Then,

Equation 5–4

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

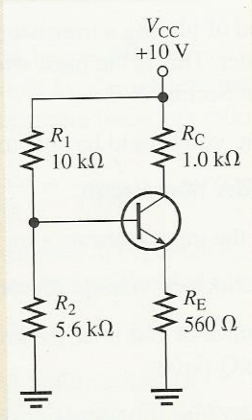
Once you know V_C and V_E, you can determine V_{CE}.

$$V_{CE} = V_C - V_E$$

EXAMPLE 5–2

Determine V_{CE} and I_C in the stiff voltage-divider biased transistor circuit of Figure 5–10 if $\beta_{DC} = 100$.

▶ FIGURE 5–10



Solution The base voltage is

$$V_B \cong \left(\frac{R_2}{R_1 + R_2}\right)V_{CC} = \left(\frac{5.6\text{ k}\Omega}{15.6\text{ k}\Omega}\right)10\text{ V} = 3.59\text{ V}$$

So,

$$V_E = V_B - V_{BE} = 3.59\text{ V} - 0.7\text{ V} = 2.89\text{ V}$$

and

$$I_E = \frac{V_E}{R_E} = \frac{2.89\text{ V}}{560\ \Omega} = 5.16\text{ mA}$$

Therefore,

$$I_C \cong I_E = \mathbf{5.16\text{ mA}}$$

and

$$V_C = V_{CC} - I_C R_C = 10\text{ V} - (5.16\text{ mA})(1.0\text{ k}\Omega) = 4.84\text{ V}$$

$$V_{CE} = V_C - V_E = 4.84\text{ V} - 2.89\text{ V} = \mathbf{1.95\text{ V}}$$

Related Problem If the voltage divider in Figure 5–10 was not stiff, how would V_B be affected?

Open the Multisim file E05-02 in the Examples folder on your CD-ROM. Measure I_C and V_{CE}. Your results should agree more closely with those in the Related Problem than with those calculated in the example. Can you explain this?

The basic analysis developed in Example 5–2 is all that is needed for most voltage-divider circuits, but there may be cases where you need to analyze the circuit with more accuracy. Ideally, a voltage-divider circuit is stiff, which means that the transistor does not appear as a significant load. All circuit design involves trade-offs; and one trade-off is that stiff voltage dividers require smaller resistors, which are not always desirable because of