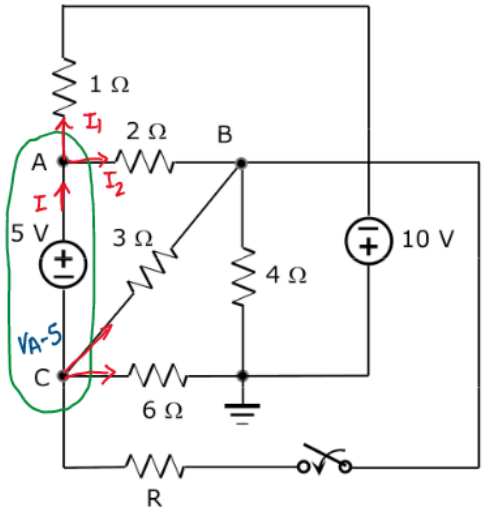
Examen 14 junio 2018.



$$\frac{V_A+10}{1}+\frac{V_A-V_B}{2}+\frac{V_A-5}{6}+\frac{V_A-5-V_B}{3}=0$$

$$\frac{V_B-V_A}{2}+\frac{V_B-V_A+5}{3}+\frac{V_B}{4}=0$$

$$V_A\left(1+\frac{1}{2}+\frac{1}{6}+\frac{1}{3}\right)-V_B\left(\frac{1}{2}+\frac{1}{3}\right)=-10+\frac{5}{6}+\frac{5}{3}$$

$$-V_A\left(\frac{1}{2}+\frac{1}{3}\right)+V_B\left(\frac{1}{2}+\frac{1}{3}+\frac{1}{4}\right)=-\frac{5}{3}$$

$$2V_A-0{,}833V_B=-7{,}5 \qquad V_A=-6{,}46\ \text{V}$$

$$-0{,}833V_A+1{,}083V_B=-1{,}67 \qquad V_B=-6{,}51\ \text{V}$$

$V_C=-11{,}46$ V
$V_{BC}=4{,}95$ V

Potencias de las resistencias:

$$P_1=\frac{(V_A+10)^2}{1}=12{,}53\ \text{W}$$

$$P_2=\frac{(V_A-V_B)^2}{2}=0{,}00125\ \text{W}$$

$$P_3=\frac{(V_B-V_C)^2}{3}=8{,}17\ \text{W}$$

$$P_4=\frac{(V_B)^2}{4}=10{,}6\ \text{W}$$

$$P_6=\frac{(V_C)^2}{6}=21{,}9\ \text{W}$$

Total 53,2 W

Potencias de las fuentes:

$$I_2=\frac{V_A-V_B}{2}=\frac{-6{,}41+6{,}51}{2}=0{,}025\ \text{A}$$

$$I_1=\frac{V_A+10}{1}=3{,}54\ \text{A}$$

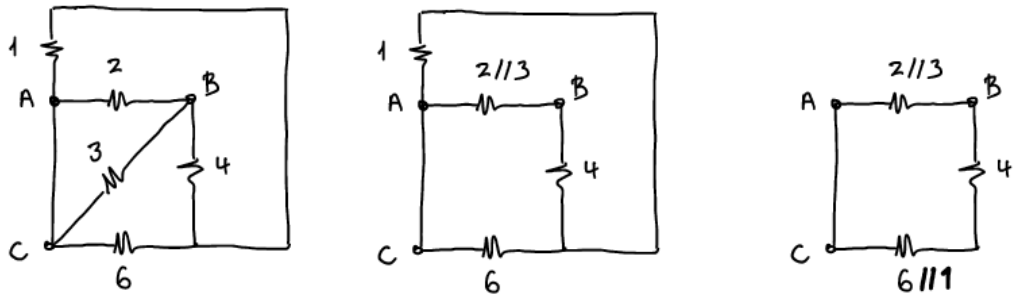
$I = I_1 + I_2 = 3{,}54 + 0{,}025 = 3{,}57$ A

$P_5 = V \cdot I = 5 \cdot 3{,}57 = 17{,}8$ W

$P_{10} = 10 \cdot I = 10 \cdot 3{,}54 = 35{,}4$ W

Total 53,2 W

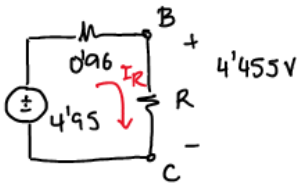
Resistencia entre B y C:



$R_{BC} = (4 + 6//1)//2//3 = 0{,}96\ \Omega$

$V_{th} = V_{BC} = 4{,}95$ V

$10\%\ V_{th} = 0{,}495$; $V'_{BC}min = 4{,}455$ V

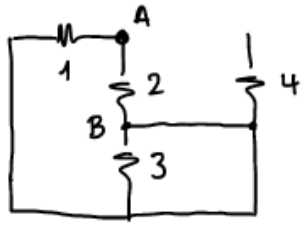


$I_R = \frac{4{,}95-4{,}455}{0{,}96} = 0{,}516$

$R_{min} = \frac{4{,}455}{0{,}516} = 8{,}63\Omega$

Si $R > R_{min}$, la caída de tensión es menor del 10%.

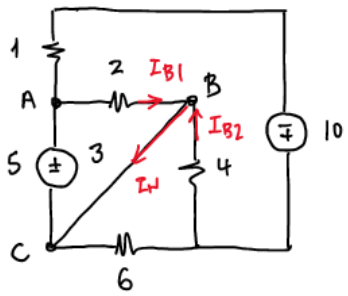
La resistencia de Thévenin también se puede calcular a partir de la intensidad de cortocircuito:



La resistencia de 3Ω está cortocircuitada y la resistencia de 4Ω está desconectada del circuito por lo que:

$R_{th} = 1//2 = \frac{2}{3} = 0{,}67\Omega$

Entonces $R_{th}//R = 0{,}5$; $\frac{R \cdot 0{,}67}{R+0{,}67} = 0{,}5 \rightarrow R = 2\Omega$



$$\frac{V_A+10}{1}+\frac{V_A-V_A+5}{2}+\frac{V_A-5-V_A}{2}+\frac{V_A-5}{6}+\frac{V_A-5}{4}=0$$

$$V_A\left(1+\frac{1}{6}+\frac{1}{4}\right)=-10+\frac{5}{6}+\frac{5}{4} \qquad V_A=-5{,}59\ \text{V}$$

$$V_B=-10{,}59\ \text{V}$$

$$I_{1B}=\frac{V_A-V_B}{2}=\frac{5}{2}=2{,}5\ \text{A}$$

$$I_{2B}=\frac{0-V_B}{4}=\frac{10{,}59}{4}=2{,}648\ \text{A}$$

$$I_N=5{,}15\ \text{A}\ ;\ \ R_{th}=\frac{V_{th}}{I_N}=\frac{4{,}95}{5{,}15}=0{,}96\ \Omega$$