28. **When using a DMM to test a transistor, an approximate reading of 0.7 V will be found with how many polarity connections?**
    a. One
    b. Two
    c. Three
    d. None

29. **What DMM polarity connection is needed on an *npn* transistor's base to get a 0.7 V reading?**
    a. Positive
    b. Negative
    c. Either positive or negative
    d. Unknown

30. **When testing an *npn* transistor using an ohmmeter, the collector-emitter resistance will be low when**
    a. The collector is positive in respect to the emitter
    b. The emitter is positive in respect to the collector
    c. The transistor is normal
    d. The transistor is defective

31. **The major advantage of a phototransistor as compared to a photodiode is its**
    a. Response to higher frequencies
    b. AC operation
    c. Increased sensitivity
    d. Durability

Problems

SEC. 7-1 VARIATIONS IN CURRENT GAIN

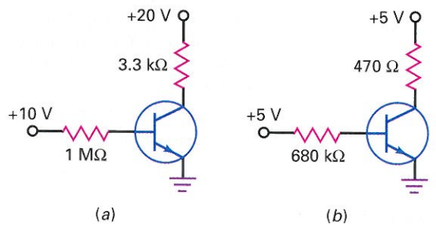
7-1 Refer to Fig. 7-1. What is the current gain of a 2N3904 when the collector current is 100 mA and the junction temperature is 125°C?

7-2 Refer to Fig. 7-1. The junction temperature is 25°C, and the collector current is 1.0 mA. What is the current gain?

SEC. 7-2 THE LOAD LINE

7-3 Draw the load line for Fig. 7-25*a*. What is the collector current at the saturation point? The collector-emitter voltage at the cutoff point?

Figure 7-25



7-4 If the collector supply voltage is increased to 25 V in Fig. 7-25*a*, what happens to the load line?

7-5 If the collector resistance is increased to 4.7 kΩ in Fig. 7-25*a*, what happens to the load line?

7-6 If the base resistance of Fig. 7-25*a* is reduced to 500 kΩ, what happens to the load line?

7-7 Draw the load line for Fig. 7-25*b*. What is the collector current at the saturation point? The collector-emitter voltage at the cutoff point?

7-8 If the collector supply voltage is doubled in Fig. 7-25*b*, what happens to the load line?

7-9 If the collector resistance is increased to 1 kΩ in Fig. 7-25*b*, what happens to the load line?

SEC. 7-3 THE OPERATING POINT

7-10 In Fig. 7-25*a*, what is the voltage between the collector and ground if the current gain is 200?

7-11 The current gain varies from 25 to 300 in Fig. 7-25*a*. What is the minimum voltage from the collector to ground? The maximum?

7-12 The resistors of Fig. 7-25*a* have a tolerance of ±5 percent. The supply voltages have a tolerance of ±10 percent. If the current gain can vary from 50 to 150, what is the minimum possible voltage from the collector to ground? The maximum?

7-13 In Fig. 7-25*b*, what is the voltage between the collector and ground if the current gain is 150?

7-14 The current gain varies from 100 to 300 in Fig. 7-25*b*. What is the minimum voltage from the collector to ground? The maximum?

7-15 The resistors of Fig. 7-25*b* have a tolerance of ±5 percent. The supply voltages have a tolerance of ±10 percent. If the current gain can vary from 50 to 150, what is the minimum possible voltage from the collector to ground? The maximum?

SEC. 7-4 RECOGNIZING SATURATION

7-16 In Fig. 7-25*a*, use the circuit values shown unless otherwise indicated. Determine whether the transistor is saturated for each of these changes:
    a. $R_B = 33\ k\Omega$ and $h_{FE} = 100$
    b. $V_{BB} = 5\ V$ and $h_{FE} = 200$
    c. $R_C = 10\ k\Omega$ and $h_{FE} = 50$
    d. $V_{CC} = 10\ V$ and $h_{FE} = 100$

7-17 In Fig. 7-25*b*, use the circuit values shown unless otherwise indicated. Determine whether the transistor is saturated for each of these changes:
    a. $R_B = 51\ k\Omega$ and $h_{FE} = 100$
    b. $V_{BB} = 10\ V$ and $h_{FE} = 500$
    c. $R_C = 10\ k\Omega$ and $h_{FE} = 100$
    d. $V_{CC} = 10\ V$ and $h_{FE} = 100$

SEC. 7-5 THE TRANSISTOR SWITCH

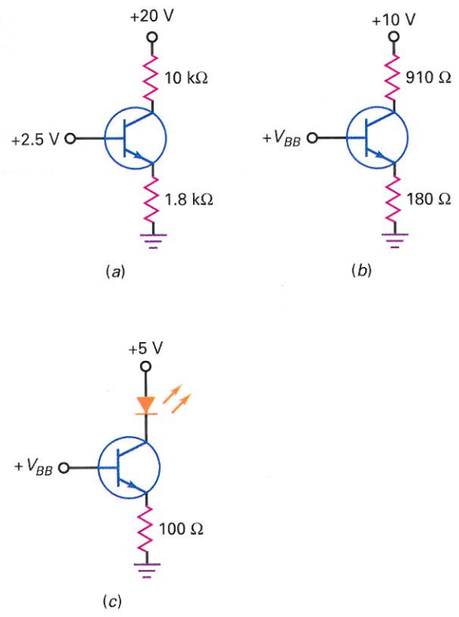
7-18 The 680 kΩ in Fig. 7-25*b* is replaced by 4.7 kΩ and a series switch. Assuming an ideal transistor, what is the collector voltage if the switch is open? What is the collector voltage if the switch is closed?

7-19 Repeat Prob. 7-18, except use $V_{CE(sat)} = 0.2\ V$ and $I_{CEO} = 100\ nA$.

SEC. 7-6 EMITTER BIAS

7-20 MultiSim What is the collector voltage in Fig. 7-26*a*? The emitter voltage?

Figure 7-26



7-21 MultiSim If the emitter resistor is doubled in Fig. 7-26*a*, what is the collector-emitter voltage?

7-22 MultiSim If the collector supply voltage is decreased to 15 V in Fig. 7-26*a*, what is the collector voltage?

7-23 MultiSim What is the collector voltage in Fig. 7-26*b* if $V_{BB} = 2\ V$?

7-24 MultiSim If the emitter resistor is doubled in Fig. 7-26*b*, what is the collector-emitter voltage for a base supply voltage of 2.3 V?

7-25 MultiSim If the collector supply voltage is increased to 15 V in Fig. 7-26*b*, what is the collector-emitter voltage for $V_{BB} = 1.8\ V$?

SEC. 7-7 LED DRIVERS

7-26 MultiSim If the base supply voltage is 2 V in Fig. 7-26*c*, what is the current through the LED?

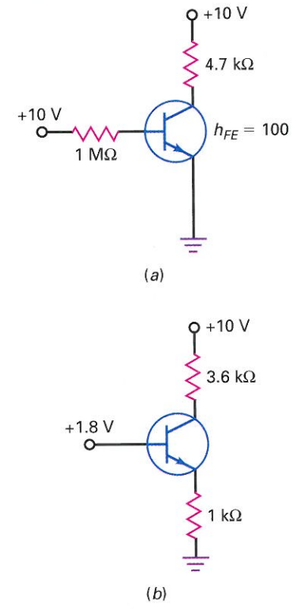
7-27 MultiSim If $V_{BB} = 1.8\ V$ in Fig. 7-26*c*, what is the LED current? The approximate V_C?

SEC. 7-8 THE EFFECT OF SMALL CHANGES

Use the letters U (up), D (down), and N (no change) for your answers in the following problems.

7-28 The base supply voltage of Fig. 7-27*a* decreases by 10 percent. What happens to the base current, collector current, and collector voltage?

Figure 7-27



7-29 The base resistance of Fig. 7-27*a* decreases by 10 percent. What happens to the base current, collector current and collector voltage?

7-30 The collector resistance of Fig. 7-27*a* increases by 10 percent. What happens to the base current, collector current, and collector voltage?

7-31 The collector supply voltage of Fig. 7-27*a* increases by 10 percent. What happens to the base current, collector current, and collector voltage?

7-32 The base supply voltage of Fig. 7-27*b* decreases by 10 percent. What happens to the base current, collector current, and collector voltage?