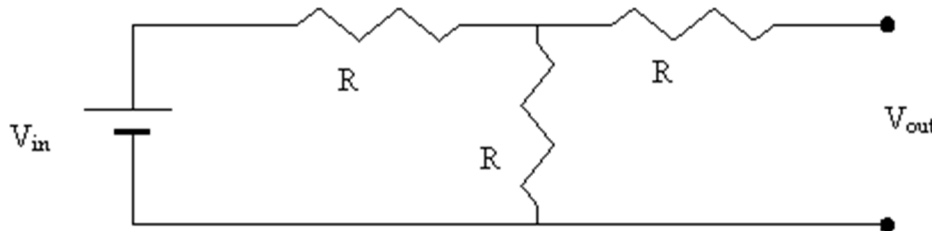


Physics 313 assignment 2 for Tuesday, Aug 30:

Topics: AC circuits; RC circuits

Problems:

1) a) Draw the Thévenin equivalent circuit for the circuit below and find the values of its components ( $V_{Th}$  and  $R_{Th}$ ). (Your answers may be in terms of  $V_{in}$  and  $R$ .)



b) A purely resistive load with  $R_{load}=R$  is now connected across the output. Use the Thévenin equivalent circuit to figure out what the voltage across the load is.

c) Check your answer to b) by using the original circuit and series/parallel/Kirchoff analysis tools.

2) a) Design a voltage divider circuit that will produce 3.0 V from a 15.0 V DC power supply, and that will not droop by more than 10% when a 10 k load is attached.

b) Is it OK to use 1/4-W resistors in your circuit? Justify your answer.

c) Explain in words why the voltage “droops” or “sags” when a load is attached.

d) For your circuit, what would be the percentage voltage droop if a 1 k load were used instead of the 10 k load?

3) You want to measure the input impedance of a voltmeter on a given scale. When the meter is placed across an ideal power supply (source of constant voltage), the voltage reading is 5.02 V. When the meter is placed in series with a 470 k resistor across the same power supply, the meter reading is 1.21 V. What is the impedance of the meter?

4) Reading questions:

a) How do you calculate the time constant for an RC circuit, and what does the time constant tell you?

b) What is the reactance of a 10  $\mu$ F capacitor at a frequency of 60 Hz (which is the AC line frequency in this country)?

c) How does the reactance of a capacitor in an AC circuit change as the frequency increases?