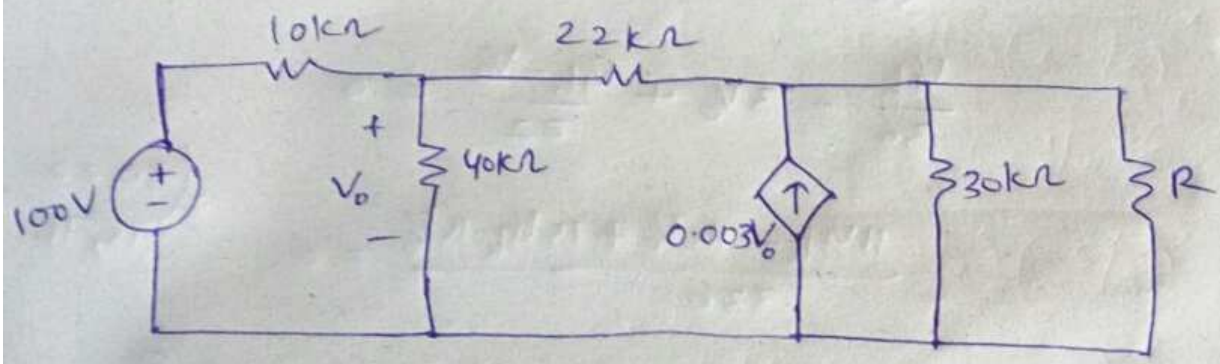
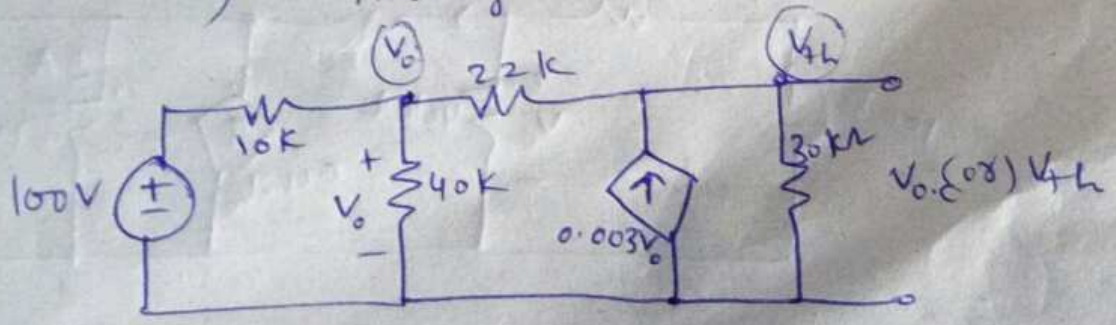
Answer



for maximum power transfered to R, R should be equal to thevinin's eqⁿ resistance across R terminals.

finding Rth

i) finding V_o.c (or) V_{th}



By applying nodal analysis

$$\frac{V_o - 100}{10K} + \frac{V_o}{40K} + \frac{V_o - V_{th}}{22K} = 0$$

$$\frac{V_o - 100}{10} + \frac{V_o}{40} + \frac{V_o - V_{th}}{22} = 0$$

$$\frac{44(V_o - 100) + 11V_o + 20(V_o - V_{th})}{440} = 0$$

$2(10, 40, 22)$
$10(5, 20, 11)$
$1, 2, 11$

$$\Rightarrow \quad 44V_o - 4400 + 11V_o + 20V_o - 20V_{th} = 0$$

$$\Rightarrow \quad 75V_o - 20V_{th} = 4400 \rightarrow (1)$$

$$\frac{V_{th}}{30K} + (-0.003V_o) + \frac{V_{th} - V_o}{22K} = 0$$

~~$\frac{V_{th}}{30} - 0.003V_o$~~

$$\frac{V_{th}}{30} - 3V_o + \frac{V_{th} - V_o}{22} = 0$$

$$\frac{11V_{th} - 110V_o + 15V_{th} - 15V_o}{330} = 0$$

$2(30, 22)$
$15, 11$

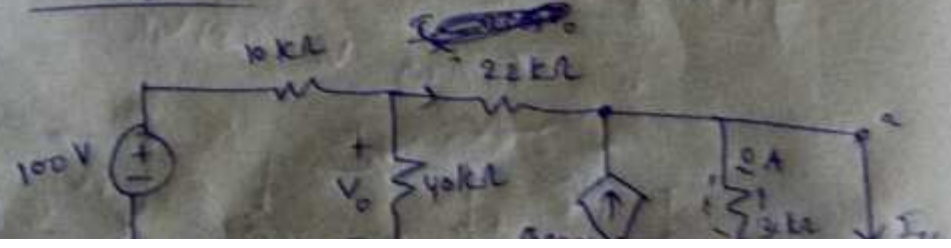
$$\Rightarrow \quad 26V_{th} - 125V_o = 0 \rightarrow (2)$$

Solving (1) & (2),

$$V_o = -208, \quad V_{th} = -1000$$

$$\boxed{V_{oc} \text{ (or) } V_{th} = -1000\ V}$$

finding I_{sc}



By KCL,

Current through 22kΩ resistor is $I_{sc} - 0.003V_o = I_{22k}$

Current through 10kΩ resistor is $I_{22k} + \frac{V_o}{40k}$

$$I_{10k} = \left(I_{sc} - 0.003V_o\right) + \frac{V_o}{40k}$$

By KVL,

$$-100V + 10k\Omega\left(I_{10k}\right) + V_o = 0$$

$$\Rightarrow \quad 10k\, I_{sc} - 30V_o + \frac{V_o}{4} + V_o = 100V$$

$$-29V_o + \frac{V_o}{4} + (10k)I_{sc} = 100 \rightarrow (1)$$

$$-V_o + (22k)\left(I_{sc} - 0.003V_o\right) = 0$$

$$\Rightarrow V_o = 22k\, I_{sc} - 66V_o$$

$$67V_o = (22k)I_{sc} \rightarrow (2)$$

Put (2) in (1);

$$\left(-29 + \frac{1}{4}\right)\left(\frac{22k}{67} I_{sc}\right) + (10k)I_{sc} = 100$$

$$-9.4940k\, I_{sc} + 10k\, I_{sc} = 100$$

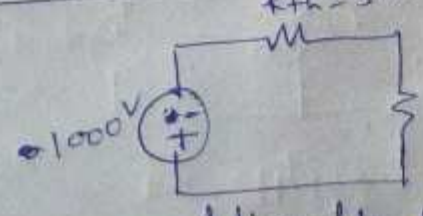
$$0.5597k\, I_{sc} = 100$$

$$I_{sc} = \frac{100}{559.70} = 0.17866\,A$$

$$= 178.66mA$$

$$R_{th} = \frac{V_{th}}{I_{sc}} = \frac{-1000}{178.66mA} = 5.597k\Omega \simeq 5.60k\Omega$$

Thevinin's eq^n ckt



max. power delivered to R = $\left(\frac{100}{2R_{th}}\right)^2 \times R_{th}$

Likes: 1 **Dislikes: 0**