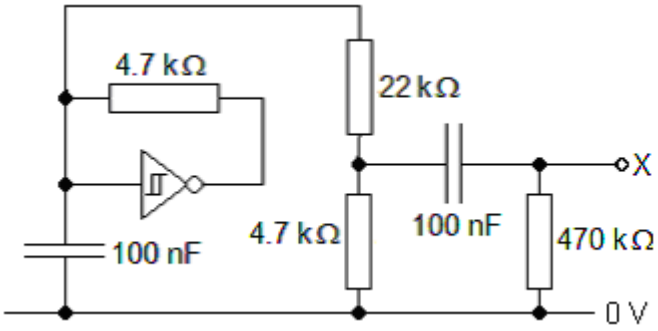
Loading signal sources

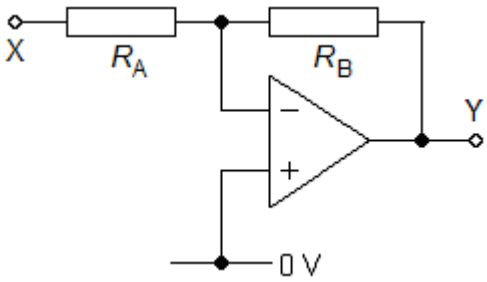
You are going to investigate the effect of input impedance on the operation of an amplifier.

1 Assemble this signal generator circuit. Use supply rails at ±5 V.



2 Use an oscilloscope to verify that the signal at X is a triangle wave with an amplitude and frequency of about 200 mV and 4 kHz.

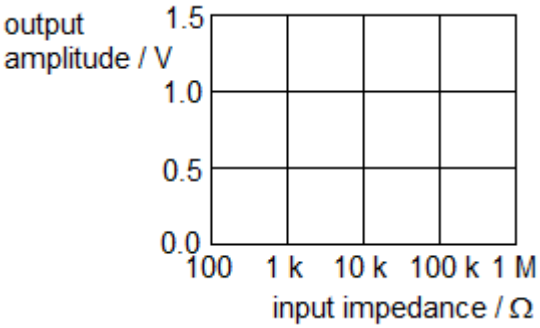
3 Now add this inverting amplifier. Start off with R_A = 1 MΩ and R_B = 10 MΩ, giving a voltage gain of -10.



4 Measure the amplitude of the signal at Y. Record it in the table below.

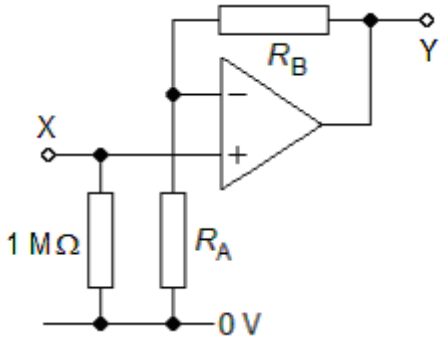
5 Repeat step 4 for the different values of R_f and R_{in} given in the table. Note that each pair gives the same voltage gain of -10.

R_B	R_A	V_Y
10 MΩ	1 MΩ	
1 MΩ	100 kΩ	
100 kΩ	10 kΩ	
10 kΩ	1 kΩ	
1 kΩ	100 Ω	



6 On the axes above, plot a graph to show how the signal at Y depends on R_A, the input impedance of the amplifier. Note the use of a log scale on the horizontal axis.

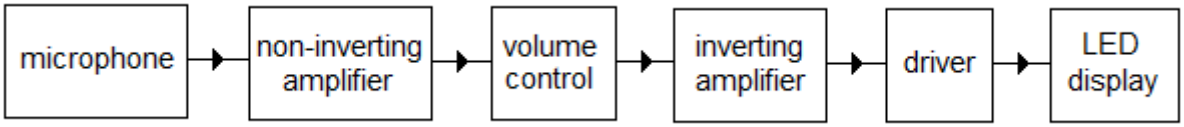
7 Replace the inverting amplifier with the non-inverting one shown opposite. Use the pairs of resistor values given in the table above, so that the voltage gain each time is +11. Verify that the signal at Y has the same value for each pair of resistor values.



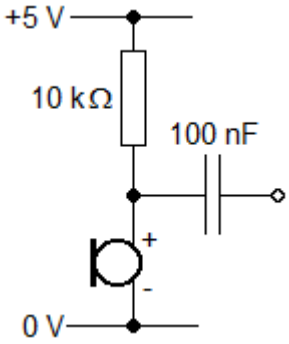
8 Comment on the results of step 7.

Sound-to-light converter

Here is a block diagram for a sound-to-light converter. The LED only glows when the microphone picks up enough sound. You are going to design circuits for some of the blocks.



1 Start off by assembling this microphone circuit.

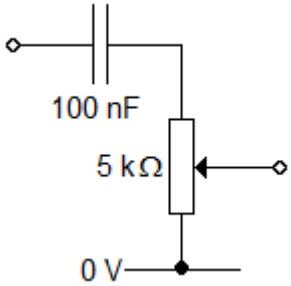


2 Use an oscilloscope to verify that there is a small a.c. signal at the output when sound enters the microphone.

3 Design a non-inverting amplifier with a gain of +6.

4 Assemble the non-inverting amplifier. Test it with signals from the microphone circuit.

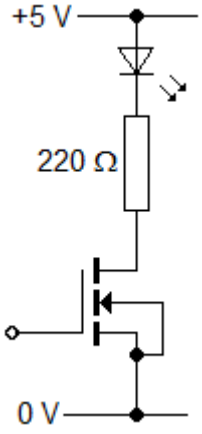
5 Add this volume control circuit. Verify that rotating the potentiometer alters the amount of signal transferred from the non-inverting amplifier.



6 Design an inverting amplifier with a gain of -50.

7 Assemble the inverting amplifier. Test it with signals from the output of the volume control.

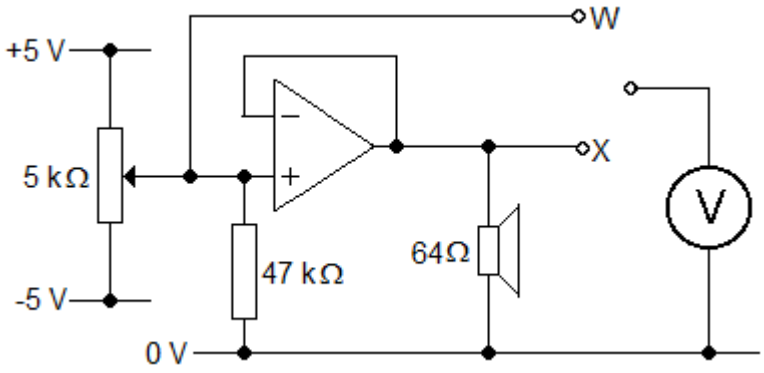
8 Finally, assemble this driver and LED circuit. Connect the input to the output of the invertinng amplifier. If all is well, the LED should glow when enough sound enters the microphone.



Power amplifier

You are going to investigate the transfer characteristic of a power amplifier made from a L272M i.c.

1 Assemble this voltage follower circuit with one of the op-amps on a TL084 i.c.



2 Connect the voltmeter to W. Verify that rotating the potentiometer allows the signal at W to be varied between +5 V and -5 V.

3 Connect the voltmeter to X. Rotate the potentiometer. Verify that the signal at X is always within the range +1 V to -1 V. This because the maximum current in the output of a TL084 op-amp is only 40 mA.

4 Replace the TL084 op-amp i.c. with a L272M op-amp i.c. Verify that the signal at X can now be in the range +4 V to -4 V, due to the larger current available at the op-amp output.

5 Replace the driver and LED display in your sound-to-light converter with this power amplifier and loudspeaker. Then link up your system with another one on the same bench, as shown below. Your microphone signal goes to their loudspeaker and vice versa - this reduces the changes of feedback making the system howl. You will need to connect the 0 V rails of the two systems.