**Section 21.1 Magnets and Magnetic Fields**

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**(pages 630–633)**

*This section describes magnetic forces and magnetic fields. Characteristics of magnetic materials also are discussed.*

# Reading Strategy (page 630)

**Using Prior Knowledge** Before you read, copy the diagram below and add what you already know about magnets to the diagram. After you read, revise the diagram based on what you learned. For more

information on this Reading Strategy, see the **Reading and Study Skills**

in the **Skills and Reference Handbook** at the end of your textbook.

**Properties of Magnets**

1. In the year 1600, William Gilbert published a book explaining the properties of .

# Magnetic Forces (page 630)

1. Is the following sentence true or false? Magnetic force can be exerted on moving charges, as well as on iron or on another magnet.
2. What did William Gilbert discover when he used a compass to map

forces around a magnetic sphere? ce ongest

1. Circle the letter of each sentence that is true about magnetic force.
   1. Two magnets that approach each other may attract or repel.
   2. Magnetic forces do not vary with distance.
   3. Opposite magnetic poles repel one another.
   4. Magnetic forces act over a distance.

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**Magnetic Fields (pages 631–632)**

*For questions 5 and 6, refer to the figure below.*



1. Where is the magnetic field the strongest?
2. Based on this figure, what would you expect to happen when the north pole of one magnet faces the south pole of another magnet?
3. Circle the letter of each sentence that is true about magnetic fields.
   1. Magnetic fields surround a magnet and can exert a magnetic force.
   2. Field lines begin near the south pole of a magnet and extend toward the north pole.
   3. Iron filings are most attracted to areas where the field is strongest.

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* 1. A magnetic field is strongest near the north and south poles of a magnet.

1. The area that is influenced by the magnetic field surrounding Earth is called the .

# Magnetic Materials (pages 632–633)

*Match each term with its description.*

**Description Term**

**9.** Can be magnetized because it has many domains

**10.** Has randomly oriented domains

**11.** Region that has many atoms with aligned magnetic fields

1. ferromagnetic material
2. magnetic domain
3. nonmagnetized material

**12.** What can cause the realignment of magnetic domains in a material?

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**Section 21.2 Electromagnetism**

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**(pages 635–639)**

*This section describes how electricity and magnetism are related. Uses of solenoids and electromagnetic devices are discussed, and a description of how these devices work is presented.*

**Reading Strategy (page 635)**

**Identifying Main Ideas** Copy the table on a separate sheet of paper. As you read, write the main idea of the text that follows each topic in the table. For more information on this Reading Strategy, see the **Reading and Study Skills** in the **Skills and Reference Handbook** at the end of your textbook.

|  |  |
| --- | --- |
| **Electromagnetism** | |
| **Topic** | **Main Idea** |
| Electricity and magnetism |  |
| Direction of magnetic fields |  |
| Direction of electric currents |  |
| Solenoids and electromagnets |  |
| Electromagnetic devices |  |

1. In 1820 Hans Oersted discovered a connection between electricity and .

**Electricity and Magnetism (pages 635–636)**

1. Electricity and magnetism are different aspects of a single force known as the force.

3. Both aspects of the electromagnetic force are caused by

.

1. Is the following sentence true or false? Moving electric charges create a magnetic field.
2. Is the following sentence true or false? The vibrating charges that produce an electromagnetic wave also create a magnetic field.

A charge moving in a magnetic field will be deflected in a direction that is to both the magnetic field and to the velocity of the charge.

**Solenoids and Electromagnets (pages 637–638)**

1. Is the following sentence true or false? The strength of the magnetic field through the center of a coil of current-carrying wire is calculated by adding together the fields from each turn of the coil.
2. A coil of current-carrying wire that produces a magnetic field is called a(n) .

3. What is an electromagnet?

4. Circle the letter of each sentence that is true about electromagnets.

* 1. Placing an iron rod in a solenoid reduces the strength of its magnetic field.
  2. Devices that utilize electromagnets include doorbells and telephones.
  3. A magnetic field can be turned on and off with an electromagnet.
  4. An electromagnet can control the direction of a magnetic field.

1. List three factors that determine the strength of an electromagnet.
2. Is the following sentence true or false? Decreasing the current in the solenoid decreases the strength of an electromagnet.

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5. What types of solenoid cores make stronger electromagnets?

**Electromagnetic Devices (pages 638–639)**

6. Electromagnetic devices change energy into

energy.

7. Complete the following table about electromagnetic devices.

|  |  |
| --- | --- |
| **Description** | **Device** |
| Uses electromagnets to convert electrical signals into sound waves |  |
|  | Electric motor |
| Uses an electromagnet to measure small amounts of current |  |

**Section 21.3 Electrical Energy Generation and Transmission**

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**(pages 642–647)**

*This section describes how electricity is generated and transmitted for human use. A description of how generators and transformers function is given.*

**Reading Strategy (page 642)**

**Sequencing** As you read the section, complete the flowchart to show how a step-up transformer works. Then make a similar flowchart for a step-down transformer. For more information on this Reading Strategy, see the **Reading and Study Skills** in the **Skills and Reference Handbook** at the end of your textbook.

**Step-up Transformers**

Current flows through smaller coil.

**Generating Electric Current (pages 642–643)**

1. Is the following sentence true or false? A magnetic field can be used to produce an electric current.
2. Circle the letter for the name of the process of generating a current by moving an electrical conductor relative to a magnetic field.
   1. electromagnetic force
   2. electromagnetic field
   3. electromagnetic induction
   4. electromagnetic conduction

Electrical charges can easily flow through materials known as

.

Why is the discovery of electromagnetic induction significant?

1. According to Faraday’s law, electric current can be induced in a conductor by .
2. Is the following sentence true or false? Moving a magnet relative to a coil of wire induces a current in the wire if the coil is part of a complete circuit.

**Generators (pages 643–644)**

A generator converts energy into

energy.

1. Circle the letter that best describes how most of the electrical energy used in homes and businesses is produced.
   1. with DC generators
   2. using AC generators at large power plants
   3. with small magnets moving inside coils
   4. by rotating a magnetic field around a coil of wire
2. Is the following sentence true or false? In an alternating current produced by an AC generator, the flow direction of charges switches back and forth.

Circle the letter of each sentence that is true about generators.

* 1. Small generators can produce enough electricity for a small business.
  2. DC generators produce current that flows back and forth.
  3. Small generators are available for purchase by the public.
  4. Most modern power plants use DC generators.

**Transformers (pages 644–645)**

1. A device that increases or decreases voltage and current of two linked AC circuits is called a(n) .

How does a transformer change voltage and current?

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Why are transformers necessary for home electrical service?

1. Is the following sentence true or false? To prevent overheating wires, voltage is decreased for long-distance transmission.

How is voltage calculated in a transformer?

1. Is the following sentence true or false? A step-down transformer decreases voltage and increases current.

**Electrical Energy for Your Home (pages 646–647)**

Name at least three sources used to produce electrical energy in

the United States.

1. A device with fanlike blades that can convert energy from various sources into electrical energy is called a(n) .