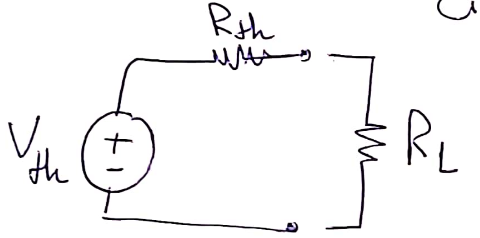
Exp 4: Thevenin and Norton techniques

- Kerchhoff's law and SPP are useful for analyzing networks that contain a few circuit elements

- Dealing with complicated networks requires more adequate methods like Thevenin and Norton techniques.

* Thevenin's Theorem:-

- we can take any complicated circuit and reduce it down to voltage source and eq resistance, if you have one section of the circuit you care about.



- Steps:-

(1). remove the R_L

(2). remove all the sources and find R_{th}

(3.) put the sources back and find V_{th} through Kirchhoff's loop.

(4). construct Thevenin equivalent circuit.

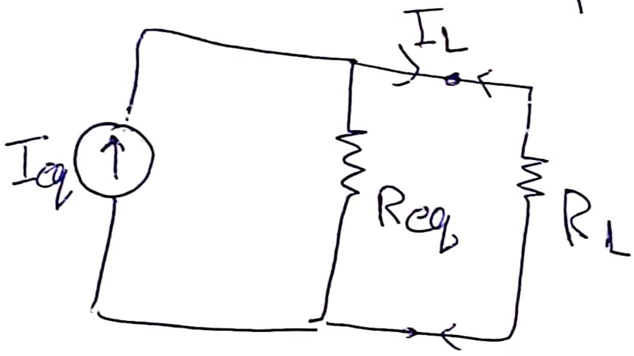
(5.) $I_{R_L} = \dfrac{V_{Th}}{R_{th} + R_L}$

Norton's:

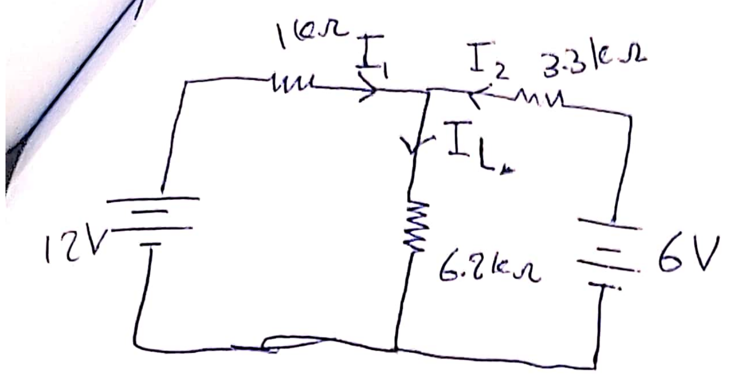
2. replace R_L with a short then find I_{eq} (put sources back)

1. To find R_{eq} use the same way as Thevenin

3. Construct Norton's equivalent circuit using a current source and parallel resistance



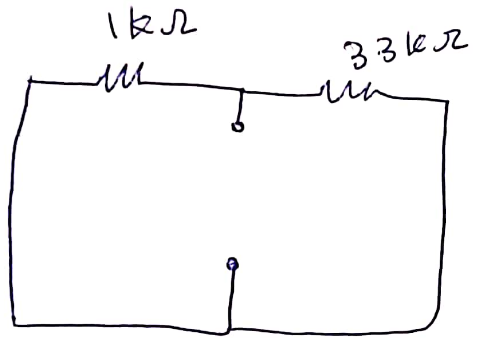
Procedure :-



1. Construct the Circuit as Shown, let 6.2kΩ be the Load.

For Thevenin's Thee :-

2. remove R_L, Kill sources to find R_{th} or R_{eq}



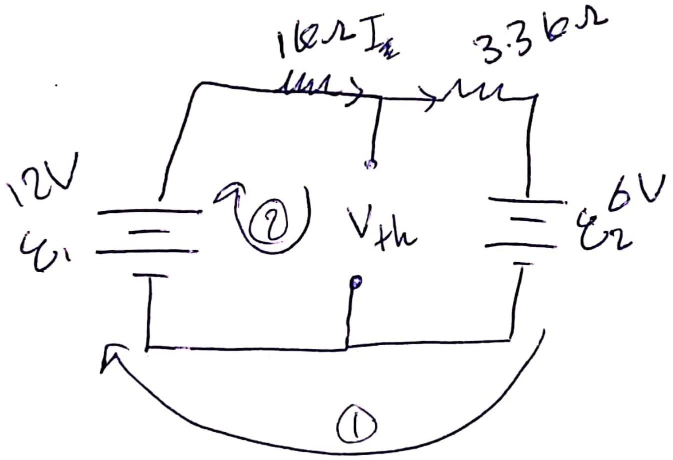
$$R_{th} = 1k\Omega \,//\, 3.3k\Omega$$

$$= \frac{(1 \times 3.3)(k\Omega)^2}{(1+3.3)\,k\Omega}$$

$$\boxed{R_{th} \approx 769\,\Omega}$$

3. put the Sources back and calculate V_{th}, V_{eq}

By Kirchhoff's loop.



① →

$$\varepsilon_1 - \varepsilon_2 = I(R_1) + IR_2$$

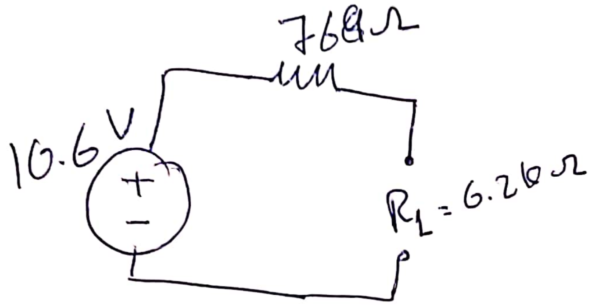
② → $\varepsilon_1 - IR - V_{th} = 0$

$$V_{th} = \varepsilon_1 - IR$$

$$V_{th} = \varepsilon_1 - \frac{(\varepsilon_1 - \varepsilon_2)R_1}{R_1 + R_2}$$

$$\boxed{V_{th} \approx 10.63}$$

(4) Construct the Thevenin equivalent circuit.



$$I_L = \frac{V_{th}}{R_{eq} + R_L}$$

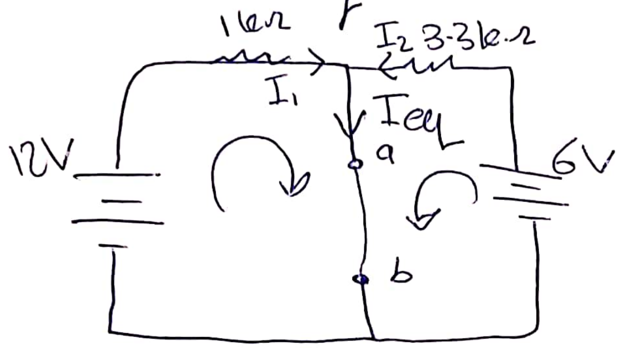
$$= \frac{10.6}{6.3\times10^3 + 769}$$

$$=$$

Norton:

② Replace R_L with a short, calculate I_{eq}

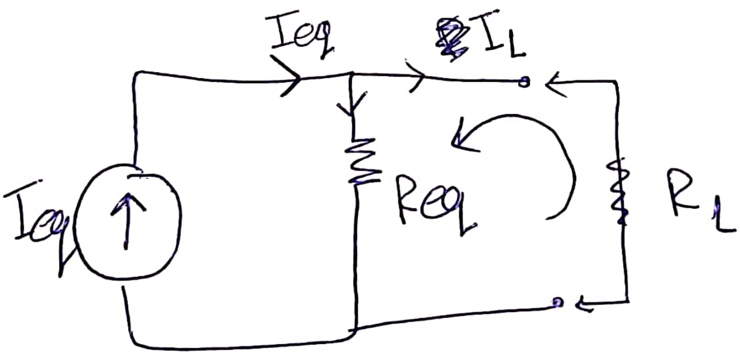
$$I_{eq} = I_1 + I_2 \qquad I_{eq} \overset{\text{like}}{=} V_{th}$$



* Since Req would be found in the same way as Thevenin ∴ then we take the value that we found earlier Req

$$\underline{\underline{I_{eq}}} = \frac{\varepsilon_1}{R_1} + \frac{\varepsilon_2}{R_2}$$

③ Construct Norton's equivalent circuit.



To find I_L

$$I_L R_L = (I_{eq} - I_L) R_{eq}$$

$$I_L = \frac{I_{eq} R_{eq}}{R_{eq} + R_L}$$

Data

	exp	Theo
(R_{Th}) R_{eq}		
(V_{Th}) $\mathcal{E}_{eq}$		
(Norton) I_{eq}		
(Theve) I_L		
(Norton) I_L		

After constricting the circuit.

I_{eq} in Norton like V_{Th} ($\mathcal{E}_{eq}$) in Thevenin.

R_{eq} in Both Cases is the same.