UNIVERSIDAD DE LAS FUERZAS ARMADAS - ESPE

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NRC: 4867

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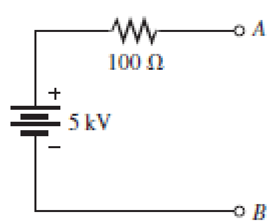
Trabajo Extra.

Solución de los ejercicios pares (sin respuesta) del Capítulo 8: Libro: Principios de Circuitos Eléctricos – Floyd (Octava Edición)

SECCIÓN 8-3 Conversiones de fuente

1. **Convierta las fuentes de voltaje prácticas de la figura 8-67 en fuentes de corriente equivalentes.**

   (a)



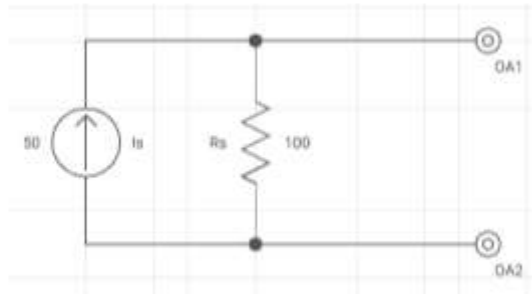
(a)

$$R_s = 100\Omega$$

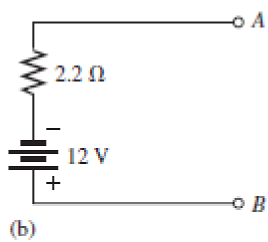
$$V_s = 5\ kV$$

$$5k\left(\frac{1000\ V}{1\ kV}\right) = 5000\ V$$

$$I_s = \frac{V_s}{R_s} = \frac{5000\ V}{100\ \Omega} = 50\ A$$



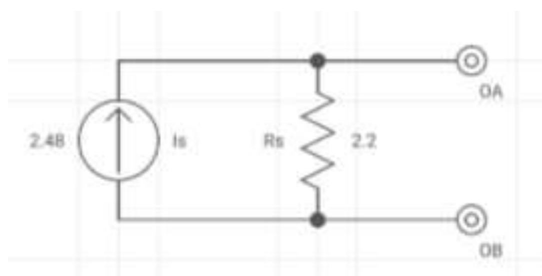
(b)



$$R_s = 2.2\ \Omega$$

$$V_s = 12\ kV$$

$$I_s = \frac{V_s}{R_s} = \frac{12\ V}{2.2\ \Omega} = 2.48\ A$$



2. **Trace los circuitos equivalentes de fuentes de voltaje y corriente para la batería tipo D del problema 3.**

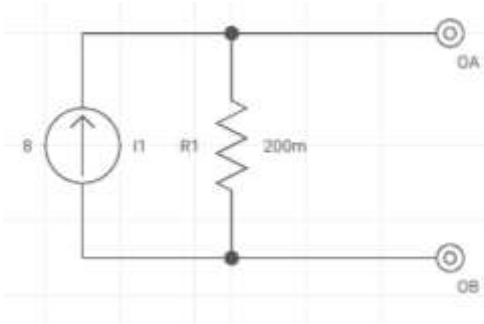
$$I_s = 8\ A$$

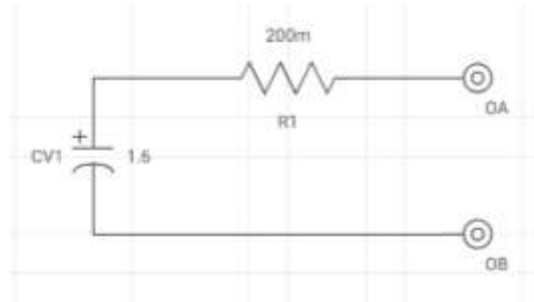
$$V_s = 1.6\ V$$

$$R_s = \frac{V_s}{I_s} = \frac{1.6\ V}{8\ A} = 0.2\ \Omega$$

$$R_s = 0.2\ \Omega \left(\frac{1000\ m\Omega}{1\ \Omega}\right) = 200\ m\Omega$$

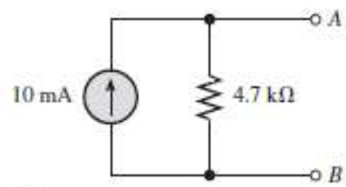
Circuito Fuente de Corriente. **Circuito Fuente de Voltaje**





3. **Convierta las fuentes de corriente prácticas de la figura 8-68 en fuentes de voltajes equivalentes.**

(a)

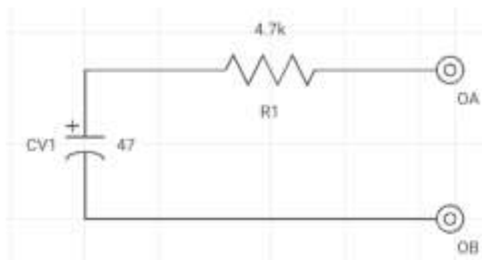


(a)

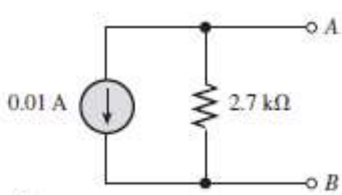
$$\boldsymbol{I_s = 10\ mA}$$

$$\boldsymbol{R_s = 4.7\ k\Omega}$$

$$\boldsymbol{V_s = I_s * R_s = 10\ mA\ (4.7\ k\Omega) = 47\ V}$$



(b)



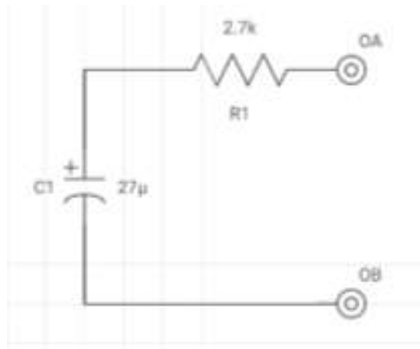
(b)

$$\boldsymbol{I_s = 0.01\ A}$$

$$\boldsymbol{R_s = 2700\ \Omega}$$

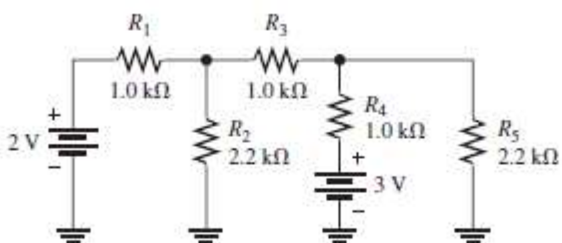
$$2.7\ k\Omega \left(\frac{1000\ \Omega}{1\ k\Omega}\right) = 2700\ \Omega$$

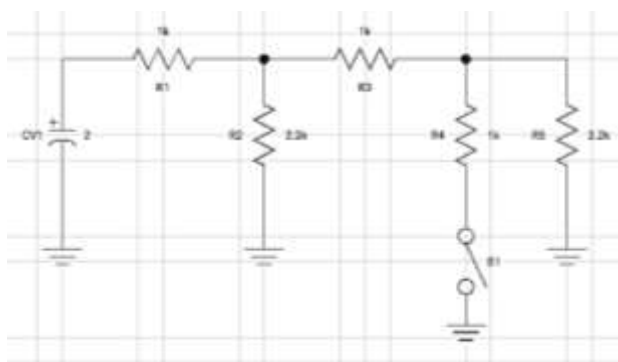
$$V_s = I_s * R_s = 0.01\ A\ (2700\ \Omega) = 27\ V$$



SECCIÓN 8-4 El teorema de superposición

4. **Use el teorema de superposición para determinar la corriente a través, y el voltaje entre, los extremos de la rama R_2 de la figura 8-69.**





$$R_T = R_1 + R_2 \| R_3$$

$$R_1 = 1.0\ k\Omega \left(\frac{1000\ \Omega}{1\ k\Omega}\right) = 1000\ \Omega$$

$$R_2 = 2.2\ k\Omega \left(\frac{1000\ \Omega}{1\ k\Omega}\right) = 2200\ \Omega$$

$$R_3 = 1.0\ k\Omega\ \left(\frac{1000\ \Omega}{1\ k\Omega}\right) = 1000\ \Omega$$

$$R_4 = 1.0\ k\Omega\ \left(\frac{1000\ \Omega}{1\ k\Omega}\right) = 1000\ \Omega$$

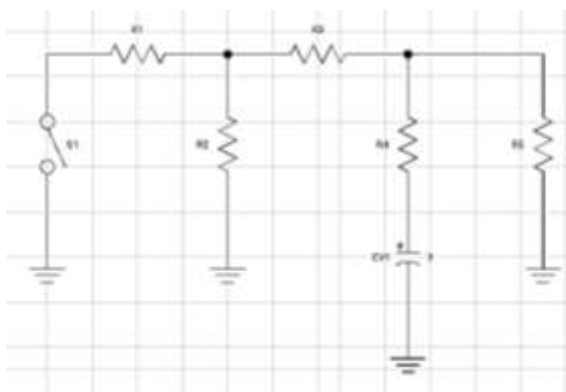
$$R_5 = 2.2\ k\Omega\ \left(\frac{1000\ \Omega}{1\ k\Omega}\right) = 2200\ \Omega$$

$$R_T = 1000\ \Omega + \frac{2200\ \Omega\ (1000\Omega)}{2200\ \Omega + 1000\ \Omega}$$

$$R_T = 1687.5\ \Omega$$

$$I_T = \frac{2\ V}{1687.5\ \Omega} = 1185\ uA$$

$$I_1 = 1185\ uA\left(\frac{1000\ \Omega}{3200\ \Omega}\right) = 370.31\ uA$$



$$R_T = R_4 + R_5 \| R_3$$

$$R_T = 1000\ \Omega + \frac{2200\ \Omega\ (1000\Omega)}{2200\ \Omega + 1000\ \Omega}$$

$$R_T = 1687.5\ \Omega$$

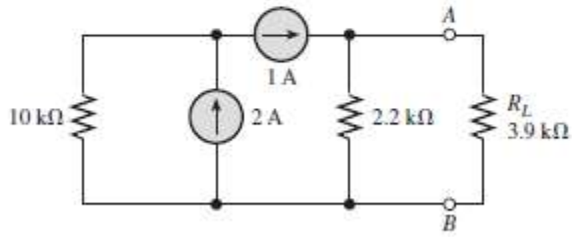
$$I_T = \frac{3\ V}{1687.5\ \Omega} = 1778\ uA$$

$$I_2 = 1778\ uA\left(\frac{1000\ \Omega}{3200\ \Omega}\right) = 556\ uA$$

$$I_1 = 556\ uA\left(\frac{1000\ \Omega}{3200\ \Omega}\right) = 173.75\ uA$$

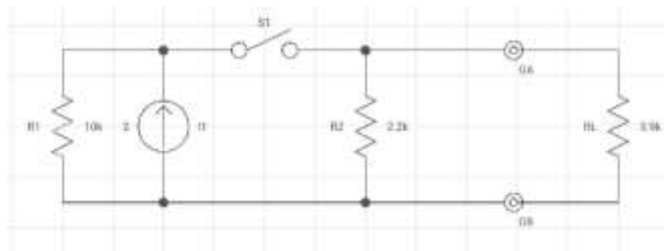
$$I_1 = I_{1(S1)} + I_{1(S2)} = 370.31\ uA + 173.75\ uA = 544.06\ uA$$

5. **Con el teorema de superposición, determine la corriente de carga en cada uno de los circuitos mostrados en la figura 8-71.**
(a)

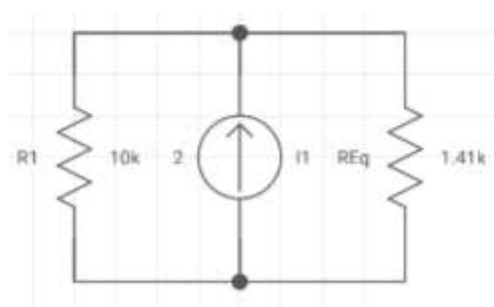


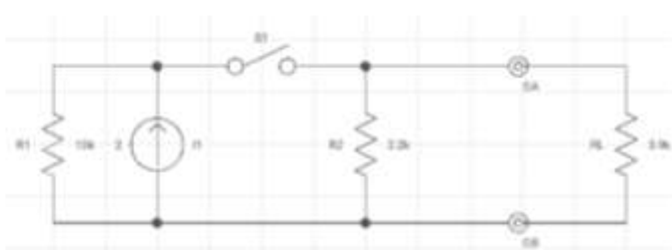
(a)

$$\boldsymbol{R_T = \frac{1}{10} + \frac{1}{3.9} = 0.126k\Omega}$$

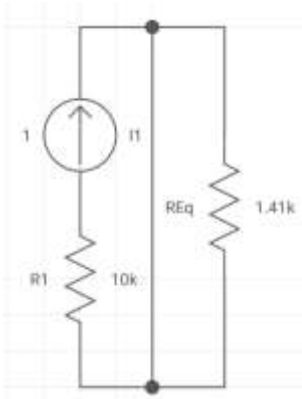


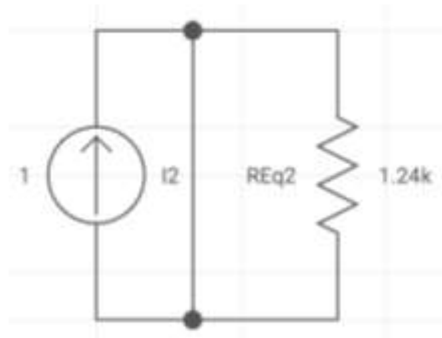
$$\boldsymbol{I_1 = \frac{R_T}{R_1}\, I = \frac{126\Omega}{10000\Omega} * 2A = 0.025\ A}$$
$$\boldsymbol{I_2 = \frac{R_T}{R_{eq}}\, I = \frac{126\Omega}{1410\Omega} * 2A = 0.179\ A}$$
$$\boldsymbol{I_{T1} = I_1 + I_2 = 0.025\ A + 0.179A = 0.2\ A}$$



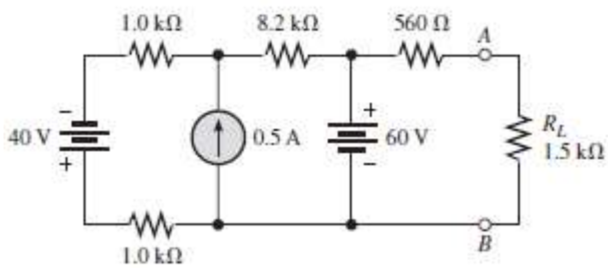


$$R_{eq1}=\frac{R_1R_2}{R_1{+}R_2}=\frac{2.2\ k\Omega*3.9\ k\Omega}{2.2\ k\Omega+3.9\ k\Omega}=1.41\ k\Omega$$
$$R_{eq2}=\frac{R_{eq1}R_3}{R_{eq1}{+}R_3}=\frac{1.41\ k\Omega*10\ k\Omega}{1.41\ k\Omega+10\ k\Omega}=1.24\ k\Omega$$
$$I_{T2}=\frac{R_{eq2}}{R_{eq2}}I_1=1\ A$$
$$I_T=0.2A+1A=1.2A$$





(b)



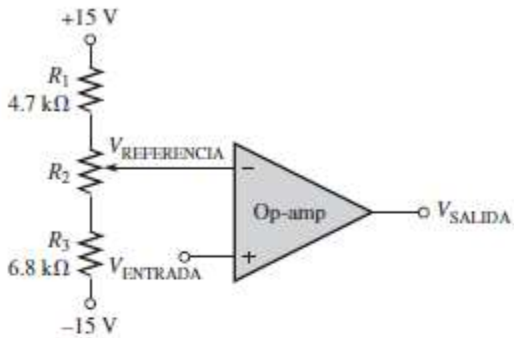
(b)

$$Req1=2k\Omega$$
$$R_{eq2}=1.5+0.56=2.06k\Omega$$
$$R_{eq3}=\frac{Req2*8.2}{Req2+8.2}=\frac{2.06*8.2}{2.06+8.2}=1.25k\Omega$$

$$R_T=\frac{Req1*Req3}{Req1+Req3}=\frac{2*1.25}{2+1.25}=0.77\ k\Omega$$
$$I_1=\frac{RT}{Req1}=\frac{770}{2000}=0.19A$$
$$I_2=\frac{RT}{Req2}=\frac{770}{1250}=0.31A$$
$$I_{T1}=0.19+0.31=0.5A$$
$$Req1=2k\Omega$$
$$R_{eq2}=1.5+0.56+8.2=10.26k\Omega$$
$$R_T=\frac{Req1*Req2}{Req1+Req2}=\frac{2*10.26}{2+10.26}=1.67k\Omega$$

$$I_1 = \frac{RT}{Req1} = \frac{1670}{2000} = 0.42A$$
$$I_2 = \frac{RT}{Req2} = \frac{1670}{1250} = 0.08A$$
$$I_{T1} = 0.42 + 0.08 = 0.5A$$
$$I_{TS} = 0.5 + 0.5 = 1A$$

6. **Repita el problema 11 si R_2 es de 10 kΩ.**

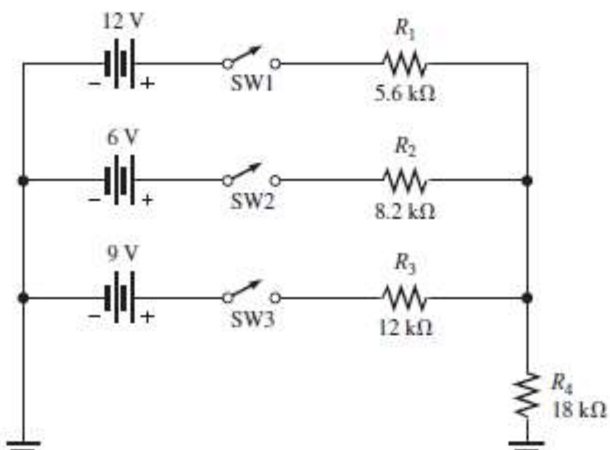


$$R_2 = 10\ k\Omega$$
$$R_T = 10\ k\Omega + 1.7\ k\Omega + 6.8\ k\Omega = 18.5\ k\Omega$$
$$V_{R2} = \frac{10\ k\Omega}{18.5\ k\Omega} * 15\ V = 8.10\ V$$
$$\pm 8.10\ V\ \ en\ \ V_e\ \ y\ \ V_R$$

Se dice que $V_e = 2.52\ V$

$$V_{max} = 2.52\ V + 8.10\ V = 10.62\ V$$
$$V_{min} = 2.52\ V - 8.10\ V = -5.58\ V$$

7. **Los interruptores mostrados en la figura 8-74 se cierran en secuencia, SW1 primero. Determine la corriente a través de R_4 después del cierre de cada interruptor.**



$$R_{eq1} = \frac{R_1 R_2}{R_1 + R_2} = \frac{5.6\ k\Omega * 8.2\ k\Omega}{5.6\ k\Omega + 8.2\ k\Omega} = 3.33\ k\Omega$$

$$R_T = R_{eq1} + R_3||R_4 = 3.33\ k\Omega + \frac{12\ k\Omega * 18\ k\Omega}{30\ k\Omega} = 10.53\ k\Omega$$

$$10.53\ k\Omega\left(\frac{1000\ \Omega}{1\ k\Omega}\right) = 10530\ \Omega$$

$$I_T = \frac{V_{S1}}{R_{T(S1)}} = \frac{12\ V}{10530\ \Omega} = 1.14 * 10^{-3}\ A$$

$$I_{1(S1)} = I_T\left(\frac{R_3}{R_3 + R_4}\right) = 1.14 * 10^{-3} A\left(\frac{12\ k\Omega}{30\ k\Omega}\right) = 4.56 * 10^{-4}\ A$$

$$R_T = 10.53\ k\Omega$$

$$I_T = \frac{V_{S1}}{R_{T(S1)}} = \frac{6\ V}{10530\ \Omega} = 0.57\ A$$

$$I_{1(S2)} = I_T\left(\frac{R_3}{R_3 + R_4}\right) = 0.57\ A\left(\frac{12\ k\Omega}{30\ k\Omega}\right) = 0.228\ A$$

$$R_T = R_3 + R_4||R_{eq1} = 12\ k\Omega + \frac{3.33\ k\Omega * 18\ k\Omega}{3.33\ k\Omega + 18} = 14.51\ k\Omega$$

$$I_T = \frac{V_{S1}}{R_{T(S1)}} = \frac{9\ V}{14510\ \Omega} = 6.077 * 10^{-4}\ A$$

$$I_{1(S3)} = I_T\left(\frac{R_{eq1}}{R_{eq1} + R_4}\right) = 6.077 * 10^{-4} A\left(\frac{3.33\ k\Omega}{21.33\ k\Omega}\right) = 9.48 * 10^{-5}\ A$$

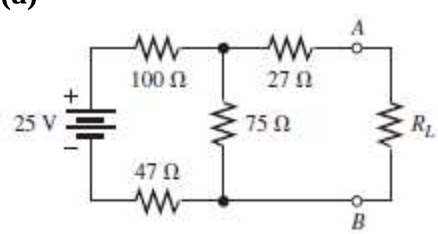
$$I_1 = I_{1(S1)} + I_{1(S2)} + I_{1(S3)}$$

$$I_1 = 4.56 * 10^{-4}\ A + 0.228\ A + 9.48 * 10^{-5}\ A$$

$$I_1 = 0.2285\ A$$

SECCIÓN 8-5 Teorema de Thevenin

8. **Para cada uno de los circuitos de la figura 8-76, determine el equivalente de Thevenin como se ve desde las terminales A y B.**
   (a)



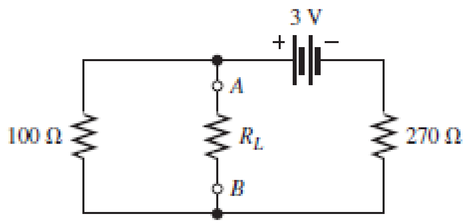
(a)

$$R_{eq1} = \frac{47\ \Omega * 75\ \Omega}{47\ \Omega + 75\ \Omega} = 29.37\ \Omega$$

$$R_{eq2} = \frac{100\ \Omega * 29.37\ \Omega}{100\ \Omega + 29.37\ \Omega} + 27\ \Omega = 49.7\ \Omega$$

$$R_{TH} = 49.7\ \Omega$$

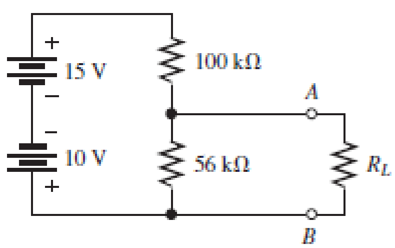
(b)



(b)

$$R_{eq1} = \frac{100\ \Omega * 270\ \Omega}{100\ \Omega + 270\ \Omega} = 72.97\ \Omega$$
$$R_L = R_{TH} = R_{eq1} = 72.97\ \Omega$$

(c)

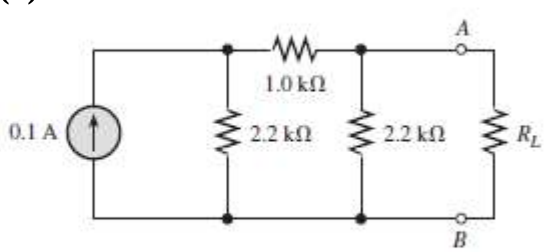


(c)

$$R_{eq1} = \frac{100\ k\Omega * 56\ k\Omega}{100\ k\Omega + 56\ k\Omega} = 35.9\ k\Omega$$

$$R_L = R_{TH} = R_{eq1} = 35.9\ k\Omega$$

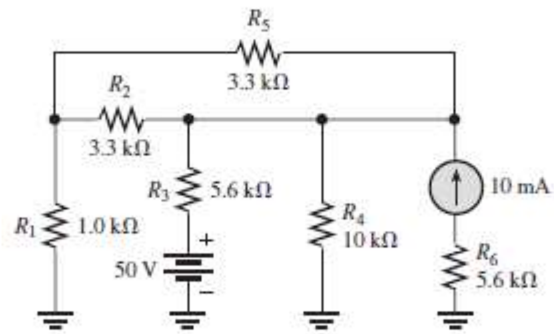
(d)

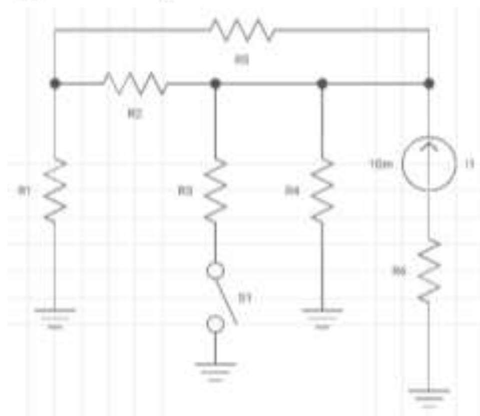


(d)

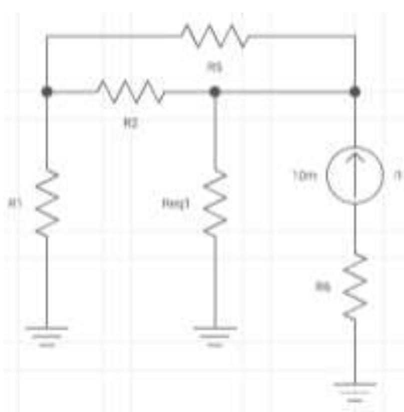
$$R_{eq1} = \frac{2.2k\Omega * \ 1\ k\Omega}{2.2\ \ k\Omega + 1\ k\Omega} = 0.6875\ k\Omega$$
$$R_{eq2} = \frac{0.6875\ k\Omega * 2.2\ k\Omega}{0.6875\ k\Omega + 2.2\ k\Omega} = 0.524\ \ k\Omega$$
$$R_{TH} = R_{eq2} = 0.524\ \ k\Omega$$

9. Con el teorema de Thevenin, determine el voltaje entre los extremos de R_4 en la figura 8-78.

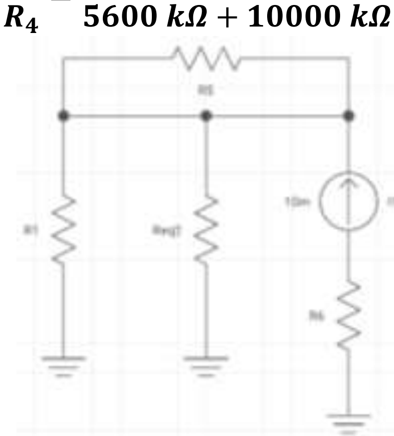




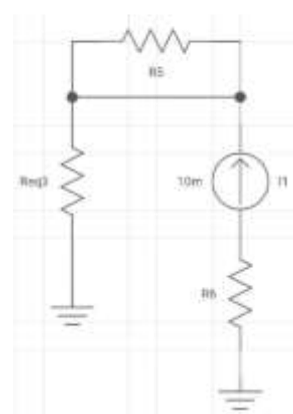
$$R_{eq1} = \frac{R_3 * R_4}{R_3 + R_4} = \frac{5600\ k\Omega * 10000\ k\Omega}{5600\ k\Omega + 10000\ k\Omega} = 3589.74\ k\Omega$$

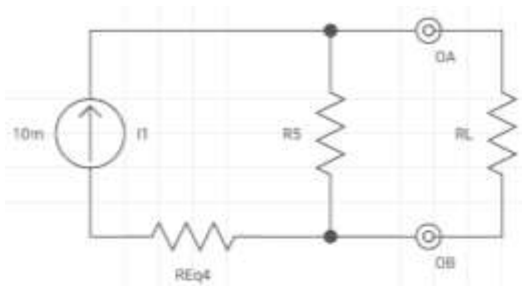


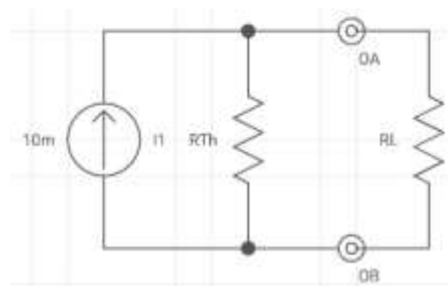
⇒



⇒







$$R_{eq2} = R_{eq1} + R_2 = 3.59\ k\Omega + 3.3\ k\Omega = 6.89\ k\Omega$$

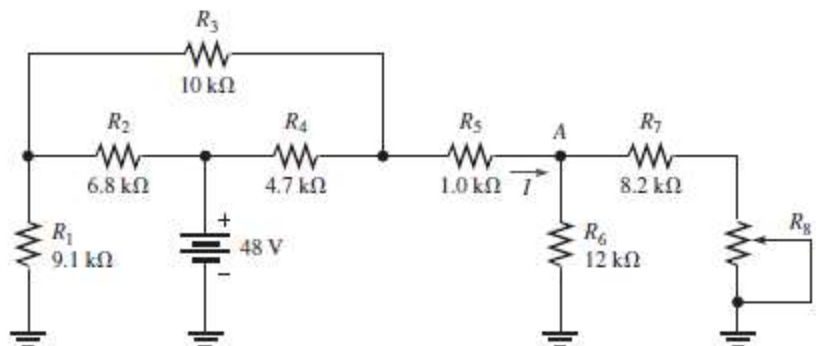
$$R_{eq3} = \frac{R_1 * R_{eq2}}{R_1 + R_{eq2}} = \frac{1\ k\Omega * 6.89\ k\Omega}{1\ k\Omega + 6.89\ k\Omega} = 0.87\ k\Omega$$

$$R_{eq4} = R_{eq3} + R_6 = 0.87\ k\Omega + 5.6\ k\Omega = 6.47\ k\Omega$$

$$R_{TH} = \frac{R_5 * R_{eq4}}{R_5 + R_{eq4}} = \frac{3.3\ k\Omega * 6.47\ k\Omega}{3.3\ k\Omega + 6.47\ k\Omega} = 2.19\ k\Omega$$

$$V_{R4} = \frac{R_4}{R_4 + R_{TH}} V_{TH} = \frac{10\ k\Omega}{10\ k\Omega + 2.19\ k\Omega} * 50\ V = 41.02\ V$$

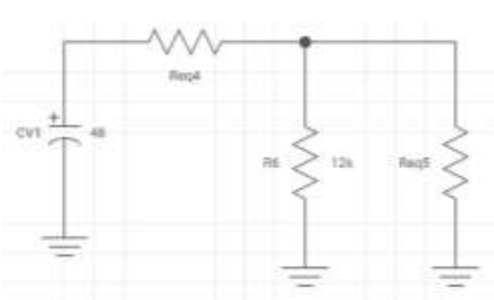
10. Determine la corriente que se dirige al punto A cuando R_8 es de 1.0 $k\Omega$, 5 $k\Omega$ y 10 $k\Omega$ en la figura 8-80.

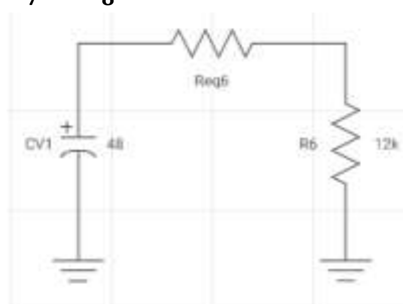


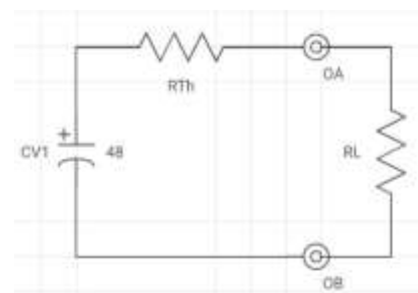
$$R_{eq1} = \frac{R_1 * R_2}{R_1 + R_2} + R_3 = \frac{9.1\ k\Omega * 6.8\ k\Omega}{9.1\ k\Omega + 6.8\ k\Omega} + 10\ k\Omega = 13.9\ k\Omega$$

$$R_{eq2} = \frac{R_{eq1} * R_4}{R_{eq1} + R_4} + R_5 = \frac{13.9\ k\Omega * 4.7\ k\Omega}{13.9\ k\Omega + 4.7\ k\Omega} + 1\ k\Omega = 4.51\ k\Omega$$

$$R_{eq3} = R_7 + R_8 = 8.2\ k\Omega + 1\ k\Omega = 9.2\ k\Omega$$







$$R_{eq4} = \frac{R_{eq2} * R_{eq3}}{R_{eq2} + R_{eq3}} = \frac{4.51\ k\Omega * 9.2\ k\Omega}{4.51\ k\Omega + 9.2\ k\Omega} = 3.03\ k\Omega$$

$$R_{TH} = R_{eq4} + R_6 = 3.03\ k\Omega + 12\ k\Omega = 15.03\ k\Omega$$

$$V_{TH} = V_S = 48\ V$$

$$V_{R6} = \frac{R_6}{R_6 + R_{TH}} * V_{TH} = \frac{12\ k\Omega}{12\ k\Omega + 15.03\ k\Omega} * 48\ V = 21.31\ V$$

$$I_6 = \frac{V_{R6}}{R_6} = \frac{21.31\ V}{12000\ \Omega} = 1.78 * 10^{-3} A$$

Cuando $R_8 = 10k\Omega$

$$R_{eq3} = R_7 + R_8 = 8.2\ k\Omega + 10\ k\Omega = 18.2\ k\Omega$$

$$R_{eq4} = \frac{R_{eq2} * R_{eq3}}{R_{eq2} + R_{eq3}} = \frac{4.51\ k\Omega * 18.2\ k\Omega}{4.51\ k\Omega + 18.2\ k\Omega} = 3.61\ k\Omega$$

$$R_{TH} = R_{eq4} + R_6 = 3.61\ k\Omega + 12\ k\Omega = 15.61\ k\Omega$$

$$V_{TH} = V_S = 48\ V$$

$$V_{R6} = \frac{R_6}{R_6 + R_{TH}} * V_{TH} = \frac{12\ k\Omega}{12\ k\Omega + 15.61\ k\Omega} * 48\ V = 20.86\ V$$

$$I_6 = \frac{V_{R6}}{R_6} = \frac{20.86\ V}{12000\ \Omega} = 1.738 * 10^{-3} A$$

Cuando $R_8 = 5k\Omega$

$$R_{eq3} = R_7 + R_8 = 8.2\ k\Omega + 5\ k\Omega = 13.2\ k\Omega$$

$$R_{eq4} = \frac{R_{eq2} * R_{eq3}}{R_{eq2} + R_{eq3}} = \frac{4.51\ k\Omega * 13.2\ k\Omega}{4.51\ k\Omega + 13.2\ k\Omega} = 3.36\ k\Omega$$

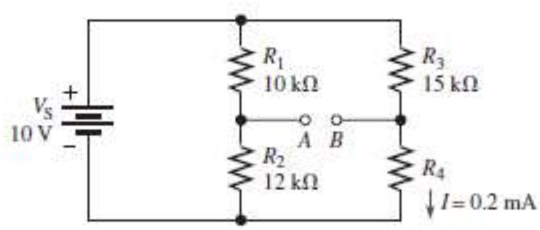
$$R_{TH} = R_{eq4} + R_6 = 3.36\ k\Omega + 12\ k\Omega = 15.36\ k\Omega$$

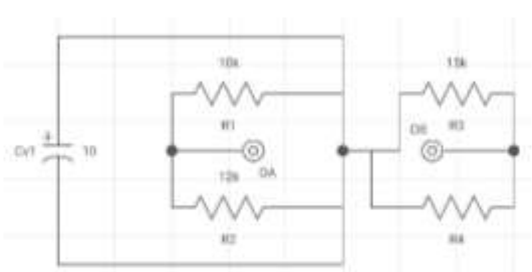
$$V_{TH} = V_S = 48\ V$$

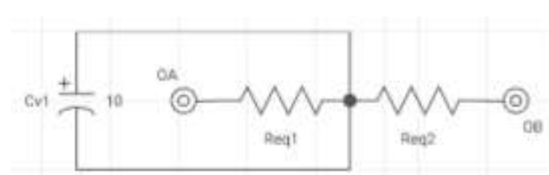
$$V_{R6} = \frac{R_6}{R_6 + R_{TH}} * V_{TH} = \frac{12\ k\Omega}{12\ k\Omega + 15.36\ k\Omega} * 48\ V = 21.05\ V$$

$$I_6 = \frac{V_{R6}}{R_6} = \frac{21.05\ V}{12000\ \Omega} = 1.75 * 10^{-3} A$$

11. Determine el equivalente de Thevenin del circuito mostrado en la figura 8-82 visto desde las terminales A y B.





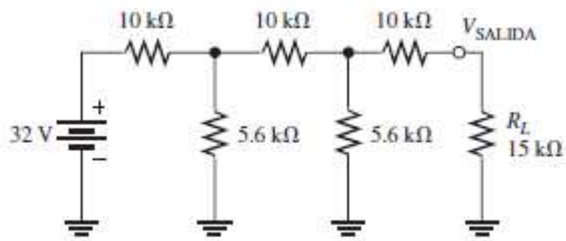


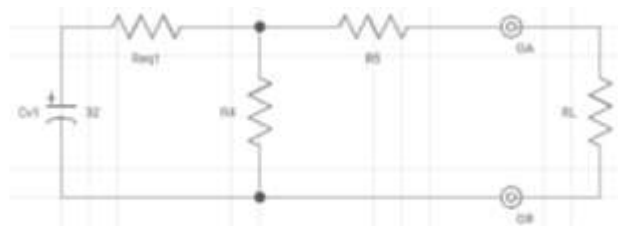
$$V_{TH} = V_A - V_B$$
$$V_{TH} = \left(\frac{R_2}{R_1 + R_2}\right) V_S - \left(\frac{R_4}{R_3 + R_4}\right) V_S$$
$$V_{TH} = \left(\frac{12\ k\Omega}{22\ k\Omega}\right) 10\ V - \left(\frac{R_4}{15\ k\Omega + R_4}\right) 10\ V$$
$$V_{TH} = 5.45\ V - \left(\frac{R_4}{15\ k\Omega + R_4}\right) 10\ V$$
$$V_{TH} = I_{TH} * R_{TH}$$
$$R_{TH} = \frac{V\left(5.45\ - \left(\frac{R_4}{15\ k\Omega + R_4}\right) 10\right)}{0.2\ mA} = \frac{\left(5.45\ - \left(\frac{R_4}{15\ k\Omega + R_4}\right) 10\right)}{0.2}\ k\Omega$$
$$R_T = 50\ k\Omega$$
$$R_{eq1} = \frac{10\ k\Omega * 12\ k\Omega}{10\ k\Omega + 12\ k\Omega} = 5.46\ k\Omega$$
$$R_{eq2} = \frac{15\ k\Omega * R_4}{15\ k\Omega + R_4}$$
$$R_{TH} = R_{eq1} + R_{eq2} = 5.46\ k\Omega + \frac{15\ k\Omega R_4}{15\ k\Omega + R_4}$$
$$R_{TH} = \frac{81.9\ k\Omega^2 + 5.46 k\Omega R_4 + 15\ k\Omega R_4}{15\ k\Omega + R_4}$$
$$R_{TH} = \frac{81.9\ k\Omega^2 + 20.46\ k\Omega R_4}{15\ k\Omega + R_4}$$
$$R_{TH} = R_{TH}$$
$$\frac{81.9\ k\Omega^2 + 20.46\ k\Omega R_4}{15\ k\Omega + R_4} = \frac{\left(5.45\ - \left(\frac{R_4}{15\ k\Omega + R_4}\right) 10\right)}{0.2}\ k\Omega$$

$$\frac{(22.932\ k\Omega^2 + 4.092\ k\Omega R_4)}{15\ k\Omega + R_4} = \frac{(81.75\ k\Omega^2\ - 4.55\ k\Omega\ R_4)}{15\ k\Omega + R_4}$$
$$22.932\ k\Omega^2 + 4.092\ k\Omega R_4 = 81.75\ k\Omega^2\ - 4.55\ k\Omega\ R_4$$
$$8.642\ k\Omega R_4 = 58.818\ k\Omega^2$$
$$R_4 = 6.806\ k\Omega$$

SECCIÓN 8-6 Teorema de Norton.

12. **Con el teorema de Norton, determine la corriente que circula a través del resistor de carga R_L en la figura 8-77.**





$$R_{eq1} = R_1 + \frac{R_2 * R_3}{R_2 + R_3} = 10\ k\Omega + \frac{5.6\ k\Omega * 10\ k\Omega}{5.6\ k\Omega + 10\ k\Omega} = 13.6\ k\Omega$$

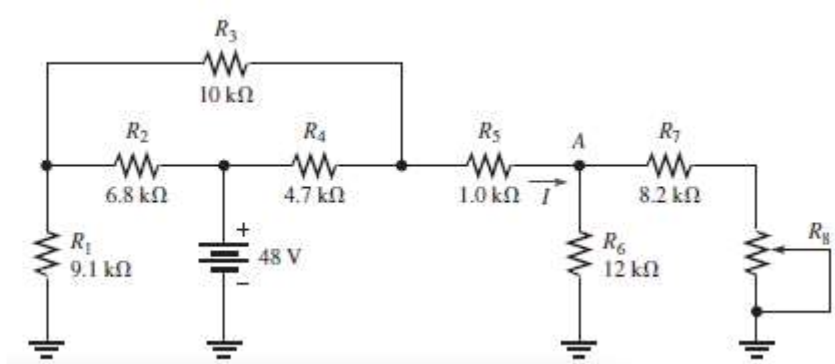
$$R_T = R_{eq1} + \frac{R_4 * R_5}{R_4 + R_5} = 13.6\ k\Omega + \frac{5.6\ k\Omega * 10\ k\Omega}{5.6\ k\Omega + 10\ k\Omega} = 17.2\ k\Omega$$

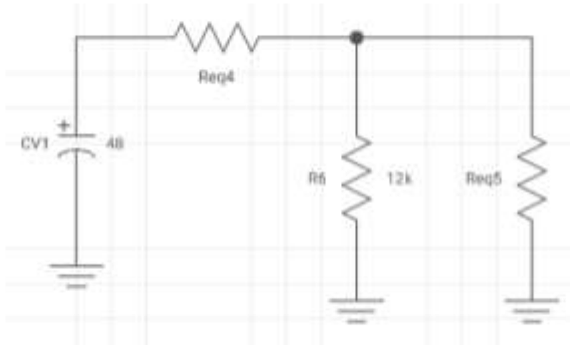
$$I_T = \frac{V_S}{R_T} = \frac{32\ V}{17.2\ k\Omega} = 1.81\ mA$$

$$I_N = I_T\left(\frac{R_4}{R_4 + R_5}\right) = 1.81\ mA\ \left(\frac{5.6\ k\Omega}{5.6\ k\Omega + 10\ k\Omega}\right) = 0.65\ mA$$

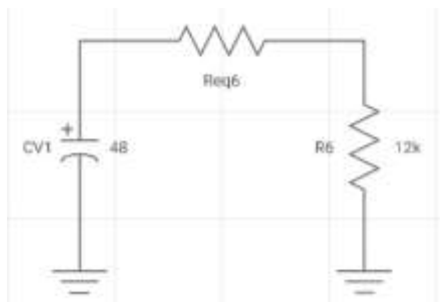
$$I_{R_L} = I_{15k\Omega} = I_N\left(\frac{R_T}{R_T + R_L}\right) = 0.65\ mA\ \left(\frac{17.2\ k\Omega}{17.2\ k\Omega + 15\ k\Omega}\right) = 0.35\ mA$$

13. Con el teorema de Norton, determine la corriente que circula a través de R_1 en la figura 8-80 cuando $R_8 = 8k\Omega$.



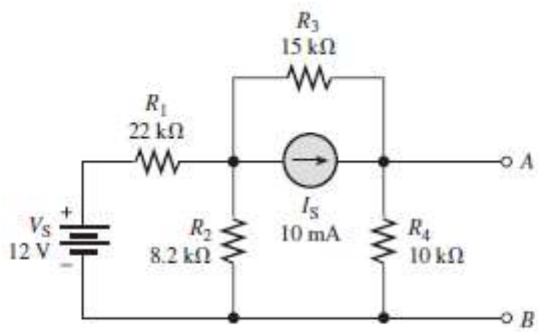


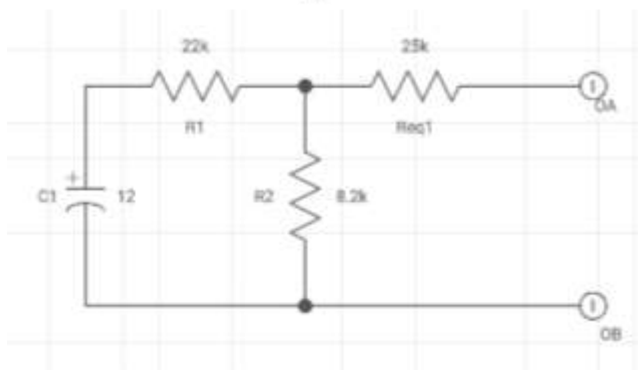
$$R_8 = 8k\Omega$$
$$R_{eq1} = R_8 + R_7 = 8k\Omega + 8.2k\Omega = 16.2\ k\Omega$$
$$R_{eq2} = \frac{R_{eq1} * R_6}{R_{eq1} + R_6} = \frac{16.2\ k\Omega * 12\ k\Omega}{16.2\ k\Omega + 12\ k\Omega} = 6.9\ k\Omega$$
$$R_{eq3} = R_{eq2} + R_5 = 6.9\ k\Omega + 1\ k\Omega = 7.9\ k\Omega$$
$$R_{eq4} = \frac{R_2 * R_3}{R_2 + R_3} = \frac{6.8\ k\Omega * 10\ k\Omega}{6.8\ k\Omega + 10\ k\Omega} = 4.05\ k\Omega$$



$$R_T = R_4 + \frac{R_{eq3} * R_{eq4}}{R_{eq3} + R_{eq4}} = 4.7\ k\Omega + \frac{7.9\ k\Omega * 4.05\ k\Omega}{7.9\ k\Omega + 4.05\ k\Omega} = 7.38\ k\Omega$$
$$I_T = \frac{V_S}{R_T} = \frac{48\ V}{7.38\ k\Omega} = 6.504\ mA$$
$$I_N = I_T\left(\frac{R_{eq3}}{R_{eq3} + R_{eq4}}\right) = 6.504\ mA\ \left(\frac{7.9\ k\Omega}{7.9\ k\Omega + 4.05\ k\Omega}\right) = 4.3\ mA$$
$$I_{R_1} = I_{9.1k\Omega} = I_N\left(\frac{R_T}{R_T + R_1}\right) = 4.3\ mA\ \left(\frac{7.38\ k\Omega}{7.38\ k\Omega + 9.1\ k\Omega}\right) = 1.92\ mA$$

14. En la figura 8-83, reduzca el circuito entre las terminales A y B a su equivalente Norton.





$$R_{eq1} = R_4 + R_3 = 10k\Omega + 15k\Omega = 25k\Omega$$

$$R_{eq2} = R_1 + \frac{R_2 * R_{eq1}}{R_2 + R_{eq1}} = 22\ k\Omega + \frac{8.2\ k\Omega * 25\ k\Omega}{8.2\ k\Omega + 25k\Omega} 28.17\ k\Omega$$

$$R_T = R_{eq2} = 28.17\ k\Omega$$

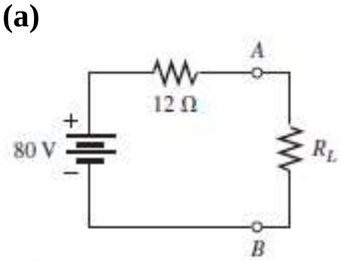
$$I_T = \frac{V_S}{R_T} = \frac{12\ V}{28.17\ \ k\Omega} = 0.423\ mA$$

$$I_N = I_T\left(\frac{R_{eq1}}{R_{eq1} + R_2}\right) = 0.423\ mA\ \left(\frac{28.17\ k\Omega}{28.17\ k\Omega + 8.2\ k\Omega}\right) = 0.327\ mA$$

SECCIÓN 8-7 Teorema de transferencia de potencia máxima.

15. En cada circuito mostrado en la figura 8-85, se tiene que transferir potencia máxima a la carga R_L en cada paso.

(a)



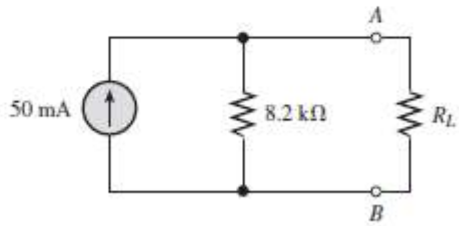
(a)

$$R_L = R_i$$

$$R_L = 12\ \Omega$$

$$I = \frac{V_S}{R_S + R_L} = \frac{80\ V}{12\ \Omega + 12\ \Omega} = 3.33\ mA$$
$$P_L = I^2 R_L = (3.33\ mA)^2 (12\ \ \Omega) = 23.0889\ mW$$

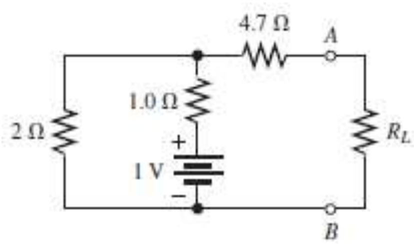
(b)



(b)

$$R_{TH} = R_{AB}$$
$$R_L = 8.2\ k\Omega$$
$$8.2\ k\Omega * \left(\frac{1000}{1}\right) = 8200\ \Omega$$
$$P_L = I^2 R_L = (50\ mA)^2 (8200\ \ \Omega) = 20500000\ mW$$

(c)

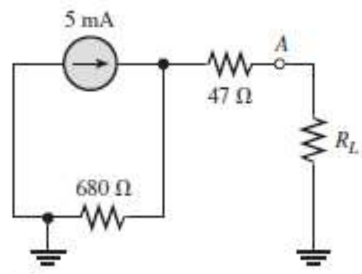


(c)

$$R_{eq1} = \frac{2\ \Omega * 1\ \Omega}{2\ \Omega + 1\ \Omega} = \frac{2}{3} = 0.67\ \Omega$$
$$R_{eq2} = R_{eq1} + R_3 = 0.67 + 4.7 = 5.37\ \Omega$$
$$R_{TH} = R_{eq2} = 5.37\ \Omega$$

$$R_L = R_{TH} = 5.37\ \Omega$$
$$I = \frac{V_S}{R_S + R_L} = \frac{1\ V}{5.37\ \Omega + 5.37\ \Omega} = 0.0931\ mA$$
$$P_L = I^2 R_L = (0.0931\ mA)^2 (5.37\ \ \Omega) = 0.0465\ mW$$

(d)



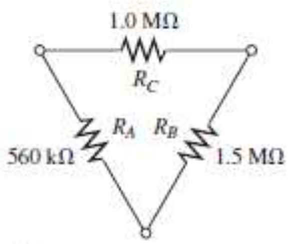
(d)

$$R_{TH} = R_L$$
$$R_{TH} = R_1 + R_2$$
$$R_{TH} = 680\ \Omega + 4.7\ \Omega$$
$$R_{TH} = 727\ \Omega$$
$$R_L = 727\Omega$$
$$P_L = I^2 R_L = (5\ \ mA)^2 18175\ mW$$

SECCIÓN 8-8 Conversiones delta a Y ($\Delta\ a\ Y$) y Y a Δ.

16. En la figura 8-88, convierta cada red delta en una red Y.

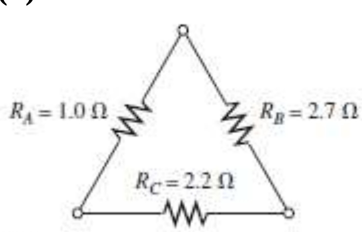
(a)



(a)

$$R_1 = \frac{R_C * R_A}{R_A + R_B + R_C} = \frac{1000 * 560}{1000 + 1500 + 560} = 183.01\ k\Omega$$
$$R_2 = \frac{R_B * R_C}{R_A + R_B + R_C} = \frac{1500 * 1000}{1000 + 1500 + 560} = 183.01\ k\Omega$$
$$R_3 = \frac{R_B * R_A}{R_A + R_B + R_C} = \frac{1500 * 560}{1000 + 1500 + 560} = 274.51\ k\Omega$$

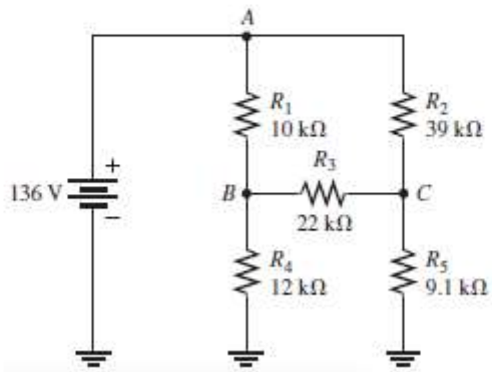
(b)



(b)

$$R_1 = \frac{R_C * R_A}{R_A + R_B + R_C} = \frac{2.2 * 1}{2.2 + 1 + 2.7} = 0.37\ \Omega$$
$$R_2 = \frac{R_B * R_C}{R_A + R_B + R_C} = \frac{2.7 * 2.2}{2.2 + 1 + 2.7} = 1.02\ \Omega$$
$$R_3 = \frac{R_B * R_A}{R_A + R_B + R_C} = \frac{1 * 2.7}{2.2 + 1 + 2.7} = 0.46\ \Omega$$

17. Determine todas las corrientes que circulan en el circuito de la figura 8-90.



$$R_{y1} = \frac{R_1 * R_3}{R_1 + R_2 + R_3} = \frac{10 * 22}{10 + 22 + 39} = 3.0986\ k\Omega$$
$$R_{y2} = \frac{R_3 * R_2}{R_1 + R_2 + R_3} = \frac{22 * 39}{10 + 22 + 39} = 12.085\ k\Omega$$
$$R_{y3} = \frac{R_1 * R_3}{R_1 + R_2 + R_3} = \frac{10 * 39}{10 + 22 + 39} = 5.49\ k\Omega$$
$$V_{y3} = \frac{R_{y3} * V_T}{R_T} = \frac{5490 * 136}{14310} = 52.18\ V$$
$$V_{eq3} = \frac{R_{eq3} * V_T}{R_T} = \frac{8820 * 136}{14310} = 83.82\ V$$
$$V_T = I_T * R_T$$
$$I_T = \frac{136\ V}{14310\ \Omega} = 9.5 * 10^{-3} A$$
$$I_{y3} = 9.5 * 10^{-3}\ A$$
$$V_{y1} = \frac{R_{y1} * V_{eq3}}{R_{eq1}} = \frac{3099 * 83.82}{15099} = 17.20\ V$$
$$I_{y1} = \frac{17.20\ V}{3099\ \Omega} = 5.6 * 10^{-3}\ A$$
$$V_4 = 66.62\ V$$
$$I_4 = \frac{66.62}{12000} = 5.5 * 10^{-3} A$$

$$\boldsymbol{V_{y2} = \frac{R_{y2} * V_{eq3}}{R_{eq2}} = \frac{12085 * 83.82}{21190} = 47.82\ V}$$

$$\boldsymbol{I_5 = \frac{47.82}{12085} = 3.96 * 10^{-3} A}$$

$$\boldsymbol{V_{R5} = 35.996\ V}$$

$$\boldsymbol{I_5 = \frac{35.996}{9100} = 3.96 * 10^{-3} A}$$

$$\boldsymbol{R_{eq3} = \frac{R_{eq1} * R_{eq2}}{R_{eq1} + R_{eq2}} = \frac{15.099 * 21.19}{15.099 + 21.19} = 8.82\ k\Omega}$$

$$\boldsymbol{R_{eq4} = R_{eq3} + R_{y3} = 8.82\ k\Omega + 5.49\ k\Omega = 14.31\ k\Omega}$$

$$\boldsymbol{R_T = R_{eq4} = 14.31\ k\Omega}$$

Programa: Electric Circuit Studio