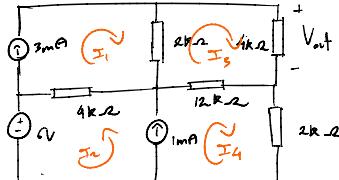


83.-



$$I_1 = 3 \text{ mA}$$

~~$$I_4 = 1 \text{ mA}$$~~

$$1 \text{ mA} = I_2 + I_3$$

$$I_4 = 1 \text{ mA} - I_2$$

Por la ley de Kirchhoff

$$\text{Malla I: } V_{L_1} = \cancel{I_1}(3k\Omega) - I_3(2k\Omega) + I_2(4k\Omega)$$

$$\text{Malla II: } V_{L_2} - 6V = I_2(4k\Omega) + \cancel{I_1}(4k\Omega)$$

$$\text{Malla III: } 0 = I_3(18k\Omega) - \cancel{I_2}(2k\Omega) - I_4(12k\Omega)$$

$$\text{Malla IV: } V_{L_4} = I_4(14k\Omega) - I_3(12k\Omega)$$

$$V_{L_1} = 18 - I_2(2k\Omega) + I_2(4k\Omega)$$

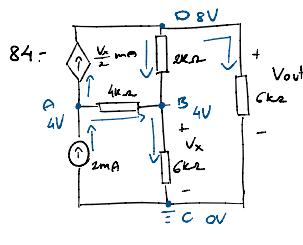
$$V_{L_2} - 6 = I_2(4k\Omega) + I_2(4k\Omega) \Rightarrow 8 - I_2(14k\Omega) - I_2(12k\Omega) = I_2(4k\Omega) + I_2(4k\Omega) \Rightarrow I_2(9k\Omega) + 12 = 0 \Rightarrow I_2(3k\Omega) - 3 + \frac{-12}{3} = 0 \Rightarrow I_2(3k\Omega) = 6 \Rightarrow I_2 = 2 \text{ mA}$$

$$0 = I_3(18k\Omega) - I_2(12k\Omega) \Rightarrow 0 = I_3(18k\Omega) - 6 - I_2(12k\Omega) \Rightarrow 0 = I_3(3k\Omega) - 3 + I_2(2k\Omega) \Rightarrow 8 + I_2(5k\Omega) = 0 \Rightarrow I_2 = -1.6 \text{ mA}$$

$$V_{L_4} = I_4(14k\Omega) - I_3(12k\Omega) \Rightarrow V_{L_4} = 14 - I_2(14k\Omega) - I_2(12k\Omega) \Rightarrow 0 = -I_2(5k\Omega) + 6 - I_2(4k\Omega) \Rightarrow I_2(5k\Omega) = 6 \Rightarrow I_2 = 1.2 \text{ mA}$$

$$V_{out} = 8.26 \text{ V}$$

$$I_2 = \frac{8}{5} \text{ mA}$$



$$A: 2 \text{ mA} = I_{AB} + \frac{V_A - V_B}{2} \Rightarrow 2 \text{ mA} = I_{AB} + I_{BC} \quad \text{3} \Rightarrow 2 = \frac{V_A - V_B}{4} + \frac{V_B}{2} \Rightarrow 8 = V_A + V_B$$

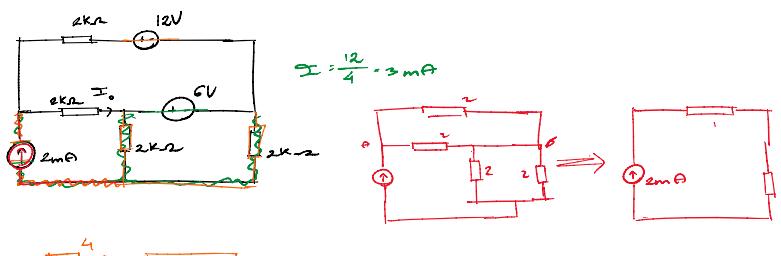
$$B: I_{AB} + I_{AC} = I_{BC} \Rightarrow \frac{V_A - V_B}{6} + \frac{V_A - V_C}{4} - \frac{V_B}{6} = 2V_B - 2V_A + 3V_A - 3V_B = 2V_B$$

$$D: I_{AC} + I_{CB} = I_{BC} \quad \text{3} \Rightarrow \frac{V_A}{6} + \frac{V_B - V_C}{2} - \frac{V_B}{6} = 3V_A - 3V_B = 3V_B$$

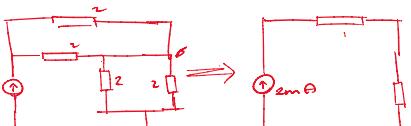
$$4V_B - 6V_B = 0$$

$$\begin{cases} 3V_A - 2V_B + 2V_C = 0 \Rightarrow 24 - 3V_B - 2V_B + 3V_B \Rightarrow V_B = \frac{24}{3} = 8 \text{ V} \\ V_A + V_B = 8 \Rightarrow V_A = 8 - V_B \Rightarrow \\ 4V_B - 6V_B = 0 \Rightarrow V_B = \frac{3V_B}{2} = 5.14 \end{cases}$$

86.-



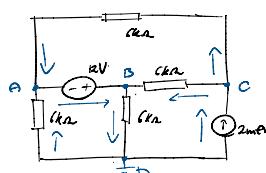
$$I = \frac{12}{4} = 3 \text{ mA}$$



$$\begin{cases} I_A = 3 - 3 + 1 = 1 \text{ mA} \\ I_B = 1 \end{cases}$$

4Ad

89.-



$$A: I_{AB} + I_{AC} = I_{BC} \Rightarrow -\frac{V_A}{6} + \frac{V_B - V_A}{6} = I_{BC} \Rightarrow -2V_A + V_B = 6I_{BC}$$

$$B: I_{AB} + I_{BC} - I_{AC} = I_{BC} \Rightarrow I_{AB} + \frac{V_B - V_C}{6} = \frac{V_B}{6} \Rightarrow 6I_{AB} + V_C - V_B = V_B$$

$$C: 2 \text{ mA} = I_{BC} + I_{CA}$$

$$(V_B = V_A + 12) \Rightarrow 2 \text{ mA} = \frac{V_B - V_A}{6} + \frac{V_C - V_B}{6}$$

$$\begin{cases} -2V_A + V_B = 6I_{BC} \\ 2V_B - V_C = 6I_{BC} \\ 12 = 2V_C - V_A - V_B \end{cases}$$

$$\begin{cases} -2V_A + V_B - 6I_{BC} = 0 \\ 2V_B - V_C - 6I_{BC} = -24 \\ 2V_C - V_A - V_B - 12 = 12 \end{cases}$$

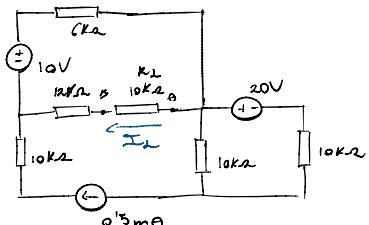
$$-12I_{BC} = -24$$

$$I_{BC} = 2 \text{ mA}$$

$$\begin{cases} -2V_A + V_C = 12 \\ -2V_A + 2V_C = 24 \end{cases}$$

$$V_C = 12 \text{ V} \Rightarrow V_A = 0 \text{ V}$$

90.-



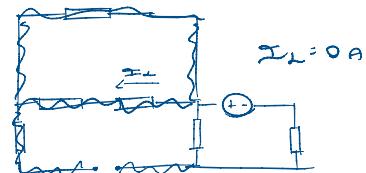
a) Por superposición:

- Con V_1 :



$$I_2 = \frac{V_1}{R_{AB} + R_s} = \frac{10}{28} = 0.35 \text{ mA}$$

- Con V_2 :



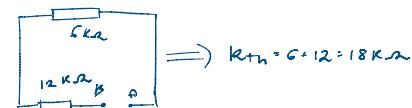
$$- \text{Con } \Sigma: \quad \left(\frac{1}{R_1} + \frac{1}{R_2 + R_s} \right)^{-1} = \left(\frac{1}{6} + \frac{1}{22} \right)^{-1} = \left(\frac{11+3}{28} \right)^{-1} = \frac{28}{14} = 4.21 \text{ k}\Omega$$

$$\begin{aligned} R_T &= 4.21 + 5 + 10 = 19.21 \text{ k}\Omega \\ V_{AB} &= \Sigma \cdot 4.21 = 2.36 \text{ V} \\ I_2 &= \frac{V_{AB}}{22} = 0.11 \Rightarrow I_2 = -0.11 \end{aligned}$$

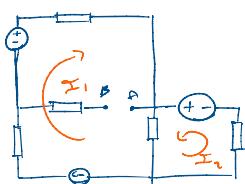
$$\text{Luego } I_2 = 0.35 - 0.11 = 0.25 \text{ mA}$$

$$V_{AB} = I_2 \cdot R_L = 0.25 \cdot 10 = 2.5 \text{ V}$$

b) Para calcular R_{Th} , si anulo todas las fuentes, obtenemos:



Para calcular V_{Th}

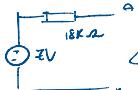


Por mallas:

$$\text{Malla I: } 10V + V_{AB} = I_1 (10k\Omega) + I_2 (10k\Omega)$$

$$\text{Malla II: } 20V = I_2 (20k\Omega) + I_1 (10k\Omega)$$

$$V_{Th} = 2V$$



$$\begin{aligned} I_N &= 0.35 \text{ mA} \\ R_{Th} &= 18k\Omega \end{aligned}$$

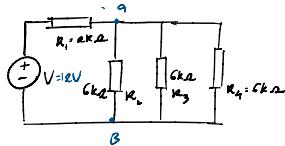
$$\begin{cases} 10V + V_{AB} = 13V + I_2 (10k\Omega) \\ 20V = I_2 (20k\Omega) + 5V \end{cases} \quad \begin{cases} V_{AB} = 10 \frac{I_2}{2} \\ 15 = I_2 (20k\Omega) \end{cases}$$

$$I_2 = \frac{15}{20} = 0.75 \text{ mA}$$

$$\Rightarrow V_{AB} = 10 \cdot 0.75 = 7.5 \text{ V}$$

c)
$$R_L = 10\text{k}\Omega \Rightarrow V_{AB} = \frac{2V}{28\text{k}\Omega} \cdot R_L = 0'25 \cdot 10 = 2'5 \text{ V} \quad \boxed{V}$$

$$R_L = 10\text{k}\Omega \Rightarrow V_{AB} = 0'39 \cdot \left(\frac{1}{18} + \frac{1}{10} \right)^{-1} \approx 2'5 \quad (\text{Debido a la approx. de } Z_N) \quad \boxed{V}$$



Para ver intensidad de cada rama, primero calculamos la total. Por la ley de Ohm:

$$I = \frac{U}{R_1} = \frac{U}{R_1 + (R_2||R_3||R_4)} = \frac{U}{1} = 3 \text{ mA}$$

$$V_{AB} = I \cdot (R_2||R_3||R_4) = I \cdot 2 \approx 6 \text{ V}$$

$$-I_{R_1} = I = 3 \text{ mA}$$

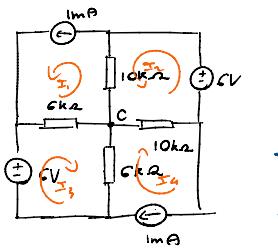
$$-I_{R_2} = I_{R_3} = I_{R_4} = \frac{V_{AB}}{R_1} = \frac{6 \text{ V}}{6 \text{k}\Omega} = 1 \text{ mA} \quad \boxed{I}$$

Y sabiendo que la expresión de la potencia: $P = I^2 R$

$$-P_{R_1} = P_{R_3} = P_{R_4} = 1 \text{ mA} \cdot 6 \text{ V} = 6 \cdot 10^{-3} \text{ W} = 0'006 \text{ W} \quad \boxed{I}$$

$$-P_{R_2} = 2 \cdot I \cdot V = 3 \text{ mA} \cdot 6 \text{ V} = 18 \cdot 10^{-3} \text{ W} = 0'018 \text{ W} \quad \boxed{I}$$

96.-



$$\text{I: } V_{d1} = 1 \text{ mA} (16\text{k}\Omega) - I_2 (10\text{k}\Omega)$$

$$\text{II: } 6\text{ V} = I_2 (20\text{k}\Omega) - I_3 (10\text{k}\Omega)$$

$$\text{III: } 6\text{ V} = I_3 (12\text{k}\Omega) - I_4 (6\text{k}\Omega)$$

$$\text{IV: } V_{d2} = 1 \text{ mA} (16\text{k}\Omega) - I_3 (6\text{k}\Omega)$$

$$\left\{ \begin{array}{l} V_{d1} = 16\text{ V} - I_2 (10\text{k}\Omega) \Rightarrow V_{d1} = 16 - 8 = 8 \text{ V} \\ 6\text{ V} = I_2 (20\text{k}\Omega) - 10\text{ V} \Rightarrow I_2 = \frac{16}{20} = \frac{4}{5} = 0'8 \text{ mA} \\ 6\text{ V} = I_3 (12\text{k}\Omega) - 6\text{ V} \Rightarrow I_3 = 1 \text{ mA} \\ V_{d2} = 16\text{ V} - I_3 (6\text{k}\Omega) \Rightarrow V_{d2} = 10 \text{ V} \end{array} \right.$$

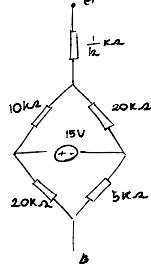
$$\text{a) } P_{I_1} = I_1 V_{d1} = 0'008 \text{ W}$$

$$P_{I_2} = I_2 V_{d1} = 0'016 \text{ W} \quad \boxed{I}$$

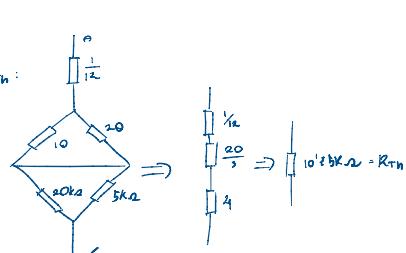
$$P_{I_3} = I_3 V_{d1} = 1 \text{ mA} \cdot 6 \text{ V} = 0'006 \text{ W} \quad \boxed{I}$$

$$P_{V_{d2}} = I_3 V_{d2} = 0'8 \text{ mA} \cdot 10 \text{ V} = 0'0048 \text{ W} \quad \boxed{I}$$

98.-



$R_{Th}:$



$$\left\{ \begin{array}{l} 10 = \frac{20}{3} \\ 10 + 5 = R_{Th} \end{array} \right.$$

V_{th} : Por mallas:

