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Invisible Forces: Exploring Electricity and Magnets

Forces That Push and Pull Without Touching

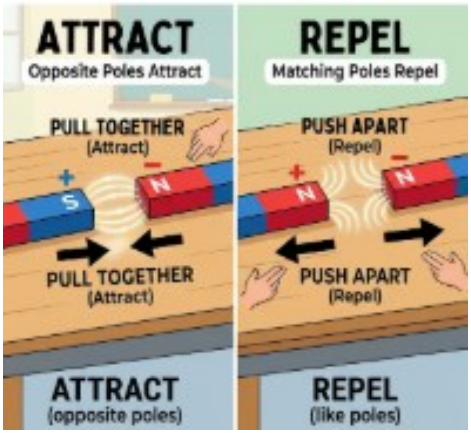
Have you ever seen an object move without anything touching it? Forces are pushes or pulls that cause objects to move. Some forces require objects to touch, like pushing a swing or kicking a soccer ball. However, electric and magnetic forces can work across a space without touching objects directly. These non-contact forces cause clear cause-and-effect relationships that scientists can investigate. For example, the distance between two objects affects how strong an electric or magnetic force will be. When objects are closer together, the push or pull force is much stronger. When they move farther apart, the force becomes weaker.

The Magic of Static Electricity



Static electricity is a non-contact force caused by electric charges. You can investigate static electricity using simple everyday items. If you rub a balloon against a wool sweater, the balloon becomes electrically charged. When you hold the charged balloon near your head without touching your hair, your hair lifts up toward the balloon! Another investigation involves rubbing a plastic rod with a cloth and holding it near tiny pieces of paper. The electrical force from the charged rod pulls the paper pieces up from the table. In both investigations, moving the charged object closer creates a stronger electrical pull on the hair or paper.

Magnet Poles and Attraction



Permanent magnets also exert forces without making direct contact. Every permanent magnet has a north pole and a south pole. The orientation, or position, of the magnets affects the direction of the magnetic force. When you place two opposite poles (north and south) near each other, they pull together, or attract. When you place two matching poles (north and north) near each other, they push apart, or repel.

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The strength of a magnetic force also changes when you add more magnets. For instance, two permanent magnets stacked together exert a stronger pulling force on steel paperclips than a single magnet can exert by itself.

Testing Electromagnets

Scientists can also build magnets that run on electricity, called electromagnets. An electromagnet uses wire wrapped around an iron nail connected to a battery. When electricity flows through the wire, the nail becomes magnetic and can pick up steel paperclips from a distance. If you move the electromagnet closer to a pile of paperclips, it attracts more paperclips because the magnetic interaction is stronger at a shorter distance. By planning investigations with electromagnets and permanent magnets, students can discover how distance and orientation cause different magnetic effects.

1. Which two details from the section "The Magic of Static Electricity" best support the main idea that electrically charged objects can pull on other objects without touching them?

A. A balloon can be rubbed against a wool sweater to gain an electric charge.

B. A charged balloon held near your head makes hair lift up toward it without touching.

C. Everyday items can be used to set up science investigations in the classroom.

D. A charged plastic rod pulls tiny pieces of paper off a table from a distance.

E. Static electricity is caused by electric charges built up on objects.

2. What is the main idea of the entire passage?

A. Electromagnets require a battery and wire to pick up paperclips.

B. Permanent magnets have north and south poles that push apart when placed together.

C. Electric and magnetic forces act across distances without contact, and factors like distance and orientation affect their strength and direction.

D. Hair moves toward balloons whenever a wool sweater is worn.

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