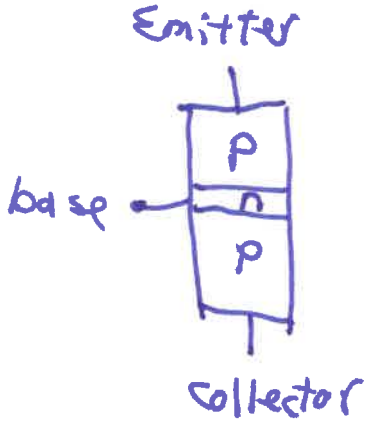
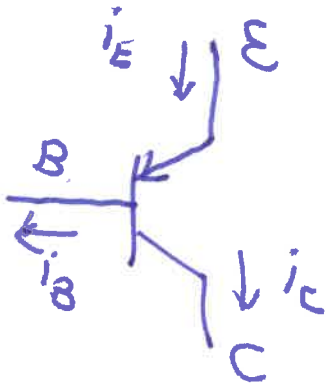
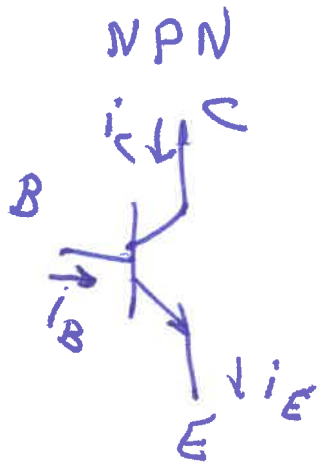
Thu 20 Oct 2016

PNP







Same as NPN

$$\begin{cases} i_C = \beta i_B \\ i_E = \alpha i_E \end{cases} \qquad \alpha = \frac{\beta}{\beta+1}$$

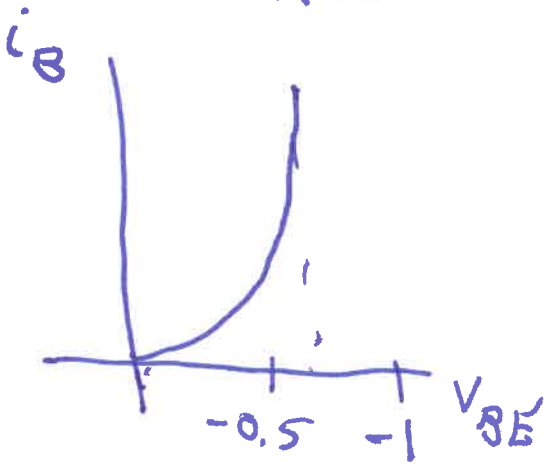
$$i_E = i_C + i_B$$

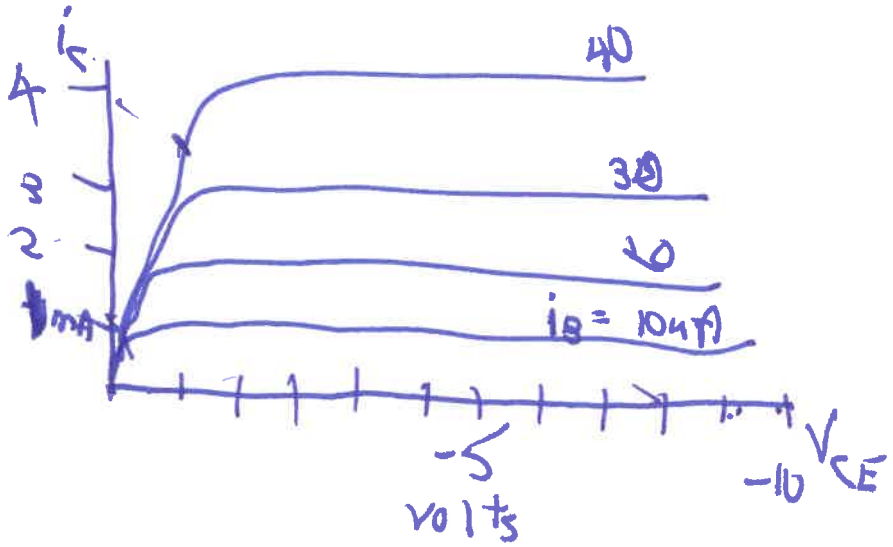
Different from NPN

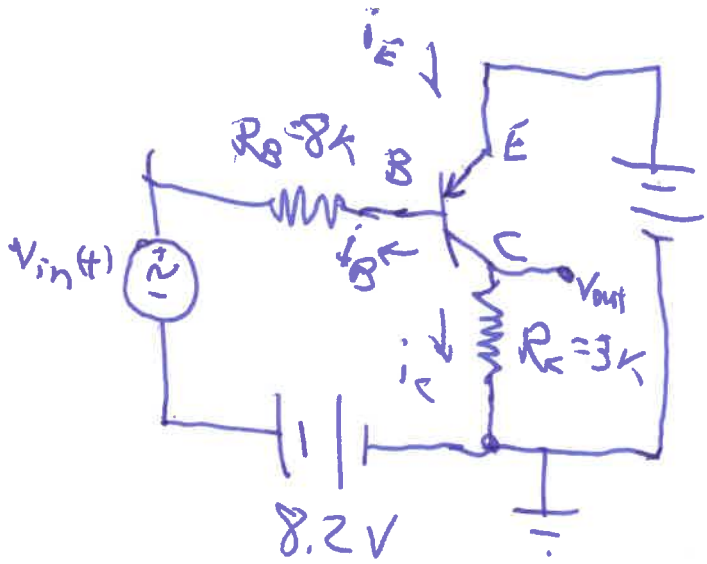
$$\begin{cases} i_E = I_{ES}\left[e^{-V_{BE}/V_t} - 1\right] \\ i_B = (1-\alpha) I_{ES}\left[e^{-V_{BE}/V_t} - 1\right] \end{cases}$$

minus

IV Curves

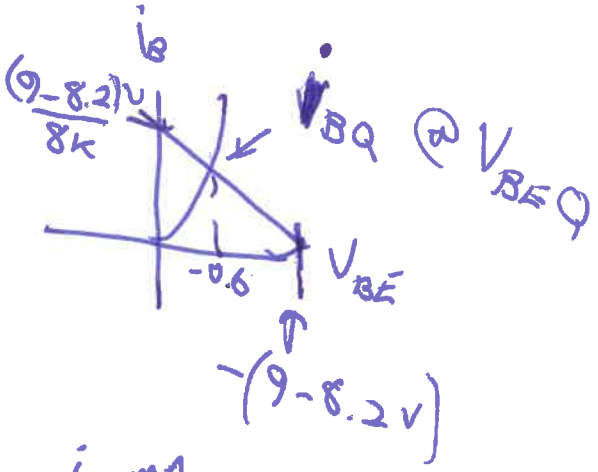






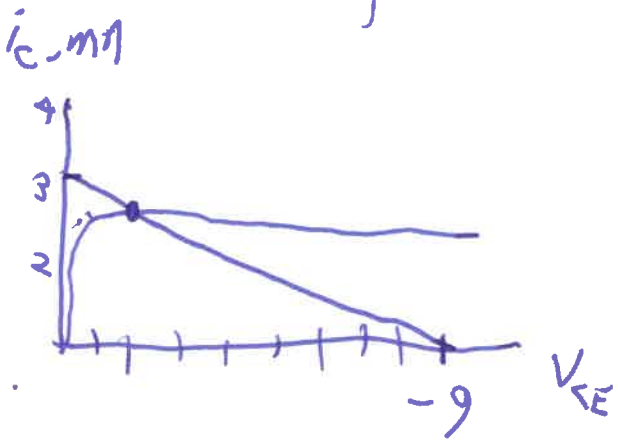
Common Emitter Amp.

Solve the DC circuit to find i_{BQ}



$$i_{BQ} = \frac{9V - 0.6V - 8.2V}{8k}$$

$$= \frac{0.2V}{8k} = 25\,\mu A$$



$i_C = \beta i_B \simeq 2.5\,mA$

DC Solution

$I_{BQ} = 25\,\mu A$

$I_{CQ} = 2.5\,mA$

$V_{CQ} = 7.5V$ $\quad V_{CE} = -2.5V$

AC circuit

$i_b = V_{in}(t) / R_B$

$i_c = \beta i_B$

$v_c = +i_c R_c$

$v_{OUT} = v_c = R_c \beta \frac{-V_{in}}{R_b}$

$= -\beta \frac{R_c}{R_b} V_{in}$

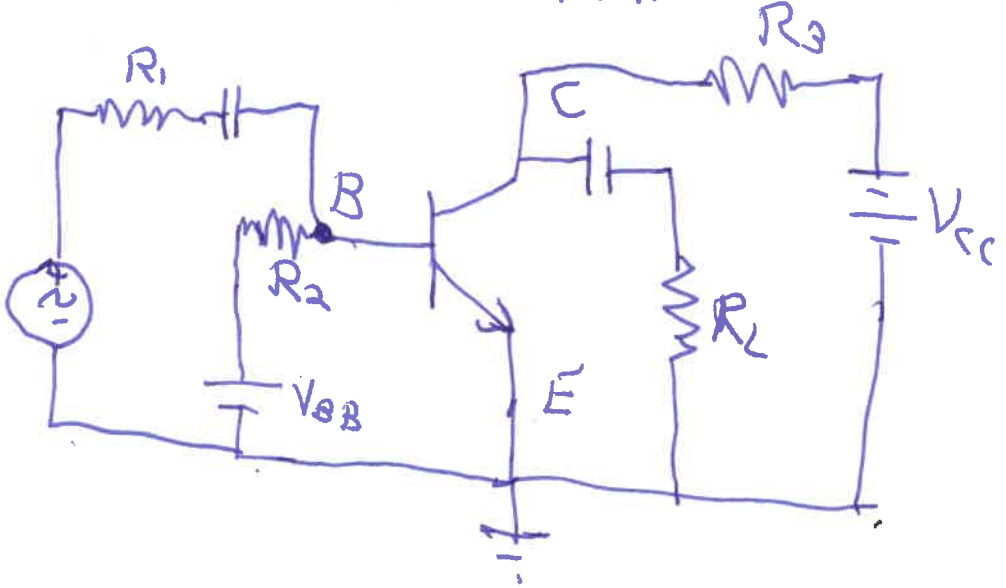
$$A_v = -\beta \frac{R_L}{R_B} = -100 \frac{3k\Omega}{8k\Omega} = -37$$

~~42 dB~~ 32 dB

AC+DC models

Superposition

NPN



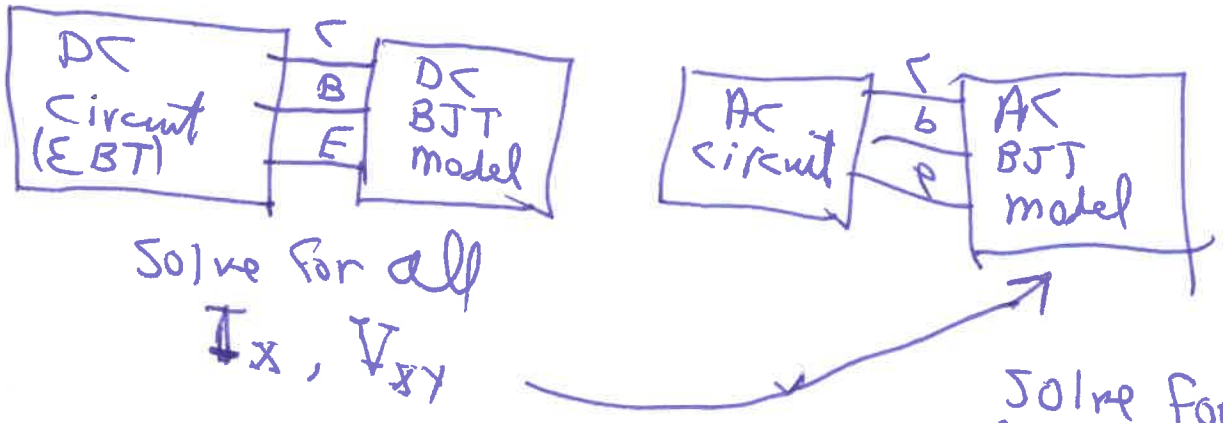
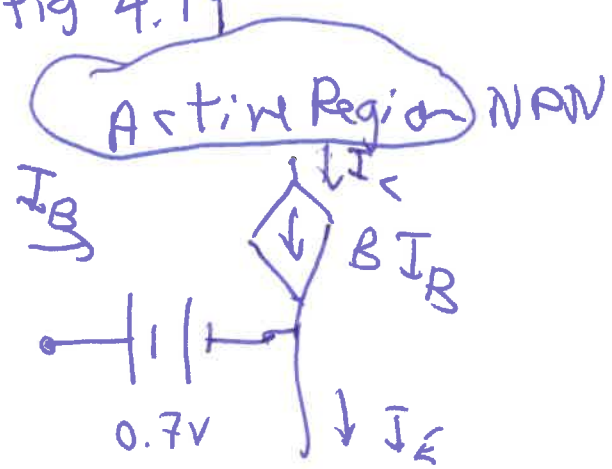
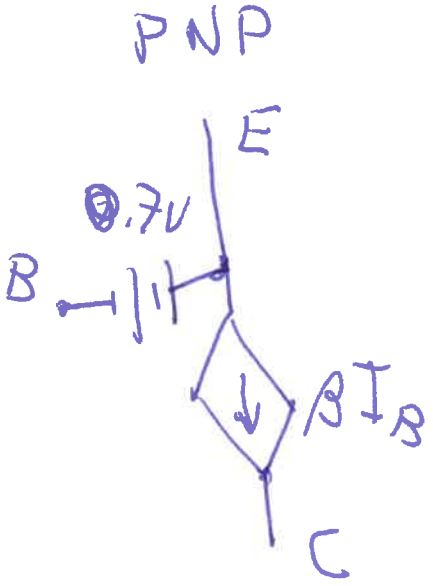
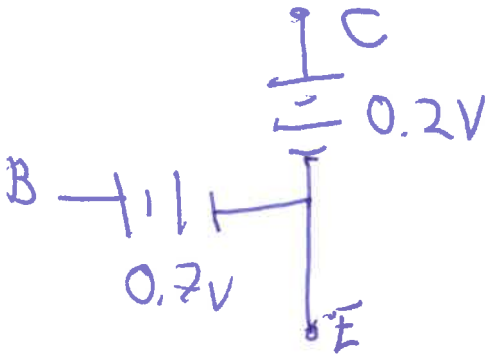


Fig 4.19

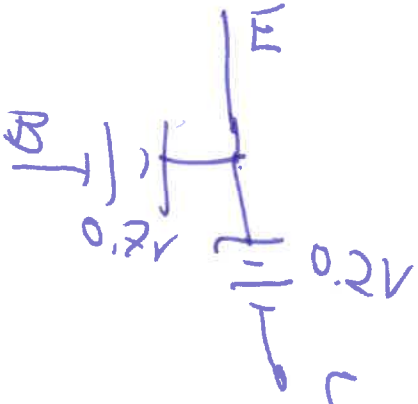


$I_B > 0 \quad V_{CE} > 0.2V$





$I_B > 0 \quad \beta I_B > I_C > 0$



$V_{BE} < 0.5V$

$V_B < 0.5V$

$V_{BE} > -0.5V$

$V_B > 0.5V$