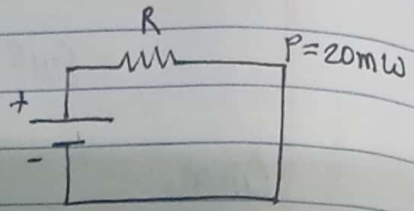
<Num-No-6>: Determine the current through a 5 kΩ resistor when the power dissipated is 20mW.

Soln:



Given,

Resistance (R) = 5 kΩ

= 5000 Ω

Power (P) = 20mW

$= 200 \times 10^{-3}$ W

Current (I) = ?

We know,

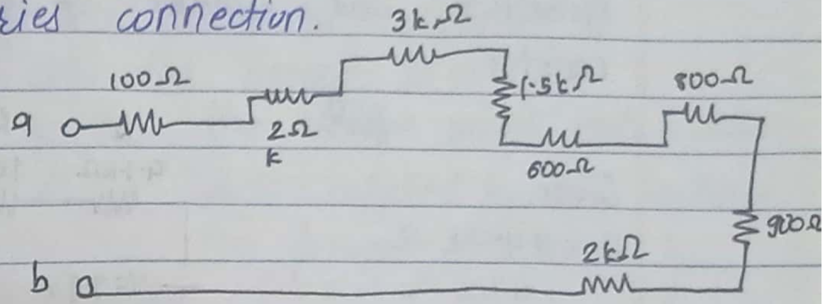
$P = I^2 R$

or, $\sqrt{\frac{P}{R}} = I$ or, $I = \sqrt{\frac{20 \times 10^{-3}}{5000}}$

$= 2 \times 10^{-3}$ A

$\therefore I = 2$ mA

<Num-No-7>: Determine the total resistance of series connection.

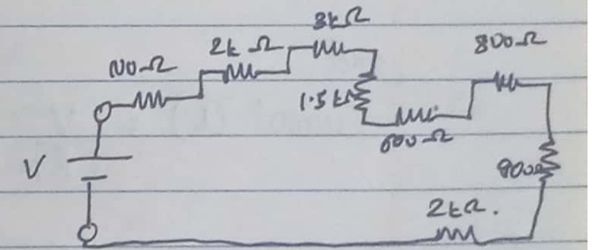


Soln:

In the diagram, we need to imaginary voltage source.

Since the same current flows through the circuit, the equivalent resistance is the sum of the resistance of all resistors.

Now,



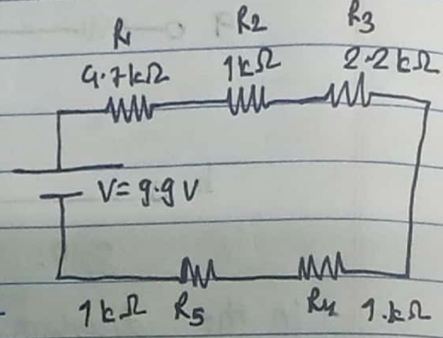
$R_T = R_1 + R_2 + R_3$
$+ R_4 + R_5 + R_6 +$
$R_7 + R_8$

$= 100\,\Omega + 2000\,\Omega + 3000\,\Omega + 1500\,\Omega + 600\,\Omega + 800\,\Omega + 900\,\Omega$
$+ 2000\,\Omega$

$= 10,900\,\Omega = 10.9\ k\Omega$

<Num-No-8>: Determine the total resistance and current of the series resistor.

Solⁿ.



Given,

$R_1 = 4.7k\Omega$

$= 4700\Omega$

$R_2 = 1k\Omega = 1000\Omega$

$R_3 = 2.2k\Omega = 2200\Omega$

$R_4 = 1k\Omega = 1000\Omega$

$R_5 = 1k\Omega = 1000\Omega$

Now,

Total resistance $(R_T) = R_1 + R_2 + R_3 + R_4 + R_5$

$= 9.9\,k\Omega = 9900\,\Omega$

and

Current $(I) = \dfrac{V}{R_T} = \dfrac{9.9}{9900} = 10^{-3}$ A

$\therefore I =$ 1mA

<Num-No-9>: For the series circuit,

i) Determine the total resistance R_T

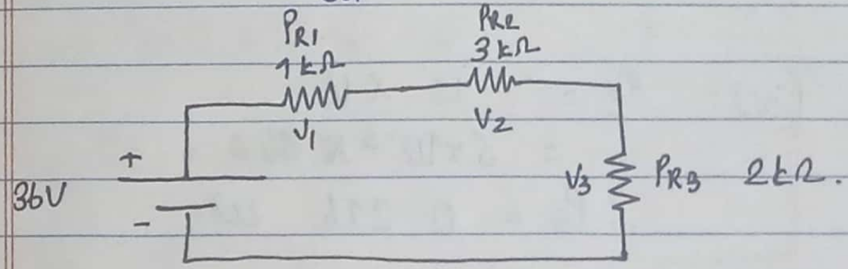
ii) Calculate the current I_s

iii) Determine the voltage across each resistor.

iv) Find the power supplied by the battery.

v) Determine the power dissipated by each resistor.

Solⁿ:



Solⁿ.

Given,

voltage (V) = 36 V

resistance $(R_1) = 1k\Omega$ Resistance $(R_2) = 3k\Omega$

resistance $(R_3) = 2k\Omega$

Now,

i) Total resistance $(R_T) = R_1 + R_2 + R_3 = 6\,k\Omega = 6000\Omega$

(ii) $V = I_s \times R_T$

or $I_s = \dfrac{36}{6000} = 6$ mA

$= 6 \times 10^{-3}$ A.

(iii): $V_1 = I_S \times R_1$

$= 6\times10^{-3} \times 1000 = 6\ V$

$V_2 = \cancel{6\times10}\ I_S \times R_2$

$= 6\times10^{-3} \times 3000 = 18\ V$

$V_3 = I_S \times R_3$

$= 6\times10^{-3} \times 2000 = 12\ V$

(iv): $P_E = I_S \times V$

$= 6\times10^{-3} \times 36$

$\therefore P_E = 0.216\ W$

(v): $P_{R1} = V_1^2/R_1$

$= (6)^2/1000 = 0.036\ W$

$P_{R2} = V_2^2/R_2$

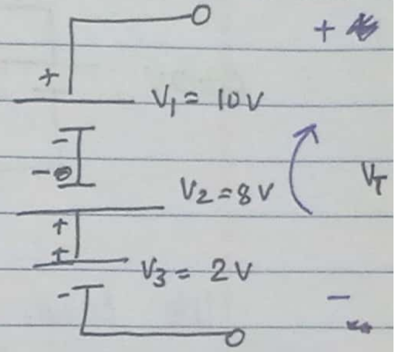
$= (18)^2/3000 = 0.108\ W$

$P_{R3} = V_3^2/R_3$

$= (12)^2/2000 = 0.072\ W$

<Num. No. 107: Determine the total voltage and polarity.

Soln:



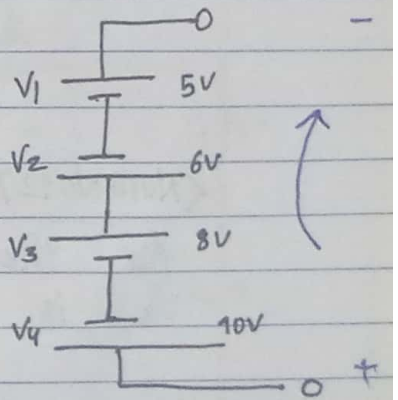
We know

$\Sigma V = 0$

or, $\cancel{V_3 - V_2 + V_1 = 0}$

or, $V_3 - V_2 + V_1 - V_T = 0$

$V_T = 4\ V$



$\Sigma V = 0$

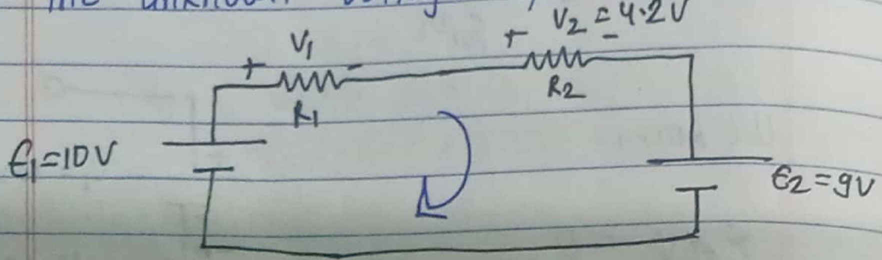
or, $-V_4 + V_3 - V_2 + V_1 + V_T = 0$

or, $-10 + 8 - 6 + 5 + V_T = 0$

$\therefore V_T = 3\ V$

< Marked in blue is our supposition >

<Num. No 11>: Use KVL to determine the unknown voltage for the circuit.



Solⁿ:

We know, from KVL,

$\sum_c V = 0$

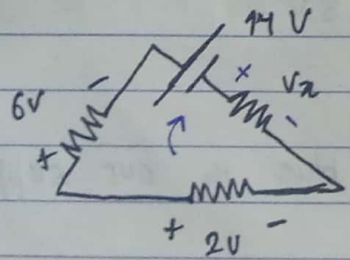
or, $+10 - V_1 - V_2 - 9 = 0$

or, $10 - 4.2 - 9 = 0$

$\therefore V = -3.2V$

<Num No 12>: Determine the voltage V_x for the circuit. Note polarity of V_x is not provided.

Solⁿ:



Using KVL,

we know,

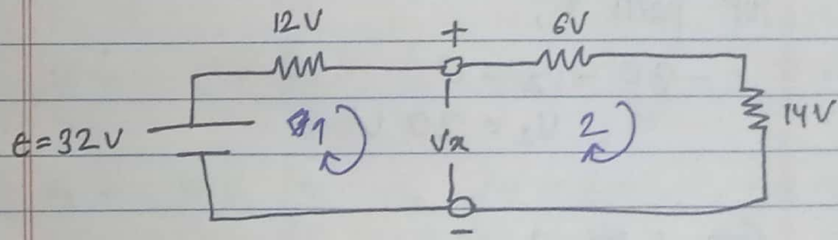
$\sum_c V = 0$

or, $-6 - 14 - V_x + 2 = 0$

$\therefore V_x = -18 V$

<Num. No-13>: Determine the unknown voltage for the circuit in figure.

Solⁿ:



By path 1,

$+32 - 12 - V_x = 0$

$\therefore V_x = 20V$

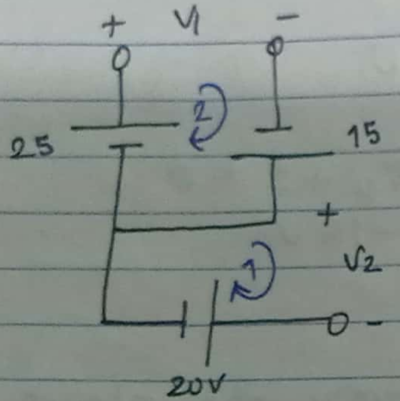
By path 2,

$-6 - 14 + V_x = 0$

$\therefore V_x = 20V$

<Num·No 14>: Determine V_1 and V_2 using KVL.

Soln:



Using KVL,

For path 1,

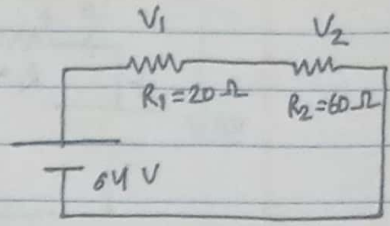
$$-20 - V_2 = 0$$
$$\therefore V_2 = 20\ V$$

For path 2,

$$25 - V_1 + 15 = 0$$
$$\therefore V_1 = 40\ V$$

<Num No 15>: Find the voltage V_1 and V_2 by using voltage divider rule.

Soln:



Given,
total voltage $(V) = 64\ V$
resistance $(R_1) = 20\ \Omega$
$(R_2) = 60\ \Omega$

Let total resistance $= R_T$.

$$\therefore R_T = R_1 + R_2 = 80\ \Omega$$

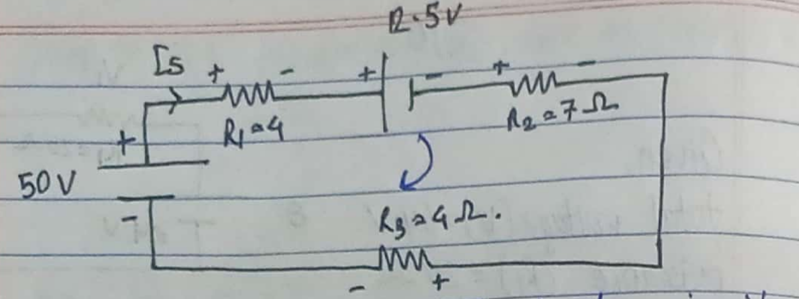
Using voltage divider rule,

$$V_1 = V \times \frac{R_1}{R_T} = 64 \times \frac{20}{80} = 16\ V$$

$$V_2 = V \times \frac{R_2}{R_T} = 64 \times \frac{60}{80} = 48\ V$$

<Num No 16>: Determine the current through the circuit and the voltage across the $7\ \Omega$ resistor for the network.

Soln:



Let Is be the current in the circuit.
Using KVL, we know,

$$\sum_{\uparrow} V = 0$$

or, $+50 - V_1 - 12.5 - V_2 - V_3 = 0$

or, $50 - 4 \times I_s - 12.5 - 7 \times I_s - 4 \times I_s = 0$

or, $37.5 - 15 I_s = 0$

$\therefore I_s = 2.5$ A

Now

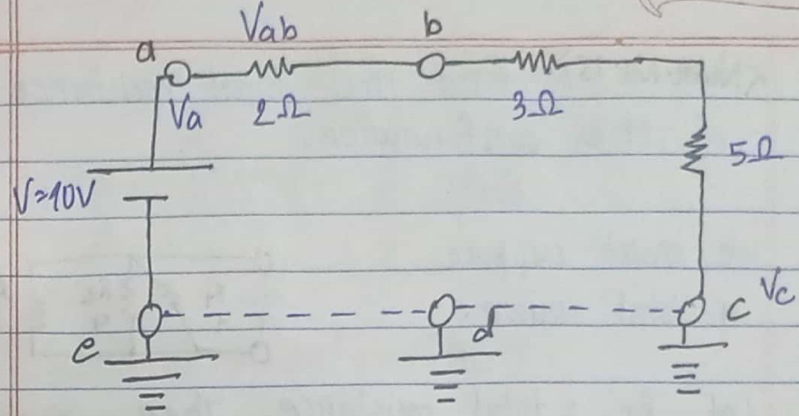
$V_2 = I_s \times R_2$

$= 2.5 \times 7$

$\therefore V_2 = 17.5$ V

<Num No: 17>: For the network
a) find V_{ab}
b) find V_b
c) calculate V_c

Soln:



Since points c, d, e is on the ground, we can connect them.

Total resistance $(R_T) = 3+2+5 = 10\,\Omega$

Using voltage single subscript and ~~[illegible]~~ double subscript rule.

(i): $V_a = 10$ V

(ii): $V_{ab} = R_1 \times \frac{V}{R_T} = \frac{2 \times 10}{10}$

$= 2$ V.

So,

$V_{ab} = V_a - V_b$

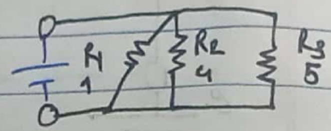
or, $2 = 10 - V_b$ $\quad \therefore V_b = 8$V

(iii): $V_c = 0$ ($\because$ grounded)

<Num. No. 18>: Find the total resistance of the configuration.

Sol^n:

We must suppose a total source.



Let R_T = total resistance. Then,

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

or $$\frac{1}{R_T} = 1 + \frac{1}{4} + \frac{1}{5} = 1.45$$

$$\therefore R_T = 0.689\ \Omega$$

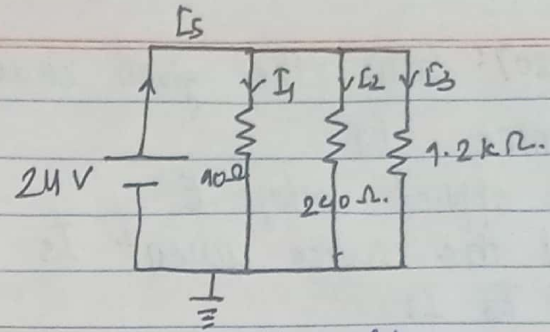
<Num. No. 19>: For the parallel network

a) find total resistance

b) calculate the source current

c) Determine the current through each resistor.

Sol^n:



Let R_T = total resistance.

Then,

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

or, $$\frac{1}{R_T} = \frac{1}{10} + \frac{1}{240} + \frac{1}{1200} = 0.10$$

i) $\therefore R_T = 9.48\ \Omega$

ii) Thus, $\frac{V}{R_T} = I_s$

$$I_s = \frac{24}{9.48} = 2.53\ A$$

iii) $I_1 = \frac{V}{R_1} = \frac{24}{10} = 2.4A$

$I_2 = \frac{V}{R_2} = \frac{24}{220} = 0.11\ A$

$I_3 = \frac{V}{R_3} = \frac{24}{1200} = 0.02\ A$

⟨Num. No. 20⟩: From the given circuit.

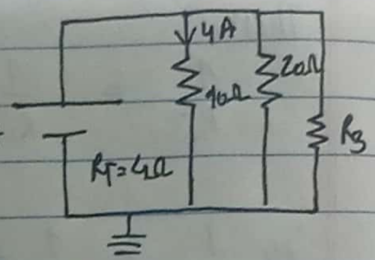
a) Determine R_3

b) Find applied voltage E

c) Find the source current I_s

d) Find ~~I_2~~ I_3.

Soln:



Let R_T be the total resistance.

(i): $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

or, $\frac{1}{R_3} = \frac{1}{4} - \frac{1}{10} - \frac{1}{20}$ $\therefore R_3 = 10\,\Omega$

(ii): We know, $V_1 = I_1 \times R_1$

or $E = 4 \times 10 = 40\,V$

(iii): $I_2 = \frac{E}{R_2} = \frac{40}{20} = 2\,A.$

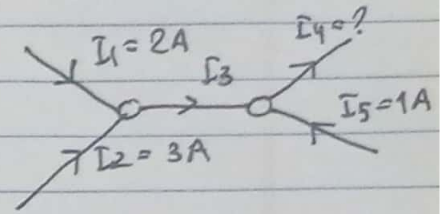
(iv): $I_3 = I_S - I_1 - I_2 = 10 - 2 - 4$

$\therefore I_3 = 4\,A.$

(v): $R_3 = \frac{E}{I_3} = \frac{40}{4} = 10\,\Omega$

⟨Num. No. 21⟩: Determine the current I_3 and I_4 in figure using KCL.

Soln:



Using KCL,

$I_1 + I_2 = I_3$

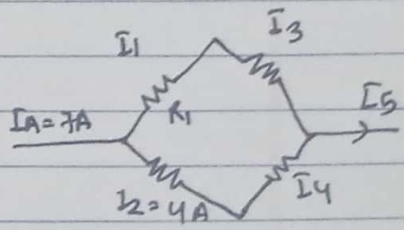
$\therefore I_3 = 5\,A$

$I_3 + I_5 = I_4$

$\therefore I_4 = 6\,A.$

⟨Num. No. 22⟩: Determine the unknown current.

Soln:



We know,

$I_A = I_1 + I_2$

$\therefore I_1 = 3\,A$

$I_3 = I_1 = 3\,A$

$I_4 = I_2 = 4\,A$

$\therefore I_3 + I_4 = I_5 = 7\,A.$