1) $I_C = I_E - I_B = 4mA - 20\mu A = 3.98mA \cong 4mA$

$V_{CC} = V_{CE} + I_C R_C = 7.2V + (3.98mA) \cdot (2.2k\Omega) = 15.96V$

$\beta = \frac{I_C}{I_B} = \frac{3.98mA}{20\mu A} = 199 \cong 200$

$R_B = \frac{V_{RB}}{I_B} = \frac{V_{CC} - V_{BE}}{I_B} = \frac{15.96V - 0.7V}{20\mu A} = 765k\Omega$

2) $R_C = \frac{V_{CC} - V_C}{I_C} = \frac{12V - 7.6V}{2mA} = 2.2k\Omega$

$R_E = \frac{V_E}{I_E} = \frac{2.4V}{2mA} = 1.2k\Omega$

$R_B = \frac{V_{RB}}{I_B} = \frac{V_{CC} - V_{BE} - V_E}{\left(\frac{I_C}{\beta}\right)} = \frac{12V - 0.7V - 2.4V}{\left(\frac{2mA}{80}\right)} = 376k\Omega$

$V_{CE} = V_C - V_E = 7.6V - 2.4V = 5.2V$

$V_B = V_{BE} + V_E = 0.7V + 2.4V = 3.1V$

3) $I_c = \beta I_B = 100 \times 20\mu A = 2\times10^{3}\times10^{-6} A = 2\times10^{-3} = 2mA$

$I_E = I_c + I_B = 2mA + 20\mu A = 2.02\,mA$

$V_E = 1.2 \times I_E = 1.2 \times 2.02 = 2.424V$

$V_{cc} - 2.7k \cdot I_c = 10.6V$

$2.7k \times 2mA + 10.6V$

$= 5.4 + 10.6 = 16V$

$V_{CE} = V_c - V_E = 10.6 - 2.42 = 8.176V$

$V_B = -8.2k \cdot I_E = -8.2 \times 2.02 = -16.564V$

$I' = I_E \cdot I_B = I_c = 2mA$

4) $V_{BE} = 0.7V$

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

$I_c = \beta I_B = 120 I_B$

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

$850.8 I_B = 16 \qquad I_B = 18.8\mu A$

$I_c = 120 I_B = 2.256\,mA$

5)

$$I_B = \frac{V_{CC} - V_{BE}}{R_B + \beta(R_C + R_E)} = \frac{30V - 0.7V}{(550k\Omega) + 180(8.2k\Omega + 1.8k\Omega)}$$

$$= 12.47\mu A$$

$$\frac{29.3}{(550 \times 10^3 \Omega) + (10 \times 10^3 \Omega)}$$

$$I_C = \beta \cdot I_B = 180 \cdot 12{,}47 = 2.24mA$$

$$V_C = V_{CC} - I_C R_C = 30V - (2.24mA) \cdot (8.2\ k\Omega)$$

$$= 11.63\ V$$

$$V_E = I_E R_C = 2.24mA \times 1.8k\Omega$$

$$= 4.03V$$

$$V_{CE} = V_{CC} - I_C (R_E + R_C)$$

$$30V - (2.24mA) \cdot (8.2 \times 10^3 \Omega + 1.8\ k\Omega)$$

$$= 30V - (2.24 \times 10^{-3} V) \cdot (10 \times 10^3 \Omega)$$

$$= 7.6V$$

6) $I_E = \frac{V_{EE} - V_{BE}}{R_E} = \frac{8V - 0.7V}{2.2k\Omega} = \underline{3.32mA}$

$V_C = V_{CC} - I_E R_C = 10V - (3.32mA).(1.8k\Omega)$

$= \underline{4.02V}$

$V_{CE} = V_{CC} + V_{EE} - I_E(R_E + R_C)$

$= 10V + 8V - (3.32mA).[2.2k\Omega + 1.8k\Omega]$

$= 18V - 13.28V$

$= \underline{4.72V}$