**Abstract:**

1. **the aim of the experiment is:** to proof thevenin’s law and Norton law .
2. **the method used:** measuring the current and the voltage difference on Rl and by sampling the circuit.
3. **the main result is:**

 **Thevenin Norton**

$ε\_{eq}= 8.92 volts I\_{eq}= 9.15 mA$

$R\_{eq}= 0.95 kΩ I\_{R\_{L}}= 1.24 mA R\_{3}$

$I\_{R\_{L}}= 1.24 mA$

$ε\_{eq}= 7.36 volts I\_{eq}= 5.13 mA$

$R\_{eq}= 1.40 kΩ I\_{R\_{L}}= 2.15 mA R\_{1}$

$I\_{R\_{L}}= 2.15 mA$

 **Calculation:**

**Theoretically:**

**Finding** $I\_{R\_{3}}$

$$R\_{eq}=\frac{R\_{1} R\_{2}}{R\_{1}+ R\_{2}}=\frac{2×10^{3}×1.8×10^{3}}{(2+1.8)×10^{3}}=0.95 kΩ $$

**Thevenin:**

$$ε\_{eq}=ε\_{1}-\frac{\left(ε\_{1}-ε\_{2}\right)R\_{1}}{R\_{1}+ R\_{2}}= 12- \frac{(12-6)×2×10^{3}}{(2+1.8)×10^{3}}=8.84 volts$$

$$I\_{R\_{L}}=\frac{ε\_{eq}}{R\_{eq}+R\_{L}}=\frac{8.84}{(0.95+6.2)×10^{3}}=1.24 mA$$

**Norton:**

$$I\_{eq}=\frac{ε\_{1}}{R\_{1}}+\frac{ε\_{2}}{R\_{2}}=\frac{12}{2×10^{3}}+\frac{6}{1.8×10^{3}}=9.33 mA$$

$$I\_{R\_{L}}=\frac{I\_{eq}R\_{eq}}{R\_{eq}+R\_{L}}=\frac{9.33×10^{-3}×0.95×10^{3}}{(0.95+6.2)×10^{3}}=1.24 mA$$

**Finding** $I\_{R\_{1}}$

$$R\_{eq}=\frac{R\_{2} R\_{3}}{R\_{2}+ R\_{3}}=\frac{1.8×10^{3}×6.2×10^{3}}{(1.8+6.2)×10^{3}}=1.40 kΩ $$

**Thevenin:**

(A)…… $ε\_{2}-I\left(R\_{2}+ R\_{3}\right)=0$

$$I=\frac{ε\_{2}}{\left(R\_{2}+ R\_{3}\right)}$$

$$ε\_{eq}=ε\_{2}-ε\_{1}-IR\_{2}=ε\_{2}-ε\_{1}-\frac{R\_{2}ε\_{2}}{\left(R\_{2}+ R\_{3}\right)}=6-12-\frac{6×1.8×10^{3}}{\left(1.8+6.2\right)×10^{3}}=-7.35 volts$$

$$I\_{R\_{L}}=\frac{ε\_{eq}}{R\_{eq}+R\_{L}}=\frac{7.35}{\left(1.4+2\right)×10^{3}}=2.16 mA$$

**Norton:**

$$I\_{eq}=I\_{3}-I\_{2}$$

(A)……… $ε\_{1}-I\_{3}R\_{3}=0 \rightarrow I\_{3}=\frac{ε\_{1}}{R\_{3}}=\frac{12}{6.2×10^{3}}=1.94 mA$

(B)……… $ε\_{2}-I\_{2}R\_{2}-I\_{3}R\_{3}=0 $

$$\rightarrow I\_{2}=\frac{ε\_{2}-I\_{3}R\_{3}}{R\_{2}}=\frac{6-12}{1.8×10^{3}}=-3.33 mA$$

$$I\_{eq}=I\_{3}-I\_{2}=1.94+3.33=5.27 mA$$

$$I\_{R\_{L}}=\frac{I\_{eq}R\_{eq}}{R\_{eq}+R\_{L}}=\frac{5.27×10^{-3}×1.4×10^{3}}{(1.4+2)×10^{3}}=2.17 mA$$

**Result And Conclusion:**

Experimentally Theoretically Experimentally Theoretically

$$ε\_{eq}=8.92 volts ε\_{eq}=8.84volts I\_{eq}=9.15mA I\_{eq}=9.33mA $$

$$R\_{eq}=0.95 kΩ R\_{eq}=0.95kΩ I\_{R\_{L}}=1.24mA I\_{R\_{L}}=1.24 mA R\_{3} $$

$I\_{R\_{L}}=1.24 mA$$I\_{R\_{L}}= 1.24 mA$

$ε\_{eq}=7.36 volts ε\_{eq}=7.35volts I\_{eq}=5.13 mA I\_{eq}=5.27 mA $

$$R\_{eq}=1.43kΩ R\_{eq}=1.40 kΩ I\_{R\_{L}}=2.15mA I\_{R\_{L}}=2.17mA R\_{1} $$

$I\_{R\_{L}}=2.15 mA$$I\_{R\_{L}}=2.16 mA$

We notice that the experimental values are very closed to the theoretical ,beside some values which are exactly the same as the theoretical values . In fact , the values which differ from the theoretical values as a result of many reasons :

1. we ignored the internal resistance of the power sources .
2. when we use the laws we assumed that the resistance of the wires is zero but there is a resistance for the wire even if it is so small.
3. even in the resistors there is some uncertainty that we can find it from the color code on the resistors.
* In this experiment we proof thevenin's law and norton's law by getting the values for circuits needed .
* In the two laws that we use here there is some conditions we have to be sure that they are available in the circuit in order to use these laws on it such as the resistors must be linear components that obey ohm’s law.
* The two techniques (Norton and Thevenin) that we used here are biased on the same aim which is that they aim to make all the power sources as one source and all of the resistors in one resistor even if the two methods use a different way.