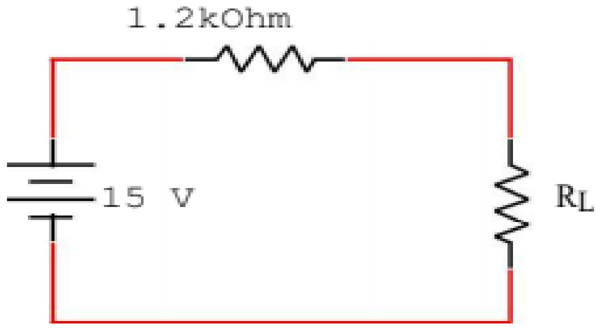
Anexos

Cálculos (Teorema de la máxima transferencia de Potencia)



1.- Para calcular la potencia experimental se tiene la siguiente formula:

$$P = \left(\frac{V_{TH}}{R_{TH}+R_L}\right)^2 \times R_L \qquad (1)$$

Donde,

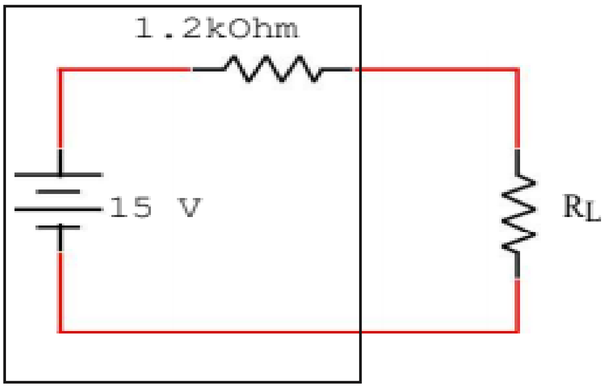
P: Es la potencia medida en watts

V_{TH}: Es el voltaje total medido en voltios

R_{TH}: Es la resistencia interna de la fuente

R_L: Es la resistencia que varia

Paso 1. Trace una gráfica que muestre la potencia suministrada a la carga contra la resistencia de carga.



Paso 2. Reemplace los valores conocidos en la fórmula 1.

Para $R_L = 220\ \Omega$

$$P = \left(\frac{15}{1200+220}\right)^2 \times 220$$

$$\boxed{P = 0.02454\ watts}$$

Para $R_L = 470\ \Omega$

$$P = \left(\frac{15}{1200 + 470}\right)^2 \times 470$$

$$\boxed{P = 0.03792\ watts}$$

Para $R_L = 680\ \Omega$

$$P = \left(\frac{15}{1200 + 680}\right)^2 \times 680$$

$$\boxed{P = 0.04328\ watts}$$

Para $R_L = 820\ \Omega$

$$P = \left(\frac{15}{1200 + 820}\right)^2 \times 820$$

$$\boxed{P = 0.04521\ watts}$$

Para $R_L = 1000\ \Omega$

$$P = \left(\frac{15}{1200 + 1000}\right)^2 \times 1000$$

$$\boxed{P = 0.04648 watts}$$

Para $R_L = 1500\ \Omega$

$$P = \left(\frac{15}{1200 + 1500}\right)^2 \times 1500$$

$$\boxed{P = 0.04629\ watts}$$

Para $R_L = 1800\ \Omega$

$$P = \left(\frac{15}{1200 + 1800}\right)^2 \times 1800$$

$$\boxed{P = 0.045\ watts}$$

Para $R_L = 2200\ \Omega$

$$P = \left(\frac{15}{1200 + 2200}\right)^2 \times 2200$$

$$\boxed{P = 0.04282\ watts}$$

Para $R_L = 3900\ \Omega$

$$P = \left(\frac{15}{1200 + 3900}\right)^2 \times 3900$$

$$\boxed{P = 0.03373\ watts}$$

Para $R_L = 4700\ \Omega$

$$P = \left(\frac{15}{1200 + 4700}\right)^2 \times 4700$$

$$\boxed{P = 0.03037\ watts}$$

2.- Para calcular la potencia teóricamente tenemos las siguientes formulas:

$$P = I \cdot V \tag{2}$$

$$P = \frac{V^2}{R} \tag{3}$$

$$P = I^2 \cdot R \tag{4}$$

En este caso utilizaremos las formula (4) y la ley de Ohm para calcular la potencia

Para $R_L = 220\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{1420} \rightarrow I = 10.56\ mA$$

$$P = I^2 \cdot R \rightarrow P = (10.56 \times 10^{-3})^2 \cdot 220$$

$$\boxed{P = 0.02454\ watts}$$

Para $R_L = 470\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{1670} \rightarrow I = 8.982\ mA$$

$$P = I^2 \cdot R \rightarrow P = (8.982 \times 10^{-3})^2 \cdot 470$$

$$\boxed{P = 0.03792\ watts}$$

Para $R_L = 680\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{1880} \rightarrow I = 7.978\ mA$$

$$P = I^2 \cdot R \rightarrow P = (7.978 \times 10^{-3})^2 \cdot 680$$

$$\boxed{P = 0.04328\ watts}$$

Para $R_L = 820\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{2020} \rightarrow I = 7.425\ mA$$

$$P = I^2 \cdot R \rightarrow P = (7.425 \times 10^{-3})^2 \cdot 820$$

$$\boxed{P = 0.04521\ watts}$$

Para $R_L = 1000\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{2200} \rightarrow I = 6.818\ mA$$

$$P = I^2 \cdot R \rightarrow P = (6.818 \times 10^{-3})^2 \cdot 1000$$

$$\boxed{P = 0.04648\ watts}$$

Para $R_L = 1500\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{2700} \rightarrow I = 5.555\ mA$$

$$P = I^2 \cdot R \rightarrow P = (5.555 \times 10^{-3})^2 \cdot 1500$$

$$\boxed{P = 0.04628\ watts}$$

Para $R_L = 1800\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{3000} \rightarrow I = 5\ mA$$

$$P = I^2 \cdot R \rightarrow P = (5 \times 10^{-3})^2 \cdot 1800$$

$$\boxed{P = 0.045\ watts}$$

Para $R_L = 2200\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{3400} \rightarrow I = 4.412\ mA$$

$$P = I^2 \cdot R \rightarrow P = (4.412 \times 10^{-3})^2 \cdot 2200$$

$$\boxed{P = 0.04282\ watts}$$

Para $R_L = 3900\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{5100} \rightarrow I = 2.941\ mA$$

$$P = I^2 \cdot R \rightarrow P = (2.941 \times 10^{-3})^2 \cdot 3900$$

$$\boxed{P = 0.03373\ watts}$$

Para $R_L = 4700\ \Omega$

$$I = \frac{V_s}{R_T} \rightarrow I = \frac{15}{5900} \rightarrow I = 2.542\ mA$$

$$P = I^2 \cdot R \rightarrow P = (2.542 \times 10^{-3})^2 \cdot 4700$$

$$\boxed{P = 0.03037\ watts}$$

3.- Para calcular el porcentaje de error en la práctica tenemos la siguiente formula

$$\%\,Error = \frac{Valor\ teorico - Valor\ expereimental}{Valor\ teorico} \times 100$$

Para $R_L = 220\ \Omega$

$$\%\,Error = \frac{0.02454 - 0.02454}{0.02454} \times 100 \rightarrow \boxed{\%\,Error = 0\%}$$

Para $R_L = 470\ \Omega$

$$\%\,Error = \frac{0.03792 - 0.03792}{0.03792} \times 100 \rightarrow \boxed{\%\,Error = 0\%}$$

Para $R_L = 680\ \Omega$

$$\%\,Error = \frac{0.04521 - 0.04521}{0.04521} \times 100 \rightarrow \boxed{\%\,Error = 0\%}$$

Para $R_L = 820\ \Omega$

$$\%\,Error = \frac{0.04648 - 0.04648}{0.04648} \times 100 \rightarrow \boxed{\%\,Error = 0\%}$$

Para $R_L = 1000\ \Omega$

$$\%\,Error = \frac{0.04628 - 0.04629}{0.04628} \times 100 \rightarrow \boxed{\%\,Error = -0.02\%}$$

Para $R_L = 1200\ \Omega$

$$\%\,Error = \frac{0.045 - 0.045}{0.045} \times 100 \rightarrow \boxed{\%\,Error = 0\%}$$

Para $R_L = 1800\ \Omega$

$$\%\,Error = \frac{0.04282 - 0.04282}{0.04282} \times 100 \rightarrow \boxed{\%\,Error = 0\%}$$

Para $R_L = 3900\ \Omega$

$$\%\,Error = \frac{0.03373 - 0.03373}{0.03373} \times 100 \rightarrow \boxed{\%\,Error = 0\%}$$

Para $R_L = 4700\ \Omega$

$$\%\,Error = \frac{0.03037 - 0.03037}{0.03037} \times 100 \rightarrow \boxed{\%\,Error = 0\%}$$