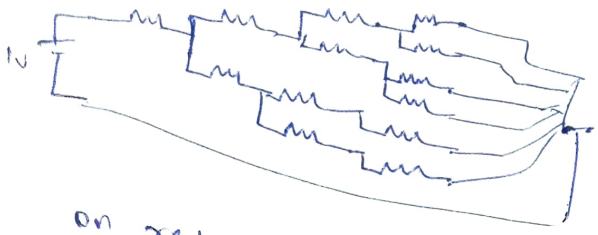
Problem set 2

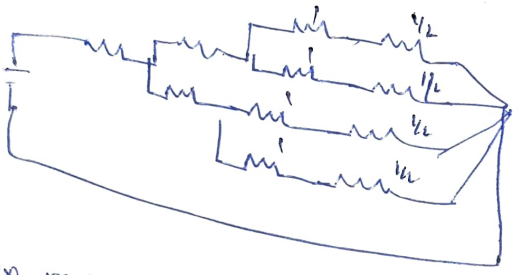
Hemanth. N
2019503519

(1)



On reducing the resistance halves, since they are in parallel.

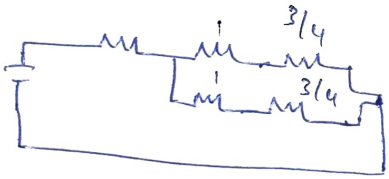
:)



On reducing the next immediate ~~pair~~ Pair,

it becomes $1+1/2 = 3/2\ \Omega$

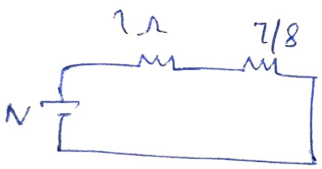
Continuing reduction, $3/4\ \Omega$



$1+3/4 = 7/4$

Two $7/4\ \Omega$ in "||"

$\Rightarrow$ ~~Req~~ : $7/8\ \Omega$



Finally, since these are in series

$1+7/8$

$\Rightarrow$ $R_{eq} = \frac{15}{8}\ \Omega$

$i = V/R \Rightarrow i = V/_{15/8} \Rightarrow \frac{18}{5}\ A = 0.533\ A$

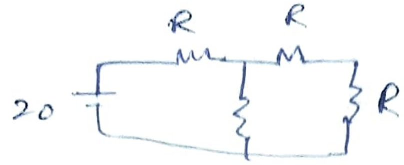
$R_{eq} = \frac{15}{8}\ \Omega$, $i = 0.533\ A$

(2)

Hemanth N
2019505519

$\therefore$ $R_{eq} = \frac{2R \times 2R}{4R} = \boxed{R}$

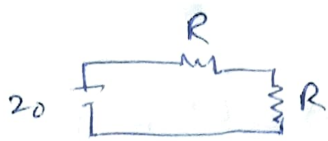
$\Rightarrow$



$\Rightarrow$ $R + R = \boxed{2R}$

& $\frac{2R(2R)}{2R+2R} = \boxed{R}$

$\Rightarrow$



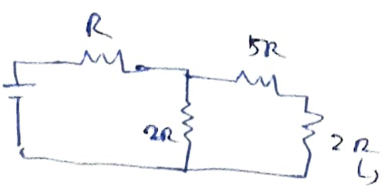
$= R + R = \boxed{2R}$

$\Rightarrow$ $\boxed{R_{eq} = 2R}$

$V = 20 \Rightarrow I = \frac{20}{2R} = 10/R$

$I_{a+2R} = \frac{10/R \times 2R}{2R+2R} = 10/R + \frac{2R}{4R}$

$\Rightarrow$ $\boxed{I_{2R} = \frac{5}{R}}$



$\hookrightarrow I \Rightarrow \frac{5/R \times 2R}{4R} = \boxed{\frac{5}{2R}}$

Hemanth I N
2019503519

Power $= 12.5 = \left(\frac{5}{2R}\right)^2 \times R$

$\Rightarrow \quad \frac{25}{4R^2} \times R = 12.5$

$\Rightarrow \boxed{R = 0.5\ \Omega}$

(a) Total Power $= \frac{10}{R} \times 2R = 20\ W$

(b) $V_{at\ R} = \frac{10}{0.5} \times 0.5 = 10\ V$

$I = \frac{10}{5/R} = \frac{20}{5} = 2\ A$

$P = (2)^2 \cdot 0.5 \qquad [P = I^2 \cdot R]$

$\Rightarrow P = 2\ W$

(c) $V_{at\ second\ R} = \frac{5}{R} \times R = 5\ V$

$\boxed{I = 10\ A} \qquad (I = V/R \Rightarrow 5/5R)$

$\Rightarrow P = (10^2) \cdot 0.5 = 50$

$\therefore \boxed{P = 50\ W}$

(d) $V_{at\ 2R} = 5/R \times 2R = 10\ V$

$I_{at\ 2R} = 5/0.5 = 10\ A$

$P_{at\ 2R} = (5/R)^2 \cdot 2R = \frac{10}{R} = \frac{10}{0.5}$

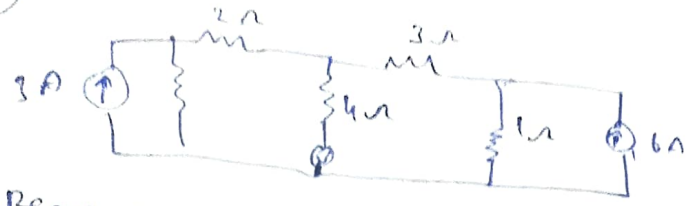
$\boxed{P_{at\ 2R} = 20\ W}$

(e) $V_{at\ second\ 2R} = \frac{5}{2R} \times 2R = 5\ V$; $\Rightarrow I = 5/2 * 0.5 = 5A$

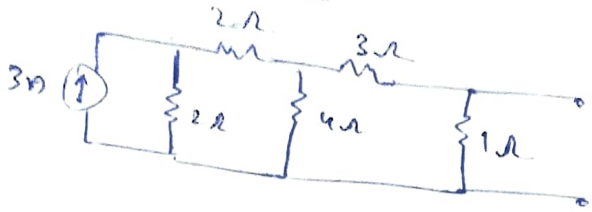
$P_{at\ 2R} = (5)^2\ 0.5 = \boxed{12.5\ W}$

(3)

Hemanth.N
2019503 51

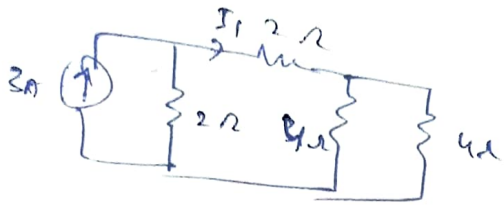


Remove 6V & 6A source

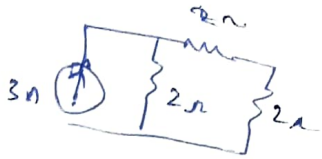


→ (1)

⇒



⇒



→ (2)

→ (3)

⇒

→ (4)

By,

$$I_{2\Omega} = \frac{4(3)}{6} = 2A$$

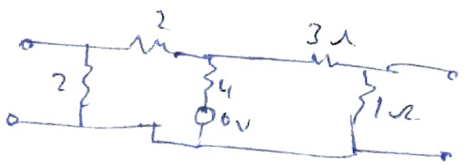
$$I_{4\Omega} = 3 - 2 = 1A$$

from (2) ⇒

$I_{4\Omega}$ current thro', will divide into 2 equal branch ⇒ current thro' both resistors are same.

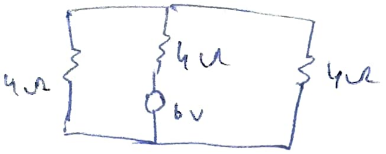
⇒ $I_{4\Omega} = 0.5A$ ↓

remove 3A & 6A

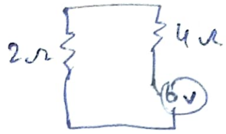


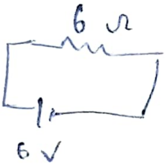
Hemanth IN
2019503519

=>



=>



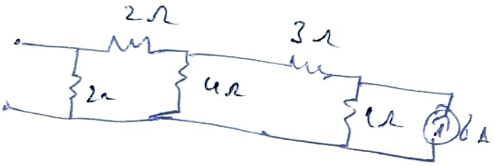


$I = V/R = 6/6$

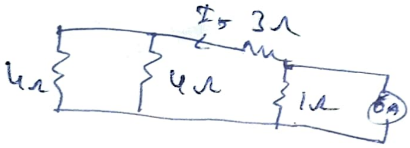
$I = 1A$ upward

remove 3A & 6V

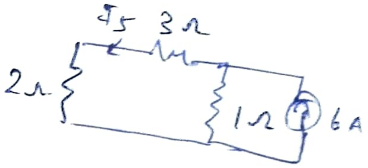
=>



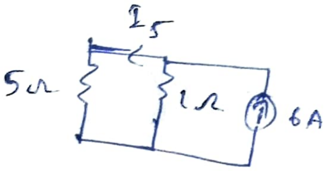
=>



=>



=>



$I_{5\Omega} = \frac{1 \times 6}{6} = 1A$

from 2nd diag, $I_{5\Omega}$ it is clear, that $I_{5\Omega}$ will divide into equal branch currents 0.5 A & 0.5A

$I_{4\Omega} = 0.5\ A$ downward

$I_T = 0.5 + 0.5 - 1$

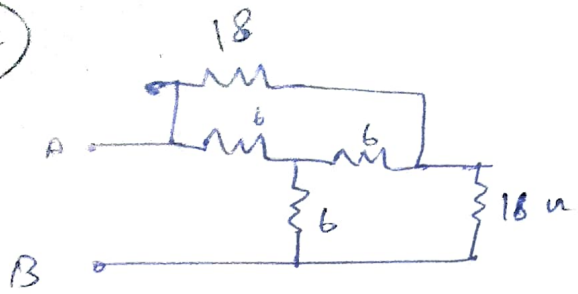
$= 0\ A$

(0.5 down, 0.5 down, 1A upward)

$\therefore I_T = 0A$

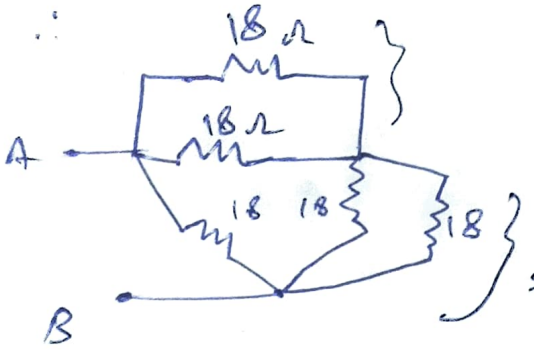
Hemanth.N
2019503519

(4)



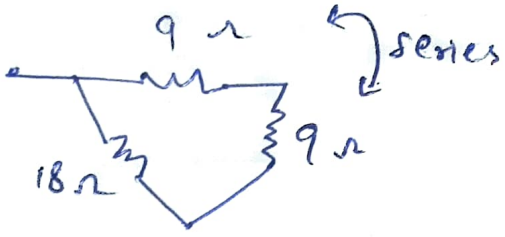
Star to Delta => R values are same :) (3R)

∴ 3 × 6 = 18 Ω



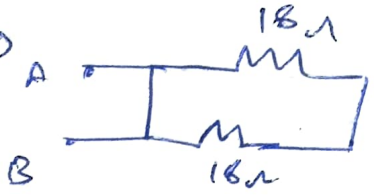
=> $\frac{18 \times 18}{36} = 9\ \Omega$

=>



=> 9 + 9 = 18 Ω

=>

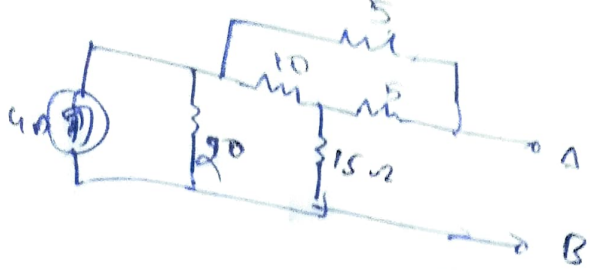


=> $\frac{18(18)}{18+18} = 9\ \Omega$

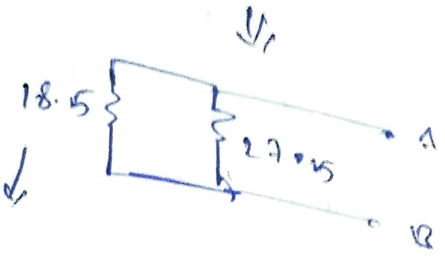
So overall resistance across AB

$R_{eq} = 9\ \Omega$

(5)



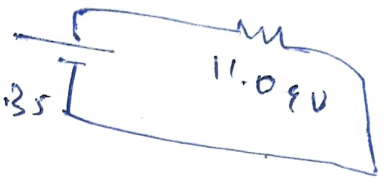
Hemanth N
2019503519



$I_{18.5} = \frac{27.5}{46} \times 4 = 2.39A$ $(R_{Th} = 11.09\ \Omega)$

$V_{18.5\Omega} = IR = 2.39(18.56) = 44.35\ V$

⇒



$R_{Th} = 11.09\ \Omega$

$V_{Th} = 44.35\ V$

$\text{Power} = \frac{V_{Th}^2}{4R_{Th}}$

$= 1966.92 / 44.38$

Power = 44.32 V