### Unit 6: Electricity and Magnetism

#### Key Ideas:

6.1 Observe, describe, and investigate the evidence of energy transfer in electrical circuits.

6.2 Construct and diagram an electrical circuit.

6.3 Identify conductors and insulators in an electrical circuit.

6.4 Compare the electrical and magnetic properties of different materials.

6.5 Investigate properties of magnets.

6.6 Explore the interaction of electricity and magnetism to create an electromagnet.

6.7 Describe how electricity can be helpful or harmful to people (safety).
### Essential Question:
What are the properties of electricity and magnetism?

### Key Idea 6.1:
Observe, describe, and investigate the evidence of energy transfer in electrical circuits.

### Scientific Terms:
1. electron  
2. electric charge  
3. electric current  
4. closed circuit  
5. open circuit  
6. switch

### Content:
Electrons can flow smoothly through matter. Flowing electrons—or a flow of an electric charge—make electric current. People can control an electric current to make electricity work for them.

Electric current flows only when it can follow a closed path called a closed circuit. The circuit in the picture has three parts. First, the battery pushes electrons through the path. Second, the bulb lights up when current passes through it. Third, a wire connects the battery to the bulb. A wire also connects the bulb back to the battery.

What would happen if you took away one of the wires of the circuit in the picture? You would break the path that the electric current follows. You open the circuit. Because current can flow only through a closed circuit, the bulb would not light up.

A switch is a device that opens or closes a circuit. When you switch on a lamp, you close the circuit. You allow two conductors to touch so that the current can flow. The bulb in the lamp glows.

When you switch off a lamp, you open the circuit and the bulb stops glowing.
When the circuit is open, the current cannot flow, the bulb doesn’t glow.

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<th>पুনরালোচনা:</th>
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<td>1. ব্রেঁপু বাজানোর জন্য চালক পাত্তীর স্টিয়ারিং হেলে চাপ দিলে কি ঘটে?</td>
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<td>2. বৈদ্যুতিক হিটার চালু করলে হিটারের মাধ্যমে বিদ্যুতের প্রবাহ কেমন হয় তা বর্ণনা কর।</td>
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<td>3. সুইচ কোন বক্তকে একত্রিত করে?</td>
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<td>1. What happens when a driver presses on the steering wheel to honk the horn of a car?</td>
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<td>2. Describe the flow of current through an electric heater when the heater is switched on.</td>
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<td>3. What does a switch bring together?</td>
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<td><strong>Essential Question:</strong></td>
<td>What are the properties of electricity and magnetism?</td>
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<tr>
<td><strong>Key Idea 6.2:</strong></td>
<td>Construct and diagram an electrical circuit</td>
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<tr>
<td><strong>Scientific Terms:</strong></td>
<td>1. series circuit  2. parallel circuit  3. path</td>
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<tr>
<td><strong>Content:</strong></td>
<td>Electrical circuits are not all laid out in the same way. Light bulbs can be a part of two kinds of circuits—<strong>series circuits</strong> and <strong>parallel circuits</strong>.</td>
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In a series circuit, the bulbs are in the same **path**. A simple example has two bulbs, one battery, and wires. The current flows in a path from the battery, through the first bulb, through the second bulb, and back to the battery. If you remove or turn off either bulb, the circuit opens. Current cannot reach the other parts of the circuit. Think about what would happen if all the lights and appliances in your home were parts of a series circuit. Unless you had all the lights and appliances on, the circuit would be open. None of the lights and appliances would work.

| **Draft – 11-09-2010** |
|------------------------|------------------------------------------------------|
| **Unit 6: Electricity and Magnetism** |
| **Essential Question:** | What are the properties of electricity and magnetism? |
| **Key Idea 6.2:** | Construct and diagram an electrical circuit |
| **Scientific Terms:** | 1. series circuit  2. parallel circuit  3. path |
| **Content:** | Electrical circuits are not all laid out in the same way. Light bulbs can be a part of two kinds of circuits—**series circuits** and **parallel circuits**. |

In a series circuit, the bulbs are in the same **path**. A simple example has two bulbs, one battery, and wires. The current flows in a path from the battery, through the first bulb, through the second bulb, and back to the battery. If you remove or turn off either bulb, the circuit opens. Current cannot reach the other parts of the circuit. Think about what would happen if all the lights and appliances in your home were parts of a series circuit. Unless you had all the lights and appliances on, the circuit would be open. None of the lights and appliances would work.
A parallel circuit has more than one path for the electric current to follow. If something stops charges from moving along one path, they can take another.

In the picture of a parallel circuit, you can see two circular paths. The current can travel through both bulbs and light them both. If one bulb is missing or damaged, however, the current can still travel through the other bulb. Breaking one path doesn’t stop the current. When one part of a parallel circuit fails, the other parts of the circuit continue to work. The electric current still has a path along which it can travel.

Review:
1. How is a parallel circuit different from a series circuit?
2. Suppose you want to decorate a room for a party. You plan to buy strings of lights. Which type of circuit would it be better to get? Why?
3. Use the following terms to draw a series circuit:
   wire, switch, bulb, battery
### Essential Question:
What are the properties of electricity and magnetism?

### Key Idea 6.3:
Identify conductors and insulators in an electrical circuit.

### Scientific Terms:
1. conductor
2. insulator
3. resistance
4. superconductor

#### Content:
Electric current passes easily through some materials. These materials are **conductors**. Many metals are good conductors, especially copper.

Electric current does not pass easily through other materials. These materials are **insulators**. Air, rubber, glass, and plastic are insulators.

Take a look at an electric cord. The metal wire inside conducts—or carries—the current into an appliance. The rubber insulator on the outside keeps the current from flowing where it should not go.

Resistance measures how well electricity flows through a material. Good insulators have high resistance. Good conductors have low resistance. **Superconductors** have no resistance at all.

Many everyday things do their jobs safely and well because of the way insulators and conductors work together. If you look at the bottom of a light bulb, you will see the small metal tip that conducts the current from the socket into the bulb. Just above the tip, you will see a black band. This band is an insulator. It does not allow the current to flow from the metal tip to the metal screw threads above it.
Review:

1. What happens when a current reaches a conductor? What happens when it reaches an insulator?

2. How are insulators and conductors different? Why are both important?
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<th>What are the properties of electricity and magnetism?</th>
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<td>Key Idea 6.4:</td>
<td>Compare the electrical and magnetic properties of different materials.</td>
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<td>Scientific Terms:</td>
<td>1. property 2. attract 3. magnet 4. iron 5. copper</td>
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<td>Content:</td>
<td>The materials that an object is made up of determine some of its properties. We know that a cork, which comes from a tree, will float in water, but a metal iron nail will sink. Another property of an iron nail is its attraction to a magnet, but not all metals have this magnetic property. Neither a copper penny nor a piece of aluminum foil will be attracted to a magnet. Metal objects with iron in them are attracted to a magnet. Many metal objects are made of steel, which has iron in it. Both copper and aluminum cannot be attracted to a magnet. However, copper has a property that is does not share with aluminum. Copper is a good conductor of electricity. Aluminum is a poor conductor of electricity. That is why copper is used in the wiring in electrical appliances and in the wires in your home. Good or poor conductivity is another property of matter.</td>
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<tr>
<td>Review:</td>
<td>1. How can you test for the property of magnetism? 2. If a paper clip can be attracted to a magnet, what must be in this paper clip? 3. Are the properties of all metals the same?</td>
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<td>থাকতে পারে?</td>
<td>৩. সব ধাতুই কি সমান বৈশিষ্ট্যের অধিকারী? তোমার জবাবের পক্ষে একটি উদাহরণ দাও।</td>
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<td>Give an example of your answer.</td>
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### Essential Question:
What are the properties of electricity and magnetism?

### Key Idea 6.5:
Investigate properties of magnets

### Scientific Terms:
1. magnet
2. attract
3. barrier
4. magnetic field
5. repel

### Content:

A **magnet** is an object that **attracts** iron and a few (not all) other metals. Magnets attract steel because it contains iron. When you bring an iron object or a steel object close to a magnet, the object moves toward the magnet.

All magnets attract iron, but they may not look alike. Some magnets are shaped like bars. Others are U-shaped. Some magnets that stick to refrigerator doors are thin, flat shapes.

Distance affects the strength of a magnet’s attraction. A small steel object that is close to a magnet moves toward it. However, if the same object is farther away, it will not move toward the magnet.

Other forces can overcome the force of a magnet. Refrigerator magnets stick well to the door, but you can easily pull them off.

**Barriers** can interfere with a magnet’s pull, too. A refrigerator magnet may hold one or two sheets of paper to the door, but if you put too many sheets under it, the magnet will fall.

Magnets can make some other objects magnetic. For example, if you rub a needle over a magnet several times in the same direction, the needle will become magnetic enough to pick up other...
The magnetic field of a magnet is the space around the magnet where its force, or magnetism, can be felt. If you sprinkle iron filings on a magnet, the filings line up in a pattern of curved lines. The filings make the pattern because the magnetic field is strongest near the ends, or poles, of the magnet.

If a magnet is hung so that it can move freely, one pole will point north. That is because Earth itself is a large magnet. Magnets have two poles, a north pole and a south pole. If you placed two magnets side by side, you would see that opposite poles attract, or come together, and like poles repel, or move apart from, each other.
Essential Question:
What are the properties of electricity and magnetism?

Key Idea 6.6:
Explore the interaction of electricity and magnetism to create an electromagnet.

Scientific Terms:
1. electromagnet

Content:
An electric current moving through a wire causes a magnetic field around the wire. If the wire is shaped into loops, the magnetic field gets stronger. An electric current running through a loop of wire makes an electromagnet. If the electric current is shut off, the electromagnet is no longer magnetic. The electromagnet is turned off.

An electromagnet usually has a piece of iron in its center. When current runs through the wire, the wire and the iron become magnetic. The magnetic field of the iron is added to the magnetic field of the wire. The electromagnet becomes stronger.

With many coils of wire and a strong current, electromagnets can be made very strong. In junkyards, such electromagnets lift many tons of scrap iron and steel.
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<td>২. কেন বিদ্যুতায়িত চুম্বক স্থায়ী চুম্বক নয়?</td>
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**Unit 6: Electricity and Magnetism**

**Essential Question:**
What are the properties of electricity and magnetism?

**Key Idea 6.7:**
Describe how electricity can be helpful or harmful to people (safety).

**Scientific Terms:**
1. conduct  2. insulation  3. electric current

**Content:**
Electricity is electric energy. Electricity can be changed into light energy and heat energy. Electricity is dangerous if it is not used correctly. It can cause burns, shock, and death if it travels through a person’s body. An important safety rule to follow is never touch anything electrical while you are wet. Water on your skin can conduct electricity. It can lead the electricity into your body.

Do not use electric lamps and appliances that have cords with worn, cut, or broken insulation around the wires. The electric current could easily travel to your body. The current also could start a fire.

People also need to be careful not to plug too many lamps and appliances into the same outlet. Too much electric current flowing through the outlet might make the wires in the wall hot enough to start a fire. However, most homes have a kind of switch that stops too much current from flowing through a circuit. This switch—a fuse or circuit breaker—opens the circuit when too much current flows through it, stopping the flow of electricity. Electric current cannot flow through the open circuit.
### Review:

1. What are two ways you can keep electric current from getting into your body?
2. Why is it unsafe to run electric cords under a rug?

### Answer Key

#### 6.1

1. Pushing on the horn control completes a circuit and lets charges flow from the battery through the horn and back again. The current flowing through the horn makes it sound.
2. When the heater is switched on, current can travel along a complete circuit, from the power source through the heater and back again.
3. A switch can bring conductors together.

#### 6.2

1. A parallel circuit has more than one path that the current can follow. If one path is open or damaged, electricity can flow along the other path. A series circuit has only one path that current can follow.
2. A parallel circuit is better, because if one path isn’t working, another path will work. A series circuit is better because it is easy to switch all parts on and off.
6.3
1. An electric current flows through a conductor. When the current reaches a good insulator, it stops.

2. Insulators stop the flow of current. They are important for safety. Conductors let electricity flow.

6.4
1. Use a magnet to see if the item is attracted to it.

2. The paper clip must with iron in it, because iron has magnetic property.

3. No, metals differ in color, electrical and magnetic ability, etc. For example, iron has electrical and magnetic ability. However, copper is a kind of metal that good in conducting electricity but will not be attracted to a magnet.

6.5
1. The most pins will be on the ends or poles of the magnet, because that is where the magnet is the strongest.

2. These metal objects do not have iron in them.

3. The force of magnetism on objects decreases as the distance increases.

6.6
1. An electric current moving through a wire creates a magnetic field around the wire.
You can make an electromagnet by shaping the wire into loops and allowing the current to flow through it. If you wrap the loops of wire around an iron core, both the iron and the loops of wire become magnetic as electricity flows through the wire, creating a much stronger electromagnet.

2. The electromagnet is not a permanent magnet because it has a magnetic force only when an electric current moves through the wire. If the electric current is shut off, the electromagnet is turned off.

### 6.7

1. Never touch anything electrical while you are wet. Do not use electric any appliances that have cords with worn, cut, or broken insulation around the wires.

2. It is unsafe to run electric cords under a rug because we would not notice if there is any cords with worn, cut, or broken insulation around the wires. The electric current could easily travel to your body. The current could also start a fire.