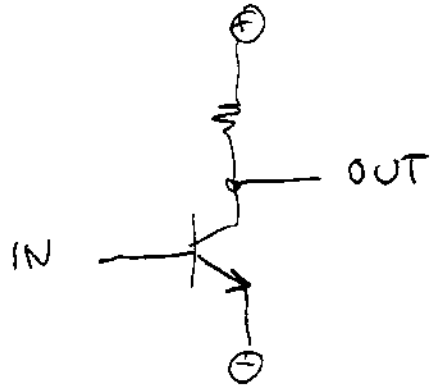
Basic Amplifier Configurations (4.3)

Common emitter (4.4, 4.5)



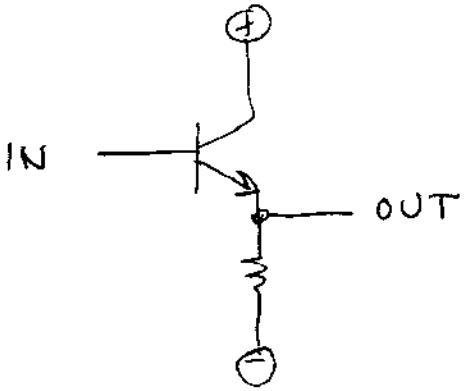
$A_v > 1$

$A_i > 1$

R_{in} moderate

R_{out} moderate to high

Common collector (4.6)



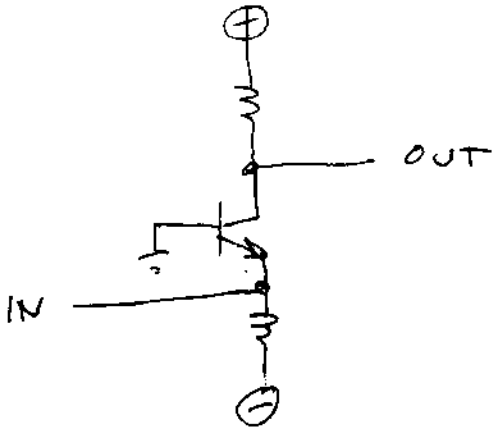
$A_v \approx 1$ (< 1)

$A_i > 1$

R_{in} high

R_{out} Low

Common base



$A_v > 1$

$A_i \approx 1$ (< 1)

R_{in} Low

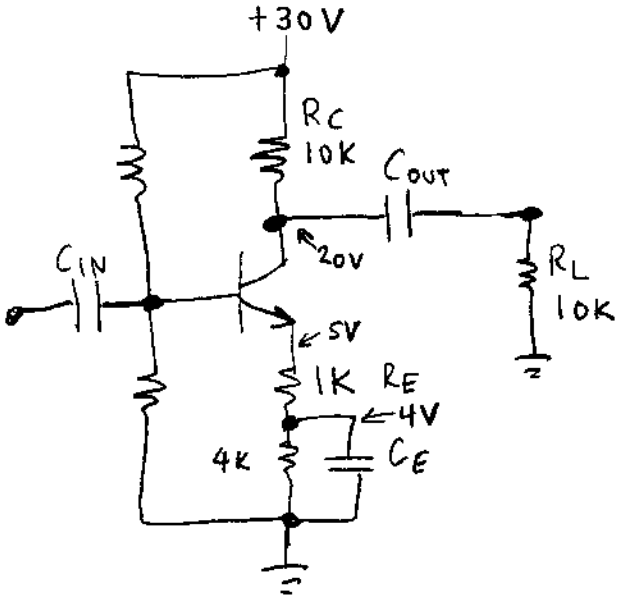
R_{out} moderate to high

HW:

P	#	P	#
177-178	1,2	230	1, 4
179	3,4		
195	5, 6, 7	231	7, 10
198	8, 9, 10, 11	232 233	13, 16, 19

AC Load Line Analysis (4.5)

Problem:



What is gain?

Output swing?

Is it biased correctly, for max symmetric output swing?

$\beta = 100$

$V_A = 85$

Gain: Reflect r_π to emitter

$$\frac{r_\pi}{\beta} = \frac{.026}{I_E} = 26\,\Omega$$

Find r_o:

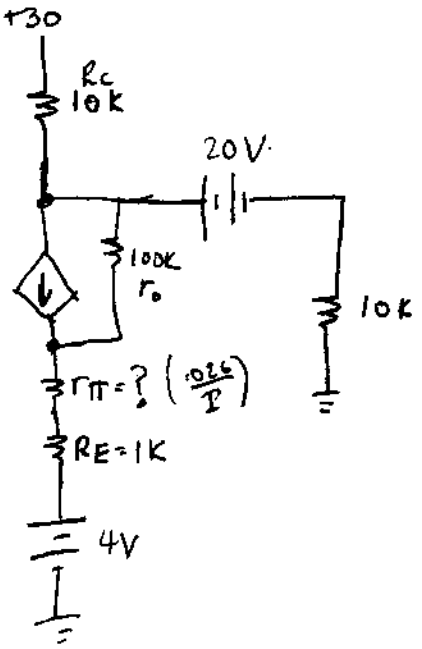
$$r_o = \frac{V_{CE} + V_A}{I_C} = \frac{100}{1ma} = 100\,K$$

Now, gain is:

$$\frac{r_o \| R_C \| R_L}{\frac{r_\pi}{\beta} + R_E} = \frac{100K \| 10K \| 10K}{26 + 1000} = 4.64$$

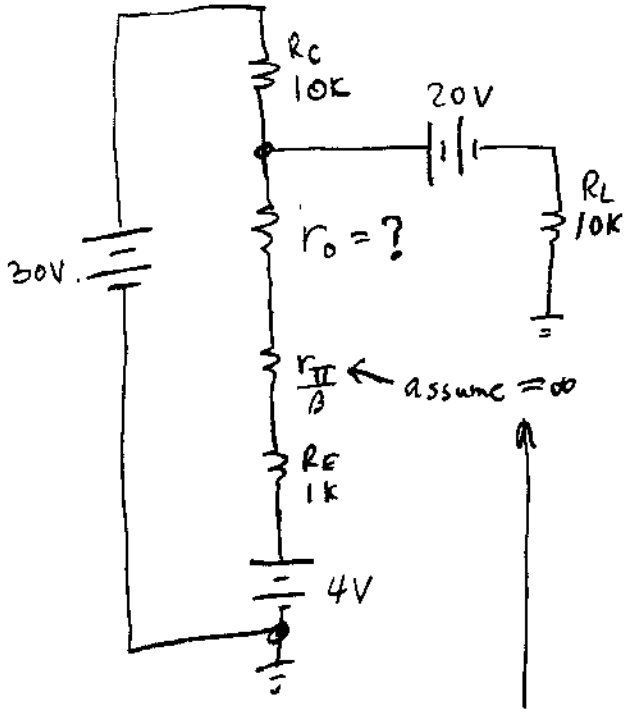
One approach...

Think of capacitors as batteries...

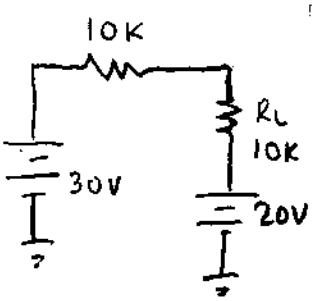


Consider the limits:

Transistor is cut off



Simplify:



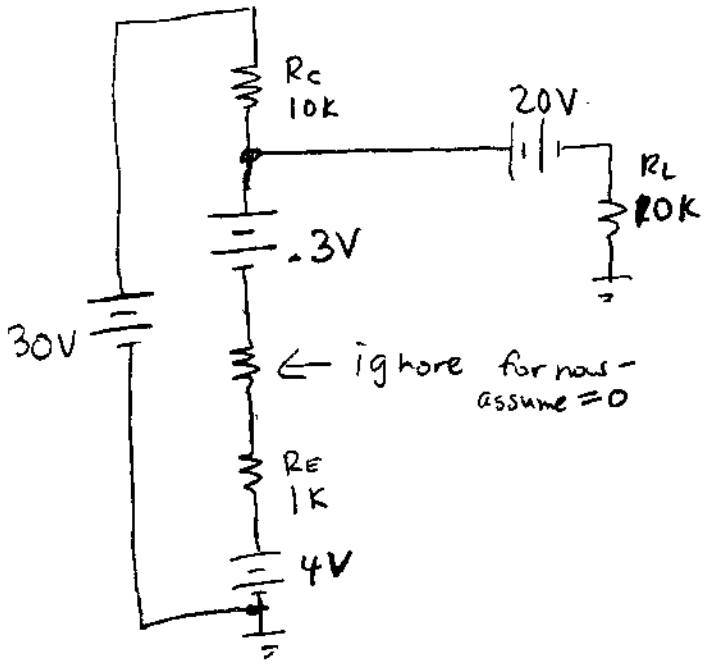
V = 25 at collector

V = 25 − 20

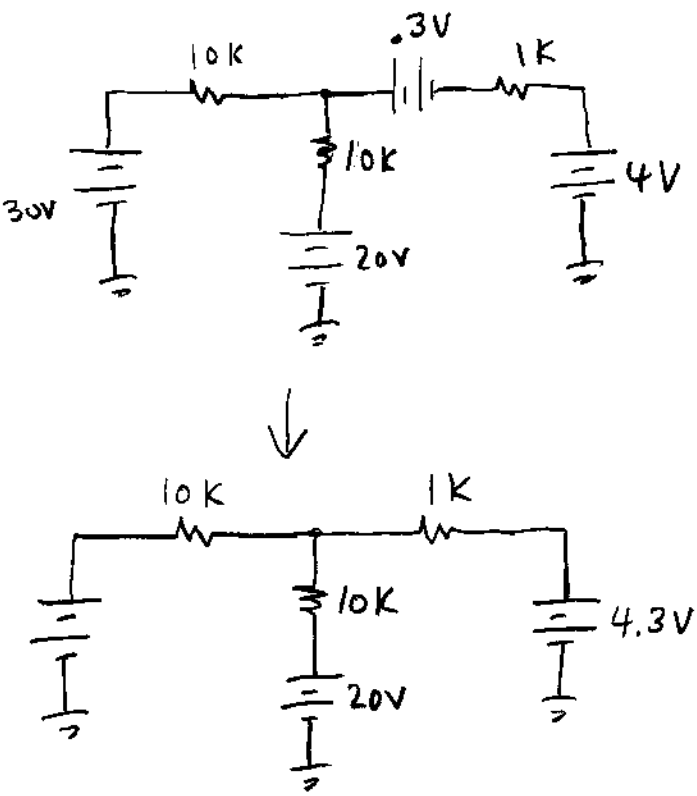
= 5 at load

$\frac{r_\pi}{\beta}$, $\frac{.026}{I_E} = \frac{.026}{0} = \infty$

Transistor is saturated



Simplify:



Nodal analysis

$$\frac{V-30}{10K} + \frac{V-20}{10K} + \frac{V-4.3}{1K} = 0$$

$$\frac{V-30}{10K} + \frac{V-20}{10K} + \frac{10V-43}{10K} = 0$$

$$12V - 93 = 0$$

$$V = \frac{93}{12} = 7.75$$

at collector

$$V = 7.75 - 20 = -12.25$$

at load.

Correct bias?

NO. it clips on top first.

Correct bias is

$$\frac{25 + 7.75}{2} = 16.375$$