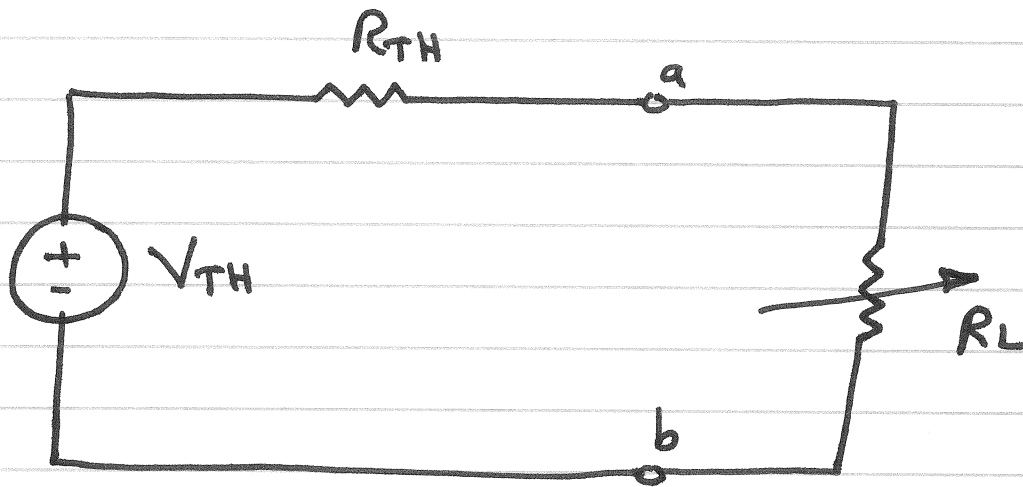


Maximum Power Transfer



A Load resistance will receive maximum power from a circuit when the resistance of the load is exactly the same as the thevenin's resistance looking back at the circuit.

$$R_L = R_{TH}$$

$$P_L = \frac{V_L^2}{R_L}$$

$$V_L = \frac{R_L}{R_L + R_{TH}} \cdot V_{TH}$$

$$P_L = \frac{V_{TH}^2 R_L}{(R_L + R_{TH})^2}$$

$$\frac{dP_L}{dR_L} = \frac{V_{TH}^2 \left((R_L + R_{TH})^2 - 2R_L(R_{TH} + R_L) \right)}{(R_L + R_{TH})^4}$$

$$\text{for } \frac{dP_L}{dR_L} = 0$$

$$(R_L + R_{TH})^2 - 2R_L(R_{TH} + R_L) = 0$$

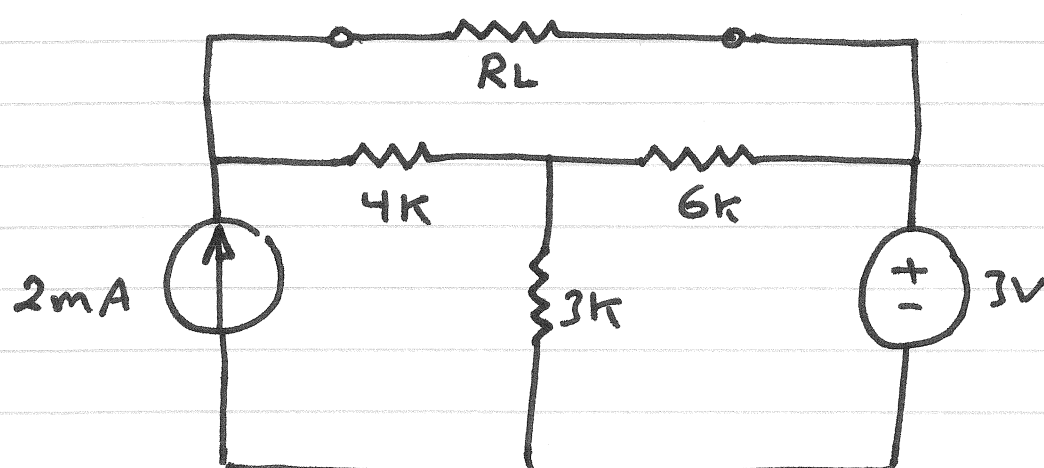
$$(R_L + R_{TH}) \left((R_{TH} + R_L) - 2R_L \right) = 0$$

$$\therefore R_{TH} - R_L = 0$$

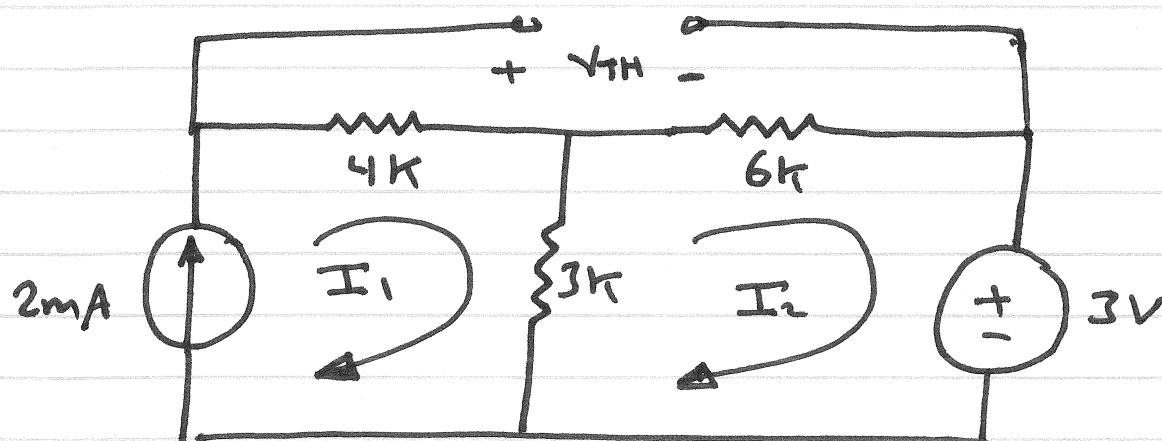
$$\therefore R_L = R_{TH}$$

$$P_{L, \max} = \frac{V_{TH}^2}{4R_L} = \frac{V_{TH}^2}{4R_{TH}}$$

- Find the value of R_L for maximum power transfer in the circuit shown.
- Find the maximum power



To find V_{TH}



$$I_1 = 2mA \quad \text{Constraint equation}$$

$$-3 = 9k I_2 - 3k I_1$$

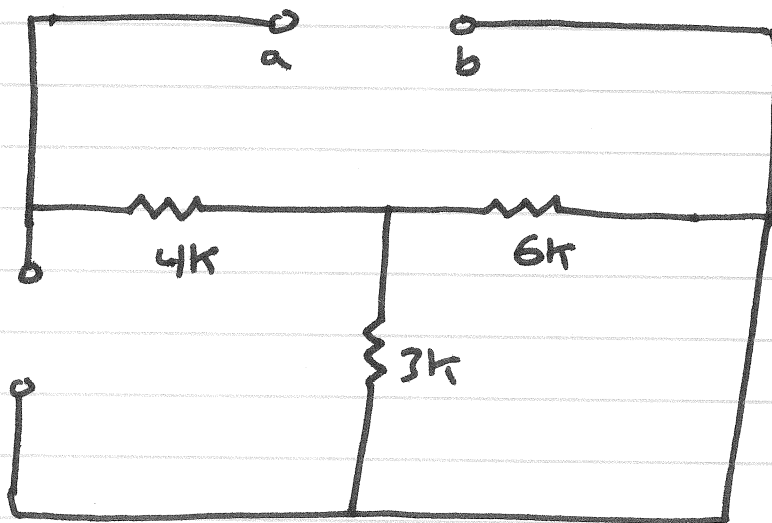
$$\therefore I_2 = \frac{1}{3} mA$$

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$$V_{TH} = 4k I_1 + 6k I_2$$

$$V_{TH} = 10V$$

To find R_{TH}



$$R_{TH} = 4k + 3k \parallel 6k$$

$$= 4k + 2k$$

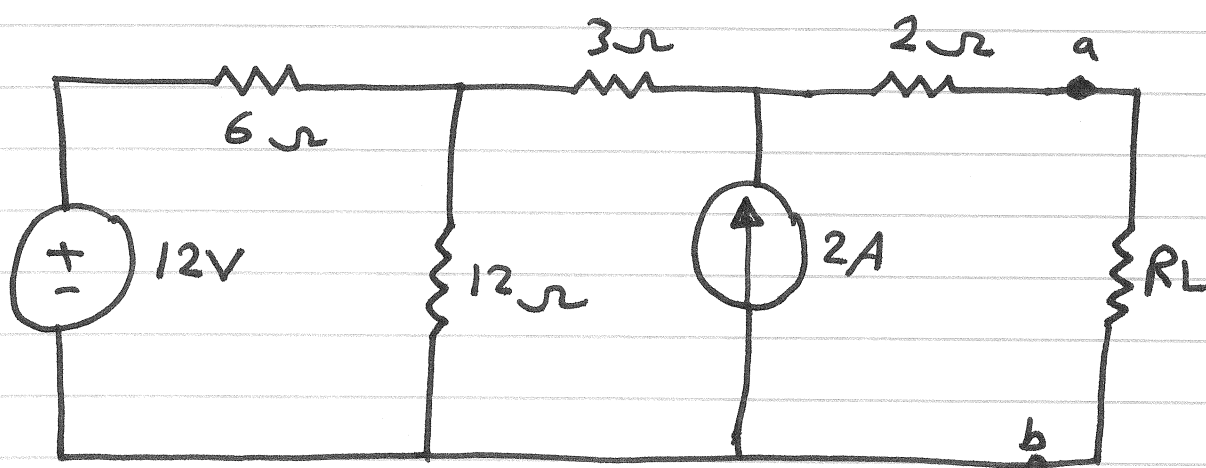
$$R_{TH} = 6k$$

$$\therefore R_L = R_{TH} = 6k$$

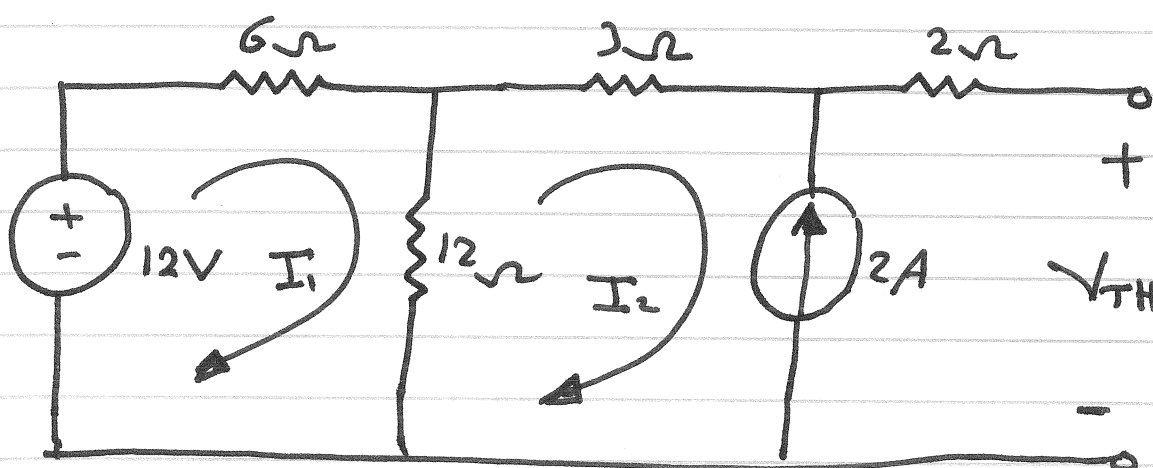
$$P_{L,max} = \frac{V_{TH}^2}{4R_{TH}} = \frac{25}{6} \text{ mW}$$

-130-

- Find the value of R_L for maximum power transfer in the circuit shown
- Find the maximum power



1) To find V_{TH}



$$I_2 = -2A \quad \text{Constraint equation}$$

$$12 = 18I_1 - 12I_2$$

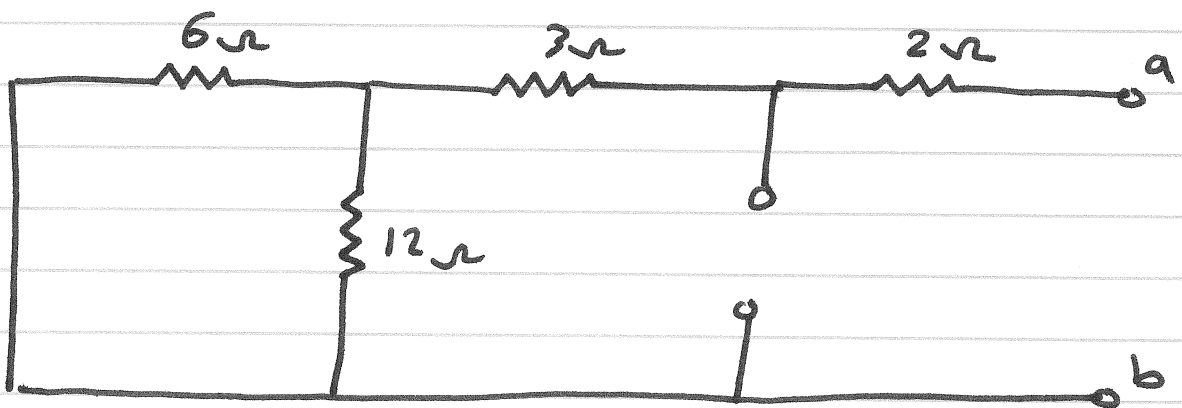
$$\therefore I_1 = -\frac{2}{3}A$$

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$$V_{TH} = -3I_2 - 6I_1 + 12$$

$$\therefore V_{TH} = 22V$$

2) To find R_{TH}



$$R_{TH} = 2 + 3 + 6 \parallel 12$$

$$R_{TH} = 2 + 3 + 4 = 9\Omega$$

$$\therefore R_L = R_{TH} = 9\Omega$$

$$\therefore P_{L, \max} = \frac{V_{TH}^2}{4R_{TH}} = 13.44W$$