

Name: \_\_\_\_\_  
Mr. Willis  
Conceptual Physics: \_\_\_\_\_  
Date: \_\_\_\_\_

Unit IX  
Electricity & Magnetism  
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# IX

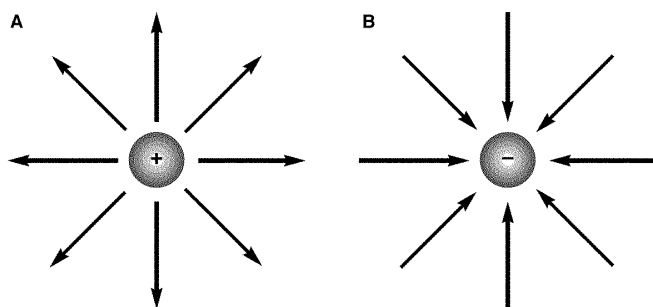
## Unit IX

### Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

- \_\_\_\_\_ 1. If an atom gains electrons, it becomes a
- a. positively charged ion.
  - b. negatively charged ion.
  - c. neutral atom.
  - d. neutral ion.

- \_\_\_\_\_ 2. The strength of an electric field depends on the
- a. amount of charge that produced the field.
  - b. distance from the charge.
  - c. amount of charge on a test charge placed in the field.
  - d. both A and B



**Figure 20-1**

- \_\_\_\_\_ 3. If the two charges represented in Figure 20-1 were brought near each other, they would
- a. Attract each other.
  - b. repel each other.
  - c. cause static discharge.
  - d. have no effect on each other.

- \_\_\_\_\_ 4. Walking across a carpet is an example of charge being transferred by
- a. contact.
  - b. induction.
  - c. static electricity.
  - d. friction.

- \_\_\_\_\_ 5. If a neutral metal comb is held near an object with a negative charge, the comb will become charged by
- a. induction.
  - b. contact.
  - c. friction.
  - d. static discharge.

- \_\_\_\_\_ 6. What type of current is produced by a battery?
- a. parallel current
  - b. alternating current
  - c. direct current
  - d. potential current

- \_\_\_\_ 7. The type of current in your school is mostly
- direct current.
  - alternating current.
  - series current.
  - produced by batteries.
- \_\_\_\_ 8. Which of the following materials allows charges to flow easily?
- Glass
  - Wood
  - an electrical conductor
  - an electrical insulator
- \_\_\_\_ 9. An electrical insulator has
- electrons that freely move.
  - more protons than electrons.
  - negatively charged ions.
  - electrons tightly bound to its atoms.
- \_\_\_\_ 10. Resistance is affected by a material's
- thickness.
  - length.
  - temperature.
  - all of the above
- \_\_\_\_ 11. Which of the following is maintained across the terminals of a battery?
- a potential difference
  - a voltage drop
  - an electric charge
  - both A and B
- \_\_\_\_ 12. How many paths through which charge can flow would be shown in a circuit diagram of a series circuit?
- One
  - two or more
  - none
  - more information is needed
- \_\_\_\_ 13. Most of the circuits in your home are
- series circuits.
  - Parallel circuits.
  - reversible circuits.
  - closed circuits.
- \_\_\_\_ 14. What is the unit of electric power?
- Ampere
  - Volt
  - watt
  - ohm
- \_\_\_\_ 15. Which of the following provides electrical safety?
- circuit breaker
  - Fuse
  - ground-fault circuit interrupter
  - all of the above
- \_\_\_\_ 16. Which of the following is made from a crystalline solid that conducts a current only under certain circumstances?
- Vacuum tube
  - Cathode-ray tube
  - analog device
  - semiconductor
- \_\_\_\_ 17. A thin slice of silicon that contains many solid-state components is a(an)
- transistor.
  - integrated circuit.
  - diode.
  - cathode-ray tube.

\_\_\_\_ 18. The force a magnet exerts on another magnet, on iron or a similar metal, or on moving charges is

- an electric force.
- a magnetic force.
- proportional to the charge of the magnet.
- proportional to the mass of the magnet.

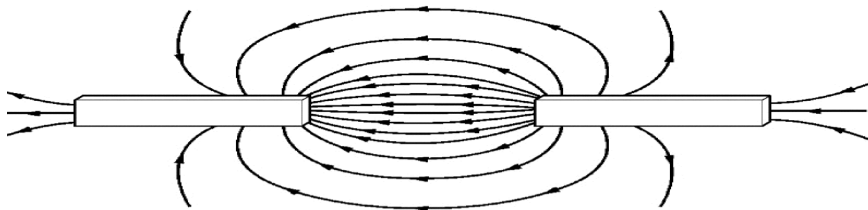
\_\_\_\_ 19. Which of the following statements describes the interaction between magnetic poles?

- Like poles attract each other.
- Like poles repel each other, and opposite poles attract each other.
- Opposite poles repel each other.
- Like poles attract each other, and opposite poles repel each other.

\_\_\_\_ 20. How does the magnetic force exerted by a magnet change as the distance between two magnets increases?

- The magnetic force increases.
- The magnetic force stays the same.
- The magnetic force decreases.
- The magnetic force does not change with distance.

**Figure 21-1**



\_\_\_\_ 21. In Figure 21-1, starting from the left what magnetic poles are shown on the two bar magnets?

- |                               |                               |
|-------------------------------|-------------------------------|
| a. north, south, north, south | c. south, north, south, north |
| b. south, south, north, north | d. north, north, south, south |

\_\_\_\_ 22. What is the name of the area surrounding Earth that is influenced by Earth's magnetic field?

- |                  |                         |
|------------------|-------------------------|
| a. magnetosphere | c. magnetic domain      |
| b. atmosphere    | d. magnetic declination |

\_\_\_\_ 23. Which of the following statements is true about Earth's magnetic poles?

- They are located at Earth's geographic poles.
- They are the areas where Earth's magnetic field is weakest.
- They are the areas where Earth's magnetic field is strongest.
- Earth has four magnetic poles.

\_\_\_\_ 24. A region that has a large number of atoms whose magnetic fields are lined up parallel to a magnet's field is

- |                              |                            |
|------------------------------|----------------------------|
| a. the magnetosphere.        | c. a magnetic domain.      |
| b. the magnetic declination. | d. a ferromagnetic region. |

- \_\_\_\_ 25. If you break a bar magnet in half, each half
- contains one magnetic pole.
  - becomes a bar magnet with two poles.
  - becomes unmagnetized.
  - is only temporarily magnetized.
- \_\_\_\_ 26. A ferromagnetic material that has domains that remain aligned for a long period of time is called
- a neutral object.
  - nonmagnetic.
  - a permanent magnet.
  - a temporary magnet.
- \_\_\_\_ 27. What creates a magnetic field?
- Charged particles that do not move
  - Moving electric charges
  - gravity
  - an isolated magnetic pole
- \_\_\_\_ 28. If the current in a wire is directed upward, what is the direction of the magnetic field produced by the current?
- counterclockwise in the horizontal plane
  - clockwise in the horizontal plane
  - in the same direction as the current
  - in the opposite direction to the current
- \_\_\_\_ 29. A coil of wire that is carrying a current and produces a magnetic field is
- a galvanometer.
  - a solenoid.
  - a magnetic domain.
  - an electric motor.
- \_\_\_\_ 30. Which of the following is the reason “soft” iron is used for the cores of electromagnets?
- It is difficult to magnetize.
  - It is easily magnetized.
  - It has no magnetic domains.
  - It is a permanent magnet.
- \_\_\_\_ 31. The device that measures current in a wire by using the deflections of an electromagnet in an external magnetic field is
- a galvanometer.
  - a solenoid.
  - an electric motor.
  - a loudspeaker.
- \_\_\_\_ 32. In an electric motor, periodically changing the direction of current in the electromagnet can cause the axle to spin because
- the electromagnet loses its magnetism.
  - mechanical energy is converted to electric energy.
  - the moving electrons push the electromagnet in the opposite direction.
  - the magnetic field reverses direction.
- \_\_\_\_ 33. Moving a magnet inside a coil of wire will induce a voltage in the coil. How can the voltage in the coil be increased?
- Move the magnet inside the coil of wire more slowly.
  - Hold the magnet stationary.
  - Move the coil of wire slowly, and keep the magnet stationary.
  - Move the magnet inside the coil of wire more rapidly.

\_\_\_\_\_ 34. The process of generating an electric current by moving an electrical conductor relative to a magnetic field is called

- a. magnetization.
- b. electromagnetic force.
- c. electromagnetic induction.
- d. alternating current.

\_\_\_\_\_ 35. A device that changes mechanical energy to electrical energy by rotating a coil of wire through a magnetic field is called a(an)

- a. transformer.
- b. generator.
- c. electromagnet.
- d. current meter.

\_\_\_\_\_ 36. The output voltage and current of a transformer are determined by the

- a. Number of turns in the primary and secondary coils.
- b. strength of the DC current in the primary coil.
- c. ferromagnetic material of the rings connecting the coils.
- d. direction of the current in the primary coil.

\_\_\_\_\_ 37. A transformer has a primary coil with 600 turns and a secondary coil with 300 turns. If the output voltage is 320 volts, what is the input voltage?

- a. 8 volts
- b. 150 volts
- c. 640 volts
- d. 600 volts

\_\_\_\_\_ 38. How are step-up transformers used in the transmission of electrical energy?

- a. They increase the voltage and the current for a home.
- b. They decrease the voltage before it leaves a power plant.
- c. They increase the voltage for efficient long-distance transmission.
- d. All of the above

\_\_\_\_\_ 39. Before electric current in power lines can be safe for your home, it must pass through a

- a. turbine.
- b. step-down transformer.
- c. step-up transformer.
- d. generator.

\_\_\_\_\_ 40. How are fossil fuels used to generate electrical energy?

- a. Heat from burning fuel spins magnets inside an electric motor.
- b. Heat from burning fuel creates steam that spins a turbine.
- c. Heat from burning fuel causes an electric motor to produce a current.
- d. Heat from burning fuel creates steam that turns a transformer.

### Completion

*Complete each sentence or statement.*

41. The electric field around a positive charge points \_\_\_\_\_ the charge.

42. Electric force is \_\_\_\_\_ proportional to the amount of charge and \_\_\_\_\_ proportional to the square of the distance between the charges.

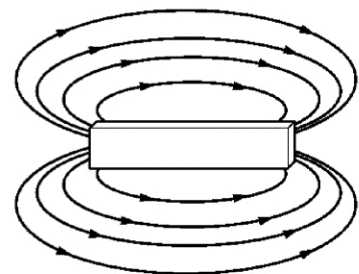
43. Like charges \_\_\_\_\_ and opposite charges \_\_\_\_\_.

44. When a pathway through which charges can move forms suddenly, \_\_\_\_\_ occurs.

45. Scientists usually define the direction of current as the direction in which \_\_\_\_\_ charges would flow.
46. Wood, plastic, and rubber are good electrical \_\_\_\_\_, and copper is a good electrical \_\_\_\_\_.
47. A material that has almost zero resistance when it is cooled to low temperatures is a(an) \_\_\_\_\_.
48. A(An) \_\_\_\_\_ signal encodes information as a string of 1's and 0's.
49. In pure form, germanium and silicon are \_\_\_\_\_ conductors.
50. In most materials, the magnetic fields of \_\_\_\_\_ cancel one another's effects.
51. A(An) \_\_\_\_\_ converts electrical energy into mechanical energy.
52. Moving a magnet through a wire coil can produce a(an) \_\_\_\_\_ in the coil.
53. Large power plants in the United States use \_\_\_\_\_ generators.
54. The energy source used to produce most of the electrical energy in the United States is \_\_\_\_\_.

**Short Answer**

55. What is a charge's electric field?
56. What is the difference between direct current and alternating current?
57. Explain why metal wire coated with plastic or rubber is used in electric circuits.
58. What are three common voltage sources?
59. What is a circuit breaker?

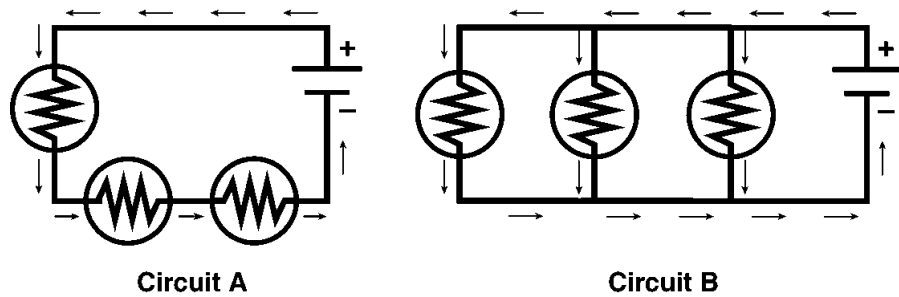
**Figure 21-2****Bar Magnet**

60. In Figure 21-2, what do the lines around the bar magnets represent?
61. Explain why Earth's magnetic North Pole would be a south pole of a bar magnet.
62. What is the difference between a temporary magnet and a permanent magnet in terms of the magnetic domains?

- 63. How does a vibrating electric charge produce an electromagnetic wave?
- 64. Compare generators and electric motors.
- 65. List five energy sources that are used in the United States to produce electrical energy.
- 66. How is water used to produce electrical energy in a hydroelectric power plant?

**USING SCIENCE SKILLS**

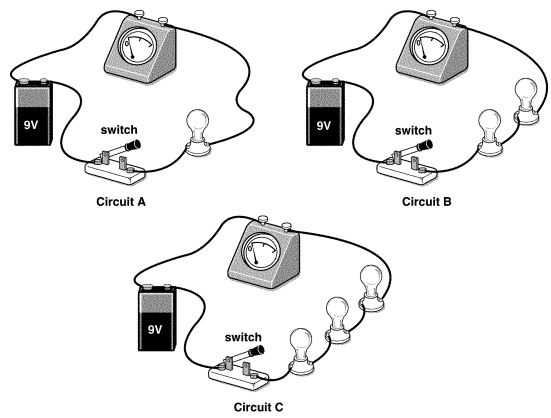
**Figure 20-2**



67. **Interpreting Graphics** What objects and how many of each object would you need to draw if symbols were not used in Figure 20-2?

68. **Comparing and Contrasting** In Figure 20-2, what device could be added to the circuits to open the circuits? Explain how this device works. Compare this device to safety devices that stop the current in a home.

**Figure 20-3**



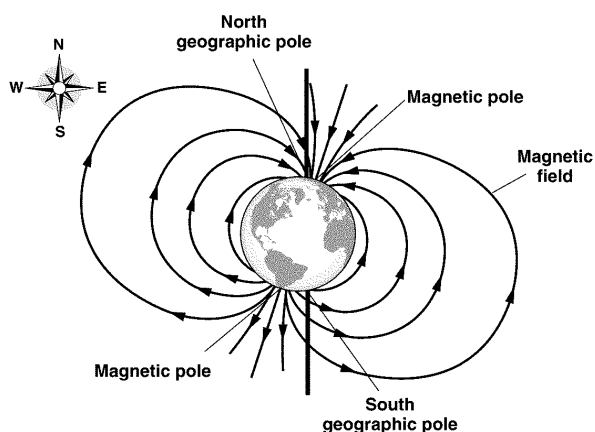
69. **Comparing and Contrasting** In Figure 20-3, how will the current compare in Circuits A, B, and C when the switches are closed? Explain your answer.

70. **Applying Concepts** Explain why the filaments in the light bulbs become hotter than the connecting wires in Figure 20-3.

71. **Predicting** When the switches are closed in Figure 20-3, which bulbs will be the brightest and which will be the dimmest? Assume that all of the light bulbs and batteries are identical. Explain your answer.

## USING SCIENCE SKILLS

Figure 21-3



72. **Interpreting Graphics** In Figure 21-3, use the direction of the magnetic field lines to determine what type of magnetic pole is located at the geographic North Pole.

73. **Inferring** Use Figure 21-3 to determine in what direction the north magnetic pole of the compass will point. What type of magnetic pole is the compass pointing toward?

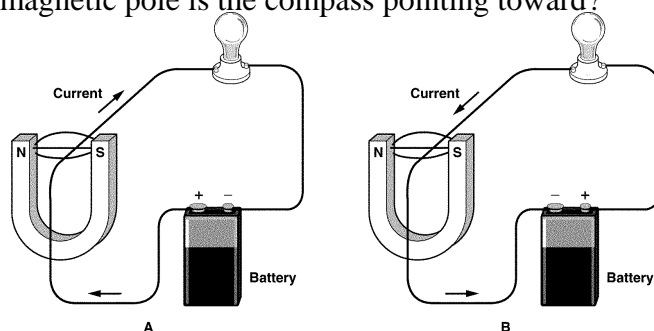


Figure 21-4

74. **Inferring** In Figure 21-4 A, in what direction do magnetic field lines point in the area between the poles of the horseshoe magnet?

75. **Inferring** In Figure 21-4 B, does the magnetic field *due to the current-carrying wire* curve in a clockwise or counter-clockwise direction in the area between the poles of the horseshoe magnet? How do you know?

## Essay

76. How are friction, induction, and static discharge involved in lightning?

77. Explain why a battery causes charge to flow spontaneously when the battery is inserted in a circuit.

78. Suppose you have one light bulb in a simple circuit. If you add a second identical light bulb in series, what would happen to the brightness of the first bulb? If instead you add the second bulb in parallel, what would happen to the brightness of the first bulb? Explain your answers.

79. Describe two household devices that use electromagnets.

80. How does a transformer decrease the voltage that is transmitted across power lines before it enters homes?