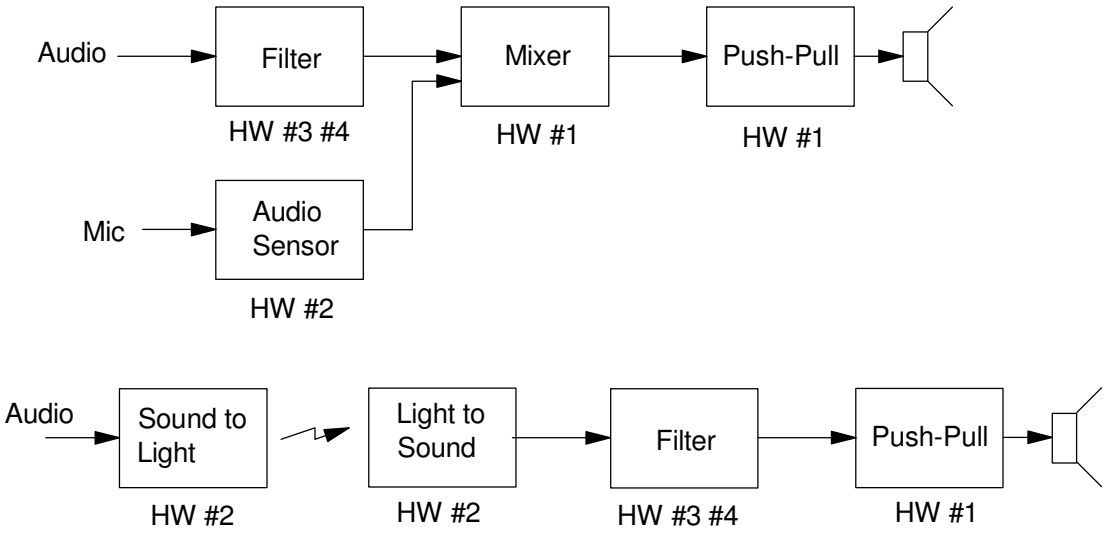
ECE 321 - Homework #1

Op Amp Amplifiers, Push-Pull Amplifiers. Due Monday, April 4th

Please make the subject "ECE 321 HW#1" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

1) Pick an amplifier to build for ECE 321 Analog Electronics. This amplifier needs to include
   - A speaker and a push-pull amplifier (homework #1)
   - An amplifier and/or mixer (homework #1),
   - A sensor (light, audio, temperature / 555 timer) and
   - A filter (homework #3 and #4),

Some suggestions are...



For all problems, assume you are using

- MCP602 Op Amps (max current = 50mA)
- 2SC6144 transistors (β = 200, 10A max, |Vbe| = 0.7V), or
- TIP112 / TIP117 NPN and PNP power transistors (for a push-pull amplifier).
  - β = 1000, 3A max, |Vbe| = 1.4V

Amplfier:

Design a circuit to implement

2a) Y = +6X

2b) Y = -6X

2c) Y = 12 - 6X

Mixer

3) Design a circuit to mix three signals together:

- Y = 3A + 7B + 2C

Push-Pull Amplifier

4) Design a circuit so that Y = X

- X = -5V to +5V, 10mA max
- Y = -5V to +5V, 200mA (25 ohm speaker (net))

5) Simulate in CircuitLab

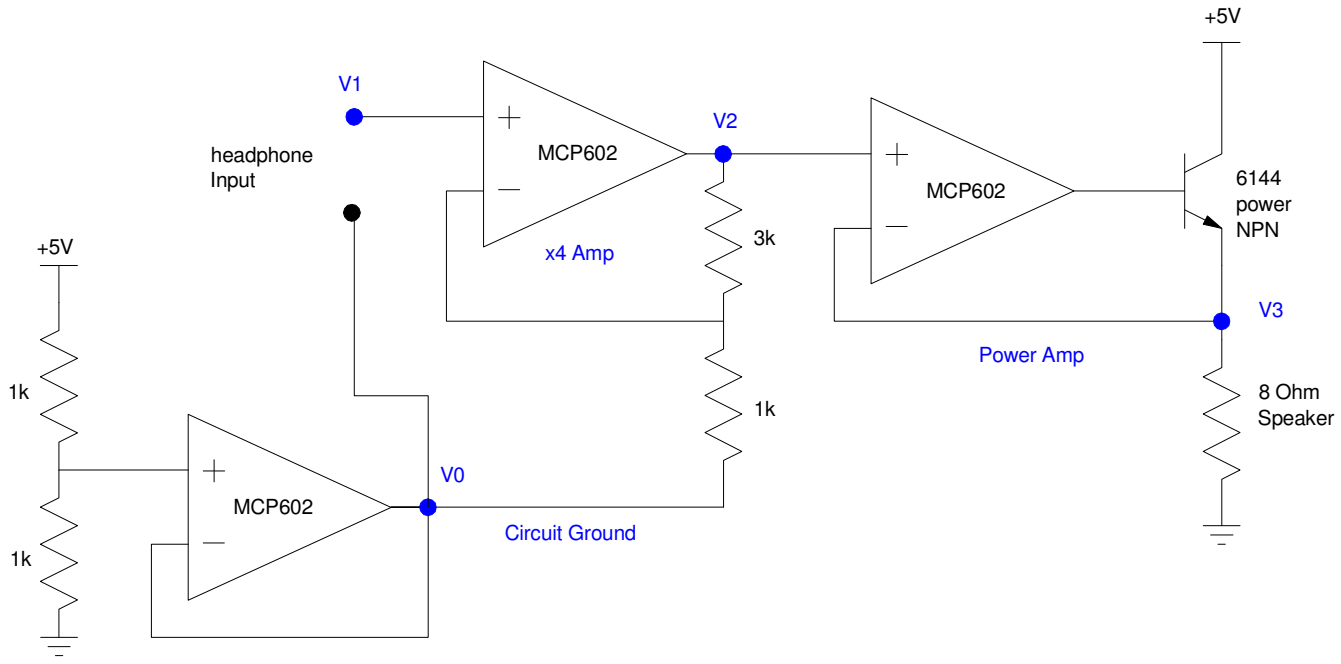
Lab (Hardware) -

Pick one of the following two circuits depending on whether you have a single +5V power supply or dual +6V/-6V power supplies available

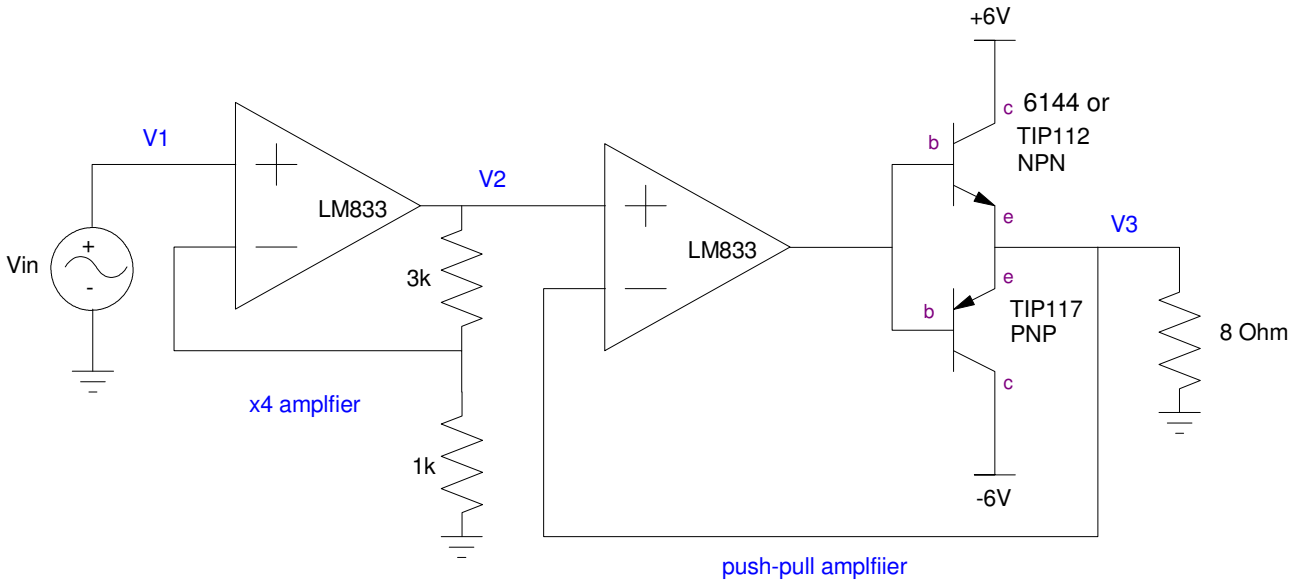
Option #1 (single +5V power supply)

The following circuit

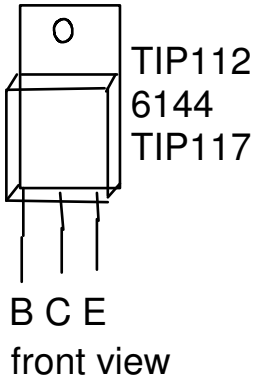
- Creates a 2.5V power supply from a single +5V supply (V0). This 2.5V supply then acts like circuit ground
- Amplifies the output of a cell phone (or computer or 555 timer) (V2), and
- Drives an 8 Ohm speaker (V3)



Option #2 (dual power supplies: +6V & -6V)



For the amplifier you're going to use for the rest of this course...



6) Calculate the voltages and currens when

- ~~Vin = 1.0V~~
- ~~V1 = 1.5V~~
- ~~V1 = 2.0V~~

Single Power Supply: Vin = {2.2V, 2.5V, 2.8V}

Dual Supply: Vin = {-0.3V, 0V, +0.3V}

7) Simulate this curcuit in CircuitLab with

- V1 = 1Vpp, 1kHz sine wave

8) Build this circuit in hardware. With a sine wave input, (1kHz) verufy that that

- V2 = 4*V1 (relative to circuit ground)
- V3 = V2 (relative to circuit ground)

8) Demo

- Replace V1 with an audio signal and verify the song plays on the speaker