5. Household outlets are often double outlets. Are these connected in series or parallel? How do you know?
6. With two identical lightbulbs and two identical batteries, how would you arrange the bulbs and batteries in a circuit to get the maximum possible total power out? (Assume the batteries have negligible internal resistance.)
7. If two identical resistors are connected in series to a battery, does the battery have to supply more power or less power than when only one of the resistors is connected? Explain.
8. You have a single 60-W bulb on in your room. How does the overall resistance of your room's electric circuit change when you turn on an additional 100-W bulb?
9. When applying Kirchhoff's loop rule (such as in Fig. 19–35), does the sign (or direction) of a battery's emf depend on the direction of current through the battery? What about the terminal voltage?

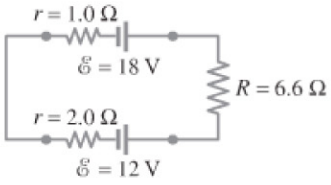
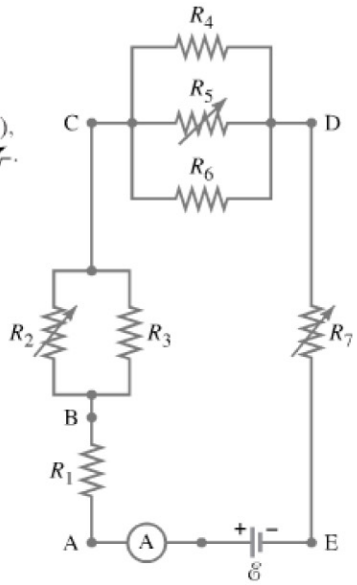


FIGURE 19–35
Question 9.

10. Given the circuit shown in Fig. 19–36, use the words "increases," "decreases," or "stays the same" to complete the following statements:
(*a*) If R_7 increases, the potential difference between A and E _____. Assume no resistance in Ⓐ and ℰ.
(*b*) If R_7 increases, the potential difference between A and E _____. Assume Ⓐ and ℰ have resistance.
(*c*) If R_7 increases, the voltage drop across R_4 _____.
(*d*) If R_2 decreases, the current through R_1 _____.
(*e*) If R_2 decreases, the current through R_6 _____.
(*f*) If R_2 decreases, the current through R_3 _____.
(*g*) If R_5 increases, the voltage drop across R_2 _____.
(*h*) If R_5 increases, the voltage drop across R_4 _____.
(*i*) If R_2, R_5, and R_7 increase, ℰ ($r = 0$) _____.

FIGURE 19–36
Question 10. R_2, R_5, and R_7 are *variable* resistors (you can change their resistance), given the symbol ⟋.



11. For what use are batteries connected in series? For what use are they connected in parallel? Does it matter if the batteries are nearly identical or not in either case?
12. Can the terminal voltage of a battery ever exceed its emf? Explain.
13. Explain in detail how you could measure the internal resistance of a battery.
14. Compare and discuss the formulas for resistors and for capacitors when connected in series and in parallel.
15. Suppose that three identical capacitors are connected to a battery. Will they store more energy if connected in series or in parallel?
16. Why is it more dangerous to turn on an electric appliance when you are standing outside in bare feet than when you are inside wearing shoes with thick soles?
17. Figure 19–37 is a diagram of a capacitor (or condenser) *microphone*. The changing air pressure in a sound wave causes one plate of the capacitor C to move back and forth. Explain how a current of the same frequency as the sound wave is produced.

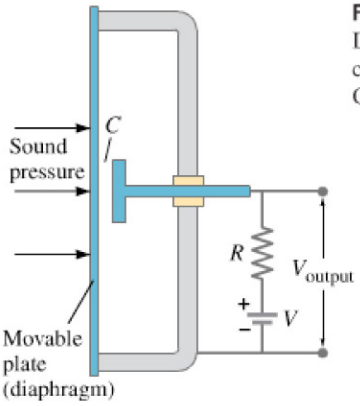


FIGURE 19–37
Diagram of a capacitor microphone. Question 17.

18. Design a circuit in which two different switches of the type shown in Fig. 19–38 can be used to operate the same lightbulb from opposite sides of a room.

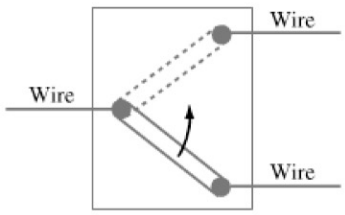


FIGURE 19–38
Question 18.

19. In an RC circuit, current flows from the battery until the capacitor is completely charged. Is the total energy supplied by the battery equal to the total energy stored by the capacitor? If not, where does the extra energy go?
* 20. What is the main difference between an analog voltmeter and an analog ammeter?
* 21. What would happen if you mistakenly used an ammeter where you needed to use a voltmeter?
* 22. Explain why an ideal ammeter would have zero resistance and an ideal voltmeter infinite resistance.