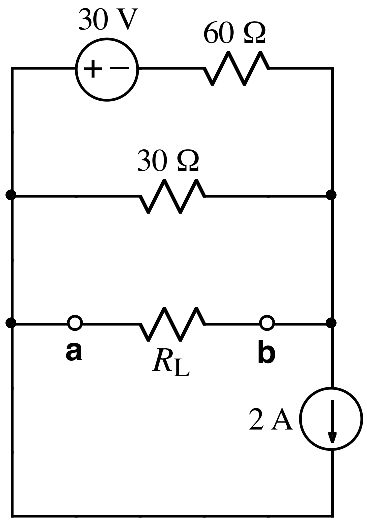
HOMEWORK #12 solution

Ex:

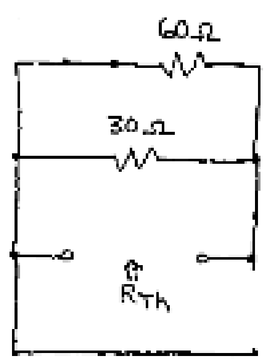


a) Calculate the value of R_L that would absorb maximum power.

b) Calculate that value of maximum power R_L could absorb.

sol'n: a) $R_L = R_{Th}$ where R_{Th} is the Thevenin equivalent resistance at a, b (with R_L removed).

Since there are no dependent sources, we find R_{Th} by turning off independent sources and looking into a, b:

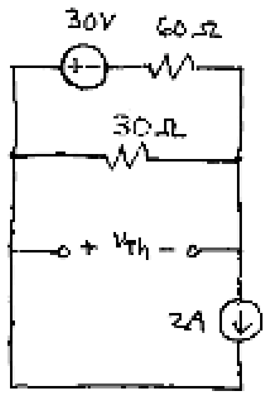


We see $30\Omega \parallel 60\Omega = 30\Omega \cdot 1 \parallel 2 = 20\Omega$.

$\therefore$ $R_L = R_{Th} = 20\Omega$ for max pwr xfer

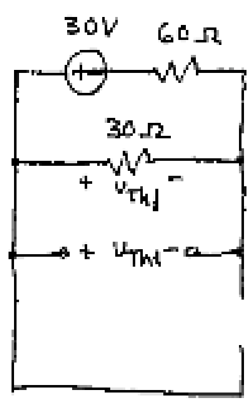
b) The max pwr is $\frac{V_{Th}^2}{4R_{Th}}$.

V_{Th} is the voltage across a,b without R_L:



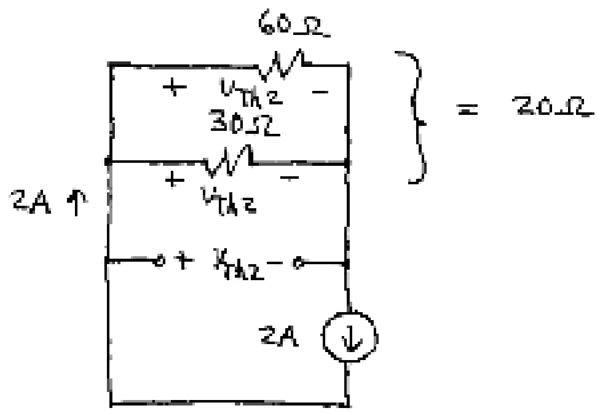
Superpositions yields a solution:

case I: 30V on, 2A off = open



Using v-divider, $V_{Th1} = \frac{30V \cdot 30\Omega}{30\Omega + 60\Omega} = 10V$.

case II: 30V off = wire, 2A on



The 2A flows thru $30\Omega \| 60\Omega = 20\Omega$ giving, by Ohm's law

$$V_{Th2} = 2A \cdot 20\Omega = 40V$$

Sum the results:

$$V_{Th} = V_{Th1} + V_{Th2} = 10V + 40V = 50V$$

$$P_{max} = \frac{V_{Th}^2}{4R_{Th}} = \frac{(50V)^2}{4 \cdot 20\Omega}$$

$$= 25 \cdot \frac{100}{80} \; W$$

$$= 25 \cdot \frac{5}{4} \; W$$

$$= \frac{125}{4} \; W$$

$$P_{max} = 31.25W$$