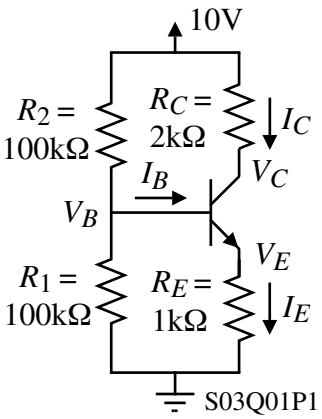
QUIZ NO. 1 - SOLUTION

(Average score = 6.9/10 of those taking the quiz)

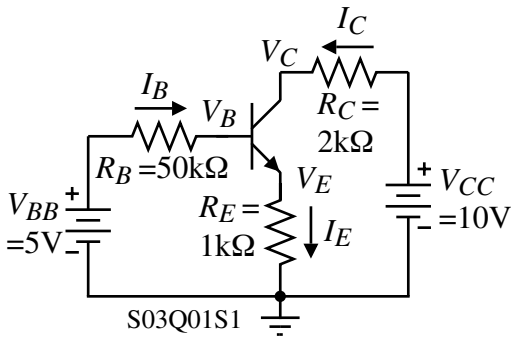
If $\beta_F = 100$ and $V_{BEQ} = 0.6$V, solve for the dc values of I_B, I_C, I_E, V_B. V_C. and V_E of the transistor circuit shown.



Solution

The first step is to find a Thevenin equivalent circuit seen from the base to ground. This circuit is shown below where

$$V_{BB} = \frac{10 \cdot R_1}{R_1 + R_2} = 5\text{V} \quad \text{and} \quad R_B = R_1 \| R_2 = 50\text{k}\Omega$$



The base current, I_B, can be found from the base-emitter voltage loop.

$$V_{BB} = I_B R_B + V_{BEQ} + I_B (1+\beta_F) R_E \rightarrow I_B = \frac{V_{BB} - 0.6}{R_B + (1+\beta_F) R_E} = \frac{4.4\text{V}}{151\text{k}\Omega} = \underline{29.14\mu\text{A}}$$

$$\therefore \quad I_C = \beta_F I_B = \underline{2.914\text{mA}} \quad \text{and} \quad I_E = I_C + I_B = \underline{2.943\text{mA}}$$

The voltages of the transistor can be found as follows.

$$V_C = 10\text{V} - I_C R_C = 10 - 2.914\text{mA} \cdot 2\text{k}\Omega = 10 - 5.83 = \underline{4.17\text{V}}$$

$$V_E = I_E R_E = 2.942\text{mA} \cdot 1\text{k}\Omega = \underline{2.942\text{V}}$$

$$V_B = V_E + V_{BEQ} = 2.942 + 0.6 = \underline{3.543\text{V}}$$