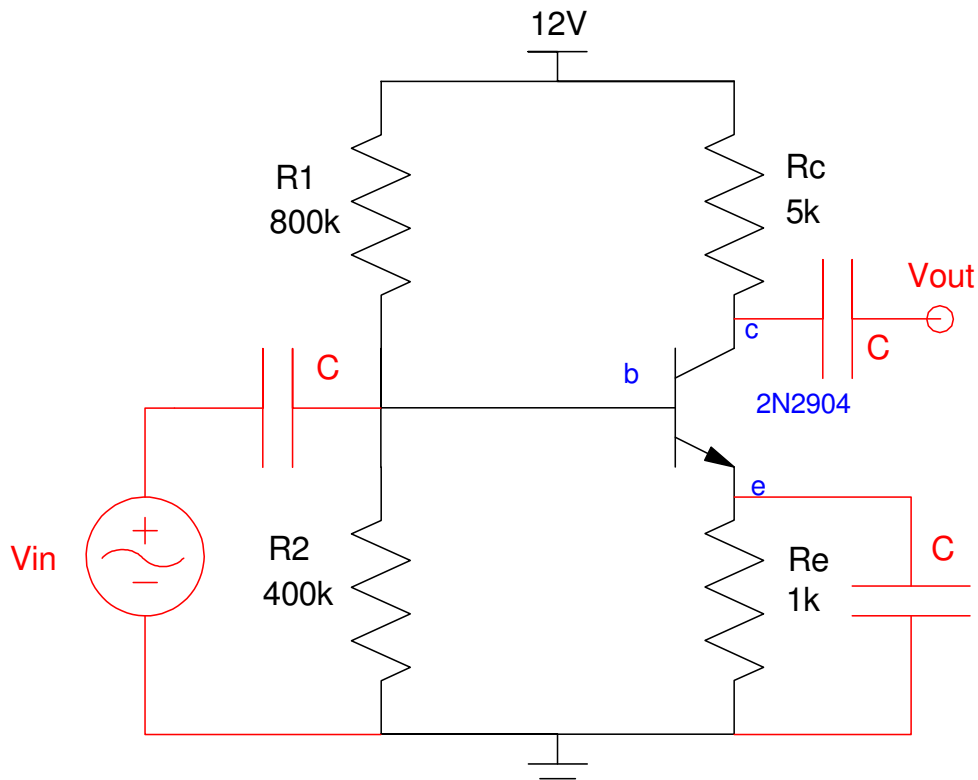


ECE 320 - Homework #9

2-Port Models, CE, CB, CC Amplifiers, Multistage Amplifier

CE Amplifiers (AC Analysis)

- 1) Draw the small signal model for the CE amplifier (below). Assume C is large.
 - Determine the resulting 2-port model
- 2) Check your answers for problem #6 in CircuitLab
 - R_{in} : If you add a resistor in series with V_s equal to R_{in} , the output drops by half
 - R_{out} : If you load V_{out} with a resistor equal to R_{out} , the output drops by half
 - A_o : Apply a 1mV, 1kHz sine wave at V_{in} . The output should be $A_o \cdot V_{in}$
- 3) Determine the 2-port model for cascading two of these CE amplifiers (CE : CE)



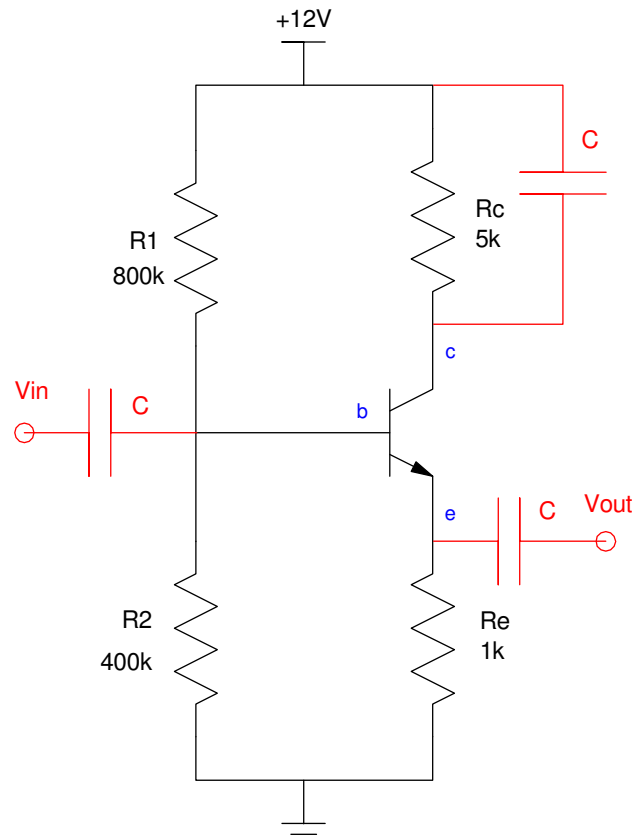
CC Amplifiers (AC Analysis)

4) Draw the small signal model for the CC amplifier (below)

- Determine the resulting 2-port model

5) Determine the 2-port model for a CE amplifier cascaded with a CC amplifier

CE : CC



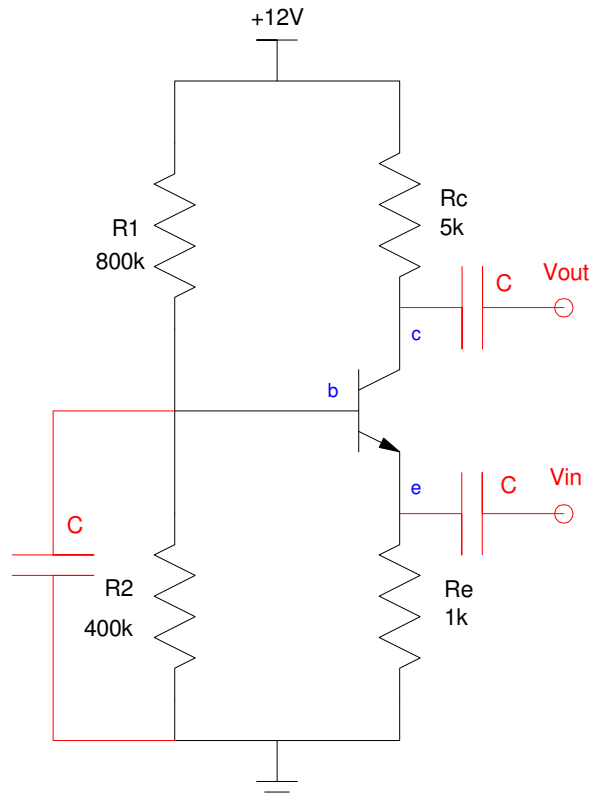
CB Amplifiers (AC Analysis)

6) Draw the small signal model for the CE amplifier (below)

- Determine the resulting 2-port model

7) Determine the 2-port model for a CB amplifier cascaded with a CE amplifier

CB : CE

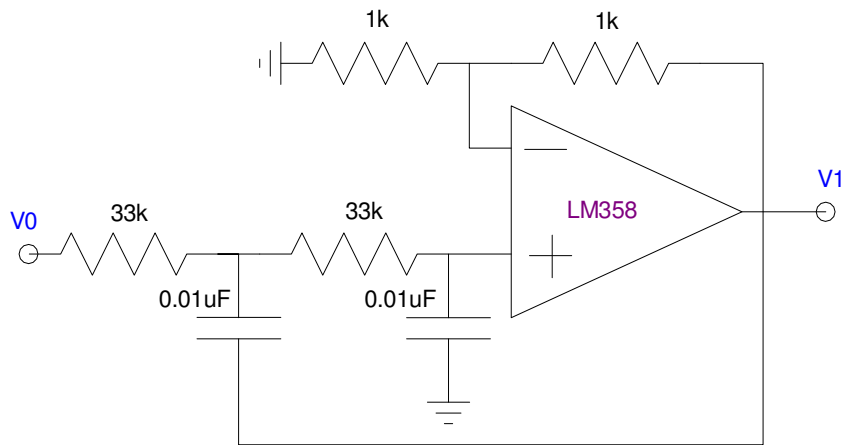


Lab (Subwoofer Crossover)

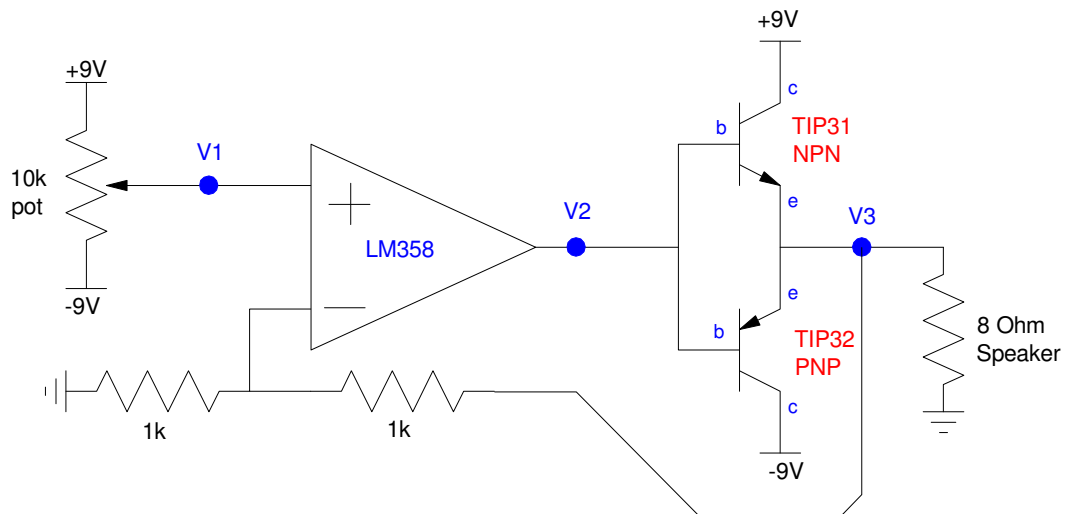
- 8) Find the transfer function for the following low-pass filter
- 9) Add this filter to the push-pull amplifier from homework #8 on your breadboard
 - Include a photo of your breadboard circuit for full credit.
- 10) Apply a 1Vp sine wave at V0 and record the voltage at {V1, V2, V3} for
 - V0 = 200Hz
 - V0 = 2kHz

Document this with a photo of your oscilloscope readings using your FNRSI multimeter

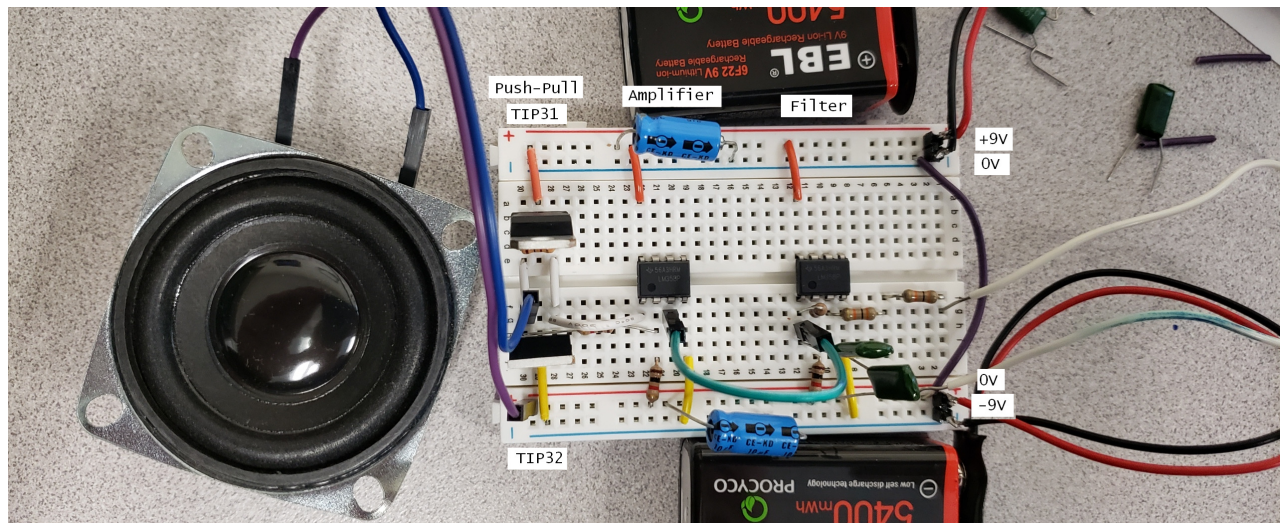
- 11) Apply music to V0 using your cell phone or the audio output of your computer playing a YouTube video. Document the output using a photo of an oscilloscope trace at V3 or a YouTube recording of your subwoofer



Low-Pass Filter: Corner = 500Hz (approx)



Homework #8 Circuit. Replace V1 with the output of the low-pass filter for a subwoofer



Sample circuit for Homework #9

Notes:

- Use two +9V batteries to provide
 - +9V and 0V (top rail)
 - 0V and -9V (bottom rail)
- Use LM358 op-amps (analog)
- Color code your wires
 - red = +9V
 - yellow = -9V
 - black = 0V
- Keep your circuit neat and orderly
- Take a photo of your final working circuit
- Make a video showing your circuit amplifies low frequencies (acts as a subwoofer driver)