Exercises

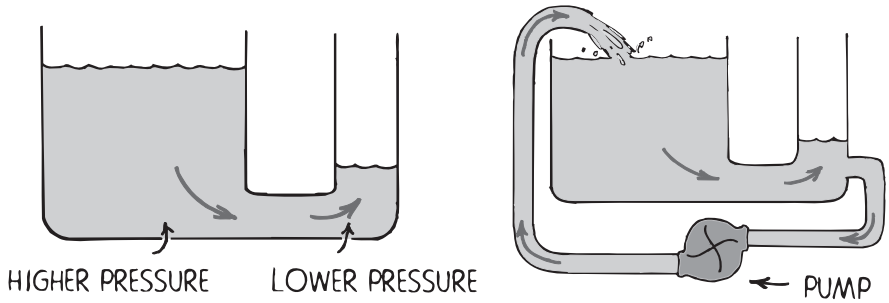
34.1 Flow of Charge (page 681)

1. Charge flows when there is a _____ between the ends of a conductor.
2. Explain what would happen if a Van de Graaff generator charged to a high potential was connected to a ground wire.

_____

_____

3. Explain how the sustained flow of charge is analogous to the flow of water from a higher reservoir to a lower one, as shown in the illustration below.



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34.2 Electric Current (page 682)

Match each phrase with the correct term or terms. Terms may be used more than once.

Phrase

_____ **4.** the flow of electric charge

_____ **5.** particles within a solid conductor that carry charge through a circuit

_____ **6.** SI unit used to measure electric current

_____ **7.** equivalent to 1 coulomb of charge per second

_____ **8.** the net charge in a current-carrying wire

Terms

a. ampere
b. zero
c. conduction electrons
d. electric current

34.3 Voltage Sources (page 683)

9. What is a voltage source? _____

_____

10. How do batteries and generators supply electrical energy?

_____

_____

_____

11. Is the following sentence true or false? The potential energy per coulomb of charge available to electrons moving between the terminals of a battery or generator is the voltage. _____

12. Charges flow _____ a circuit because of an applied voltage _____ the circuit.

34.4 Electric Resistance (page 684)

13. Is the following sentence true or false? The amount of charge that flows in a circuit does not depend on the voltage provided by the voltage source. _____

14. What is electric resistance?

_____

_____

15. Circle the letter of each statement that is true.

a. The resistance of a wire depends on the conductivity of the material used in the wire.

b. The resistance of a wire does not depend on the thickness of the wire.

c. Longer wires have less resistance than short wires.

d. Electric resistance depends on the temperature of the wire.

16. The resistance of some materials becomes zero at very low temperatures, a phenomenon known as _____.

17. Electric resistance is measured in units called _____.

34.5 Ohm's Law (page 685)

18. The relationship among current, voltage, and _____ is called Ohm's law.

19. State Ohm's law.

_____

_____

20. How can you express Ohm's law mathematically?

_____

21. What is the relationship among the units of measurement for the three quantities related by Ohm's law?

_____

22. What are resistors?

_____

34.6 Ohm's Law and Electric Shock (pages 686–688)

23. The damaging effects of electric shock are the result of _____ passing through the body.

24. Is the following sentence true or false? The resistance of your body is much greater when you're soaked with water than when your skin is dry. _____

25. Explain why it is dangerous to handle electric devices while taking a bath.

_____

_____

_____

_____

26. Is the following sentence true or false? A bird perched on a high-voltage wire is not shocked because there is not a potential difference between one part of its body and another part. _____

27. What is the purpose of the third prong on a three-prong electric plug?

_____

34.7 Direct Current and Alternating Current (pages 688–689)

28. Circle the letter of each statement that is true.

a. Direct current refers to a charge that always flows in one direction.

b. In a DC circuit, electrons always move from the positive terminal toward the negative terminal.

c. A battery produces direct current.

d. AC is current that repeatedly reverses direction.

29. Circle the letter of the correct answer. A 60-hertz current means that the current

a. equals 60 amperes.

b. alternates back and forth at 60 cycles per second.

c. changes direction once every 60 seconds.

d. travels at a speed of 60 meters per second.

30. Circle the letter of the correct answer. What is the standard voltage of AC in the United States?

a. 9 V b. 12 V

c. 110–120 V d. 220–240 V

31. Will an appliance that operates on 220–240 volts work when plugged into a wall socket in the United States? Explain your answer.

_____

_____

_____

_____

_____

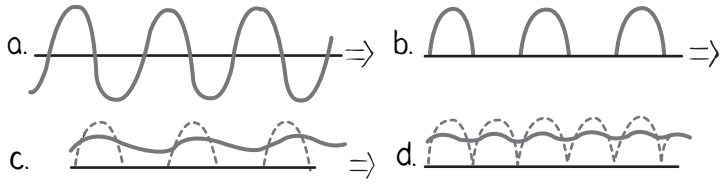
34.8 Converting AC to DC (page 690)

32. The current in laptops and cell phones is _____.

33. With an _____, you can operate a battery-run device on AC instead of batteries.

34. In addition to a transformer to lower the voltage, an AC-DC converter uses a _____, which acts as a one-way valve to allow electron flow in only one direction.

The diagrams below show the effect of an AC–DC converter on alternating current. Match the letter of each diagram to the correct description.



_____ **35.** Charging and discharging of a capacitor provides continuous but bumpy current.

_____ **36.** Only half of each cycle of AC passes through the diode, resulting in a pulsating DC.

_____ **37.** The input to the diode is AC.

_____ **38.** By using a pair of diodes, there are no gaps in the current output.

34.9 The Speed of Electrons in a Circuit (pages 691–692)

39. Circle the letter of each statement that is true.

a. Energy is transported through connecting wires of a circuit at nearly the speed of light.

b. The electrons that make up an electric current travel at the speed of light.

c. The electric field inside a current-carrying wire has no effect on the motion of conduction electrons.

d. The random thermal motion of the electrons inside a wire is what produces current.

40. Is the following statement true or false? A pulsating electric field can travel through a circuit at nearly the speed of light. _____

41. Explain why current-carrying wires become hot.

_____

_____

_____

_____

42. In a current-carrying wire, collisions interrupt the motion of the electrons so that their actual _____, or net speed through the wire due to the field, is extremely low.

43. In an AC circuit, do the conduction electrons make any net progress in a single direction? Explain your answer.

_____

_____

34.10 The Source of Electrons in a Circuit (page 693)

44. The source of electrons in a circuit is the

_____.

45. When you plug a lamp into an AC outlet, _____ flows from the outlet into the lamp, not _____.

46. If 120 volts AC are impressed on a lamp, then an average of _____ joules of energy are dissipated by each coulomb of charge that is made to vibrate.

47. When you turn on an electric lamp, what two forms of energy are produced? _____

48. Explain what happens in your body when you are jolted by an AC electric shock.

_____

_____

_____

34.11 Electric Power (pages 693–694)

49. Define electric power.

_____

_____

50. Electric power = current × _____

51. Express the equation in Question 50 in terms of units.

_____

52. One kilowatt-hour is the amount of energy consumed in _____ hour at the rate of _____ watts.

53. If the power and voltage on a lightbulb read "60 W, 120 V," how much current will flow through the bulb?

_____