INTEGRATING TECHNOLOGY: MAGNETIC RESONANCE IMAGING

1. MRI provides a noninvasive view of internal body tissue.
2. a strong magnetic field
3. The signal of the hydrogen atoms as they move back into alignment after being forced out of alignment by radio waves produces the radio waves that result in an image.
4. Because the metal parts might be attracted to the strong magnetic field, MRI instruments cannot be used on people with metal implants.

Pretest

1. The ions repel each other.
2. The negatively charged object will be attracted to the fixed positively charged object and accelerate toward it. Also, it will have greater electrical potential energy when farther from the positively charged object, and this energy will be converted to kinetic energy as it moves toward the positively charged object.
3. The magnets repel each other.
4. A compass needle points in a certain direction because of the presence of a magnetic field, such as from a magnet or Earth's magnetic field.
5. a
6. b
7. Charges have electrical potential energy as they leave one terminal of the battery, which is converted to kinetic energy as they move through the circuit to the other terminal. Some of the energy is lost as heat or light due to the resistance in the light bulb. The battery increases the energy of the charges as they move through the battery.

Quizzes

SECTION: MAGNETS AND MAGNETIC FIELDS

1. d
2. a
3. c
4. b
5. d
6. b
7. a
8. b
9. c
10. a

SECTION: MAGNETISM FROM ELECTRIC CURRENTS

1. c
2. a
3. a
4. b
5. d
6. a
7. b
8. d
9. a
10. b

SECTION: ELECTRIC CURRENTS FROM MAGNETISM

1. b
2. c
3. b
4. a
5. d
6. e
7. a
8. f
9. b
10. c

Chapter Tests

TEST A (5 POINTS PER ITEM)

1. c
2. a
3. a
4. c
5. a
6. b
7. c
8. b
9. d
10. c
11. b
12. The magnets will repel each other.
13. An electric current can be produced in a circuit by changing the magnetic field crossing the circuit.
14. In most cases, magnetic fields in an element cancel out and leave the atom essentially nonmagnetic. In other materials, however, not all fields cancel. The magnetism of the fields combine to make these materials magnetic overall.
15. A galvanometer detects, measures, and determines the direction of a small electric current.
16. A generator is a device that uses electromagnetic induction to convert mechanical energy to electrical energy.
17. Answers may vary, but should include at least three of the following: burning coal, nuclear fission, wind, hot water from geysers (geothermal), or solar power.
18. Electric and magnetic fields are oriented at 90 degrees relative to each other in an electromagnetic wave.
19. The voltage across the secondary coil of a transformer is proportional to the number of loops it has.

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20. Earth's magnetic poles are not in the same place as the geographic poles. Also, Earth's magnetic field points from the South geographic pole to the North geographic pole. The magnetic pole in Antarctica is actually a magnetic N pole, and the magnetic pole in northern Canada is actually a magnetic S pole.

TEST B (5 POINTS PER ITEM)

1. a
2. a
3. b
4. d
5. c
6. d
7. c
8. b
9. c
10. a
11. a
12. d
13. The magnets will attract each other.
14. A compass aligns with Earth's magnetic field just as iron filings align with a bar magnet's field. The N pole of the compass points toward Earth's North geographic pole.
15. Increasing the current and inserting an iron core will both increase the magnetic field strength of a solenoid.
16. All of these forces are field forces that act at a distance.
17. Generators convert mechanical energy to electrical energy, whereas electric motors convert electrical energy to mechanical energy.
18. running water
19. The step-down transformer reduces the voltage of the current to about 120 V. Most household appliances in the United States operate at 120 V.
20. Grasp an insulated wire with the right hand so that the thumb points in the direction of the positive current. When the hand holds the wire, the fingers encircle the wire, and the fingertips point in the direction of the magnetic field.

Standardized Test Practice

1. B
2. D
3. A
4. C

Inquiry Lab: Magnetic Poles

1. The magnetic force must be equal to the force of gravity (weight) of the upper magnet.
2. The force changes direction (from repulsive to attractive, or vice versa) when one of the magnets is flipped.

Quick Lab: Magnetic Poles

ANALYSIS

1. When one pole of the hand-held magnet is brought near one end of the suspended magnet, it moves away from the pole. When the same pole of the hand-held magnet is brought near the other end of the suspended magnet, it moves closer to the pole.
2. If left alone, the hanging magnet would align itself with Earth's magnetic field, with its N pole pointing north. Using this fact, you could determine the unknown poles of both magnets.

Quick Lab: Magnetic Field of a File Cabinet

ANALYSIS

1. The file cabinet can become magnetized because of prolonged exposure to Earth's magnetic field. However, the amount of magnetization that occurs is dependent upon the kind of metal from which the cabinet is made. If the cabinet is aluminum, for example, it will not be magnetic at all. If the cabinet is steel, it is slightly magnetic and therefore causes the compass needle to be deflected.
2. Answers may vary. Some may include metal book shelves or desks.

Quick Lab: Electromagnet

ANALYSIS

1. An electromagnet—the coil of wire is the solenoid, and the nail is the magnetic core.
2. The direction of the compass needle reverses when the current is reversed because the charges move in the opposite direction.
3. Drop the nail several times, or hit the nail sharply with a hammer.

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