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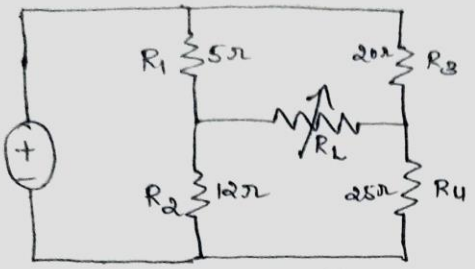
1ALIBEC055

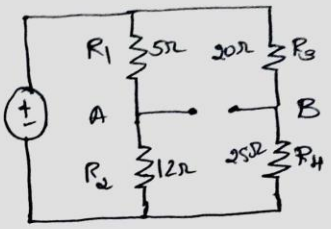
Circuit challenge

Max Power transfer:



Disconnect the load resistance from the load terminals a & b. To represent the given circuit as Thevenin's equivalent we have to determine the thevenins voltage V_{th} and Thevenins equivalent

The thevenins voltage (or) voltage across the terminal AB is $V_{AB} = V_A - V_B$



$$V_A = V \times R_2 / (R_1 + R_2)$$
$$= 30 \times 12 / (5+12)$$
$$V_A = 21.17V$$

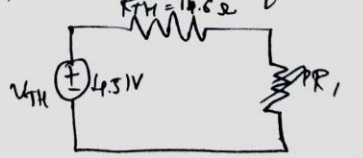
$$V_B = V \times R_4 / (R_3 + R_4)$$
$$= 30 \times 25 / (20+25)$$
$$V_B = 16.66V$$

$$\therefore V_{TH} = V_{AB} = V_A - V_B$$
$$= 4.51V$$

To Calculate the thevenin's equivalent circuit R_{TH} by replacing source with their internal resistance

$$R_{TH} = R_{AB} = (R_1 R_2 / (R_1 + R_2)) + (R_3 R_4 / (R_3 + R_4))$$
$$R_{TH} = 14.64\Omega$$

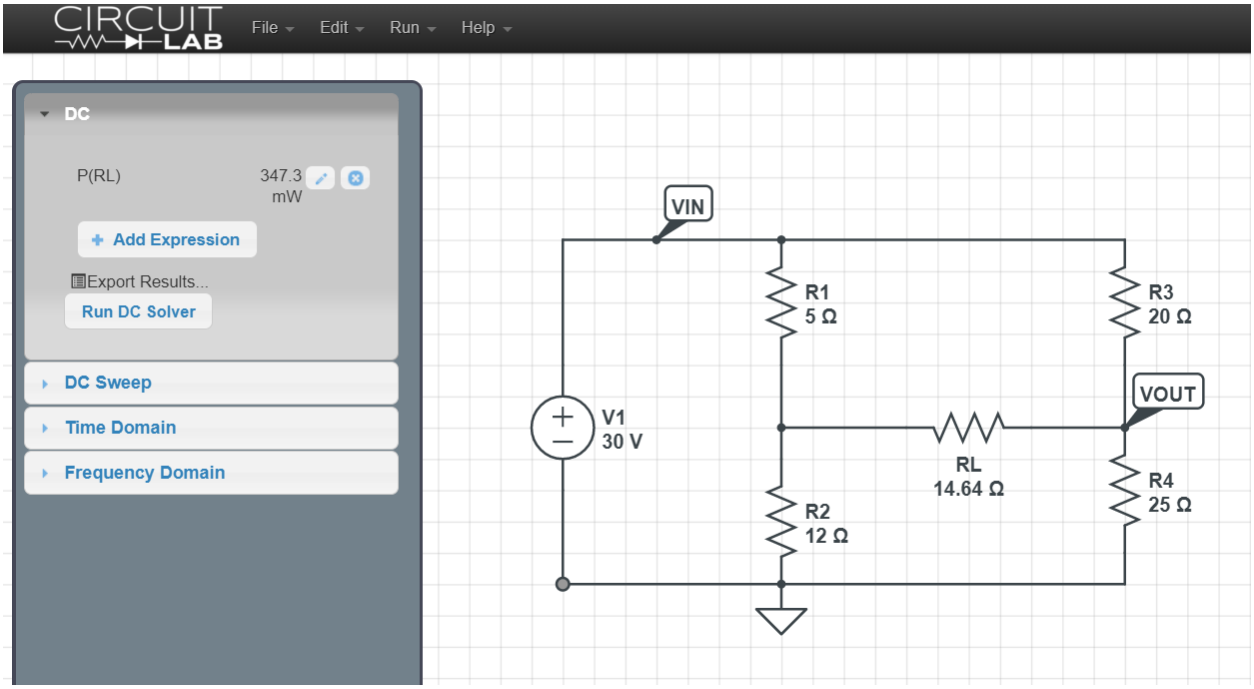
by reconnecting the load resistance the thevenin's equivalent circuit can be obtained as



For the maximum power transfer theorm, R_L value must be equal to R_{TH} to deliver maximum power to the load. $\therefore R_L = R_{TH} = 14.64\Omega$

And the maximum power transfered to load R_L is $P_{max} = V_{TH}^2 / 4R_{TH}$

$$P_{max} = (4.51)^2 / 4 \times 14.64 = 347.3 \text{ Watt}$$


CIRCUIT LAB
File
Edit
Run
Help
DC
P(RL)
347.3 mW
Add Expression
Export Results...
Run DC Solver
DC Sweep
Time Domain
Frequency Domain
VIN
R1
5 Ω
R3
20 Ω
V1
30 V
VOUT
RL
14.64 Ω
R4
25 Ω
R2
12 Ω