

14.1 STATIC ELECTRICITY

1. Compare and contrast gravitational and electrostatic forces.
2. The driver of a car slides across the seat when exiting the car. Upon touching the door, the driver feels a shock. What happened?
3. You rub one end of a glass rod with silk, and then you bring a negatively charged plastic ruler near the glass rod. What happens?
4. Describe the particles that make up a neutral atom. What could you do to give the atom a positive charge?
5. A proton at a particular distance from a charged particle is repelled with a given force.
 - a. What is the sign of the particle?
 - b. How much will the force decrease when the proton is three times as far from the particle?
 - c. How much will the force decrease when the proton is five times as far from the particle?
6. How did Coulomb make sure that the pair of spheres he was using had equal charges?
7. Two table tennis balls hang with their centers 10.0 cm apart. The charge on ball A is $+12 \times 10^{-9}$ C, and the charge on ball B is -1.5×10^{-9} C. What is the force of attraction between the balls?
8. Two identical, small spheres are charged, touched together, and then separated. Their centers are 12 cm apart. They repel one another with a force of 3.0×10^{-5} N. How much charge do they have?

14.2 ELECTRIC FIELDS

11. An electric charge, q , produces an electric field. A test charge, q' , is used to measure the strength of the field generated by q . Why must q' be relatively small?
12. Define each variable in the formula $F = Eq$.
13. Describe how electric field lines are drawn around a freestanding positive charge and a freestanding negative charge.
14. A positive charge of 1.5×10^{-8} C experiences a force of 0.025 N to the left in an electric field. What are the magnitude and direction of the field?
15. A test charge of -3.4×10^{-6} C is in an electric field with a strength of 5.1×10^5 N/C. What is the force it experiences?
16. How is the volt related to the joule and the coulomb?
17. How does a capacitor work?
18. There is a potential difference of 120 V between two oppositely charged plates that are 14.0 cm apart. What is the magnitude of the electric field between them?
19. How much work is done to move a charge of 2.2×10^{-4} C from one plate to the other in Question 18?
20. What is the capacitance of a sphere that has been charged to 4.5×10^{-5} C when it has a potential difference of 35 V between it and Earth?

14.3 CURRENT ELECTRICITY

21. If 20.0 coulombs of charge move past a given point in 4 s, what is the current?
22. A 6.0 V battery delivers a 0.5 A current to an electric motor connected across its terminals. What is the power of the motor?
23. What are the four factors that affect the resistance properties of a piece of metal wire?
24. A resistance of $30\ \Omega$ is placed across a 90 V battery. What current flows in the circuit?
25. A current of 0.50 A is carried through a lamp when it is connected to a 120 V source. What is the resistance of the lamp?
26. Why do ammeters have low resistance?
27. When you feel a small electric shock such as the small spark you might experience touching a metal object on a dry day, does the voltage or the current cause the sensation?
28. Why do wires heat up when a current flows in them?
29. A heating coil has a resistance of $100\ \Omega$. It is designed to operate on 120 V. What is the power consumed by the heating coil?
30. How much energy, in joules, does a 100 W light bulb use in 20 s?
31. How much energy, in kilowatt-hours, does a 40 W light bulb use in one year?
32. The electric power generated at an electric power plant has high current and low voltage. Why is a transformer used to decrease the current and increase the voltage of the electric power before the power is delivered to the consumer?

14.4 SERIES AND PARALLEL CIRCUITS

33. What is equivalent resistance? How do you calculate it for a series circuit?
34. What is a voltage divider? How would a circuit designer create one?
35. Three resistors of $25\ \Omega$, $30\ \Omega$, and $40\ \Omega$ are in a series circuit with a 6.0 V battery. Draw a schematic for the circuit and find the current in the circuit?
36. Three resistors of $25\ \Omega$, $30\ \Omega$, and $40\ \Omega$ are in a parallel circuit with a 6.0 V battery. Draw a schematic for the circuit and find the current in the circuit?
37. What is a short circuit? What is the relationship between a fuse and a short circuit?
38. What does an ammeter measure? What does a voltmeter measure? How would you insert each in a circuit?
39. Draw a series circuit with a $20.0\ \Omega$ resistor in series with a $30.0\ \Omega$ resistor and a 9.0 V battery. Find the current of the circuit.
40. Draw a parallel circuit with a 9.0 V battery, and a $20.0\ \Omega$ resistor in parallel with a $30.0\ \Omega$ resistor. Find the current of the circuit.