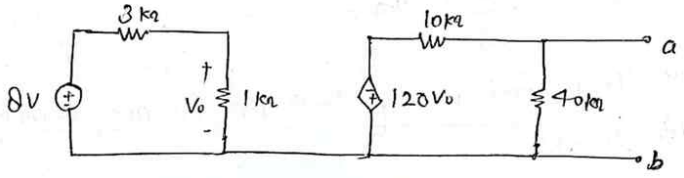
Answer

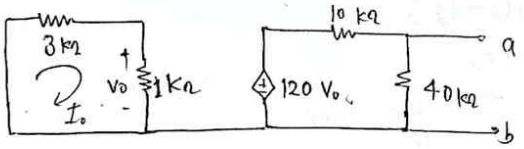
Soln: The ckt given to us can be represented as:



We need to find R_L across terminal a-b for maximum power transfer. for P_{max}

$$\boxed{R_L = R_{th}}$$

⇒ To find the R_{th} across terminal (a-b) we have to short ckt all the independent source (i.e 8V = 0 volt), then ckt become



On Apply KVL in left side loop, we get

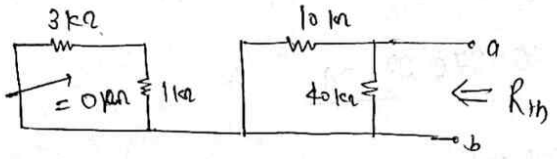
$$3I_o + 4I_o = 0$$

$$7I_o = 0$$

$$I_o = 0$$

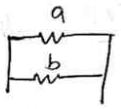
$$V_o = 1 \times I_o = 0$$

$$\boxed{V_o = 0}$$



$R_{th} = (10\text{k}\Omega) \parallel_{or} (40\text{ k}\Omega)$

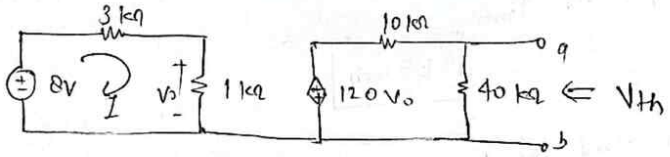
$R_{th} = \dfrac{10 \times 40}{50}$ $\quad \left\{ R_{ab} = \dfrac{a.b}{a+b} \right\}$



$R_{th} = \dfrac{400}{50} = 8\text{k}\Omega$

Hence, the required value of load resistance across terminal a-b is 8kΩ.

⇒ Now, we have to find $V_{th} = ?$ across terminal a-b as:-



Apply KVL in left side loop, we get

$-8 + (3+1) I_0 = 0$

$4 I_0 = 8$

$I_0 = \dfrac{8}{4} = 2\text{ mA}$

$v_0 = 1\text{k}\Omega \times 2\text{ mA} = 2\text{ volt}$

$V_{th} = \dfrac{40}{40+10} \times (120 \times 2) = \dfrac{4}{5} \times 240 = 192\text{ volt}$

The maximum power is given by:

$$P_{max} = \frac{V_{th}^2}{4R_{in}}$$

$$P_{max} = \frac{(192)^2}{4 \times 8} = 1152 \text{ watt}$$

$$\therefore P_{max} = 1152 \text{ watt}$$