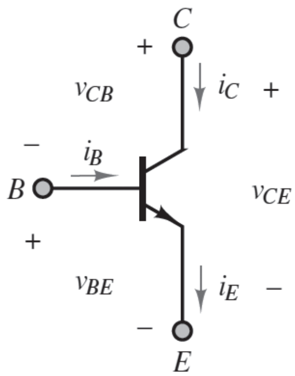
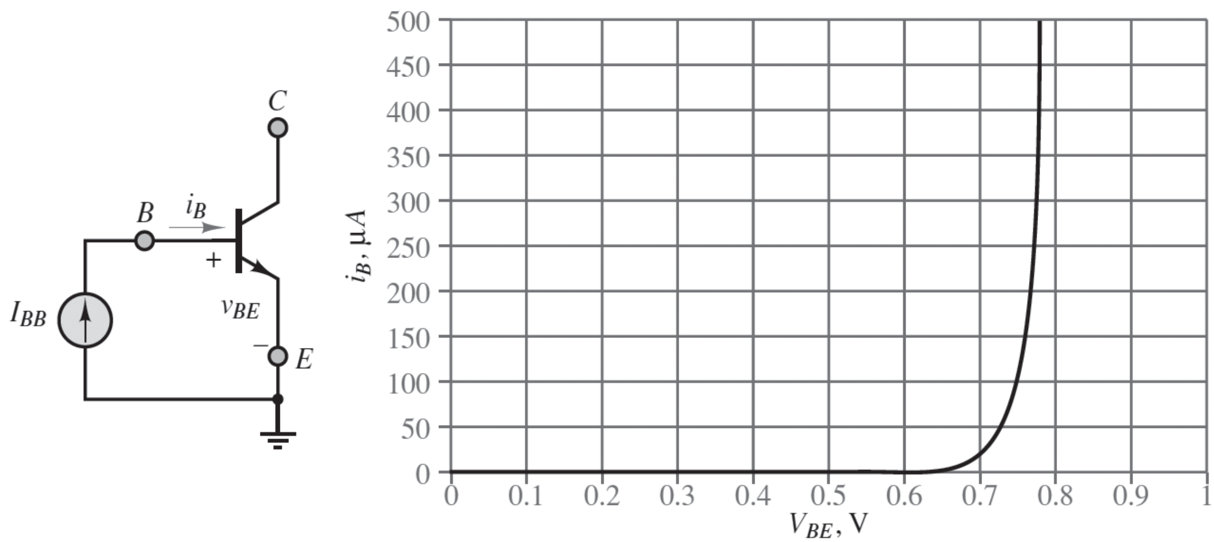
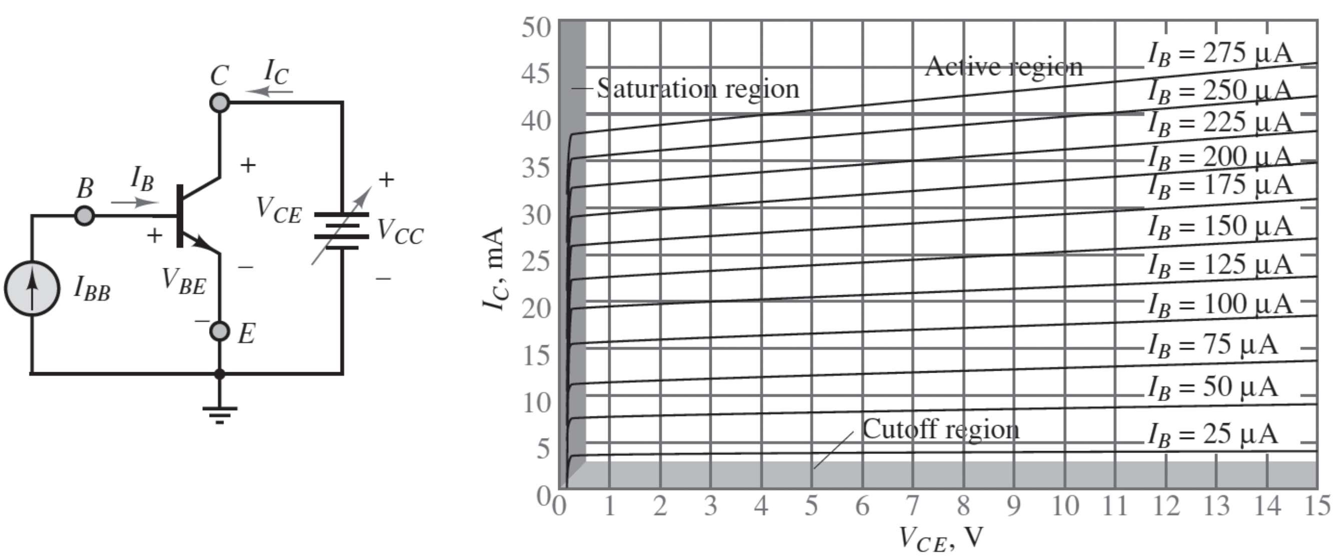
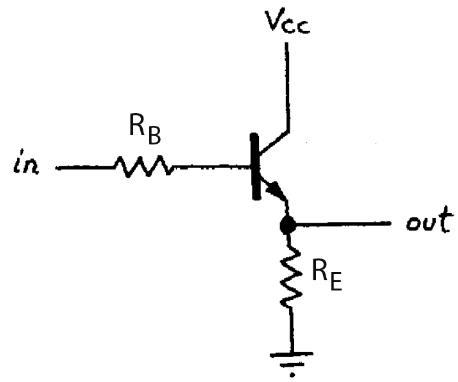


KCL: $i_E = i_B + i_C$
KVL: $v_{CE} = v_{CB} + v_{BE}$





Sketch of the emitter-follower, a unity gain impedance buffer.



This circuit can be understood by applying Kirchhoff's voltage law to the left-hand loop. We have:

$-V_{in} + I_B R_B + V_{BE} + I_E R_E = 0.$

In the linear regime, $I_E = (1+\beta) I_B$ so:

$V_{out} = I_E R_E = (V_{in} - V_{BE}) R_E / [R_E + R_B / (1+\beta)] \approx V_{in} - V_{BE}$

since β>>1. To within an offset of V_{BE}, the magnitude of output is the same as the input.

The input impedance, found by opening the current source Ic and shorting the voltage drop V_{BE} is just:

$Z_{in} = V_B / I_B = I_E R_E / [I_E / (1+\beta)] = (1+\beta) R_E$.

So we see that the emitter-follower functions as a high impedance input.

The output impedance is approximated by $Z_{out} \approx V_{source}/\beta$. Can you show this?