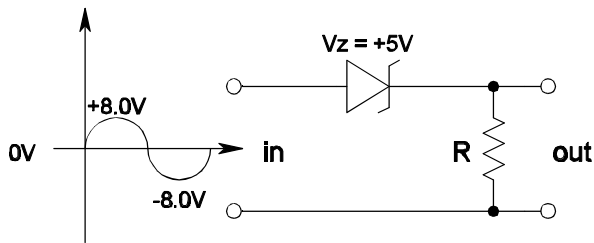


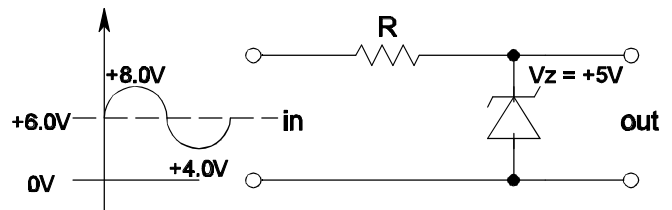
Homework Set #3 Electronics

1. Sketched below are several circuits involving diodes, some of which are zener diodes. Assuming the diodes are ideal ones, sketch the expected output waveforms for the inputs indicated. Indicated on the sketches of the outputs their peak values. (Consider an ideal zener diode to behave as a regular diode for forward voltages, and to have a vertical I vs V characteristic at the "zener" voltage for reverse voltages.)

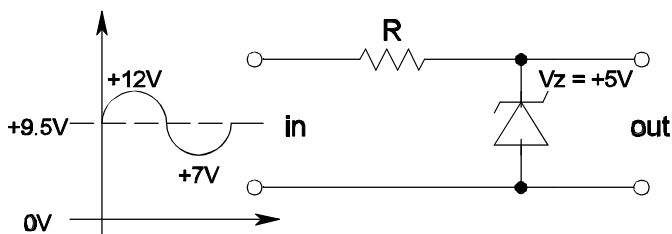
a.)



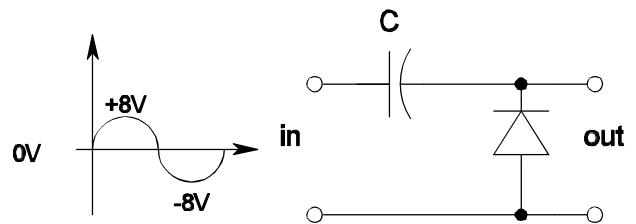
b.)



c.)

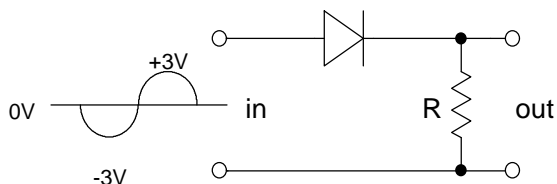


d.)

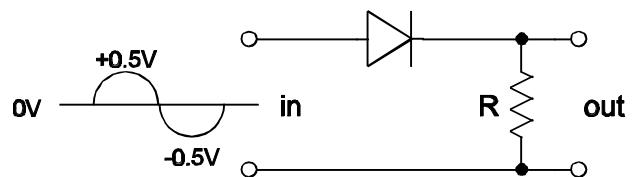


2. Sketch the expected output waveforms, with the indicated inputs, for the circuits sketched below. Consider the diodes to be real ones, made of silicon.

a.)



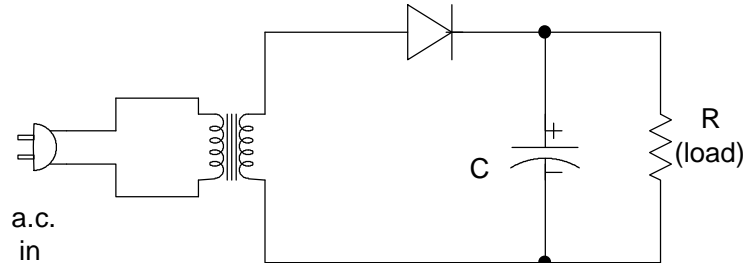
b.)



3. A "standard" half-wave rectified power supply circuit with a capacitor filter is sketched below, with a load attached. Use a combination of sketches, verbal discussion, and equations to answer the following questions.

a. What is meant by ripple, and ripple factor?

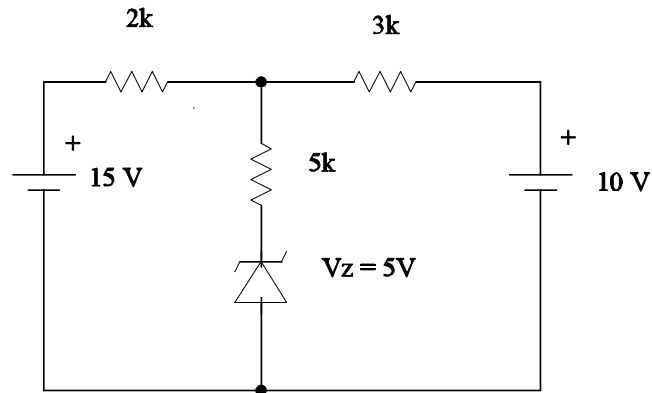
b. Explain qualitatively how the ripples arises, and why it will be greater for less C as well as for less R.



c. Why is a full-wave rectifier a better circuit?

4. a. Sketch the "standard" circuit for using a zener diode to "regulate" an input voltage.
- b. Calculate a usable resistance value (and its power rating) based on the following situation:
- i) $8V \leq V_{in} \leq 10V$.
 - ii) $V_{out} = 7V$
 - iii) $I_{out} = 200\text{ma}$
 - iv) $I_z \geq 10\text{ma}$
(diode current)
 - v) Diode Power $\leq 10W$.
- c. For your circuit, conclude whether or not it is "safe" to have no load connected, by calculating the power in the resistor and the power in the diode with no load.
- d. What maximum load current can your circuit provide before the diode current becomes unacceptably low? What minimum current can it provide before the power ratings of the R or diode are exceeded?

5. Use any method you choose to **calculate the current in the 5k resistor** of the circuit sketched below. (The zener diode has $V_z = 5V$.)



6. The zener diode in the circuit shown below has $V_z = 7.5V$, but requires that 20 ma. pass through the diode before this voltage is established.
- For the circuit as shown, calculate the **minimum** value of V necessary for establishing $V_z = 7.5V$ (@ 20 ma.).
 - Calculate the current through the diode when $V = 20V$.

