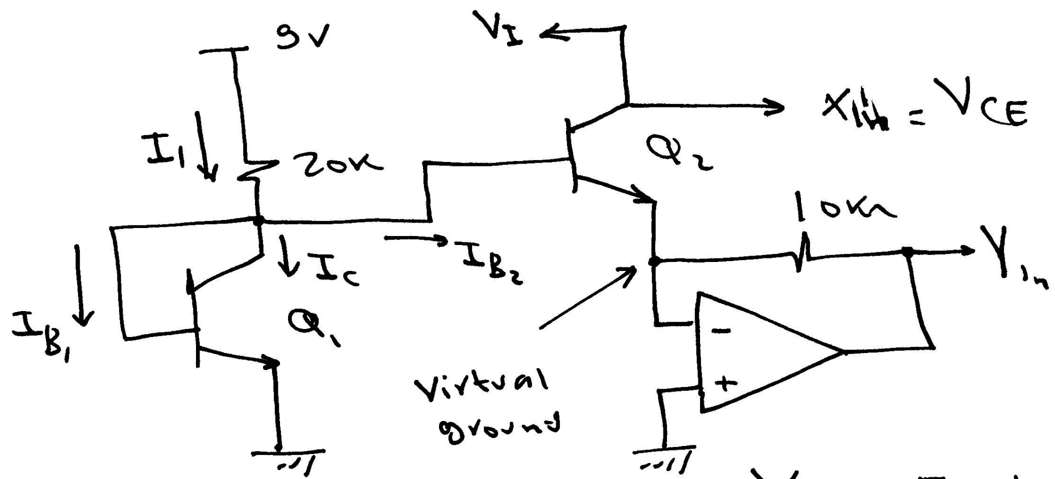


$Y_{in} = -I_E \times 10k$

$V_{BE1} = V_{BE2}$ $\qquad$ $Y_{in} \simeq -I_C \times 10k$

$V_{CB1} = 0 \implies Q_1$ in forward activ region

$$\frac{9 - V_{BE}}{20k} = (I_C + 2I_B)$$

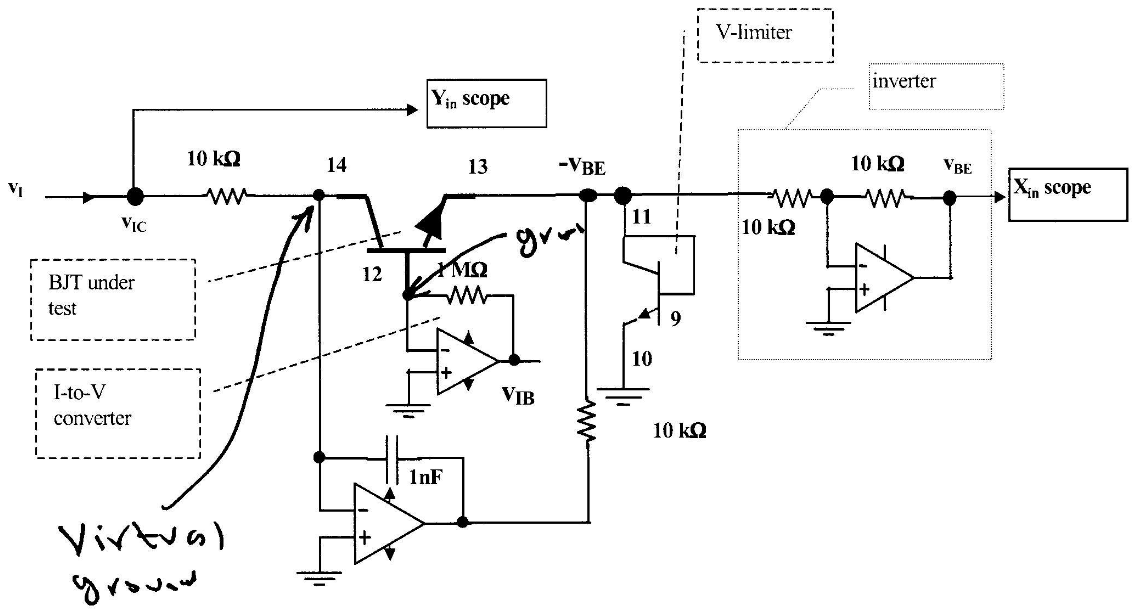
$$\frac{9 - V_{BE}}{20k} = I_B(\beta + 2) = I_B(V_{BE})(\beta + 2)$$

or $V_{BE} \simeq 0.7V$

$$\therefore I_1 = \frac{9 - 0.7}{20k}$$

$$I_{B_1} = I_{B_2} = \frac{I_1}{(\beta + 2)}$$

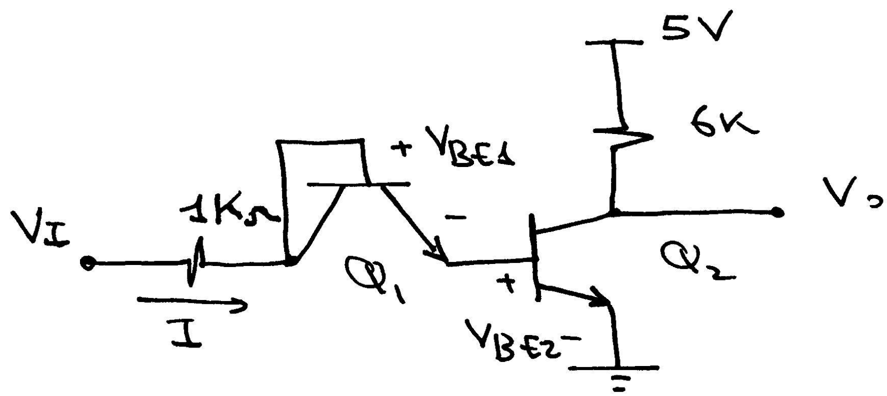
L3. (a) Connect the circuit shown. Set the FG controls so that v_I is a triangle-wave of 100 Hz varying between 0 V and +5 V, i.e. +2.5 V *dc offset*. Hence display, *first* the $\mathbf{i_C}$ **versus** $\mathbf{v_{BE}}$ characteristic, and *then* the $\mathbf{i_B}$ **versus** $\mathbf{v_{BE}}$ characteristic, on the scope.



L3. (b) Using the FG as a variable dc voltage source, adjust the dc offset control so that $\mathbf{V_{IC}}$ has the dc values in the following table:

β_F = BF	I_C [μA]	V_{IC} [Volts dc]	V_{IB} [Volts dc]	V_{BE} [Volts dc]	ΔV_{BE}[Volts dc]
		0.100			
		0.200			
		0.500			
		1.00			
		2.00			
		5.00			

Complete the table by measuring $\mathbf{V_{IB}}$ and $\mathbf{V_{BE}}$ with the digital scope (*mean* or dc value) or DMM.



if $V_I = 0 \Rightarrow$ both Q_1 and Q_2 are off $\Rightarrow V_o = 5V$

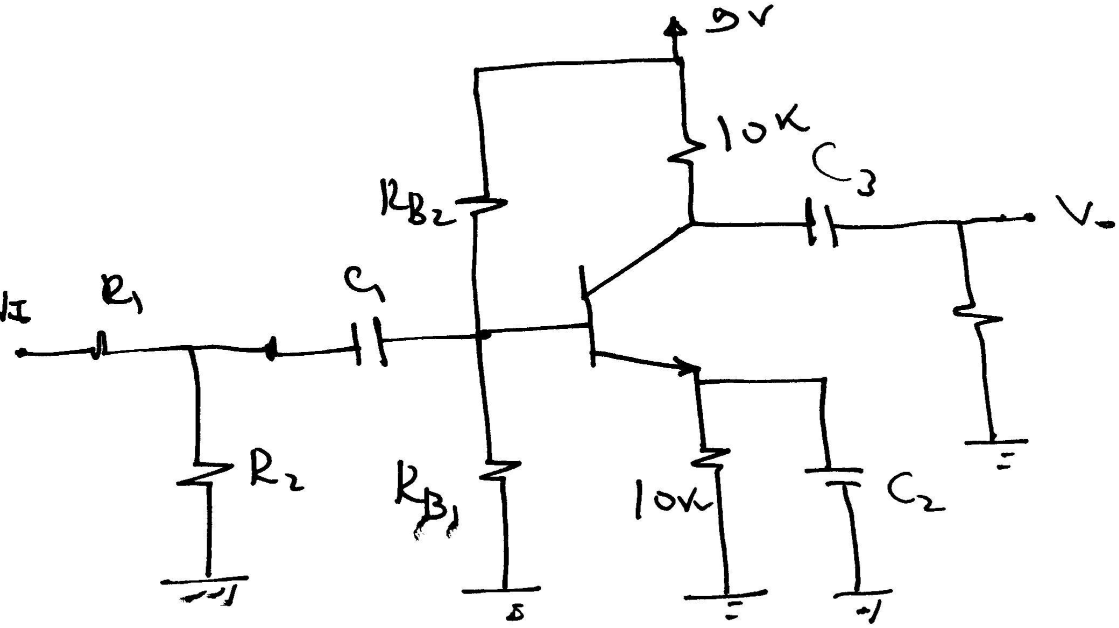
if $V_I = 5V$

$$I = \frac{5 - 1.4}{1k} = 3.6\,mA$$

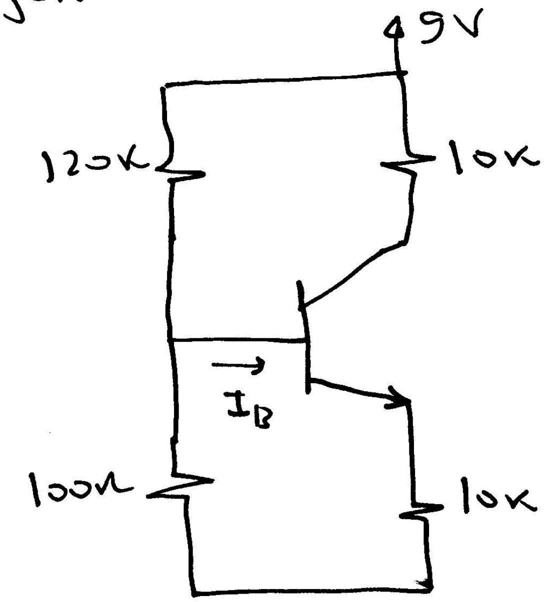
$$I_{B2} = I_{E1} \simeq I = 3.6\,mA$$

This very large current causes Q_2 to saturate $\Rightarrow V_o \simeq 0.2V$

INVERTER CIRCUIT



Dc Analysis



neglecting I_B, we get

$$V_B = 9 * \frac{100K}{220K}$$

$$V_E = V_B - 0.7V$$

$$I_E = \frac{V_E}{10K}$$

$$I_C = I_E * \alpha$$

operating point (V_{CE}, I_C)

~~V_{BE}~~