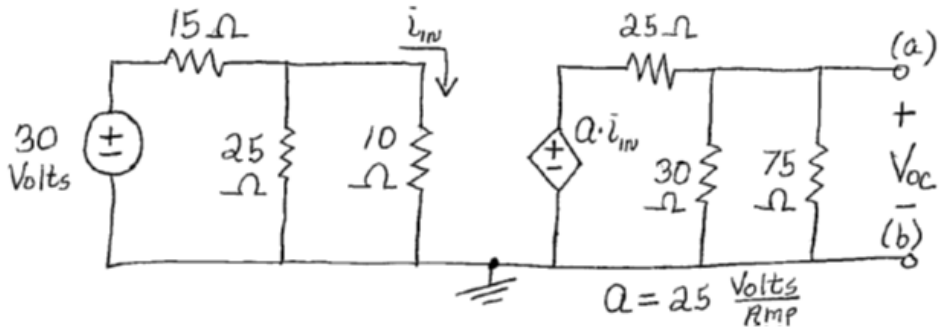
Problem of the Week Three

Saturday, October 24, 2020 6:11 PM

"I pledge my honor I have abided by the Stevens Honor system."

-Alex Gaskins



Part (a): A load resistance is placed between terminals "a" and "b". We want to select the value of the load resistance which will result in the maximum power being delivered to this load resistance. Determine the value of this load resistance for maximum power transfer. **(20 points)**

$$R_{eq} = \frac{30(75)}{75+30} = 21.43\ \Omega$$

$$V_{oc} = \frac{21.43}{25+21.43}(a\,i_{in}) = .46(25)\,i_{in} = 11.54\,i_{in}$$

$V = iR$

$a\,i_{in} = i_{sc}(25)$

$i_{sc} = i_{in}$

$$R_T = \frac{V_{oc}}{i_{sc}} = \frac{11.54\,i_{in}}{i_{in}}$$

$R_T = 11.54\ \Omega$

For maximum power: $R_T = R_L$

$$\boxed{R_L = 11.54\ \Omega}$$

Part (b): Determine the maximum power that can be delivered to a resistive load for the given circuit. **(5 points)**

$25(10) = 7.14\ \Omega$

Part (b): Determine the maximum power that can be delivered to a resistive load for the given circuit. **(5 points)**

$$R_{eq} = \frac{25(10)}{25+10} = 7.14\ \Omega$$

$$15 + 7.14 = 22.14$$

$$R_{total} = 22.14$$

$$V = iR$$

$$i = \frac{30}{22.14} = 1.355\ A$$

$$V = iR$$

$$V = 1.355(7.14)$$

$$V = 9.67\ V$$

$$V = iR$$

$$i_{in} = \frac{9.67}{10}$$

$$i_{in} = .967\ A$$

$$V_{oc} = 11.54(.967)$$

$$V_{oc} = 11.16\ V$$

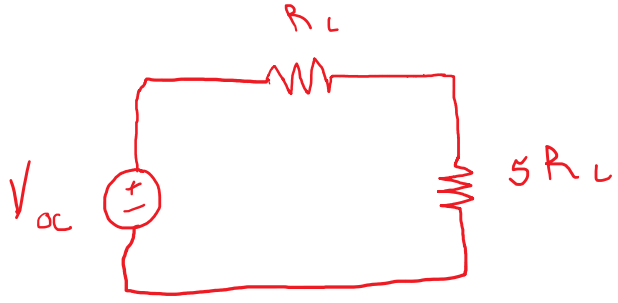
$$P_{Max} = \frac{\left(\frac{V}{2}\right)^2}{R}$$

$$P_{Max} = \frac{\frac{1}{4}(11.16)^2}{11.54}$$

11.54

$P_{Max} = 2.7$ Watts

Part (c): One of your colleagues (who has not taken this course!) incorrectly determines the value of the load resistor for maximum power transfer to be five times the correct answer to Part (a). Determine the power that can be delivered to a resistive load whose value is five times the correct answer to Part (a). (Note; the value for the power you calculate in this part of the problem should be less than the value for the power you calculated in part (b)). **(5 points)**



$$V_{(5R_L)} = \frac{5R_L}{R_L + 5R_L} V_{OC}$$

$$V_{(5R_L)} = \frac{5}{6}(11.54)$$

$$V_{(5R_L)} = 9.62\,V$$

$$P = \frac{V^2}{R}$$

$$P = \frac{(9.62)^2}{57.7}$$

$P = 1.6$ Watts