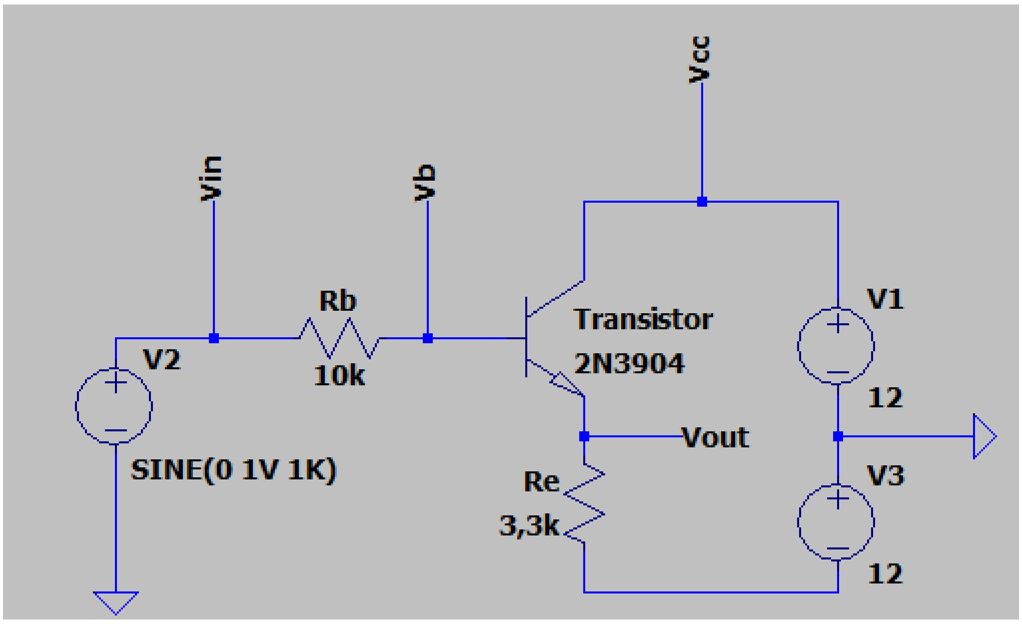
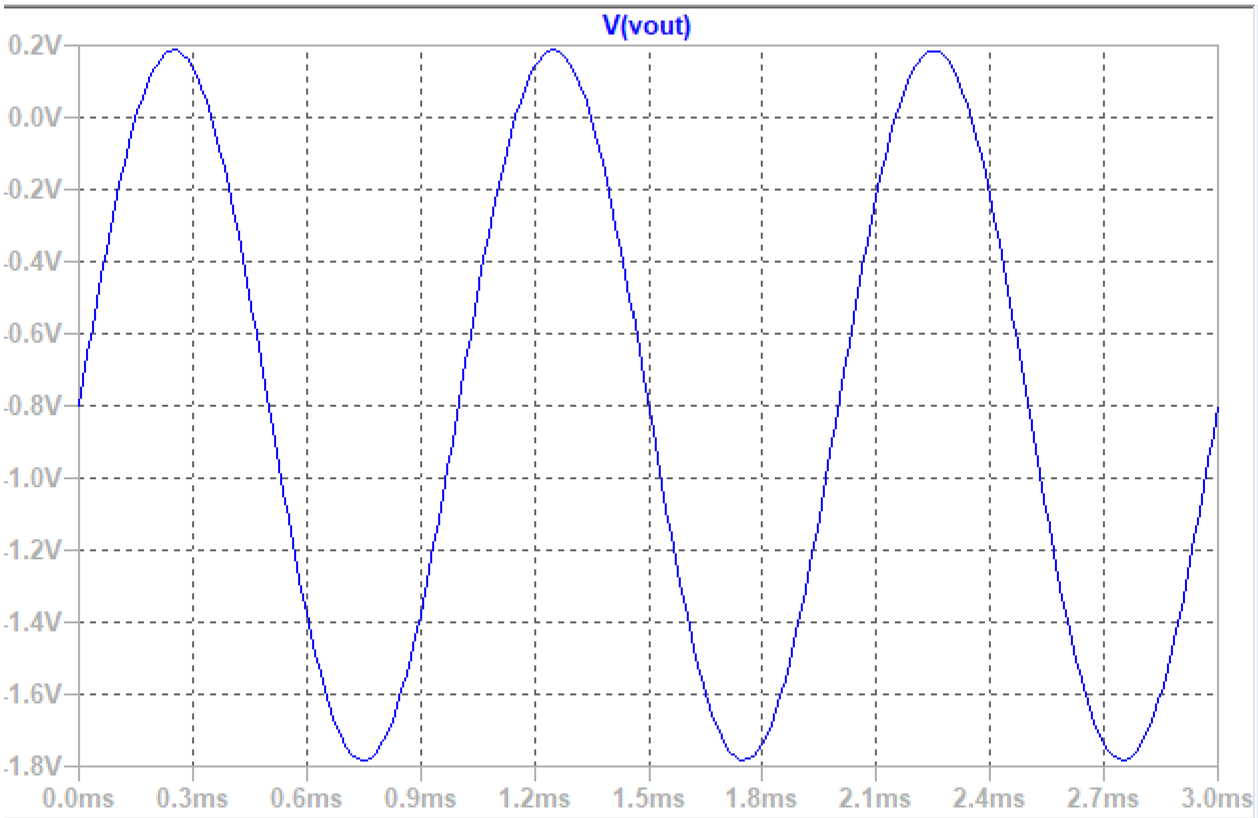
LAB04 ekstra 1

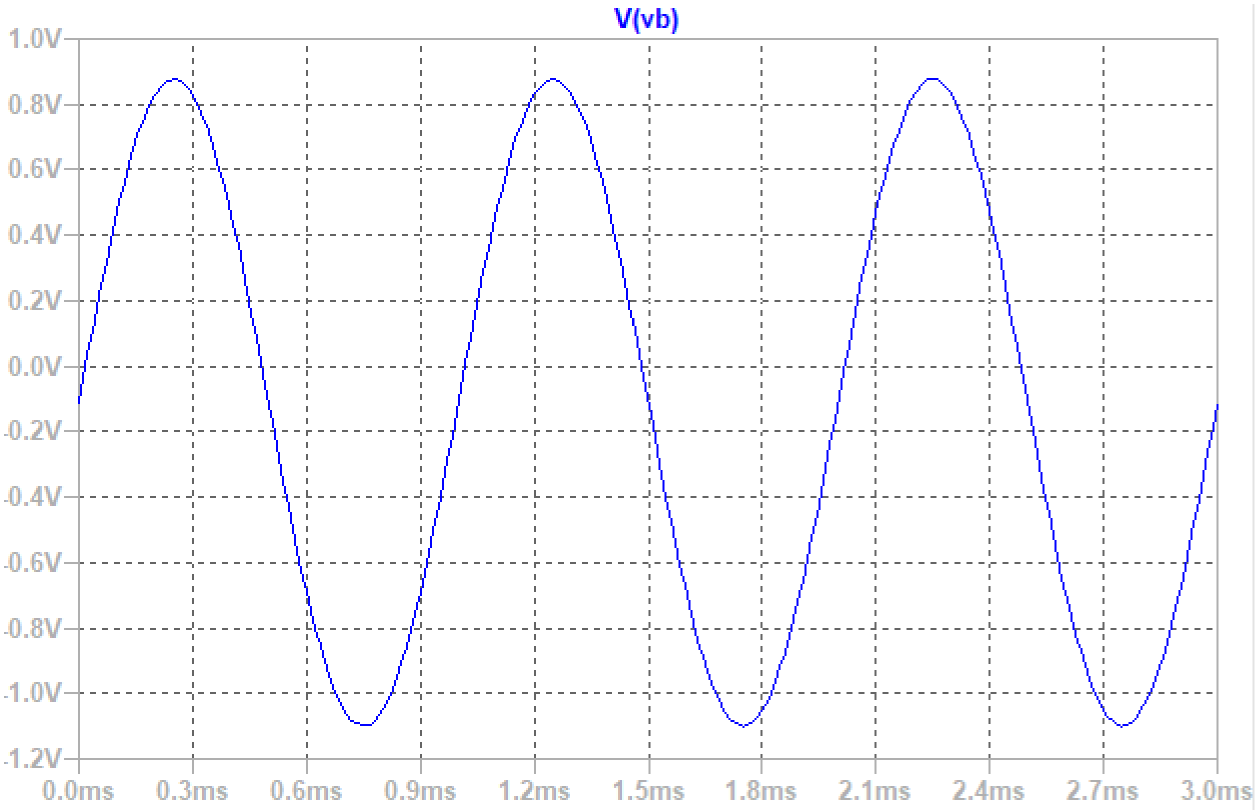
Circuit:



Measure the voltage (DC+ac) in emitter:



Measure the voltage (DC+ac) in base:



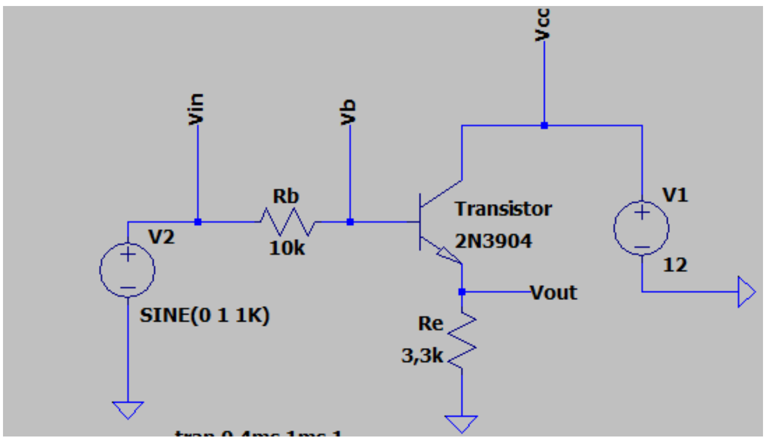
Determine the emitter current (DC+ac) using ohm's law and your previous voltage measurement:

Ib = Vin/Rb
Ib = 1V/10k ohm = 0.1mA
Ve = -12V, therefore Vre = Ve - Vbe
=> Vre = -12V - 0.7V = -12.7V

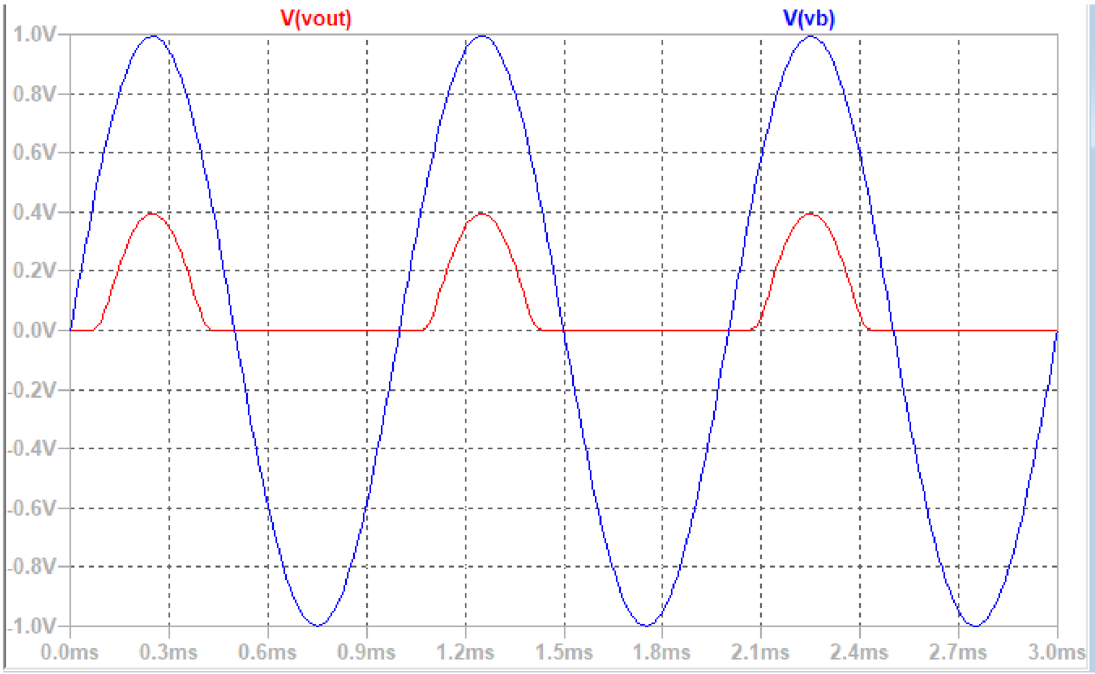
Ie = Vre/Re

Ie = -12.7V/3.3k ohm = -3.82mA

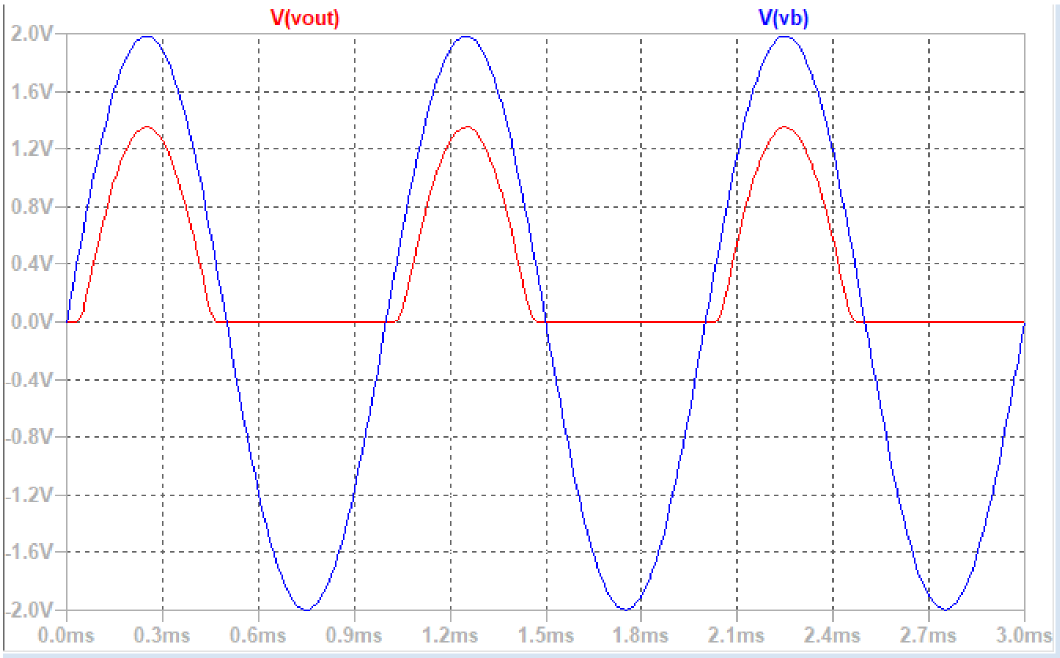
Now connect the emitter resistor (RE) to ground instead of - 12 V:



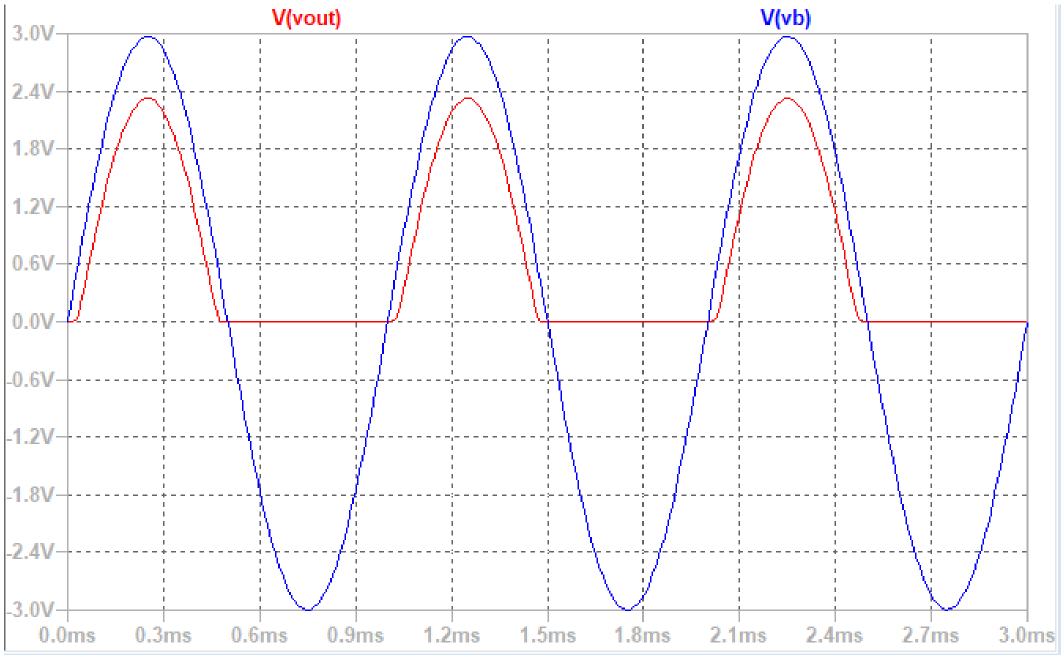
Observe the display for several amplitudes of input:



(offset 0V, 1V)



(offset 0V, 2V)

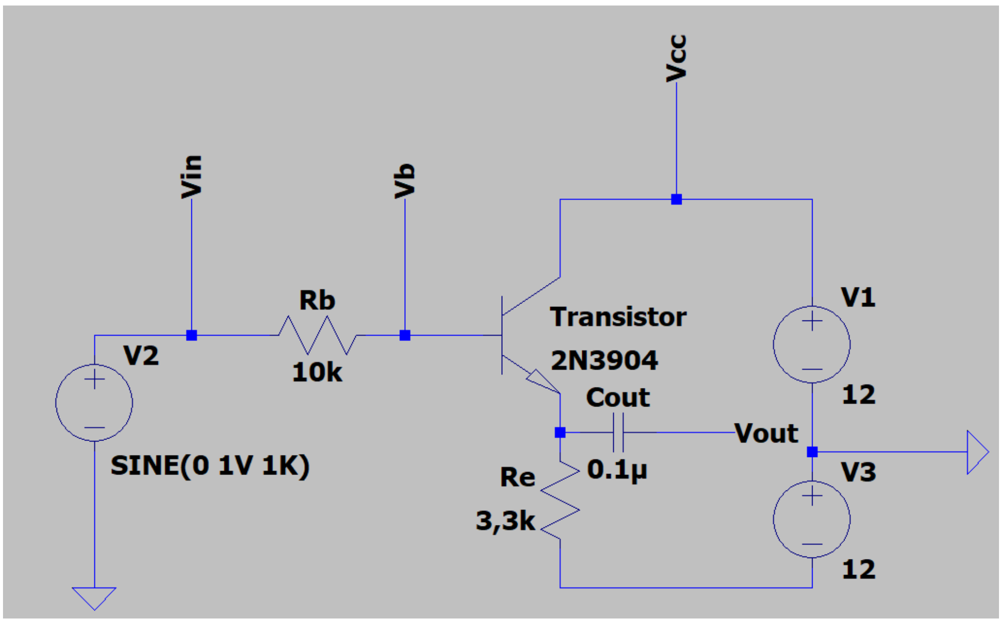


(offset 0, 3V)

Explain how and why the circuit functions more poorly:

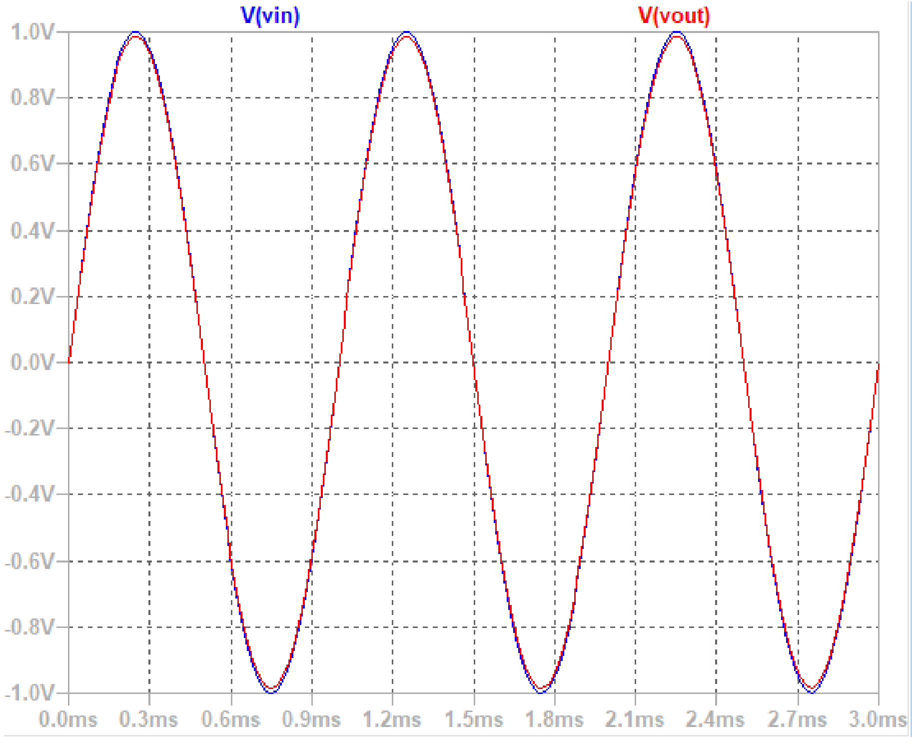
In a typical emitter-follower setup where the emitter resistor Re is connected to ground, changes in the base voltage Vb directly affect the emitter voltage Ve. This occurs because the emitter voltage Ve closely tracks the base voltage Vb minus the base-emitter voltage drop Vbe. As Vb increases, Ve follows closely, maintaining a voltage drop of approximately 0.7V between the base and emitter. On the other hand, when a negative voltage (-12V in our case) is connected to the emitter pin, it introduces a different dynamic. The emitter voltage Ve is fixed at this negative voltage level, creating a sort of "offset" for the emitter. Consequently, the emitter voltage Ve doesn't directly follow the base voltage Vb changes as in the traditional setup.

Connect the emitter back to -12 V. Add a blocking capacitor to the output:



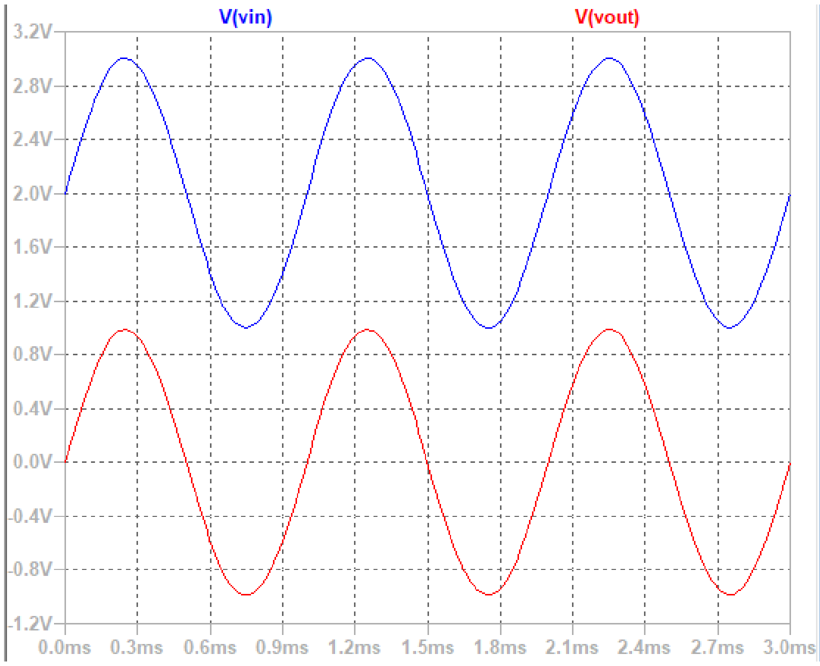
Question: Why don't we use a blocking capacitor at the input?
In case we would want to use an offset, the capacitor would filter the DC component.

Measure the ac voltage gain:



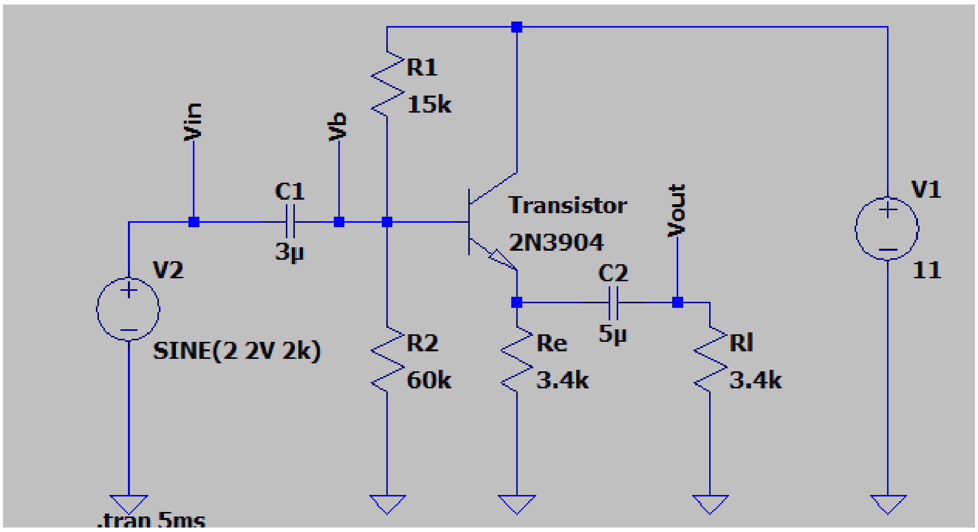
Confirm that the output capacitor is blocking a dc bias:

To accomplish this. We need to introduce a 2V DC offset to our 1V AC input signal. Then we can measure Vin and Vout simultaneously and compare the signals. There we can see if any DC bias is filtered.



Requirements:

Design, **simulate** and implement a working voltage follower with one sided supply voltage only. design your own version of it, where Collector current is about 5 mA. Include the simulation results and calculations in your lab report, implement the circuit and measure that it works as expected



Calculate circuit component values:

Re = Rl || RL
Re = 3.4k ohm || 3.4k ohm = 250 ohm

Vb = R2 / R2 + R1*Vcc
Vb = (60k ohm/60k ohm + 15k ohm) *11V = 8,8 V

Ve = Vb - Vbe

Ve = 8,8, V – 0,7 V = 8,1 V

Ie = Ve/Re

Ie = 8,1 V / 1k7 ohm = 4.76 mA, **rough estimate.**

Ic = Ie
Ic => 4.76 mA

Assuming B = 100
Ib = Ic/B
Ib = 4.76mA/100 = 47.6uA

Input resistance = R1 || R2 || (B * Re)

R1 || R2 = 1/((1/60k ohm) +(1/15k ohm)) = 12k ohm

(B * Re) = 100 * 1.7k ohm = 17k ohm

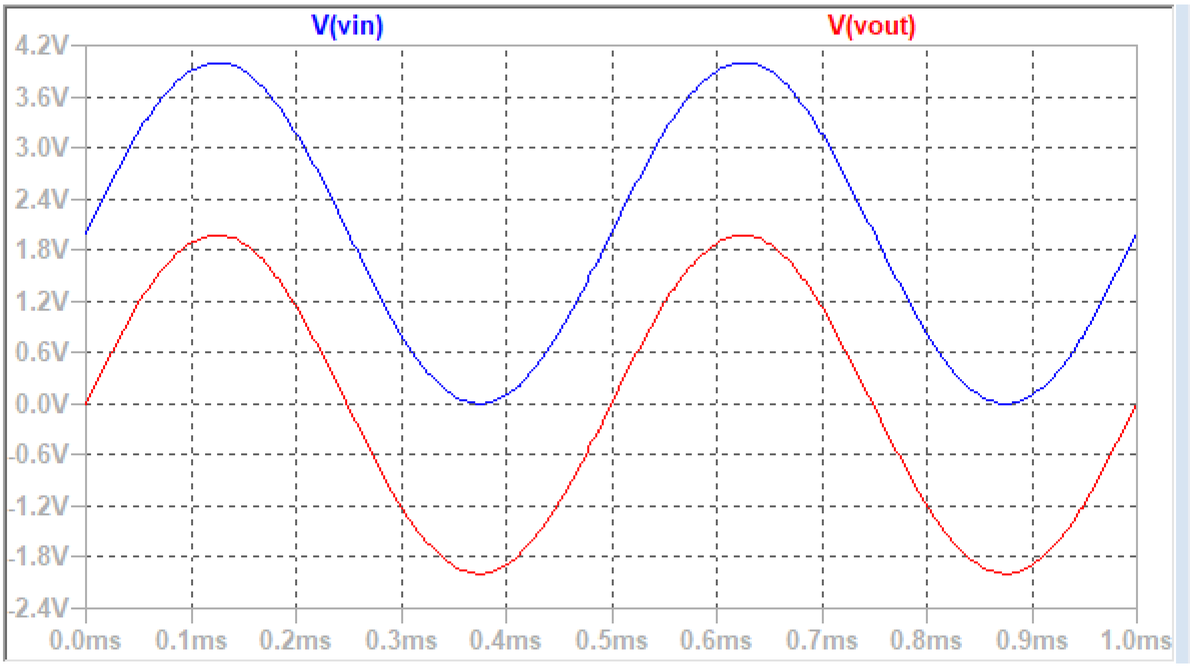
input resistance = 12k ohm || 25k ohm = 7 034 ohm

Vrms = Vpeak/root ()

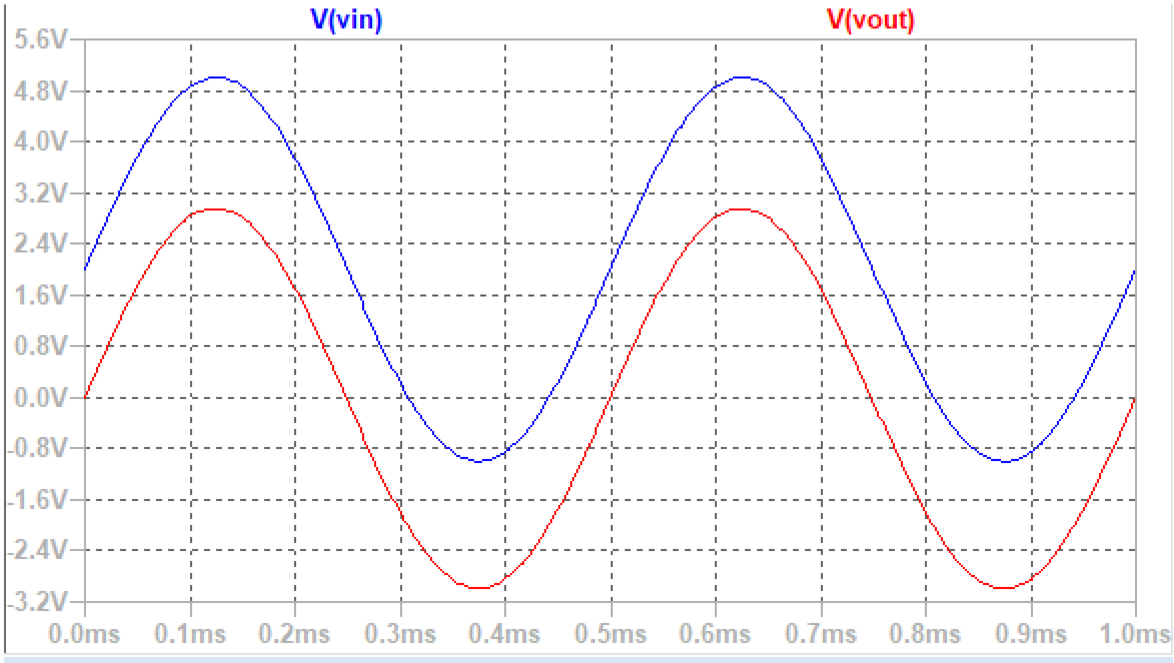
Vrms = 2V / root (2) = around 1,41Vrms

Iin = Vin / Rinput resistance
Iin = 1.41Vrms / 7 034 ohm = 0.2mA

Current gain is Iout/Vin = 117.6



(Here we can review that +2V DC bias has been blocked at output.)

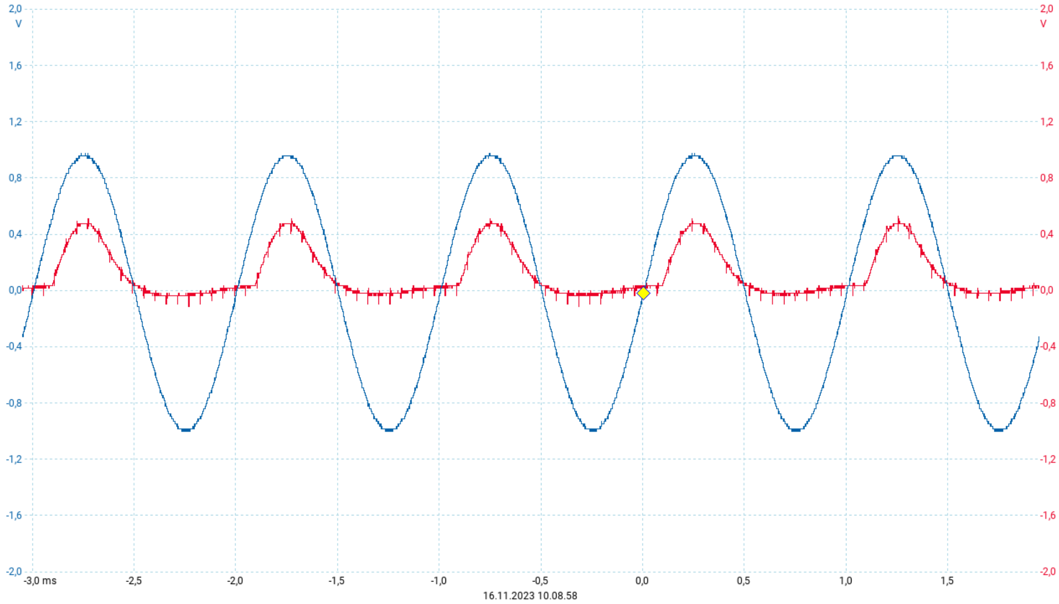


(By increasing input signal to 3V, output signal follows.)

Physical work to test simulations in real world context:

Create the circuit based on the 1st circuit picture above.

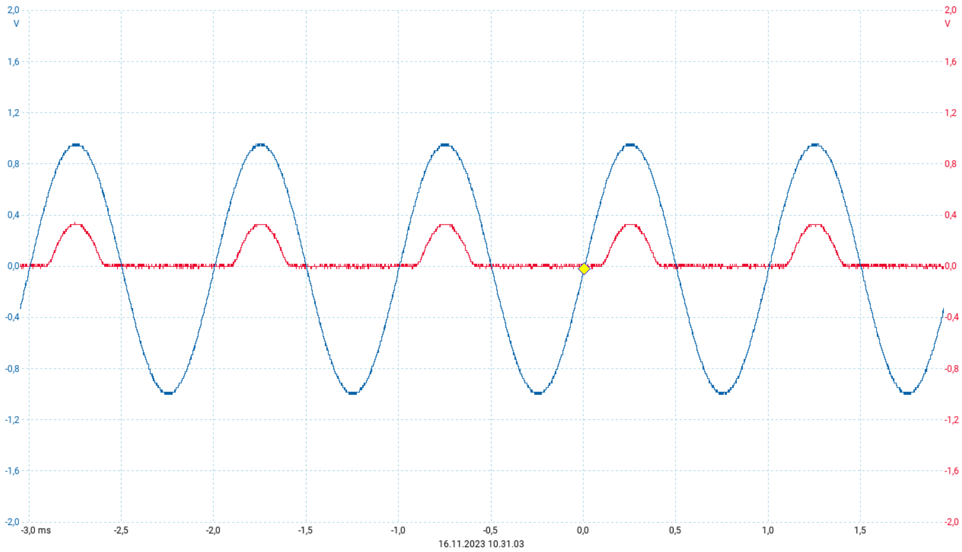
Measure the voltage (DC+ac) in emitter and Measure the voltage (DC+ac) in base:



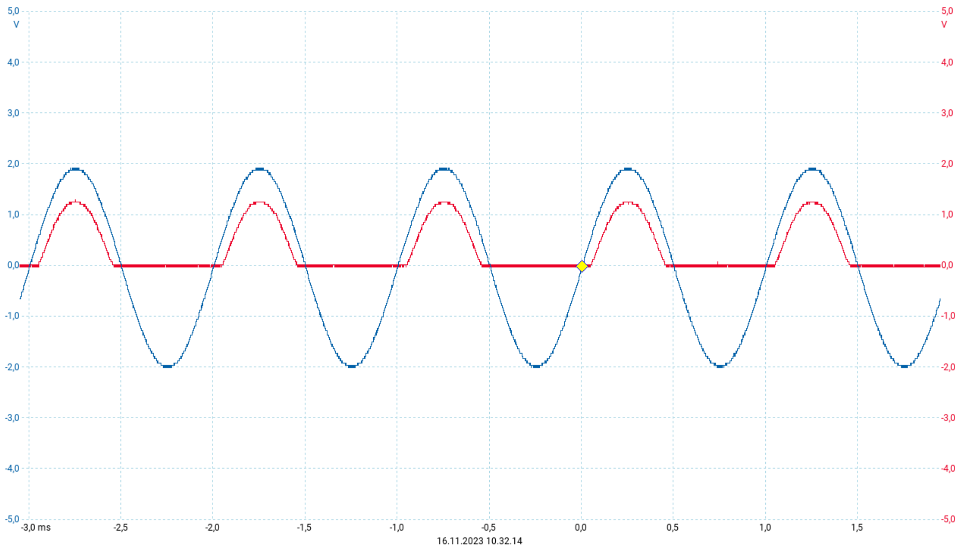
(Vin = ‘blue’ and Vout = ‘red’.)

Now connect the emitter resistor (RE) to ground instead of - 12 V:
Create the circuit shown above.

Observe the display for several amplitudes of input:



(offset 0V, 1V)



(offset 0V, 2V)

Due to oscilloscope limits we can not output 3V. (offset 0V, 3V)

Explain how and why the circuit functions more poorly:

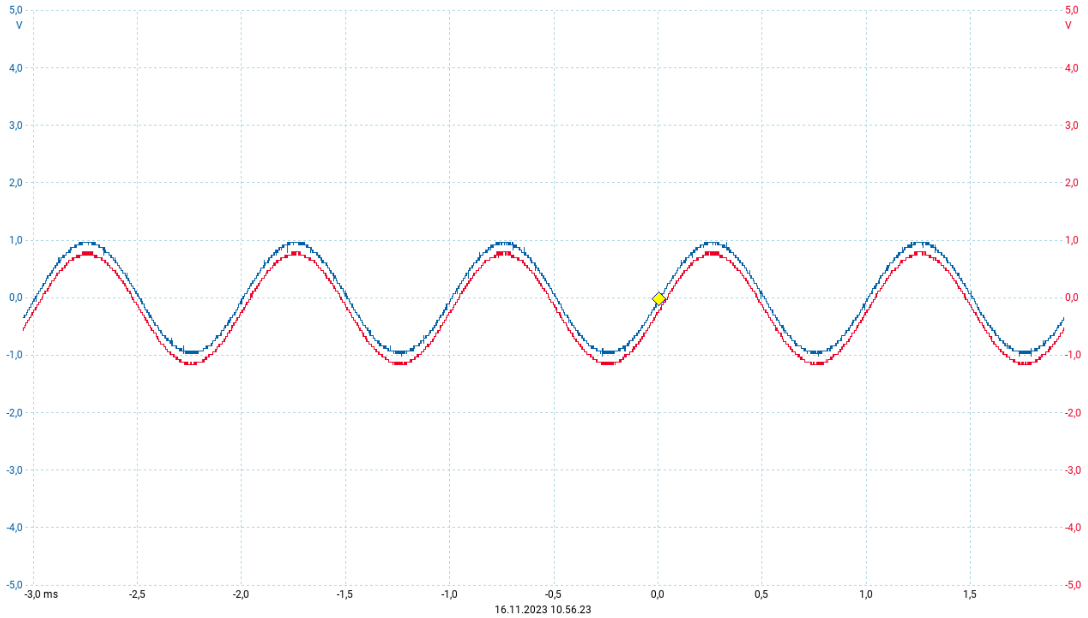
Return to the simulations section. The explanation is written there.

Connect the emitter back to -12 V. Add a blocking capacitor to the output:

Create the circuit shown above.

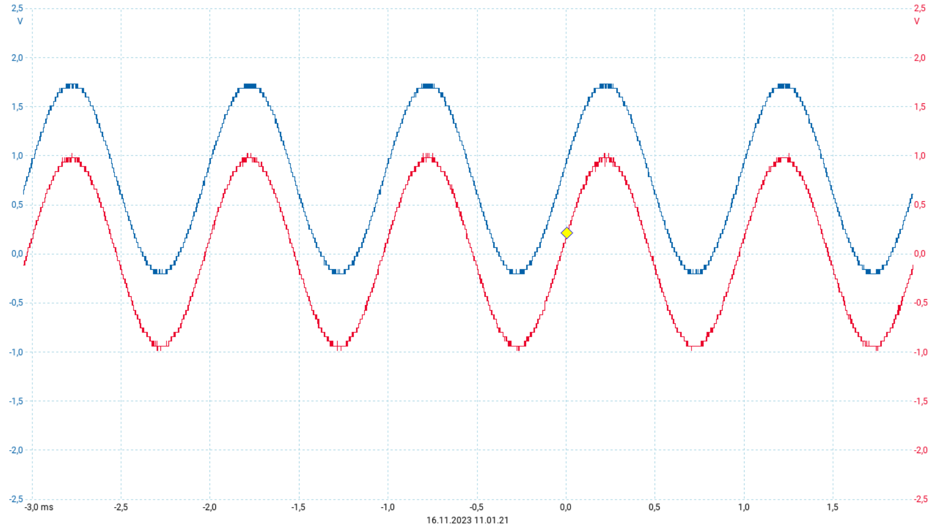
Question: Why don't we use a blocking capacitor at the input?
In case we would want to use an offset, the capacitor would filter the DC component.

Measure the ac voltage gain:



Confirm that the output capacitor is blocking a dc bias:

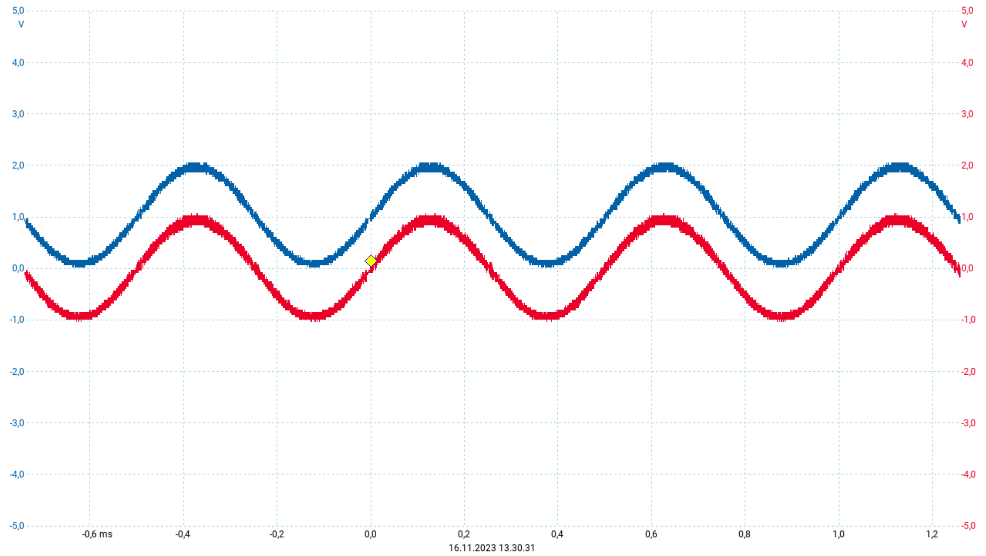
To accomplish this. We need to introduce a 1V DC offset to our 1V AC input signal. Then we can measure Vin and Vout simultaneously and compare the signals. There we can see if any DC bias is filtered.



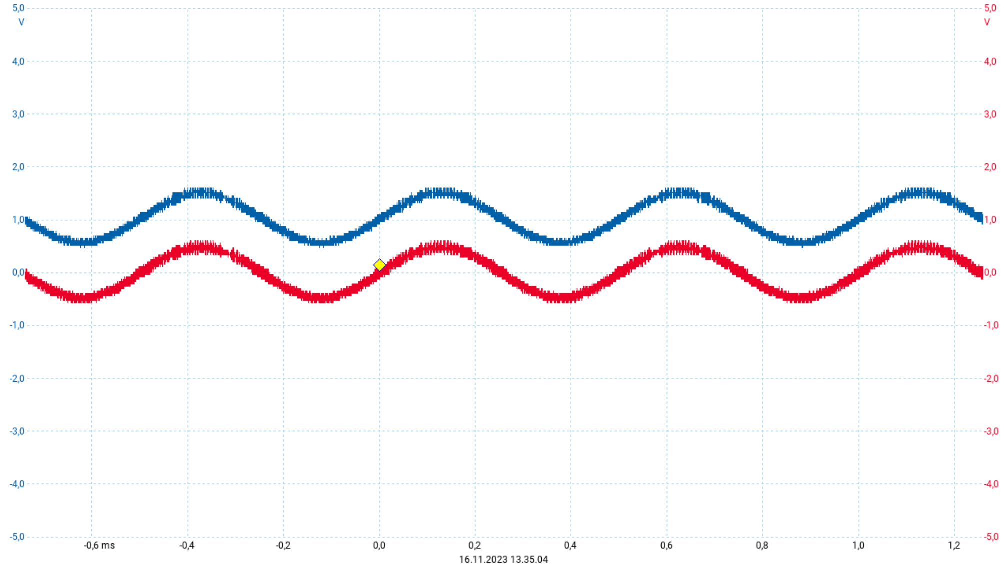
Requirements:

Design, **simulate** and implement a working voltage follower with one sided supply voltage only. design your own version of it, where Collector current is about 5 mA. Include the simulation results and calculations in your lab report, implement the circuit and measure that it works as expected

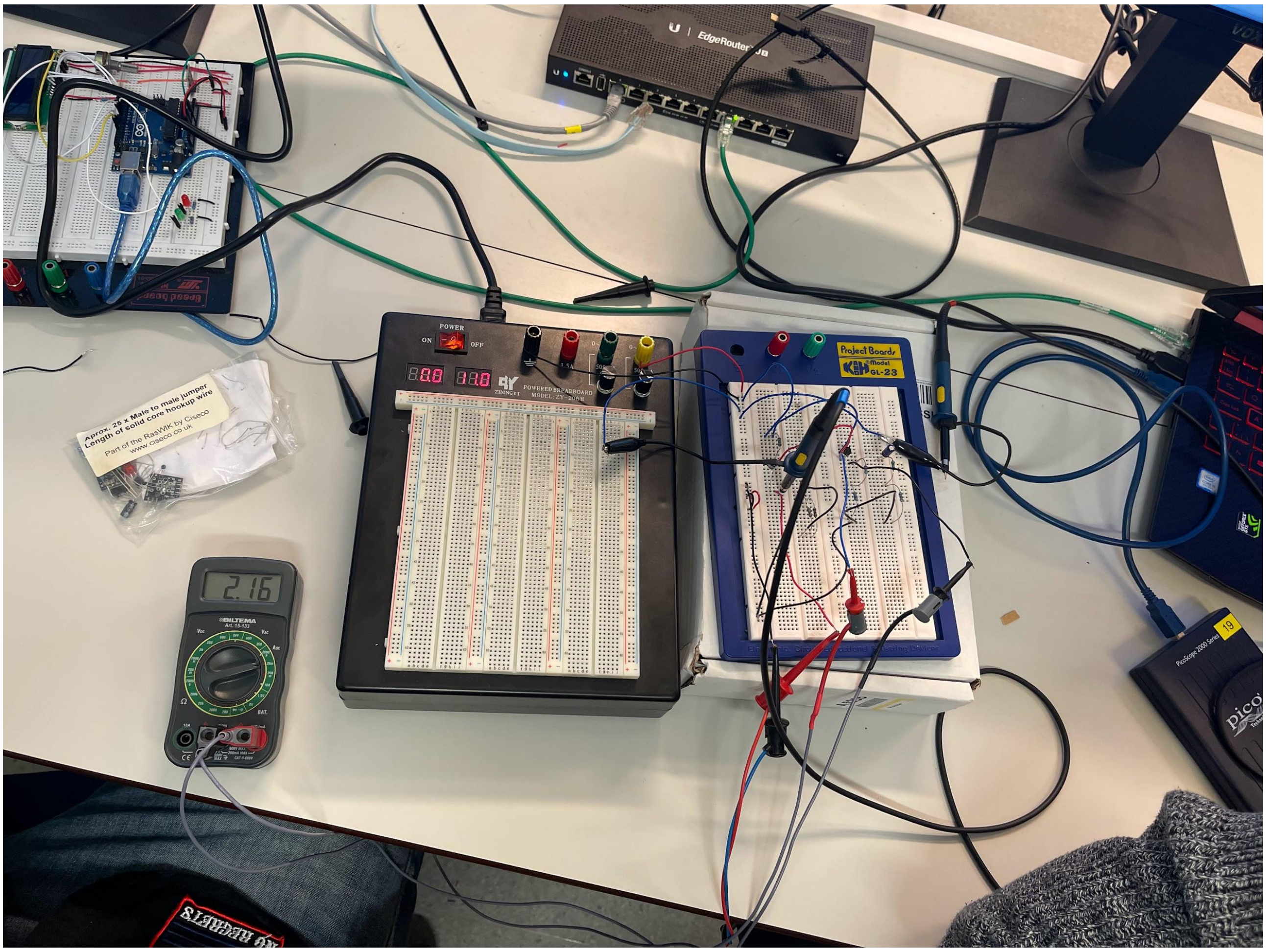
Create the circuit shown above.



(Here we can review that +1 DC bias has been blocked at output. Input signal is also changed to 1V due to picoscope 7 constraints.)



(By decreasing input signal to 0.5V, output signal follows.)
Measured Ie is 2.07mA.


EdgeRouter
POWER
ON
OFF
POWERED BREADBOARD
Project Boards
GL-23
Aprox. 25 x Male to male jumper
Length of solid core hookup wire
Part of the RasWIK by Ciseco
www.ciseco.co.uk
2.16
BILTEMA