Circuit challenge [Simulation]

Max. power transfer

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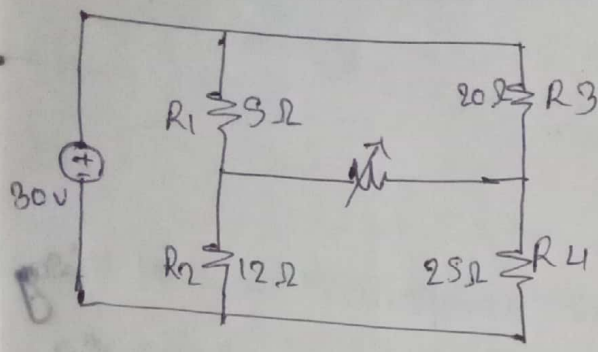


Disconnect the load resistance from the load terminals a & b.

To represent the given ckt as thevenin's equivalent we have to determine V_{th} & R_{TH}.

The thevenin's voltage or voltage across the terminal AB is $V_{AB} = V_A - V_B$

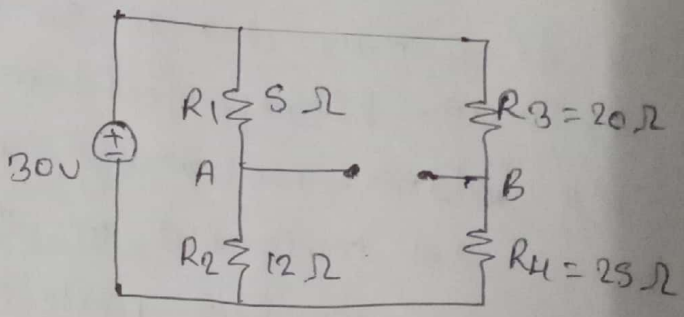
$$V_A = V \times \frac{R_2}{(R_1+R_2)} = 30 \times \frac{12}{(5+12)}$$

$$V_A = 21.7\,V$$

$$V_B = V \times \frac{R_4}{(R_3+R_4)} = 30 \times \frac{25}{20+25}$$

$$V_B = 16.66\,V$$

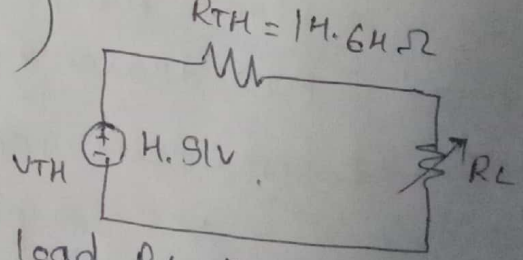
$$\therefore V_{TH} = V_{AB} = V_A - V_B = 4.91\,V$$



- To calculate R_{TH}: By replacing source with their internal resistance.

$$R_{TH} = R_{AB} = \left(\frac{R_1 R_2}{R_1+R_2}\right) + \left(\frac{R_3 R_4}{R_3+R_4}\right)$$

$$R_{TH} = 14.6\,\Omega$$



where $R_L = R_{TH} = 14.6\,\Omega$

And the max. power transmitted to load R_L is

$$P_{max} = V_{TH}^2 / 4R_{TH}$$

$$= \frac{(4.91)^2}{4 \times 14.6}$$

$$= 343.3\,mW$$