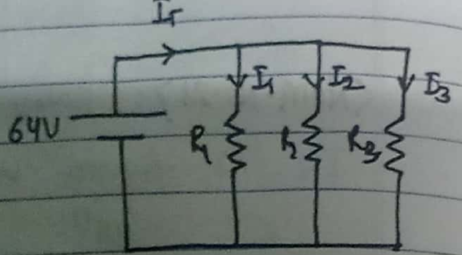
<Num. No. 23>: Find the R_T, I_T, I_1, I_2 and I_3 using CDR.

Soln.



Given,

voltage (V) = 64 V

$R_1 = 5k\Omega$

$R_2 = 6k\Omega$

$R_3 = 8k\Omega$

(i) Let 'R_T' be the total resistance.

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

or, $$\frac{1}{R_T} = \frac{1}{5000} + \frac{1}{6000} + \frac{1}{8000}$$

or, $$\frac{1}{R_T} = 4.916 \times 10^{-7}$$

$\therefore R_T = 2033.89\,\Omega$

(ii) $$I_T = \frac{V}{R_T} = \frac{64}{2033.89} = 0.03146\,A = 31.46\,mA$$

(iii): $$I_1 = I_T \times \frac{R_T}{R_1} = \frac{31.46 \times 2033.89}{5000} = 12.79\,mA$$

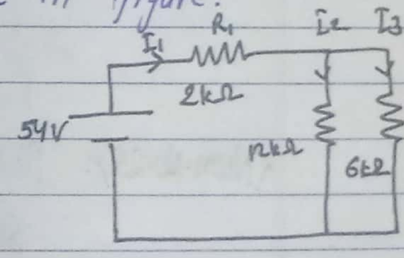
$$I_2 = I_T \times \frac{R_T}{R_2} = \frac{31.46 \times 2033.89}{6000} = 10.66\,mA$$

$I_3 = 31.46 - 12.79 - 10.66$

$\therefore I_3 = 7.99\,mA$.

<Num. No. 24>: Find the current I_s for the series parallel network in figure.

Soln:



Here,

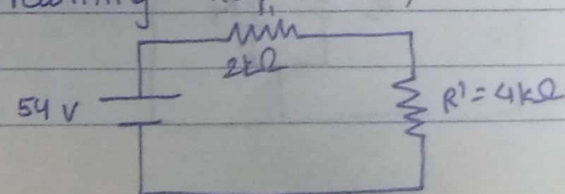
$R_1 = 2k\Omega$ $\quad R_2 = 12k\Omega$

$R_3 = 6k\Omega$ $\quad V = 54V$

Now,

$$R' = R_2 \| R_3 = \frac{R_2 R_3}{R_2 + R_3} = \frac{12 \times 6}{18} = 4k\Omega$$

So, rewriting the circuit,



So, $R_T = R_1 + R' = 2 + 4 = 6 k\Omega$.

(i): $I_T = \dfrac{V}{R_T} = \dfrac{54}{6} = 9mA$

$\cancel{I_x} = \cancel{I_T} \times \dfrac{\cancel{R_T}}{R_1} = \cancel{\dfrac{(9mA) \times 6}{2k}}$

$I_2 = I_T \times \dfrac{R_{eqT}}{R_2} = \dfrac{9mA \times 6}{12}$

$= 3mA.$

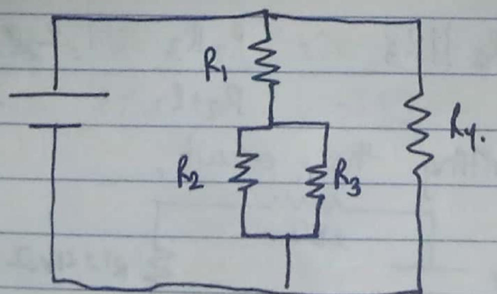
$\therefore I_1 = I_3 + I_2$

or, $I_2 = 9mA - 3mA$

$= 6mA$.

<Num.No 25>: Determine I_4, I_1, I_s and V_2.

Soln:



Here,

$R_1 = 6.8 k\Omega$ $\quad$ $R_2 = 18 k\Omega$

$R_3 = 2 k\Omega$ $\quad$ $R_4 = 8.2 k\Omega$

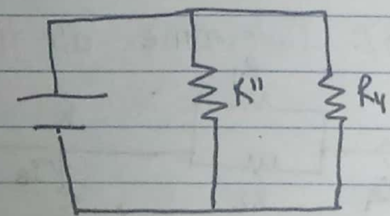
$V = 12V$.

Now,

(i): $R' = \dfrac{R_2 R_3}{R_2 + R_3} = \dfrac{18 \times 2}{18 + 2} = 1.8 k\Omega$

(ii): $R'' = R_1 + R' = 1.8 + 6.8 k\Omega = 8.6 k\Omega$

Rewriting circuit,



$R_T = \dfrac{R'' R_4}{R'' + R} = \dfrac{8.6 \times 8.2}{8.6 + 8.2} = 4.2 k\Omega$

So, $I_T = \dfrac{V}{R_T} = \dfrac{54}{4.2} = 2.85 mA$

(i): $I_4 = I_T \times \frac{R_T}{R_4} = \frac{2.85 \times 4.2}{8.2}$

$= 1.46\,mA$

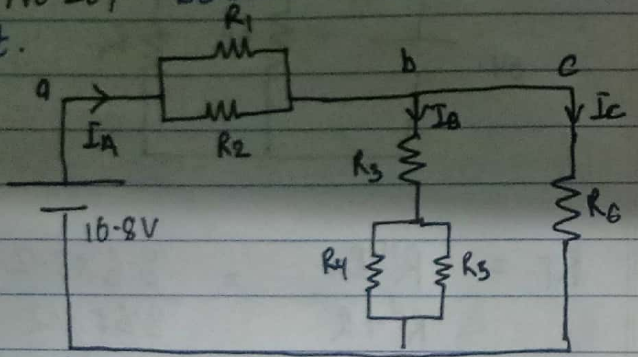
(ii): $I_1 = \cancel{I_T} \times \frac{\cancel{R_T}}{\cancel{R_1}} = \cancel{\frac{2.85 \times 4.2}{6.8}}$

$I_T - I_4 = 1.39\,mA.$

(iii): $V_2 = V \times \frac{R'}{R''} = \frac{12 \times 1.8}{8.6}$

$= 2.51\,V.$

<Num.No.267: Determine all the unknown current.

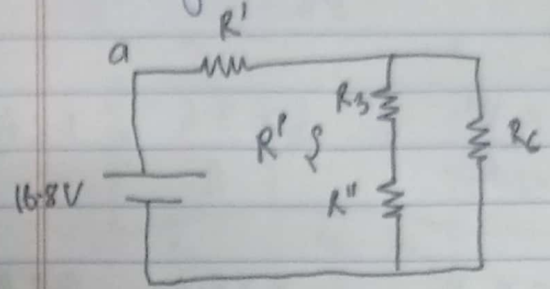


Soln: Here,

$R_1 = 9\Omega$ $R_3 = 4\Omega$ $R_5 = 3\Omega$

$R_2 = 6\Omega$ $R_4 = 6\Omega$ $R_6 = 3\Omega$

Rewriting the circuit,



$R' = \frac{9 \times 6}{9+6} = 3.6\Omega$

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

$R^P = R_3 + R'' = 6\Omega$

$R''' = R^P \| R_6 = \frac{R^P R_6}{R^P + R_6} = \frac{6 \times 3}{9} = 2\Omega.$

So, $R_T = 3.6 + 2 = 5.6\,\Omega$

Now,

i) $I_A = \frac{V}{R_T} = \frac{16.8}{5.6} = 3A$

ii) $I_1 = I_T \times \frac{R'}{R_1} = \frac{3 \times 3.6}{9} = 1.2A$

iii) $I_2 = I_T \times \frac{R'}{R_2} = \frac{3 \times 3.6}{6} = 1.8A$

We know,

$V_b = 3 \times 3.6 = 10.8\ V$

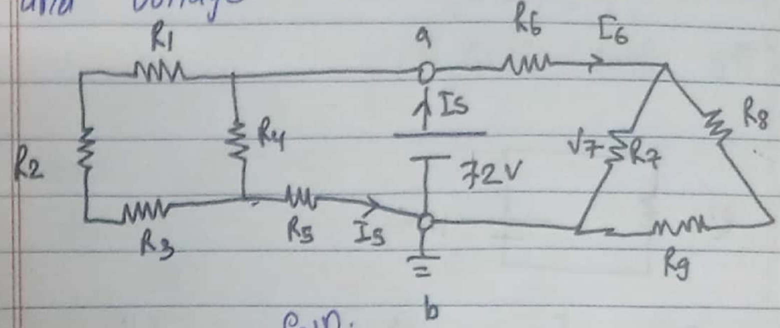
$V_{ab} = \cancel{4}\, V_a - V_b = 16.8 - 10.8 = 6\ V$

Since b and c are in parallel,

$I_B = \cancel{V_{ab}}\ \frac{V_b}{R^P} = \frac{6}{6} = 1\ A$

$I_c = \frac{V_c}{R_6} = \frac{6}{3} = 2\ A$

<Num.No.27>: Calculate the indicated current and voltage.



Soln:

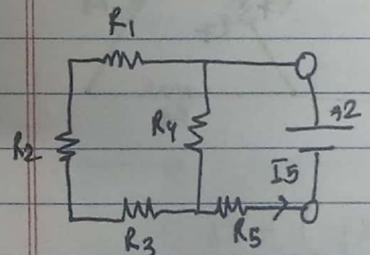
Given,

$R_1 = 4k\Omega$ $R_4 = 24k\Omega$ $R_7 = 9k\Omega$

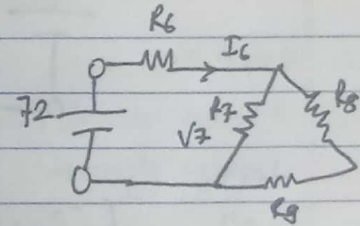
$R_2 = 8k\Omega$ $R_5 = 12k\Omega$ $R_8 = 3k\Omega$ $V = 72V$

$R_3 = 12k\Omega$ $R_6 = 12k\Omega$ $R_9 = 6k\Omega$

Let us divide the circuit into two parts:



(A)



(B)

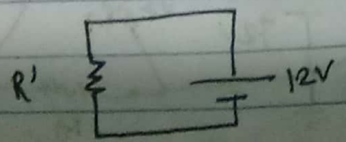
Taking circuit A,

$R' = ((R_1 + R_2 + R_3) \| R_4) + R_5$

$= \left(\frac{(R_1+R_2+R_3) \times R_4}{R_1+R_2+R_3+R_4}\right) + R_5$

$$= \left(\frac{24 \times 24}{24+24}\right) + 12 = 24\,k\Omega.$$

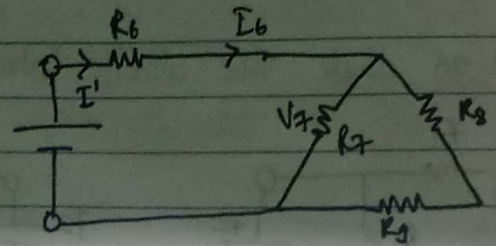
The final circuit A,



So,
$$I_5 = \frac{V}{R'} = \frac{72}{24}$$

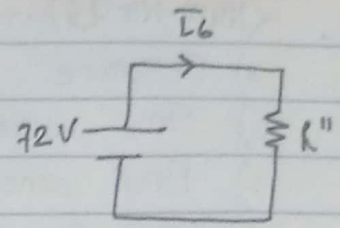
$$\therefore I_5 = 3mA$$

Taking circuit B,



Here,
$$R'' = ((R_8+R_9) \| R_7) + R_6$$
$$= \left[\frac{(R_8+R_9) \times R_7}{R_8+R_9+R_7}\right] + R_6$$
$$= \left[\frac{(3+6) \times 9}{3+6+9}\right] + 12$$
$$\therefore R'' = 16.5\,k\Omega$$

Rewriting circuit B,



Now,
$$\frac{1}{R_T} = \frac{1}{R'} + \frac{1}{R''}$$

or
$$\frac{1}{R_T} = \frac{24+16.5}{24 \times 16.5} \qquad \therefore R_T = 9.77\,\Omega$$

$$I_S = \frac{V}{R_T} = \frac{72}{9.77} = 7.35mA.$$

So,
$$I' = I_S - I_5$$
$$= 7.35 - 3 = 4.35\,mA = I_6$$

[$\because$ same current flows through series resistor]

~~from KCL, at a~~,

I

Now,
$$V_6 = I_6 R_6$$
$$= \cancel{5.22\,V}\ 52.2\,V$$

$$\therefore V_7 = 72 - 52.2 = 19.8\,V.$$

<Num.No.28>: For the network in figure,

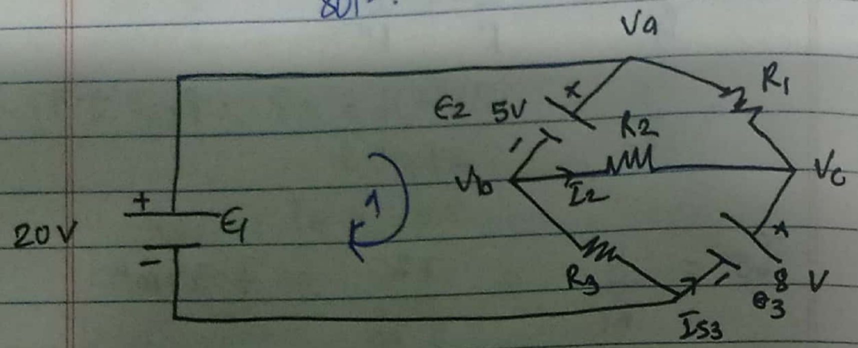
a) Determine V_a, V_b, V_c.

b) Find voltage V_{ac} & V_{bc}

c) Find current I_2

d) Find the source current I_{s3}.

Soln:



Given,

$R_1 = 10\Omega$ $\quad R_2 = 4\Omega$ $\quad R_3 = 5\Omega$

a):

i) $V_a = 20$ V [Voltage directly across E_1]

ii) $V_c = 8$ V [voltage directly across E_3]

Applying KVL in loop 1,

$+E_1 - E_3 - V_3 = 0$

Here, V_3 = voltage across $R_3 = V_b$

So,

$V_b = 20 - 5 = 15$ V

b): Using double subscript method,

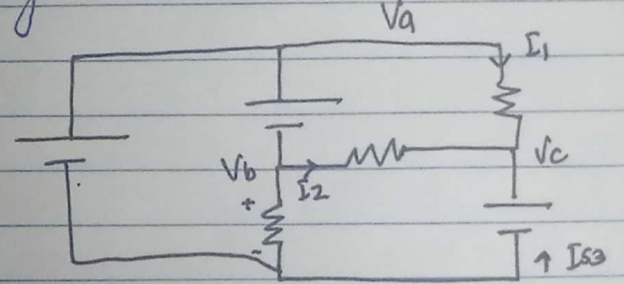
$V_{ac} = V_a - V_c = 20 - 5 = 15$ V

$V_{bc} = V_b - V_c = 15 - 8 = 7$ V

c): $I_2 = \frac{V_2}{R_2}$

$= \frac{V_{bc}}{R_2} = \frac{7}{4} = 1.75$ A

Redrawing the circuit,



Applying KCL at node C,

$\Sigma I_{in} = \Sigma I_{out}$

$I_1 + I_2 + I_3 = 0$

$\therefore I_{s3} = -I_1 - I_2$

$= -\frac{V_1}{R_1} - I_2 = -\frac{V_{ac}}{R_1} - I_2$

$= -1.2 - 1.75 = -\cancel{1}2.95$ A