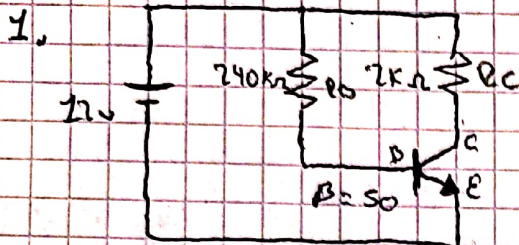


①

TALENT 2.



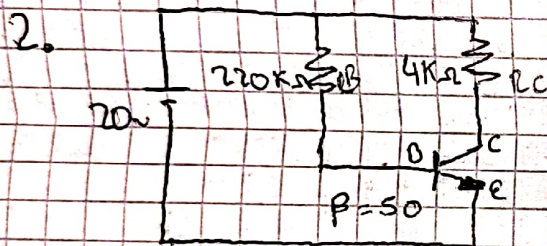
$$V_{CE} = 7.3V$$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{12V - 0.7V}{240k\Omega} = \frac{11.3}{240} = 47.08 \mu A$$

$$I_C = \beta \cdot I_B = 50 \cdot 47.08 \mu A = 2.35 mA$$

$$V_{EC} = I_C \cdot R_C = 2.35 mA \cdot 2k\Omega = 4.7V$$

$$V_{CE} = V_{CC} - V_{EC} = 12V - 4.7V = \boxed{7.3V}$$



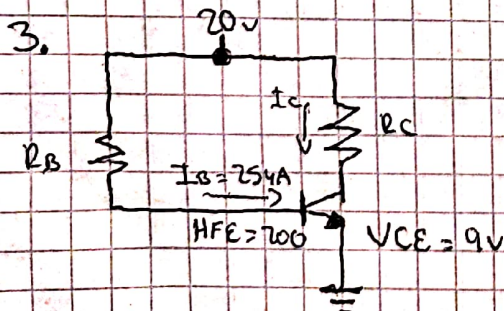
$$V_{CE} = 2.45V$$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{20V - 0.7V}{220k\Omega} = \frac{19.3V}{220k\Omega} = 87.73 \mu A$$

$$I_C = \beta \cdot I_B = 50 \cdot 87.73 \mu A = 4.386 mA$$

$$V_{EC} = I_C \cdot R_C = 4.386 mA \cdot 4k\Omega = 17.544V$$

$$V_{CE} = V_{CC} - V_{EC} = 20V - 17.544V = \boxed{2.45V}$$



$$I_C = \beta \cdot I_B = 200 \cdot 25 \mu A = 5 mA$$

$$V_{EC} = V_{CC} - V_{CE} = 20V - 9V = 11V$$

$$R_C = \frac{V_{EC}}{I_C} = \frac{11V}{5mA} = \boxed{2.2k\Omega}$$

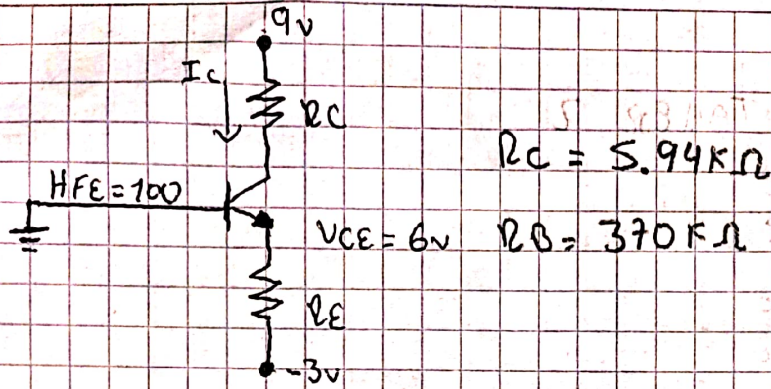
$$R_C = 2.2k\Omega$$

$$V_{EB} = V_{CC} - V_{BE} = 20V - 0.7V = 19.3V$$

$$R_B = 772k\Omega$$

$$R_B = \frac{V_{EB}}{I_B} = \frac{19.3V}{25 \mu A} = \boxed{772k\Omega}$$

4.



$$V_{RE} = V_E - (-3\text{V}) = 3\text{V} + 3\text{V} = 6\text{V}$$

$$? \star I_C = 1\text{mA} \rightarrow I_E = I_C + I_B = 1\text{mA} + 0.01\text{mA} = 1.01\text{mA}$$

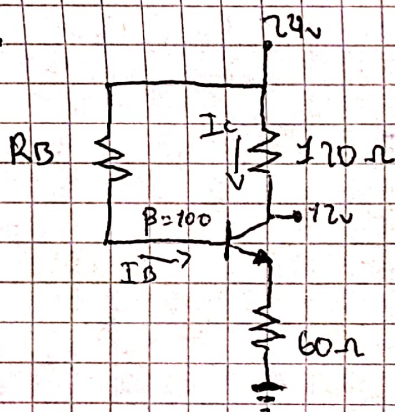
$$I_B = \frac{I_C}{\beta} = \frac{1\text{mA}}{100} = 10\mu\text{A}$$

$$R_E = \frac{V_{RE}}{I_E} = \frac{6\text{V}}{1.01\text{mA}} = \boxed{5.94 \text{ k}\Omega}$$

$$V_B = V_E + V_{BE} = 3\text{V} + 0.7\text{V} = 3.7\text{V}$$

$$R_B = \frac{V_B}{I_B} = \frac{3.7\text{V}}{10\mu\text{A}} = \boxed{370 \text{ k}\Omega}$$

5.



$$V_{RC} + V_{CE} + V_{RE} = 24\text{V}$$

$$V_{RC} = I_C \cdot 120 \Omega$$

$$V_{RE} = I_E \cdot 60 \Omega = I_C \cdot 60 \Omega$$

$$R_C = 28.94 \text{ k}\Omega$$

$$V_{CE} = 12\text{V}$$

$$I_C \cdot 120 + 12 + I_C \cdot 60 = 24 \rightarrow I_C \cdot (120 + 60) + 12 = 24$$

$$I_C \cdot 180 = 12 \rightarrow I_C = \frac{12}{180} = 66.7 \text{ mA}$$

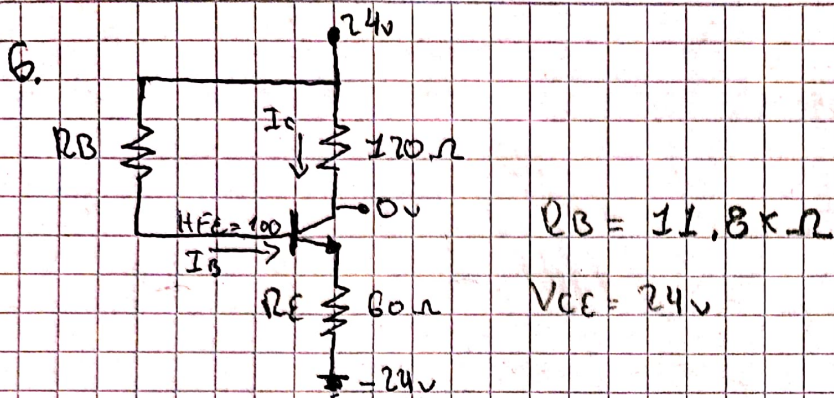
$$I_B = \frac{I_C}{\beta} = \frac{66.7 \text{ mA}}{100} = 667 \mu\text{A}$$

$$V_E = I_E \cdot R_E = 66.7 \text{ mA} \cdot 60 \Omega = 4\text{V}$$

$$V_B = V_E + V_{BE} = 4\text{V} + 0.7\text{V} = 4.7\text{V} \rightarrow V_{RB} = 24\text{V} - 4.7\text{V} = 19.3\text{V}$$

$$R_B = \frac{V_{RB}}{I_B} = \frac{19.3\text{V}}{667 \mu\text{A}} = \boxed{28.94 \text{ k}\Omega}$$

②



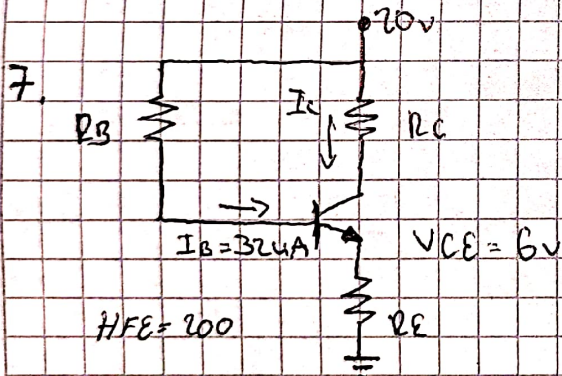
$$V_B = V_E + V_{BE} = -24 \text{ V} + 0,7 \text{ V} = -23,3 \text{ V}$$

$$V_{CE} = V_C - V_E = 0 - (-24 \text{ V}) = 24 \text{ V}$$

$$I_E = \frac{V_{RE}}{R_E} = \frac{24 \text{ V}}{60 \Omega} = 0,4 \text{ A} \rightarrow I_C = I_E = 0,4 \text{ A}$$

$$I_B = \frac{I_C}{H_{FE}} = \frac{0,4 \text{ A}}{100} = 4 \text{ mA} \rightarrow V_{RB} = 24 - (-23,3) = 47,3 \text{ V}$$

$$R_B = \frac{V_{RB}}{I_B} = \frac{47,3 \text{ V}}{0,004 \text{ A}} = 11,825 \text{ k}\Omega$$



$$I_C = 6 \text{ mA} \quad I_B = 32 \mu\text{A}$$

$$I_E = I_C + I_B = 6 \text{ mA} + 0,032 \text{ mA} = 6,032 \text{ mA}$$

$$V_{CE} = V_C - V_E = 6 \text{ V}$$

$$V_{RC} = V_{CC} - V_C = 20 \text{ V} - V_C$$

$$V_{RE} = V_E - 0 = V_E \rightarrow V_C = V_E + 6$$

$$R_B = 540,6 \text{ k}\Omega$$

$$R_C = 2 \text{ k}\Omega$$

$$R_E = 331,6 \Omega$$

$$V_{RC} = 20 - (V_E + 6) = 14 - V_E$$

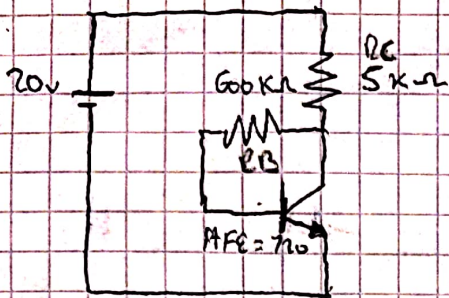
$$R_C = \frac{V_{RC}}{I_C} = \frac{14 - V_E}{6 \text{ mA}} \quad \vee \quad R_E = \frac{V_E}{I_E} = \frac{V_E}{6,032 \text{ mA}}$$

$$V_C = V_E + 6 \text{ V} = 8 \text{ V} \rightarrow V_{RC} = 20 - 8 = 12 \text{ V}$$

$$R_C = \frac{12 \text{ V}}{6 \text{ mA}} = 2 \text{ k}\Omega \quad \vee \quad R_E = \frac{2}{6,032 \text{ mA}} = 331,6 \Omega$$

$$V_{RB} = V_{CC} - V_B = 20 - 2,7 = 17,3 \text{ V} \quad R_B = \frac{V_{RB}}{I_B} = \frac{17,3 \text{ V}}{32 \mu\text{A}} = 540,6 \text{ k}\Omega$$

8.



$$I_E = 3.89 \text{ mA}$$

$$V_{CE} = 0.7 \text{ V}$$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{20 \text{ V} - 0.7 \text{ V}}{600 \text{ k}\Omega} = \frac{19.3 \text{ V}}{600 \text{ k}\Omega} = 32.17 \mu\text{A}$$

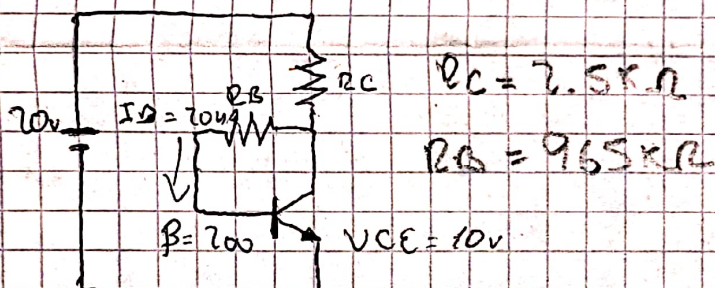
$$I_C = H_{FE} \cdot I_B = 120 \cdot 32.17 \mu\text{A} = 3.86 \text{ mA}$$

$$I_E = I_B + I_C = 3.86 \text{ mA} + 32.17 \mu\text{A} = \boxed{3.89 \text{ mA}}$$

$$V_{EC} = I_C \cdot R_C = 3.86 \text{ mA} \cdot 5 \text{ k}\Omega = 19.3 \text{ V}$$

$$V_{CE} = V_{CC} - V_{EC} = 20 \text{ V} - 19.3 \text{ V} = \boxed{0.7 \text{ V}}$$

9.



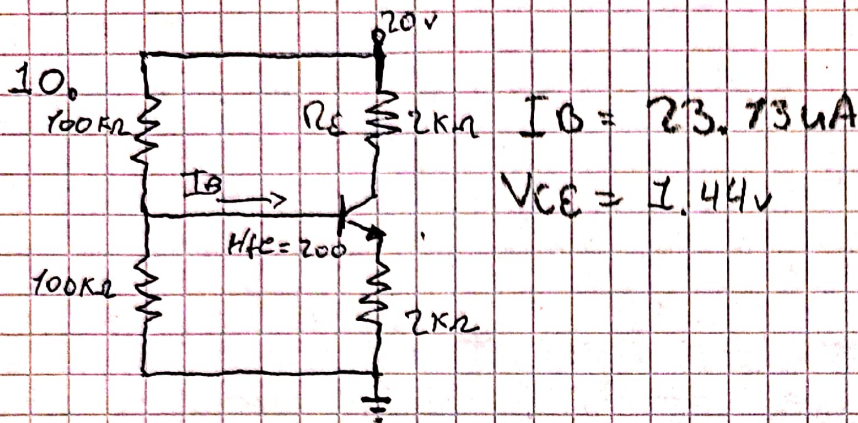
$$R_C = 2.5 \text{ k}\Omega$$

$$R_B = 965 \text{ k}\Omega$$

$$R_C = \frac{V_{CC} - V_{CE}}{I_C} = \frac{20 \text{ V} - 10 \text{ V}}{4 \text{ mA}} = \frac{10 \text{ V}}{4 \text{ mA}} = \boxed{2.5 \text{ k}\Omega}$$

$$R_B = \frac{V_{CC} - V_{BE}}{I_B} = \frac{20 \text{ V} - 0.7 \text{ V}}{20 \mu\text{A}} = \frac{19.3 \text{ V}}{20 \mu\text{A}} = \boxed{965 \text{ k}\Omega}$$

3



$$V_B = V_{CC} \cdot \frac{R_2}{R_1 + R_2} = 20V \cdot \frac{100k\Omega}{100k\Omega + 100k\Omega} = 10V$$

$$V_E = V_B - V_{BE} = 10V - 0.7V = 9.3V$$

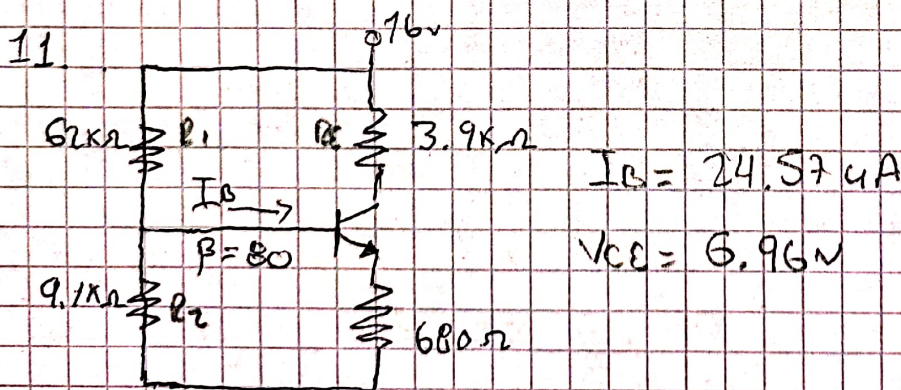
$$I_E = \frac{V_E}{R_E} = \frac{9.3V}{2k\Omega} = 4.65mA$$

$$I_B = \frac{I_E}{\beta + 1} = \frac{4.65mA}{201} = 23.13\mu A$$

$$I_C = HFE \cdot I_B = 200 \cdot 23.13\mu A = 4.63mA$$

$$V_{EC} = I_C \cdot R_C = 4.63mA \cdot 2k\Omega = 9.26V$$

$$V_{CE} = V_{CC} - V_{EC} - V_E = 20V - 9.26V - 9.3V = 1.44V$$



$$V_B = V_{CC} \cdot \frac{R_2}{R_1 + R_2} = 16V \cdot \frac{9.1k\Omega}{62k\Omega + 9.1k\Omega} = 2.05V$$

$$V_E = V_B - V_{BE} = 2.05V - 0.7V = 1.35V$$

$$I_E = \frac{V_E}{R_E} = \frac{1.35V}{680\Omega} = 1.93mA$$

$$I_B = \frac{I_E}{\beta + 1} = \frac{1.99 \text{ mA}}{81} = \boxed{24.57 \mu\text{A}}$$

$$I_C = \beta \cdot I_B = 80 \cdot 24.57 \mu\text{A} = 1.97 \text{ mA}$$

$$V_{EC} = I_C \cdot R_C = 1.97 \text{ mA} \cdot 3.9 \text{ k}\Omega = 7.69 \text{ V}$$

$$V_{CE} = V_{CC} - V_{EC} - V_E = 16 \text{ V} - 7.69 \text{ V} - 1.35 \text{ V} = \boxed{6.96 \text{ V}}$$