1. An underwater microphone is being used to listen to whales. A boisterous humpback is generating a 2 kHz signal on the microphone. The microphone output is 2V p-p when viewed on a high impedance oscilloscope. The microphone has an output resistance of 50 Ω. When the microphone is connected directly to an 8 Ω speaker, how large is the voltage across the speaker?

2. For the following amplifier, determine $V_{out}$ in terms of $R$, $V_1$ and $V_2$. Remember the basic rules of op-amp design.

![Image of amplifier circuit]

3. In the circuit below all the resistors are 1K.
   (a) What is the voltage drop across resistor C?
   (b) What is the current through resistor B?

![Image of circuit with 12V voltage source and resistors B, C, D]
4. For the following circuit, circle all the values of $V_{in}$ that will light the bulb.

A. $V_{in} = 5V$
B. $V_{in} = 1V$
C. $V_{in} = -1V$

5. A hand-warmer is a resistive heater that follows Ohm’s law. Consider a hand-warmer with an internal resistance of 1 $\Omega$. The power is provided by two 1.5 volt batteries, each with an output resistance of 0.5 $\Omega$. What is the output resistance of a power circuit that consists of the two batteries in series? If connected to the hand-warmer, how much power would these series batteries provide to the hand-warmer?

6. You are looking at a signal from a plasma discharge experiment that is in the frequency range of 50 kHz – 5 MHz. Unfortunately, the discharge itself produces lots of high-frequency noise at frequencies above 500 MHz. Design a RC filter that will leave the desired signal intact but attenuate the nasty very-high frequency stuff. Use a 1 k resistor in this filter. Draw a circuit diagram for the filter below and label the components with their values. Be sure to specify what frequency you are designing this filter for.