

$$R = 1 \text{ k}\Omega$$

$$V_1 = 1 \text{ V}$$

$$V_2 = 2 \text{ V}$$

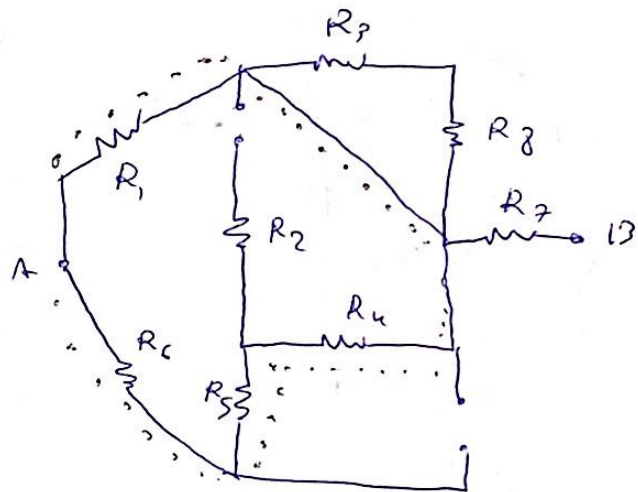
$$I_1 = 1 \text{ mA}$$

$$I_2 = 2 \text{ mA}$$

a) Calcular  $R_{th}$ .

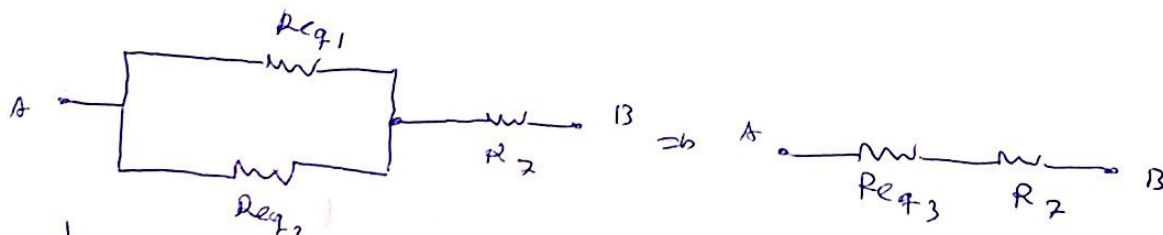
1º Anulamos las fuentes

Diferenciamos el camino de arriba y el camino de abajo



Arriba  $\rightarrow R_1 = 1 \text{ k}\Omega = R_{eq1}$

Abajo  $\rightarrow R_6 + R_5 + R_4 = 3 \text{ k}\Omega = R_{eq2}$

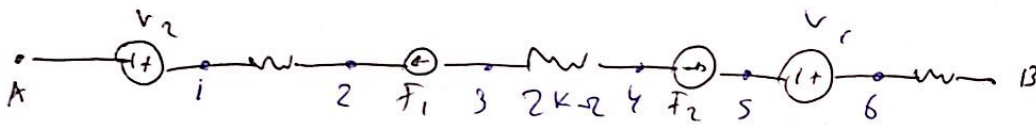


$$\frac{1}{R_{eq3}} = \frac{1}{R_{eq1}} + \frac{1}{R_{eq2}} = \frac{1}{1} + \frac{1}{3} = \frac{4}{3} \Rightarrow R_{eq3} = 0.75 \text{ k}\Omega$$



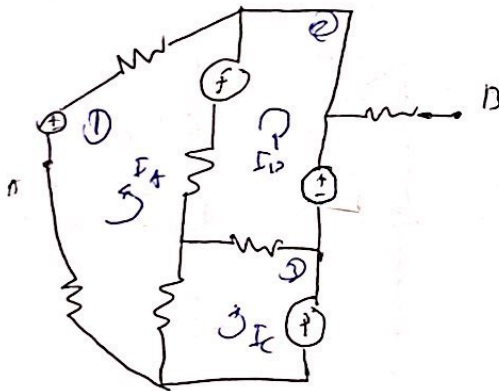
$$R_{th} = R_{eq3} + R_7 = 1.75 \text{ k}\Omega$$

Calculus  $V_{th}$



$$V_A - V_2$$

Resolvamos el circuito



Mallo 1

$$-V_2 + \mathcal{E}_1 = I_A \cdot (R + R + R + R) + I_B \cdot R - I_C \cdot R$$

Mallo 2

$$\mathcal{E}_1 - V_1 = I_B \cdot (R + R) + I_A \cdot (R) + I_3 \cdot R$$

Mallo 3

$$\mathcal{E}_2 = I_C \cdot (R + R) - I_A \cdot R - I_B \cdot R$$

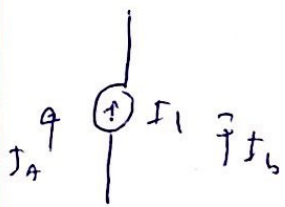
Si observamos,  $I_C = I_2 = 2 \text{ mA}$



$$2I_B + I_A + I_E + 1$$

$$I_C + 1 \Rightarrow 3I_A - I_B = -1 \text{ V}$$

$$\mathcal{E}_2 = 4 - I_A - I_B$$



$$I_1 - I_A + I_B = 1 \Rightarrow I_A = 1 - I_B$$

$$I_C = I_2 = 2 \text{ mA}$$

$$\mathcal{E}_1 = 4I_A - I_C + I_B + 2 \text{ V}$$

$$\mathcal{E}_1 = 2I_B + I_C + I_A + 1$$

$$\mathcal{E}_2 = 2I_C - I_A + I_B$$

4)

$$\mathcal{E}_1 = 4 - 3I_B$$

$$\mathcal{E}_1 = 4 + I_B$$

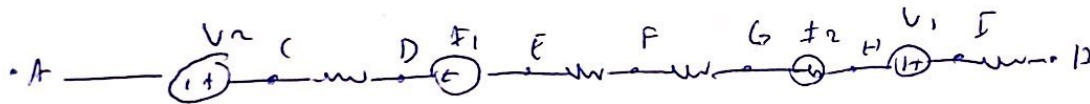
$$\mathcal{E}_2 = 3 + 2I_B$$



$$I_B = 0 \text{ mA} \quad I_A = 1 \text{ mA}$$

$$\mathcal{E}_2 = 3 \text{ V} \quad \mathcal{E}_1 = 4 \text{ V}$$

$V_{th}$



$$V_C - V_A = 2 \text{ V}$$

$$V_D - V_C = I_A \cdot R_1 = 1 \text{ V}$$

$$V_D - V_E = \mathcal{E}_1 = 4 \text{ V}$$

$$V_I - V_E = 4 \text{ V}$$

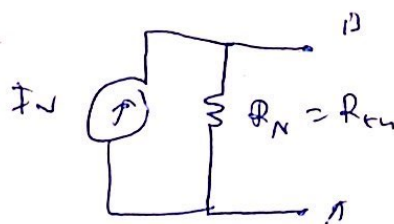
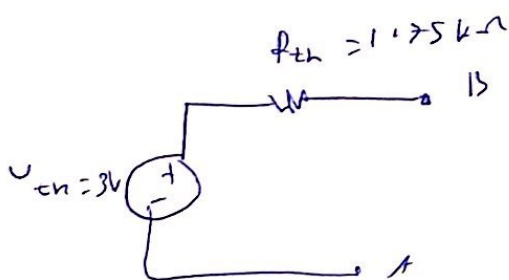
$$V_F - V_G = (I_C - I_A) \cdot R = 1 \text{ V}$$

$$V_H - V_G = \mathcal{E}_2 = 3 \text{ V}$$

$$V_I - V_H = 1 \text{ V}$$

$$V_B - V_A = 3 \text{ V}$$

$$V_{th} = 3 \text{ V}$$



$$I_N = \frac{V_{th}}{R_{th}} = 1.71 \text{ mA}$$