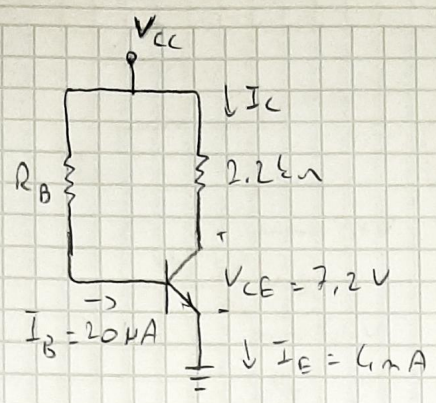


Q1) a) I_C

b) V_{CC}

c) β

d) R_B

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} \Rightarrow \frac{V_{CC} - 0,7}{R_B} = 20\mu A$$

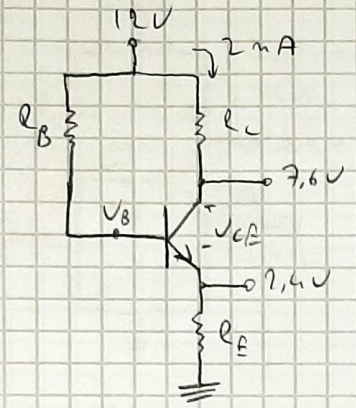
$$I_E = (\beta + 1)\, I_B \Rightarrow 4mA = (\beta + 1) \cdot 20\mu A$$

$$\beta + 1 = 200 \Rightarrow \beta = 199 //$$

$$I_C = \beta \cdot I_B = 199 \cdot 20\mu A = 3,98mA //$$

$$V_{CC} = V_{CE} + I_C R_C = 7,2 + 8,756 = 15,956V //$$

$$\frac{15,956 - 0,7}{R_B} = 20\mu A \Rightarrow R_B = 762,8k\Omega$$



$\beta = 80$

Q2) a) R_C

b) R_E

c) R_B

d) V_{CE}

e) V_B

$I_C = \beta \cdot I_B \Rightarrow 2mA = 80 \cdot I_B \Rightarrow I_B = 25\,\mu A$

$I_E = (\beta+1) \cdot I_B = 81 \cdot 25\,\mu A = 2,025\,mA$

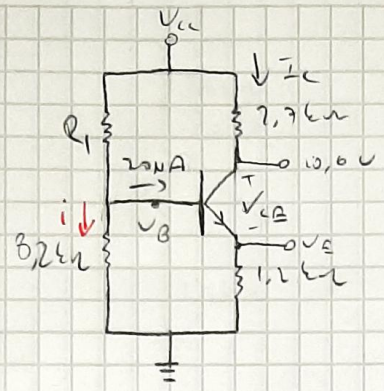
$R_E = \frac{2,4}{I_E} = \frac{2,4}{2,025m} = 1,19k\Omega$

$R_C = \frac{12 - 7,6}{2m} = 2,2k\Omega$

$V_{CE} = 7,6 - 2,4 = 5,2V$

$I_B = \frac{V_{CC} - V_{BE}}{R_B + (\beta+1) R_E} \Rightarrow \frac{12 - 0,7}{R_B + 81 \cdot 1,19k} = 25\,\mu A \Rightarrow R_B = 355,66k\Omega$

$V_B = V_{BE} + 2,4 = 0,7 + 2,4 = 3,1V$



$\boxed{\beta = 100}$

Q3) a) I_c

b) V_E

c) V_{cc}

d) V_{CE}

e) V_B

f) R_1

$I_c = \beta \cdot I_B = 100 \cdot 20\,\mu A = 2\,mA$ //

$I_E = (\beta+1) \cdot I_B = 101 \cdot 20\,\mu A = 2,02\,mA$

$V_E = 1,2k \cdot 2,02m = 2,424\,V$ //

$V_{CE} = V_C - V_E = 10,6 - 2,424 = 8,176\,V$ //

$V_{cc} = V_{CE} + I_c \cdot 2,2k + I_E \cdot 1,2k = 16V$ //

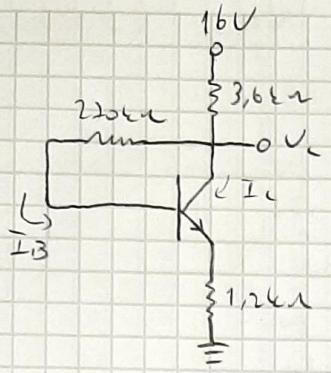
$8,2k \cdot i = V_B + V_{BE} + V_E = 6,248V$

$i = \frac{6,248}{8200} = 0,762\,mA$

$V_{cc} = R_1 (i + 20\mu A) + 8,2k \cdot i \Rightarrow 0,782\,mA\,R_1 + 6,248V = 16V$

$\Rightarrow R_1 = 12,674\,k\Omega$ //

$V_B = V_{BE} + V_E = 0,7 + 2,424 = 3,124\,V$ //



$\beta = 120$

Q4) a) I_B

b) I_c

c) V_c

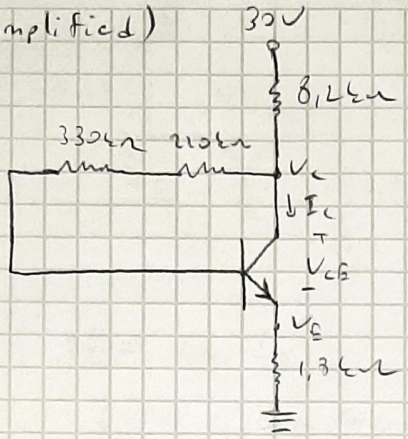
$16 = 3,6k \cdot 121 \cdot I_B + 220k\, I_B + 0,7 + 1,2k \cdot 121 \cdot I_B$

$850.800\, I_B = 15,3 \Rightarrow I_B = 18\,\mu A$ //

$I_c = 120 \cdot 18\,\mu A = 2,16\,mA$ //

$V_c = 16 - 3,6k \cdot 121 \cdot 18\,\mu V = 8,16\,V$ //

(simplified)



$\beta = 180$

Q5) a) I_C

b) V_C

c) V_E

d) V_{CE}

$30 = 8{,}2k \cdot 181 \cdot I_B + 550k\, I_B + 0{,}7 + 1{,}8k \cdot 181 \cdot I_B$

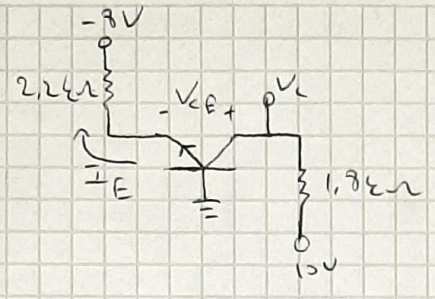
$2.360.000\, I_B = 29{,}3 \Rightarrow I_B = 12{,}4\ \mu A$

$I_C = 180 \cdot 12{,}4\,\mu = 2{,}232\ mA$ //

$V_C = 30 - 8{,}2k \cdot 181 \cdot 12{,}4\,\mu = 11{,}6\ V$ //

$V_E = 1{,}8k \cdot 181 \cdot 12{,}4\,\mu = 4{,}04\ V$ //

$V_{CE} = V_C - V_E = 11{,}6 - 4{,}04 = 7{,}56\ V$ //



Q6) a) I_E

b) V_C

c) V_{CE}

$18 = 4k\ I_E$

$I_E = 4,5mA$ //

$V_C = 10 - 1,8k \cdot 4,5m = 1,9V$ // $V_E = 1,9V$

$V_{CE} = V_C - V_E = 1,9 - 1,9 = 0V$ //