18. **The ac collector current is approximately equal to the**
    a. AC base current
    b. AC emitter current
    c. AC source current
    d. AC bypass current

19. **The ac emitter current times the ac emitter resistance equals the**
    a. DC emitter voltage
    b. AC base voltage
    c. AC collector voltage
    d. Supply voltage

20. **The ac collector current equals the ac base current times the**
    a. AC collector resistance
    b. DC current gain
    c. AC current gain
    d. Generator voltage

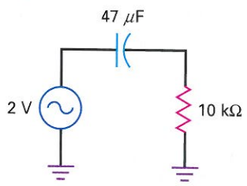
21. **When the emitter resistance R_E doubles, the ac emitter resistance**
    a. Increases
    b. Decreases
    c. Remains the same
    d. Cannot be determined

Problems

SEC. 9-1 BASE-BIASED AMPLIFIER

9-1 MultiSim In Fig. 9-24, what is the lowest frequency at which good coupling exists?

Figure 9-24



9-2 MultiSim If the load resistance is changed to 1 kΩ in Fig. 9-24, what is the lowest frequency for good coupling?

9-3 MultiSim If the capacitor is changed to 100 μF in Fig. 9-24, what is the lowest frequency for good coupling?

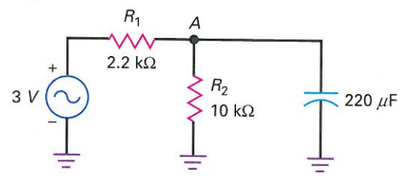
9-4 If the lowest input frequency of Fig. 9-24 is 100 Hz, what *C* value is required for good coupling?

SEC. 9-2 EMITTER-BIASED AMPLIFIER

9-5 In Fig. 9-25, what is the lowest frequency at which good bypassing exists?

9-6 If the series resistance is changed to 10 kΩ in Fig. 9-25, what is the lowest frequency for good bypassing?

Figure 9-25



9-7 If the capacitor is changed to 47 μF in Fig. 9-25, what is the lowest frequency for good bypassing?

9-8 If the lowest input frequency of Fig. 9-25 is 1 kHz, what *C* value is required for effective bypassing?

SEC. 9-3 SMALL-SIGNAL OPERATION

9-9 If we want small-signal operation in Fig. 9-26, what is the maximum allowable ac emitter current?

9-10 The emitter resistor of Fig. 9-26 is doubled. If we want small-signal operation in Fig. 9-26, what is the maximum allowable ac emitter current?

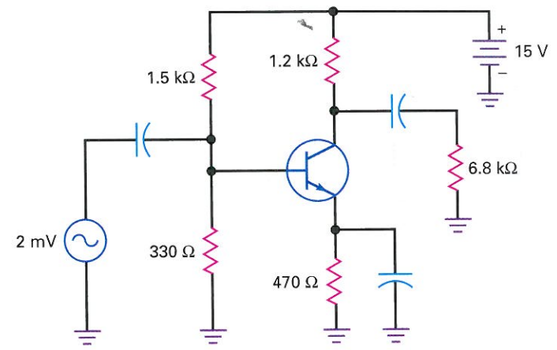
SEC. 9-4 AC BETA

9-11 If an ac base current of 100 μA produces an ac collector current of 15 mA, what is the ac beta?

9-12 If the ac beta is 200 and the ac base current is 12.5 μA, what is the ac collector current?

9-13 If the ac collector current is 4 mA and the ac beta is 100, what is the ac base current?

Figure 9-26



SEC. 9-5 AC RESISTANCE OF THE EMITTER DIODE

9-14 MultiSim What is the ac resistance of the emitter diode in Fig. 9-26?

9-15 MultiSim If the emitter resistance of Fig. 9-26 is doubled, what is the ac resistance of the emitter diode?

SEC. 9-6 TWO TRANSISTOR MODELS

9-16 What is the input impedance of the base in Fig. 9-26 if $\beta = 200$?

9-17 If the emitter resistance is doubled in Fig. 9-26, what is the input impedance of the base with $\beta = 200$?

9-18 If the 1.2 kΩ resistance is changed to 680 Ω in Fig. 9-26, what is the input impedance of the base if $\beta = 200$?

SEC. 9-7 ANALYZING AN AMPLIFIER

9-19 MultiSim Draw the ac equivalent circuit for Fig. 9-26 with $\beta = 150$.

9-20 Double all the resistances in Fig. 9-26. Then, draw the ac equivalent circuit for an ac current gain of 300.

SEC. 9-8 AC QUANTITIES ON THE DATA SHEET

9-21 What are the minimum and maximum values listed under "Small-Signal Characteristics" in Fig. 9-23 for the h_{fe} of a 2N3903? For what collector current are these values given? For what temperature are these values given?

9-22 Refer to the data sheet of a 2N3904 for the following. What is the typical value of r'_e that you can calculate from the *h* parameter if the transistor operates at a collector current of 5 mA? Is this smaller or larger than the ideal value of r'_e calculated with 25 mV/I_E?

Critical Thinking

9-23 Somebody has built the circuit of Fig. 9-24. The builder cannot understand why a very small dc voltage is measured across the 10 kΩ when the source is 2 V at zero frequency. Can you explain what is happening?

9-24 Assume that you are in the laboratory testing the circuit of Fig. 9-25. As you increase the frequency of the generator, the voltage at node *A* decreases until it becomes too small to measure. If you continue to increase the frequency well above 10 MHz, the voltage at node *A* begins to increase. Can you explain why this happens?

9-25 In the rule for good coupling, *R* represents all the resistance that is in series with the coupling capacitor. With this hint in mind, what is the lowest frequency for good coupling in Fig. 9-27*a*?

9-26 What is the lowest frequency for good bypassing in Fig. 9-27*b*? (*Hint:* Thevenin resistance.)

9-27 In the two-stage amplifier of Fig. 9-28, what is the input impedance of the first base if the ac current gain is 250? If the second transistor has $\beta = 100$, what is the input impedance of the second base?

9-28 Draw the ac equivalent circuit for Fig. 9-28 using $\beta = 200$ for both transistors.

9-29 In Fig. 9-26, the Thevenin resistance seen by the bypass capacitor is 30 Ω. If the emitter is supposed to be ac ground over a frequency range of 20 Hz to 20 kHz, what size should the bypass capacitor be?