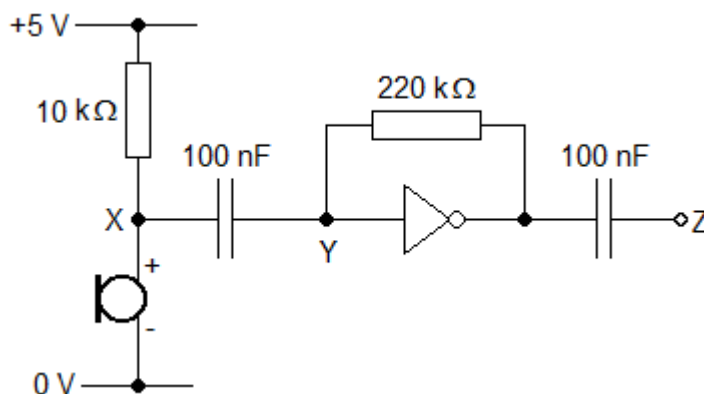
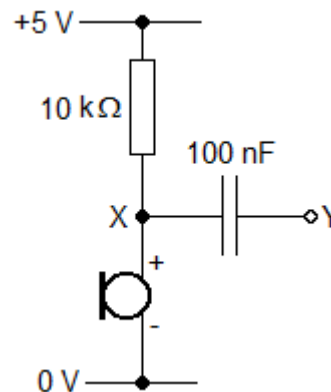


Investigating a microphone

You are going to investigate the transfer characteristics of a microphone.

- 1 Assemble this microphone circuit. Note that the microphone has a polarity.
- 2 Use a double-beam oscilloscope to display the signals at X and Y. You will need to ensure that the oscilloscope is set to DC. Start off with a timebase of 1 ms / div and speak into the microphone.
- 3 Verify that the signals at X and Y have different d.c. levels but the same a.c. signals.
- 4 Note the effect of replacing the 10 k Ω pullup resistor with 1 k Ω and 100 k Ω in turn.
- 5 Now add an amplifier to the microphone as shown below. Run the 4069 i.c. off supply rails at +5 V and -5 V instead of the usual +5 V and 0 V.

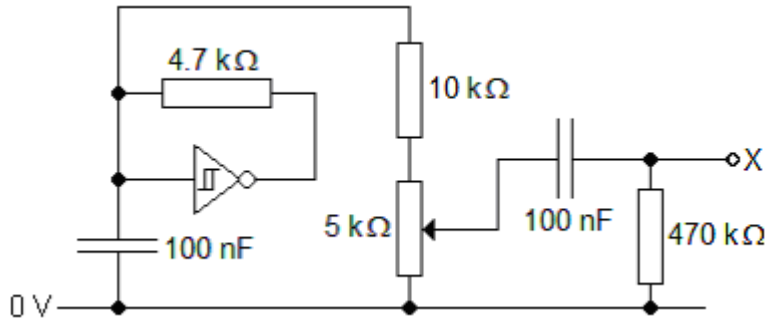


- 6 Use the double-beam oscilloscope to display the signals at the input and output of the amplifier (X and Z). Set the oscilloscope to AC. Verify that the output signal:
 - has the same shape as the input signal, with inversion
 - has a much larger amplitude than the input signal.
 Use the traces on the screen to estimate a value for the voltage gain of the amplifier.

Voltage gain

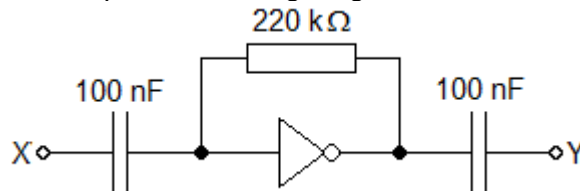
You are going to measure the voltage gain of a simple amplifier.

- 1 Assemble the signal generator circuit shown below. Run the 40106 i.c. off supply rails at ± 5 V instead of the usual +5 V and 0 V.



- 2 Use a double beam oscilloscope to display the signal at the output X. Set the timebase to $50 \mu\text{s} / \text{div}$ and the vertical amplifier to $50 \text{ mV} / \text{div}$. If all is well, the screen should display a triangle-shaped waveform with a period of $200 \mu\text{s}$ and an amplitude of up to about 200 mV, depending on the setting of the potentiometer.

- 3 Assemble the simple amplifier shown below. Run the 4069 i.c. off supply rails at ± 5 V. Connect the input to the output X of the signal generator.



- 4 Use the oscilloscope to display the signals at input and output of the amplifier (X and Y). Vary the amplitude of the input signal and verify that there is distortion of the output when the amplitude is large.

- 5 Set the amplitude of the signal at X (V_{in}) to 160 mV. Measure the amplitude of the signal at Y (V_{out}). Calculate the gain of the amplifier with $G = V_{out}/V_{in}$.

| V_{in} | V_{out} | G |
|----------|-----------|-----|
| 160 mV | | |
| 80 mV | | |
| 40 mV | | |
| 20 mV | | |
| 10 mV | | |

- 6 Repeat step 5 for the other input signals given in the table.