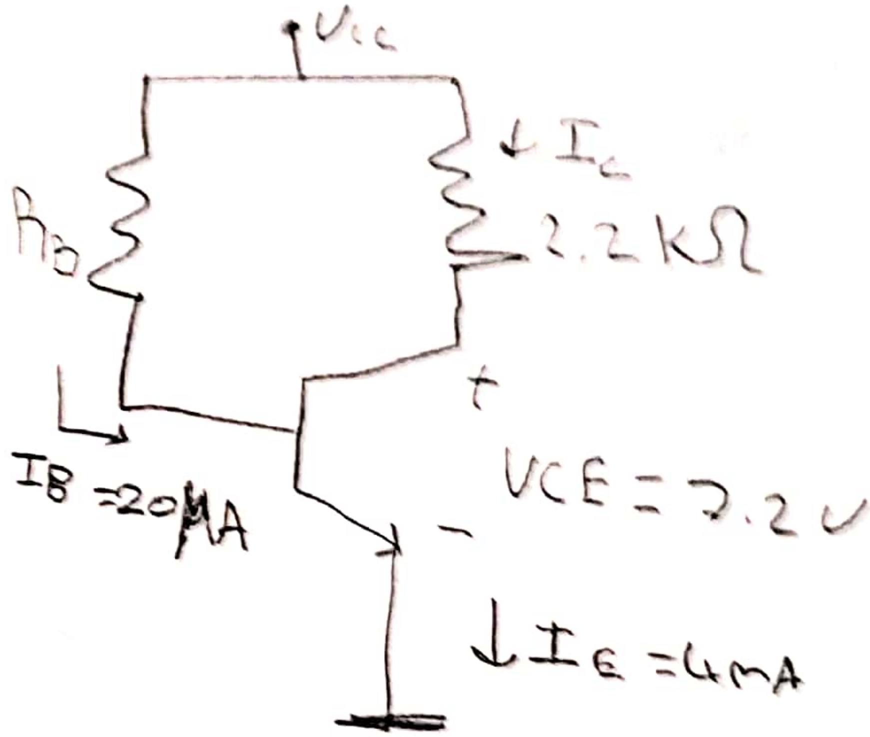
a)



$I_E = I_c + I_B$ $I_c = \beta I_B$

a) $I_c = 3.98\,mA$ $4\,mA = I_c + 20\,\cancel{\mu A}$

$\frac{3.98\,mA}{20\,\mu A} = \beta$

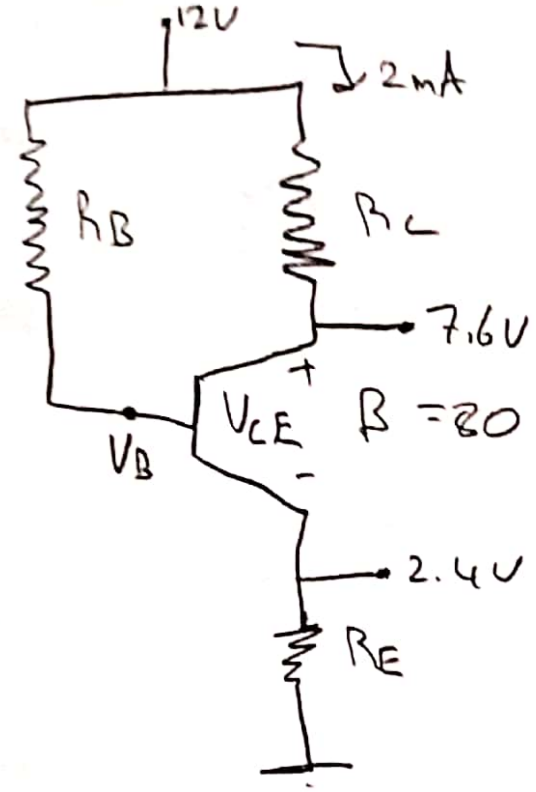
b) $\frac{V_{cc} - 7.2}{3.98\,mA} = 2.2\,k\Omega$

$V_{cc} = 15.956 \cong 16\,\underline{V}$

c) $\beta = 199$

d) $R_B = \frac{V_{cc} - V_{BE}}{20\,\mu a} = \frac{15.956 - 0.7}{20} = \boxed{762.8\,k\Omega}$

b)



a-) $R_C = \dfrac{12-7.6}{2mA} = \boxed{2.2\,K\Omega}$

b-) $I_B = I_C/\beta = 2mA/80 = 0{,}025\,mA$

$I_E = I_C + I_B$

$= 2{,}025\,mA$

$R_E = 2.4/I_E = \boxed{1{,}185\,K\Omega}$

c-) $R_B = \dfrac{12-(0.7+2.4)}{I_B} = \boxed{356\,K\Omega}$

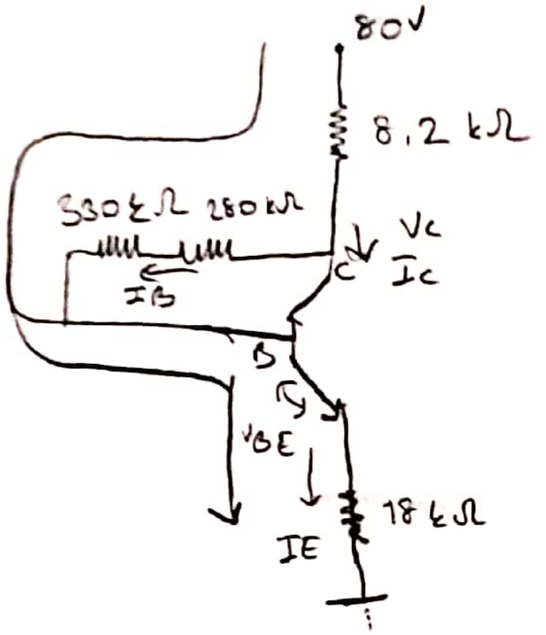
d-) $V_{CE} = 7.6V - 2.4V = \boxed{5.2V}$

e-) $V_{BE} = 0.7$

$V_B = 0.7 + 2.4 = \boxed{3.1V}$

2 a. ANALYSIS;

For D.C analysis all capacitors will act as open circuit so the circuit becomes;



$$I_C' = I_C + I_B$$

$$I_C = \beta I_B, \quad \beta = 180$$

$$I_C' = (\beta + 1) I_B$$

$$I_E = I_C + I_B$$

$$= I_C'$$

To find IB KVL is applying

$$30 - I_C' R_C - I_B R_B - V_{BE} - I_E R_E = 0$$

$$I_C' R_C + I_E R_E + I_B R_B + V_{BE} = 30$$

$$I_E (R_C + R_E) + I_B R_B = 30 - V_{BE}$$

$V_{BE} = 0.7V$ $\qquad\qquad$ $\beta + 1 = 181$

$$181 I_B (R_C + R_E) + I_B R_B = 29.3$$

$$I_B (181 (R_C + R_E) + R_B) = 29.3$$

$$I_B = \frac{29.3}{(181 \times 10k + 550k)}$$

$$\boxed{I_B = 12.415\ mA}$$

$$I_C = \beta I_B = 180 \times 12.415 \times 10^{-6} = 2.234\ mA$$

$$I_C' = I_E = 181 \times 12.415 \times 10^{-6} = 2.247\ mA$$

$30 - V_C = I_C' \times 8 \times 10^3$ [Voltage Difference between $V_{CC} - V_C$]

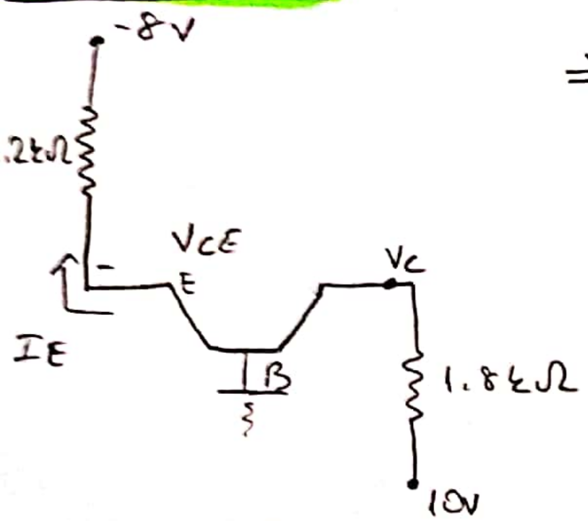
$V_C = 30 - 2.247 \times 10^{-3} \times 8.2 \times 10^3$

$\boxed{V_C = 11.5746\ V}$

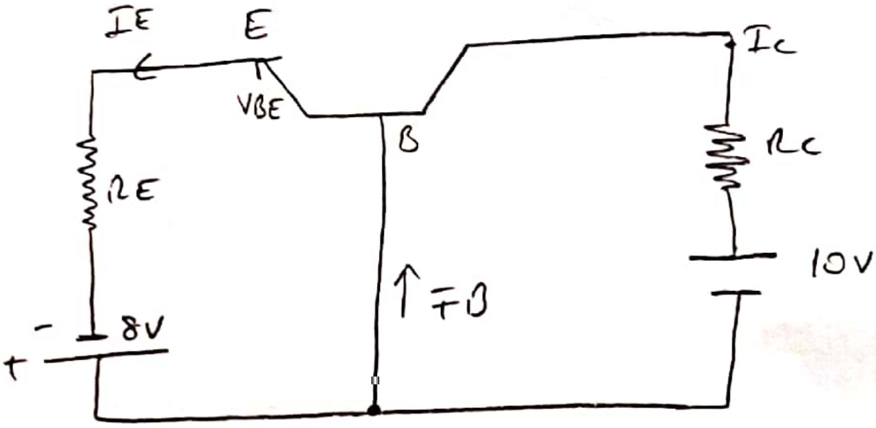
$V_E - 0 = 1.8 \times 10^3 \times I_E = 1.8 \times 10^3 \times 2.247 \times 10^{-3} = 4.0446\ V$

$V_E = 4.0446V$ $\quad V_{CE} = V_C - V_C = 11.5746 - 4.0446 = 7.53V$

b. ANALYSIS



=>



This transister to be same as the figure(a).

$\beta = 18$

$\alpha = \dfrac{\beta}{\beta + 1} = \dfrac{180}{181} = 0.994$

$R_E = 2.2k\Omega$, $R_C = 1.8\ k\Omega$

$I_E = I_B + I_C$ (Apply KVL)

$I_C = \alpha I_E$

$I_B = (1 - \alpha) I_E = (1 - 0.994) I_E$

$I_B = 5.52 \times 10^{-3} I_E$

$V_{BE} = 0.7V$

Applying KVL to emitter side

$8 - I_E R_E - V_{BE} = 0$

$8 = I_E R_E + 0.7$

$I_E R_E = 8 - 0.7 = 7.3$

$I_E = \dfrac{7.3}{2.2k} = 3.318\ mA$

$I_C = \alpha I_E = 0.994 \times 3.318m = 3.298\ mA = I_C$

$V_{CC} = I_C R_C + V_{CB}$

$V_{CB} = V_{CC} - I_C R_C$

$V_{CC} = 10V$

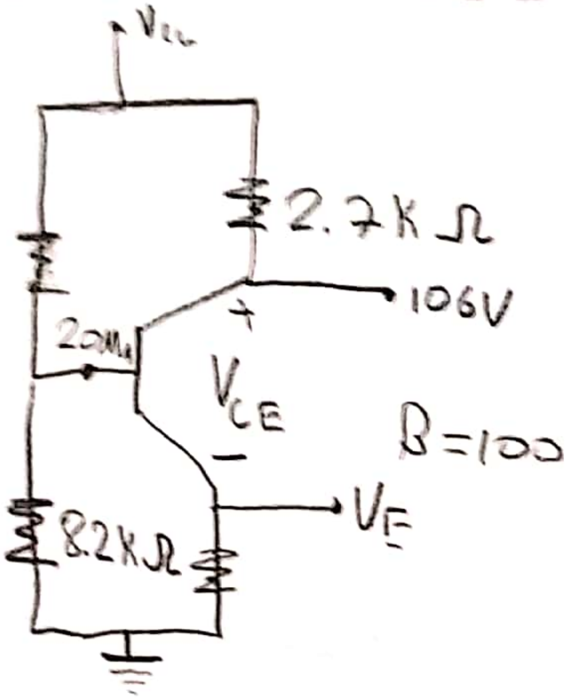
$V_{CB} = 10 - 3.2298 \times 10^{-3} \times 1.8 \times 10^{3}$

$\boxed{V_{CB} = 4.0636 V}$

$V_{CB} = V_C - V_B$

$V_B = 0V$ as base ground

2a)



a-) $I_C = \beta I_B = 100 \times 20 \times 10^{-6}$

$I_C = 2mA$

b-) $V_E = I_E \times 1.2K$

$= \frac{\beta+1}{\beta} \, I \times 1.2K$

$V_E = \frac{100+1}{100} \times 2mA \times 1.2k\Omega$

$\underline{V_E = 2.424 V}$

c-) $V_{CC} = V_C + I_C R_C$

$V_{CC} = 10.6 + 2 \cdot 2.7 = \boxed{16V}$

d-) $V_{CE} = V_C - V_E = 10.6 - 2.424 = \boxed{8.176 V}$

e-) $V_{BE} = 0.7$

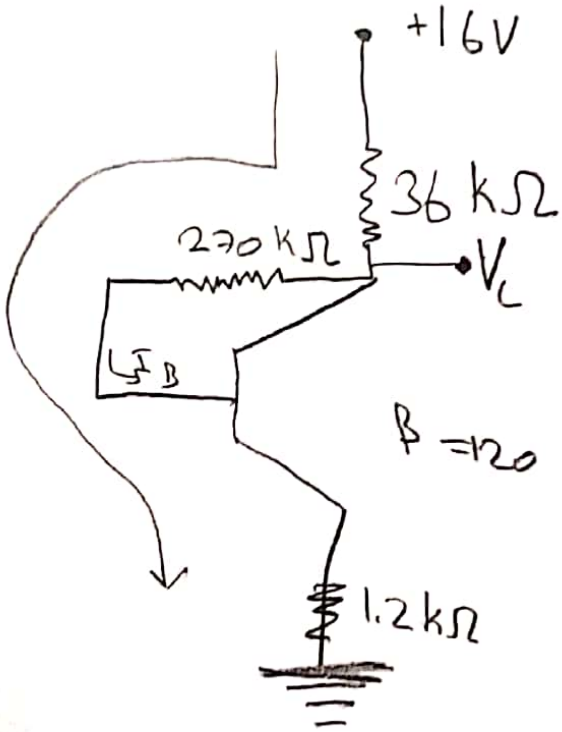
$V_{BE} = V_B - V_E$

$V_B = V_{BE} + V_E = 0.7 + 2.424 = \boxed{3.124 V}$

f-) $V_B = \frac{V_{CC} \times 8.2}{R_1 + 8.2}$

$3.124 = \frac{16 \times 8.2}{R_1 + 8.2}$

$\boxed{R_1 = 33.7974 k\Omega}$



a -) $U_{BE} = 0,7V$

$\beta = 120$

Apply KVL on loop (1)

We get:

(1) $-16 + 3.6(I_C + I_B) + 270 I_B + 1.2(I_C + I_B) = 0$

(2) $I_C = \beta I_B = 120 I_B$

from eq (1) and (2)

$-16 + 3.6(121 I_B) + 270 I_B + 1.2(121 I_B) = 0$

$850.8 I_B = 16$

$\boxed{I_B = 18.8 \mu A}$

b -) $\beta I_B = 120 \times 18.8 \times 10^{-6}$

$\boxed{I_C = 2.256 \, mA}$

c -) $V_C = 16 - 3.6(I_C + I_B)$

$V_C = 16 - 3.6(2,256 + 0,0188) = \boxed{7.808V}$