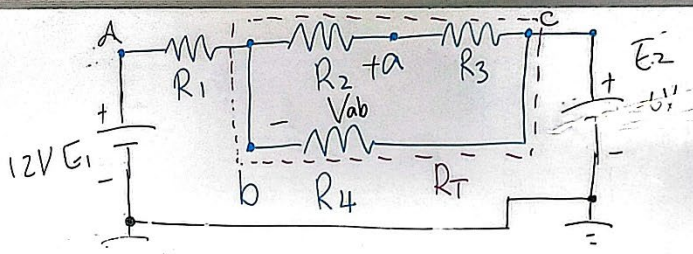
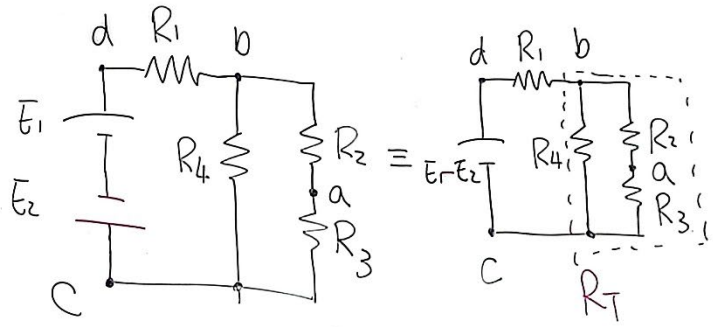


1° $V_{bc}=\frac{(R_4 // (R_2+R_3))}{R_1+(R_4 // (R_2+R_3))}(E_1-E_2)$

$=\frac{(30 // (10+50))}{10+(30 // (10+50))}(12-(-6))$

$=\frac{20}{10+20}\times 18$

$=12$



2° $V_{ab}=-V_{ba}$

$=-\frac{R_2}{R_2+R_3}\times V_{bc}$

$=-\frac{10}{10+50}\times 12$

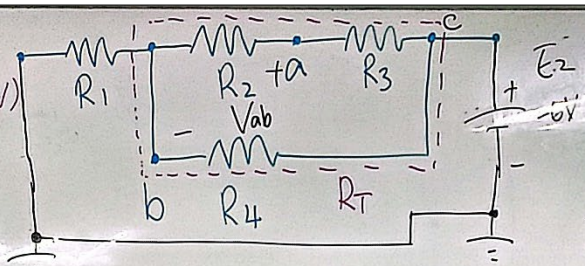
$=-2(V)$

3° $V_{ab}=V_{ab1}+V_{ab2}$

$=-\frac{4}{3}V+(-\frac{2}{3}V)$

$=-\frac{6}{3}V$

$=-2V$



$V_{b2}=\frac{R_1}{R_1+R_T}E_2=\frac{10}{10+20}\times(-6)=-2(V)$

$V_{a2}=\frac{R_2}{R_2+R_3}V_{cb}+V_b$

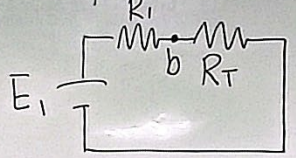
$V_{ab2}=\frac{R_2}{R_2+R_3}V_{cb2}=\frac{10}{10+50}\times(V_{c2}-V_{b2})$

($V_{c2}=E_2$)

$=\frac{1}{6}\times(-6-(-2))$

$=\frac{4}{6}=-\frac{2}{3}$

1° Analysis only E_1 provide power ($E_2=0V$)



$R_T=(R_2+R_3) // R_4$

$=(10+50) // 30$

$=60 // 30$

$=20(\Omega)$

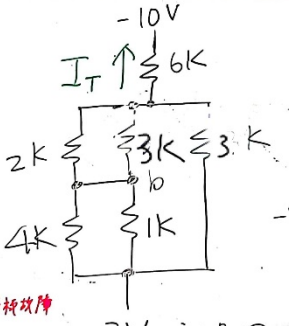
$V_{b1}=\frac{R_T}{R_1+R_T}\times E_1=\frac{20}{10+20}\times 12=8(V)$

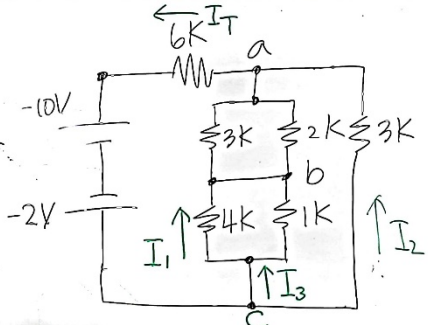
$V_{a1}=\frac{R_3}{R_2+R_3}\times V_{b1}=\frac{50}{10+50}\times 8=\frac{400}{60}=\frac{20}{3}(V)$

$V_{ab1}=V_{a1}-V_{b1}=\frac{20}{3}V-8V=-\frac{4}{3}V$

2° Analysis only E_2 provide power

($E_1=0V$)





1° $R_T=6K+(3K // ((3K // 2K)+(4K // 1K)))$

$=6K+(3K // (1.2K+0.8K))$

$=6K+(3K // 2K)$

$=6K+1.2K$

$=7.2K(\Omega)$

2° $I_T=-\frac{(-10V-(-2V))}{R_T}=\frac{-(-8V)}{7.2K\Omega}=1.11mA$

3° $I_2=\frac{(3K // 2K)+(4K // 1K)}{3K+(3K // 2K)+(4K // 1K)}I_-$

$=\frac{2K}{3K+2K}\times 1.11mA=0.444mA$

$I_1=\frac{1K}{4K+1K}\times I_3=\frac{1}{5}\times(I_T-I_2)$

$=\frac{1}{5}(1.11mA-0.444mA)=0.133mA$

4° $V_{ab}=V_{ac}-V_{bc}$

$=-I_2\cdot 3K-(-I_1)\cdot 4K$

$=-(.332-(-0.532)$

$=-0.8(V)$

2° $I_T = -\frac{(-10V-(-2V))}{R_T} = \frac{-(-8V)}{7.2k\Omega} = 1.11mA$

3° $I_2 = \frac{(3k//2k)+(4k//1k)}{3k+(3k//2k)+(4k//1k)} \cdot I_T$

$= \frac{2k}{3k+2k} \times 1.11mA = 0.444mA$

$I_1 = \frac{1k}{4k+1k} \times I_3 = \frac{1}{5} \times (I_T - I_2)$

$= \frac{1}{5}(1.11mA - 0.444mA) = 0.133mA$

4° $V_{ab} = V_{ac} - V_{bc}$

$= -I_2 \cdot 3k - (-I_1) \cdot 4k$

$= -(.332) - (-0.532)$

$= -0.8(V)$

a. $R_x = 0\Omega$

$V_b = \frac{0}{R_2+0} \times 10 = 0V$

$V_{ab} = V_a - V_b = 8V - 0V = 8V$

$I = \frac{10V}{250\Omega // (5k\Omega)}$

$= \frac{10V}{238\Omega}$

$= 0.042A$

b. $R_x = 15k\Omega$

$V_b = \frac{15k\Omega}{R_2+15k\Omega} \times 10V = \frac{15k\Omega}{20k\Omega} \times 10V = 7.5V$

$V_{ab} = V_a - V_b = 8V - 7.5V = 0.5V$

$I = \frac{10V}{250\Omega // (20k\Omega)}$

$= \frac{10V}{246.9\Omega}$

$= 0.0405A$

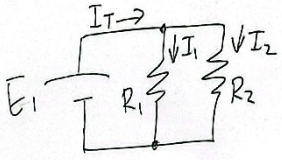
c. $R_x = \infty$

$V_b = \frac{\infty}{R_2+\infty} \times 10V = 10V$

$V_{ab} = 8V - 10V = -2V$

$I = \frac{10V}{250\Omega // (\infty)}$

$= \frac{10V}{250\Omega} = 0.04A$



$I_T = \frac{E}{(R_1 // R_2)} = \frac{100mV}{(25\Omega // 5\Omega)}$

$= \frac{100mV}{25 \cdot 125 \Omega} = 24mA$

$I_1 = \frac{R_2}{R_1+R_2} I_T = \frac{5}{25+5} \times 24mA = 4mA$

$I_2 = \frac{R_1}{R_1+R_2} I_T = \frac{25}{25+5} \times 24mA = 20mA$