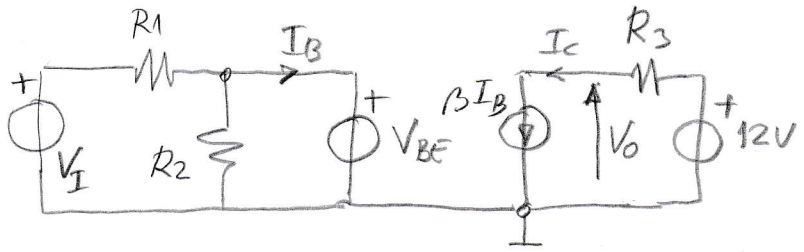
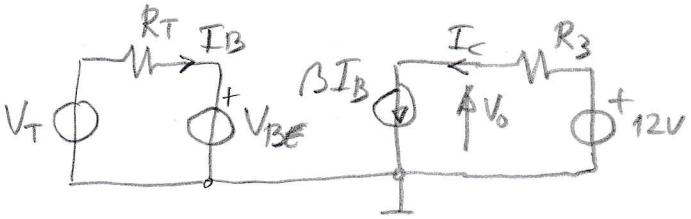
AE-20200205

(1)





$$V_T = \frac{R_2}{R_1+R_2} \cdot V_I = 0{,}244\, V_I$$

$$R_T = R_1 \| R_2 = 22\|168 = 16{,}62\,k\Omega$$

$V_T < V_{BE} \Rightarrow I_B = 0$; $I_C = 0$; $V_o = 12 - R_3 I_C = \underline{12V}$

$$V_T = \frac{R_2}{R_1+R_2} V_I < 0{,}7 \Rightarrow V_I < 0{,}7 \cdot \frac{R_1+R_2}{R_2} = 0{,}7\ \frac{90}{22} = 2{,}86V$$

$V_I > 2{,}86V$:

$$I_B = \frac{V_T - V_{BE}}{R_T} = V_I \cdot \frac{\cancel{R_2}}{\cancel{R_1+R_2}} \cdot \frac{\cancel{R_1+R_2}}{\cancel{R_2} R_1} - V_{BE} \cdot \frac{R_1+R_2}{R_1 \cdot R_2} = \frac{V_I}{R_1} - \frac{0{,}7}{16{,}62k} = \frac{V_I}{68k} - 42\mu$$

$V_I = 0 \Rightarrow V_o = 12V$; $V_I = 1V \Rightarrow V_o = 12V$; $V_I = 2V \Rightarrow V_o = 12V$;

$V_I = 3V \Rightarrow I_B = 2{,}12\mu A \Rightarrow V_o = 12 - 150 \cdot 2{,}12\, 10^{-6} \cdot 10^3 = 11{,}68V$

$V_I = 4V \Rightarrow I_B = 16{,}8\mu A \Rightarrow V_o = 9{,}48\,V$;

$V_I = 5V \Rightarrow I_B = 31{,}53\mu A \Rightarrow V_o = 7{,}2V$;

$V_I = 6V \Rightarrow I_B = 46{,}24\mu A \Rightarrow V_o = 5{,}06V$;

$V_I = 7V \Rightarrow I_B = 60{,}94\mu A \Rightarrow V_o = 2{,}86\,V$;

$V_I = 8V \Rightarrow I_B = 75{,}65\mu A \Rightarrow V_o = 0{,}65\,V$;

$V_I = 9V \Rightarrow I_B = 90{,}35\mu A \Rightarrow V_o = -1{,}55V$! $\Rightarrow V_o = V_{CEsat} = 0{,}2V$

$V_I = 10, 11, 12V \Rightarrow \underline{V_o = 0{,}2V}$