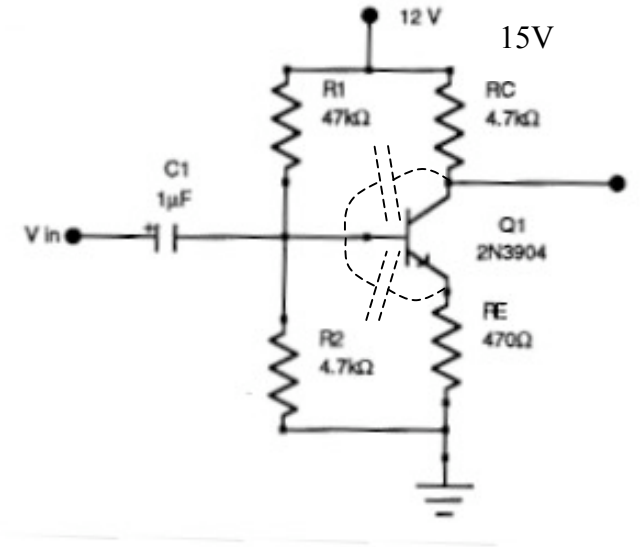
COMMON EMITTER AMPLIFIER

The transistor can be used as a voltage amplifier. The gain will be temperature dependent, and certain distortions will be encountered. More suitable amplifiers in which combinations of transistors called OP-AMPS , operational amplifiers, are more practical devices. But it will be instructive to build a simple transistor amplifier.



stray capacitance

Voltage gain = Vout/Vin = **- R_C / R_E**
Zin = **β R_E**
Zout = **R_C**

-The input signal is AC coupled to the amplifier. The input capacitor blocks the DC.

-The output impedance is selected to be **R_C = 4700Ω** .

-We choose the voltage drop across V_C to be half the supply voltage V_C = 15V/2 = 7.5V.

-The current then is I_C = 15V – V_C / R_C = 7.5/ 4.7K = 1.6mA

-For a gain of 10 then **R_E** = R_C /10 = **470Ω**

-To set the base voltage divider note that $V_E = I_E R_E = I_C R_E$ = (1.6mA)(470Ω) = 0.75V

-V_B = 0.75V + 0.6V = 1.35 V

–β R_E >> R_2 to limit the power supply current through the base.
R_2 = 10 R_E = **4700 Ω**

-I2 = V_B / R2 = 1.35V/4700 Ω = 0.29mA $I_B = I_C/\beta$ = 8μA
-$I_1 = I_2 + I_B$ = 0.30mA

-R_1 = (15V- V_B) / I_1 = 13.6V/.30e-3A = **45 kΩ** (Use 47 kΩ

hfe

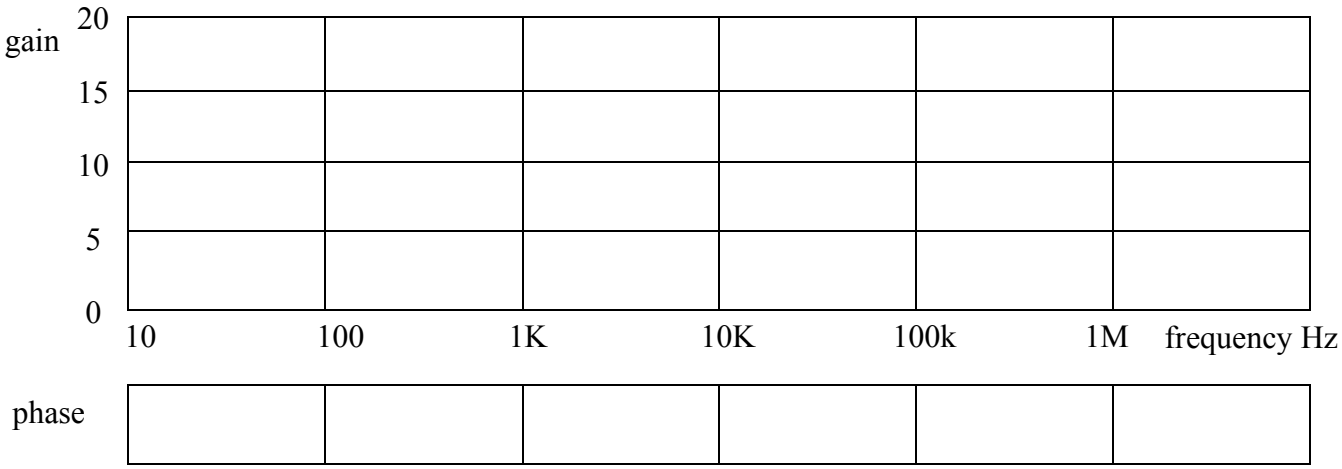
Measure the β = **hfe** of your transistor with the DMM.

β = _____

GAIN

Construct the circuit and drive it with at the smallest voltage available on your sweep generator (~500mv). Vary the frequency from 10 Hz to 1MHz in decades of ten. Record and plot the output voltage gain. Record the relative phase eg. -180^{o}.

Gain vs Frequency



Question#1- Is the voltage gain and phase what you expected from theory of the common emitter amplifier? Explain.

Question#2- What is the input and output impedance of your amplifier?

Question#3- Explain any frequency dependance of the voltage gain.

Question#4- Is it possible to modify the circuit to give a gain of 1000. Explain.