

Conceptual Physics electricity exercises

4. What happens to the brightness of light emitted by a lightbulb when the current that flows in it increases?
5. Is a current-carrying wire electrically charged?
6. Your tutor tells you that an *ampere* and a *volt* really measure the same thing, and the different terms only serve to make a simple concept seem confusing. Why should you consider getting a different tutor?
7. In which of the circuits below does a current exist to light the bulb?



8. Does more current flow out of a battery than into it? Does more current flow into a lightbulb than out of it? Explain.
9. Energy is given to electric charge by pumping it from a low potential to a high potential. How do we get energy out of electricity?
10. Sometimes you hear someone say that a particular appliance “uses up” electricity. What is it that the appliance actually uses up and what becomes of it?
11. The engine in your automobile turns an alternator that supplies electricity to the car battery. Does this mean that the battery is an alternating-current device? Explain.
12. Suppose you leave your car lights on while at a movie. When you return, your battery is too “weak” to start your car. A friend comes and gives you a jump start with his battery and battery cables. What is happening when your friend gives you a jump start?
13. After your car is running, your friend disconnects the battery cables and you’re on your way. Why is everything okay now? What about your weak battery?
14. An electron moving in a wire collides again and again with atoms and travels an average distance between collisions that is called the *mean free path*. If the mean free path is less in some metals, what can you say about the resistance of these metals? For a given conductor, what can you do to lengthen the mean free path?
15. Why will the resistance of a wire be slightly different immediately after you have held it in your hand?
16. Why is the current in an incandescent bulb greater immediately after it is turned on, than it is a few moments later?
17. A simple lie detector consists of an electric circuit, one part of which is part of your body—like from one finger to another. A sensitive meter shows the current that flows when a small voltage is applied. How does this

technique indicate that a person is lying? (And when does this technique not tell when someone is lying?)

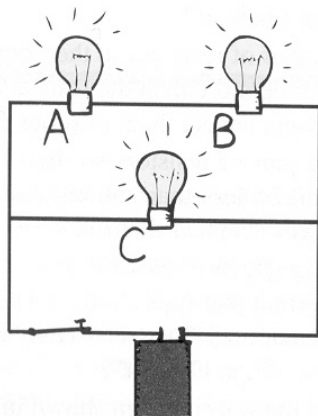
18. Only a small percentage of the electric energy fed into a common lightbulb is transformed into light. What happens to the rest?
19. Why are thick wires rather than thin wires usually used to carry large currents?
20. Will a lamp with a thick filament draw more current or less current than a lamp with a thin filament?
21. A 1-mile-long copper wire has a resistance of 10 ohms. What will be its new resistance when it is shortened by (a) cutting it in half; (b) doubling it over and using it as “one” wire?
22. What is the effect on current if both the voltage and the resistance are doubled? If both are halved?
23. Will the current in a lightbulb connected to a 220-V source be greater or less than when the same bulb is connected to a 110-V source?
24. Which will do less damage—plugging a 110-V appliance into a 220-V circuit or plugging a 220-V appliance into a 110-V circuit? Explain.
25. If a current of one- or two-tenths of an ampere flows into one of your hands and out the other, you will probably be electrocuted. But if the same current flows into your hand and out the elbow above the same hand, you can survive even though the current may be large enough to burn your flesh. Explain.
26. Would you expect to find dc or ac in the filament of a lightbulb in your home? How about in the headlight of an automobile?
27. Are automobile headlights wired in parallel or in series? What is your evidence?
28. A car’s headlights consume 40 W on low beam, and 50 W on high beam. Is there more or less resistance in the high beam filament?
29. To connect a pair of resistors so their equivalent resistance will be more than the resistance of either one, should you connect them in series or in parallel?
30. To connect a pair of resistors so their equivalent resistance will be less than the resistance of either one, should you connect them in series or in parallel?
31. The damaging effects of electric shock result from the amount of current that flows in the body. Why, then, do we see signs that read “Danger—High Voltage” rather than “Danger—High Current”?
32. Comment on the warning sign shown in the sketch.



33. Is this label on a household product cause for concern?
 "Caution: This product contains tiny electrically charged particles moving at speeds in excess of 100,000,000 kilometers per hour."



34. Why is the wingspan of birds a consideration in determining the spacing between parallel wires in a power line?
35. Estimate the number of electrons that a power company delivers annually to the homes of a typical city of 50,000 people.
36. If electrons flow very slowly through a circuit, why does it not take a noticeably long time for a lamp to glow when you turn on a distant switch?
37. Why is the speed of an electric signal so much greater than the speed of sound?
38. If a glowing lightbulb is jarred and oxygen leaks inside, the bulb will momentarily brighten considerably before burning out. Putting excess current through a lightbulb will also burn it out. What physical change occurs when a lightbulb burns out?
39. In the circuit shown, how do the brightnesses of the identical lightbulbs compare? Which lightbulb draws the most current? What will happen if bulb A is unscrewed? If C is unscrewed?



40. Consider a pair of flashlight bulbs connected to a battery. Will they glow brighter connected in series or in parallel? Will the battery run down faster if they are connected in series or in parallel?
41. If several bulbs are connected in series to a battery, they may feel warm to the touch but not visibly glow. What is your explanation?
42. As more and more bulbs are connected in series to a flashlight battery, what happens to the brightness of each bulb? Assuming heating inside the battery is negligible, what happens to the brightness of each bulb when more and more bulbs are connected in parallel?
43. What changes occur in the line current when more devices are introduced in a series circuit? In a parallel circuit? Why are your answers different?
44. When a pair of identical resistors are connected in series, which of the following is the same for both resistors: Voltage across each, power dissipated in each, current through each? Do any of your answers change if the resistors are different from each other?
45. When a pair of identical resistors are connected in parallel, which of the following is the same for both resistors: Voltage across each, power dissipated in each, current through each? Do any of your answers change if the resistors are different from each other?
46. A battery has internal resistance, so if the current it supplies goes up, the voltage it supplies goes down. If too many bulbs are connected in parallel across a battery, will their brightness diminish? Explain.
47. Why are devices in household circuits almost never connected in series?
48. Figure 22.19 shows a fuse placed in household circuitry.
 (a) Where else might a fuse be placed in this circuitry to serve a useful purpose, melting only if a problem arises?
 (b) Where would it be foolish to place a fuse in this circuitry because it would melt immediately?
49. Is the resistance of a 100-W bulb greater or less than the resistance of a 60-W bulb? Assuming the filaments in each bulb are of the same length and made of the same material, which bulb has the thicker filament?
50. If a 60-W bulb and a 100-W bulb are connected in series in a circuit, across which bulb will there be the greater voltage drop? How about if they are connected in parallel?