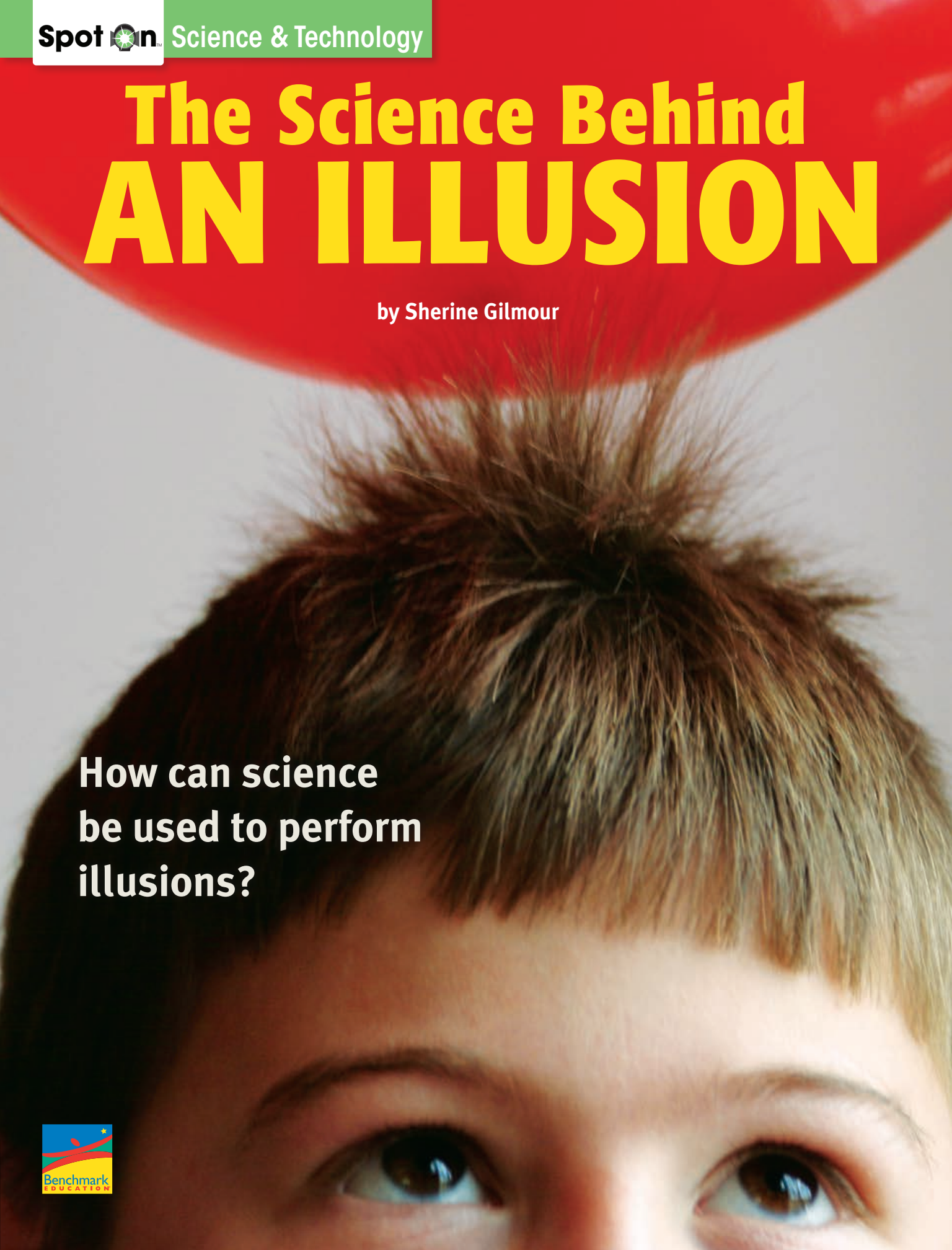
Spot On Science & Technology

The Science Behind AN ILLUSION

by Sherine Gilmour



How can science be used to perform illusions?

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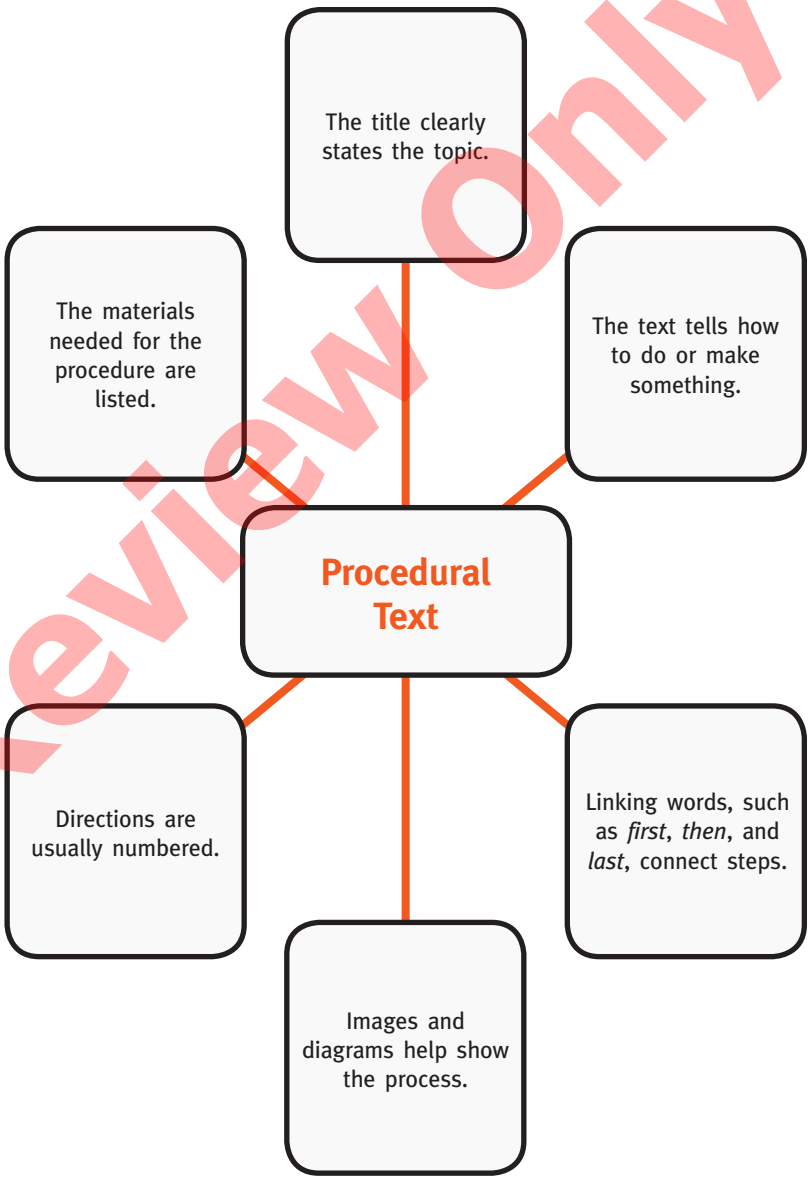

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How Do They DO THAT?

▶ This performer appears to float, but there are metal bars under his clothing holding him up.

"Ooh!"

"Wow."

"How did that happen?"

"But that's impossible!"

This is what might be heard from a crowd of people watching an illusionist. An illusionist is an entertainer who performs unique visual tricks. An illusionist might appear to move a fork without touching it or cause a small ball to hover in the air. Illusionists sometimes perform for fans in packed theaters, to tourists on crowded streets, and at children's birthday parties.

Often people are left wondering how an illusionist managed to complete these amazing tricks. Fans and onlookers watch in awe, trying to figure out how, exactly, these illusions are performed. Some illusionists use hard-to-see strings to move objects around, or they use tape, glue, or other gadgets to trick their audience. But an illusionist's most important tool is science!

In this book, you will learn how science can be used to perform tricks that shock and amaze. You will also learn how to perform some tricks of your own. Read on to learn how to use the powers of science to stop objects in midair, move water without touching it, and cause an object to float—all as if under your command.

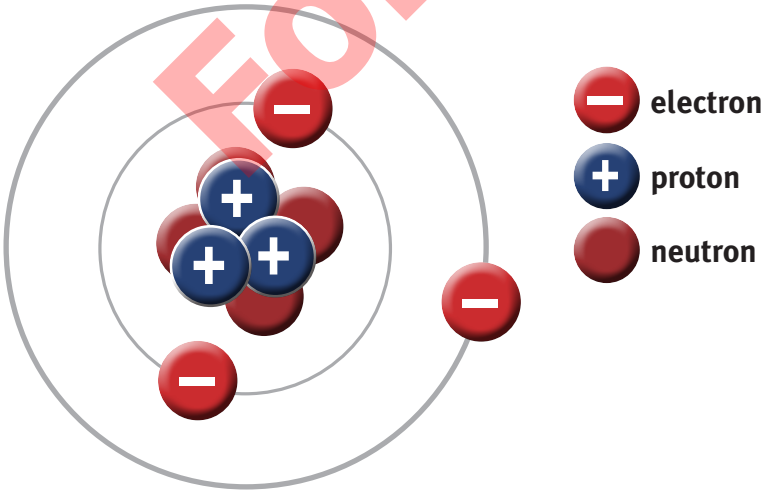
▲ **How can water bend? How can a comb pick up paper? Static electricity can be used to perform visual tricks.**

The Power of ELECTRICITY

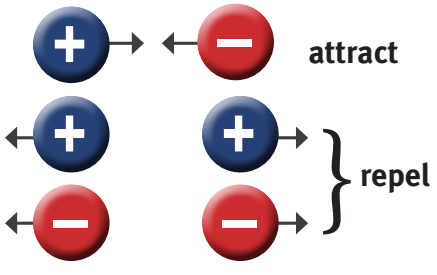
In order to make objects float or fly, an illusionist has to understand matter and energy. **Matter** is what all things are made of. All matter is made of tiny particles, called atoms. Inside atoms are even tinier particles. Protons have a positive charge. Electrons have a negative charge. And neutrons have a neutral, or balanced, charge. This means that all objects have these charges.

If an object has more protons than electrons, it has a positive charge. If an object has more electrons than protons, it has a negative charge. Opposite charges **attract**. They pull toward each other. Similar, or "like," charges **repel**. They push away from each other. Often, the positive and negative charges inside an object are balanced. This means the object has a neutral charge.

▼ An atom has charged particles.



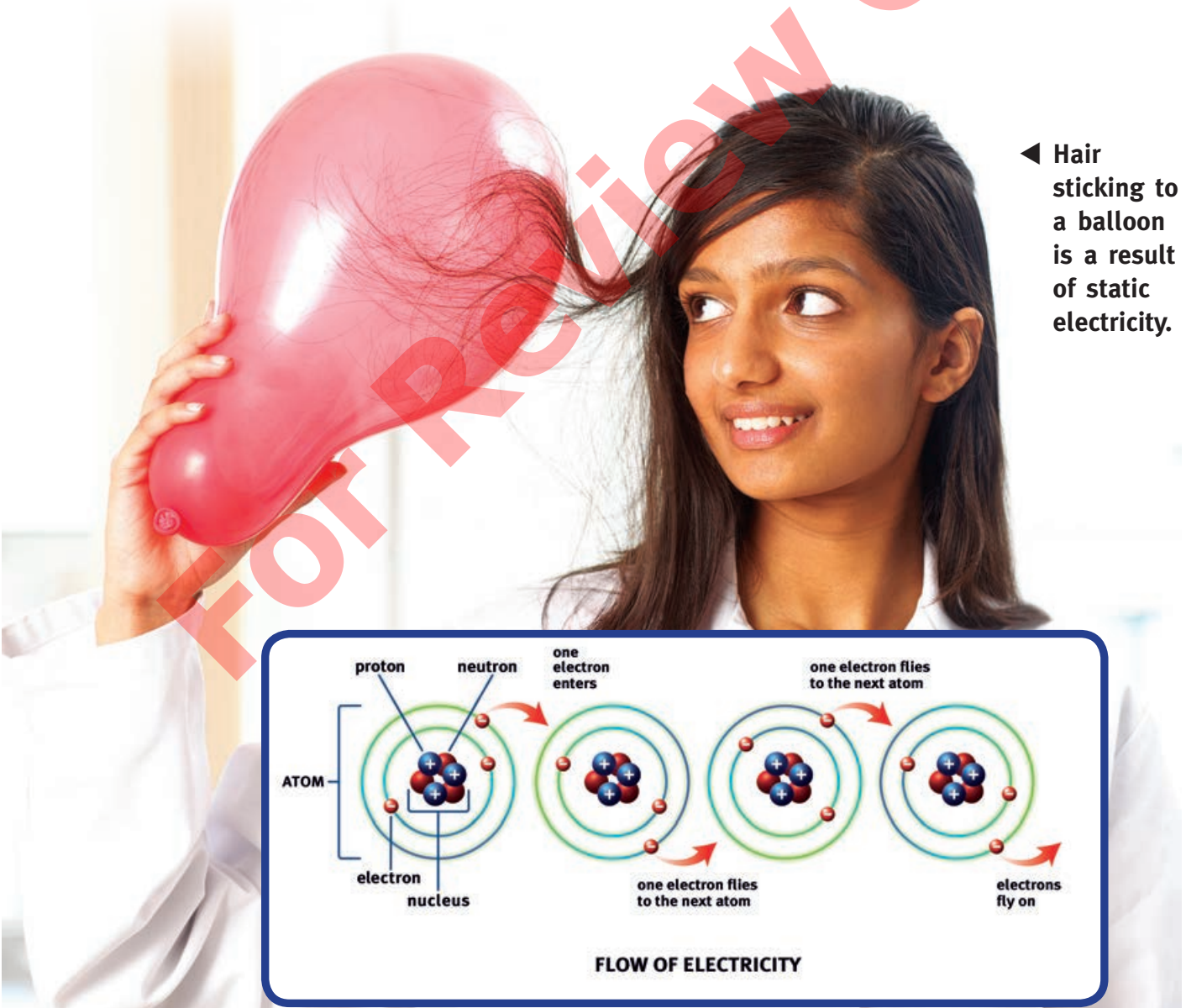
▼ These particles attract or repel one another.



An atom can gain or lose electrons. When an atom loses electrons, the lost electrons can move to another atom. This flow of electrons moving in the same direction—from one atom to the next—is electrical energy, or **electricity**.

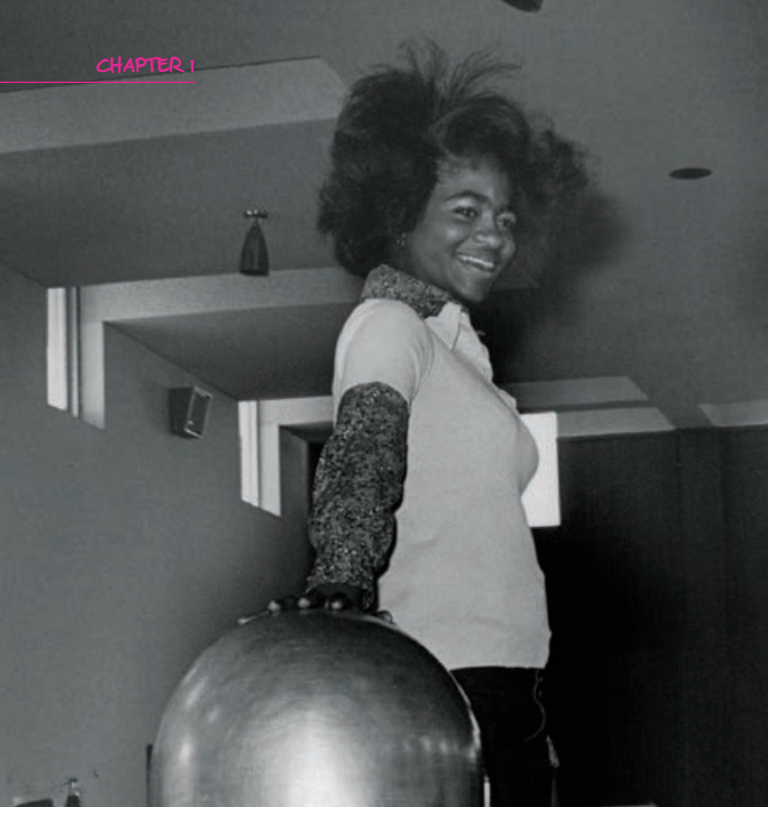
Electricity is a form of **energy**. Energy is what is needed to make things happen. Light, heat, and sound are also forms of energy. Electricity can be in the form of current electricity or static electricity.

Current electricity is a constant flow of electrons. This is the type of electricity that can move along wires. People use current electricity to power appliances or devices, such as a toaster or a tablet. Static electricity is the buildup of a negative charge in an object. This happens when the positive and negative charges in an object are not balanced.



◀ **Hair sticking to a balloon is a result of static electricity.**

FLOW OF ELECTRICITY



▲ **This machine, called a Van de Graaf generator, generates static electricity.**

There are many examples of static electricity in everyday life. One example is when a person's hair stands up after taking off a woolen hat. The hat rubs against the person's hair. This rubbing is a force called friction. The friction loosens electrons from atoms in the hat. The strands of hair take on the loose electrons, giving each strand a negative charge. Since like charges repel, the strands of hair push away from one another, causing the hair to stand on end. Then, if the person touches a doorknob, the charge is released, or discharged. The person may feel a zap or a light shock.

Friction and static electricity can also cause things to stick together or attract. For example, when clothing tumbles around in a dryer, the fabrics rub together. The friction causes some pieces of clothing to lose electrons and others to gain them. The clothing that loses electrons has a positive charge. The clothing that gains electrons has a negative charge. Since opposite charges attract, these pieces of clothing stick together. This is referred to as static cling.

LET'S TRY IT

Attract or Repel?

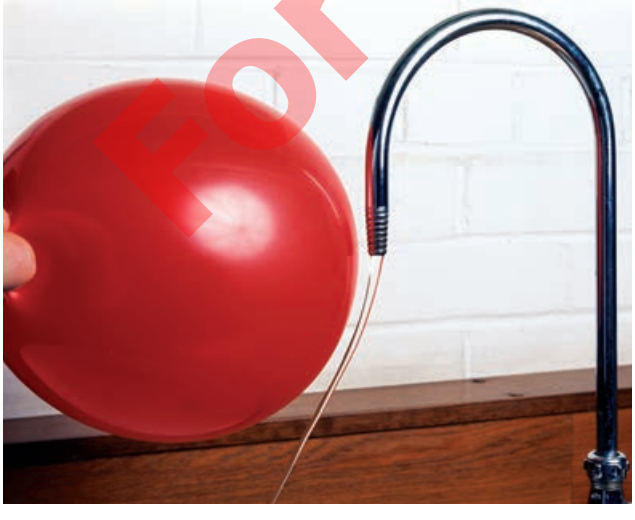
Harris is planning a trick with charged objects. He wants to predict how the charged objects will move.

1. Which of the pictures below show objects that will be repelled, or move away from each other?

2. Which of the pictures below show objects that will be attracted, or move toward each other?

See answers on page 24.

Static electricity can be used to perform fantastic illusions and amaze people. When one object is rubbed against another, friction transfers electrons. This causes an imbalance of charges. Sometimes, the static electricity will cause two objects to push apart. Other times, it will cause the objects to stick together. These movements can be used to create illusions!

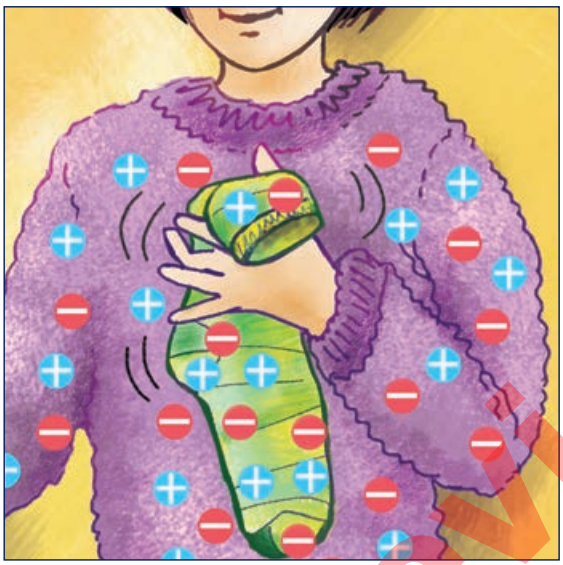


Plastics, Metals, and More

Certain materials allow charges to build up easily, while other materials lose charges easily. For instance, wool and aluminum tend to give up electrons, while polyester (a plastic-based fabric) tends to gain electrons. Plastics, wool, and metals are all materials that build up and lose charges easily. Other materials, such wood, do not lose or build up charges easily. Therefore, plastic, metal, and wool are ideal to use when performing tricks involving static electricity.

LET'S TRY IT

USING FRICTION TO CREATE AN ILLUSION



1 Rub a wool sock against a polyester or fleece top. This causes friction.

2 Electrons move and cause an imbalance of charges.

3 Opposite charges attract, so the sock moves toward or sticks to the fleece top.