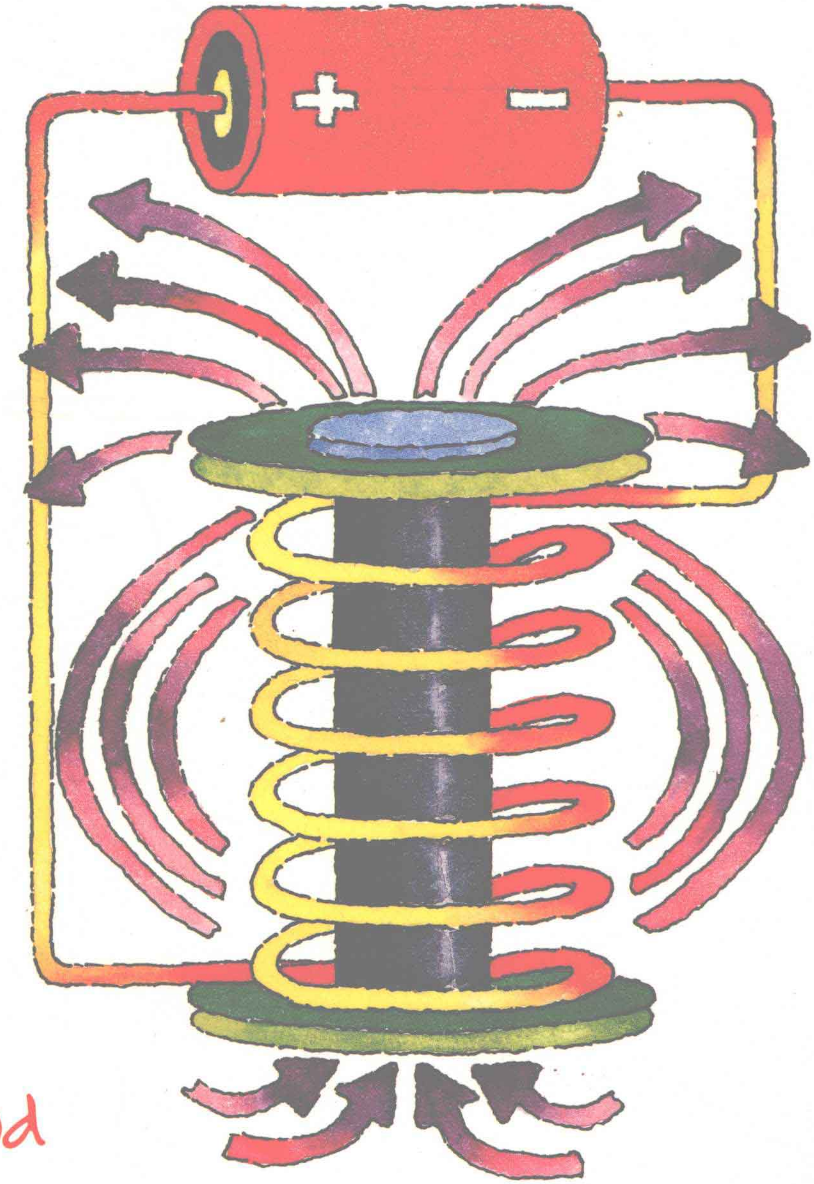
Electricity & Magnetism FUNDAMENTALS

FUNtastic Science Activities for Kids



- **Over 25 simple and fun activities**
- **Activities include: building a motor, creating a lemon battery, and making a compass**
- **Use materials from around the house**

Robert W. Wood

ELECTRICITY AND MAGNETISM FUNDAMENTALS

FUNtastic Science Activities for Kids

Robert W. Wood

Illustrated by Bill Wright

LEARNING TRIANGLE PRESS

Connecting kids, parents, and teachers through learning

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ELECTRICITY AND MAGNETISM

FUNDAMENTALS

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Light FUNdamentals

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INTRO

This book opens the door to one of the most exciting fields in science—the study of electricity and magnetism. Experiments in electricity can be traced back to 600, when the Greek Thales of Miletus rubbed amber (a brown or yellow translucent, or see-through fossil resin) and silk together to produce static electricity. In fact, the word *electricity* comes from the Greek word *elektron*, which means "amber."

Static electricity is a charge that builds up on something and is waiting for some suitable connection to discharge—like between the clouds and earth during a thunderstorm. *Current electricity* is an electrical current moving along a wire. When any electrical current flows, it develops an invisible force around it called a *magnetic field*.

To understand electricity, you need to know something about the relationship of electricity and magnetism. The two subjects are closely related. Electricity can produce magnetism, and magnetism can produce electricity. Understanding their relationship has led to the development of most of today's entertaining and labor-saving devices. Our imaginations are the only limit to exciting discoveries in the future.

The experiments in this book are a basic introduction to the study of electricity and magnetism. You'll learn what electricity and magnetism are, where they come from, and some of the ways you can use them. Each experiment begins with an objective, followed by a materials list and step-by-step procedures. Results are given to explain what is being demonstrated, as well as a few questions for further discussion. Each experiment concludes with fun facts to educate and entertain.

Where measurements are used, they are given in both the English and metric systems as numbers that will make the experiments easy to perform. Use whichever system you like, but realize that the numbers might not be exact equivalents.

Be sure to read Safety Stuff before you begin any experiment. It recommends safety precautions you should take. It also tells you whether you should have a teacher or another adult help you. Keep safety in mind, and you will have a rewarding first experience in the exciting world of physics.

Safety Stuff

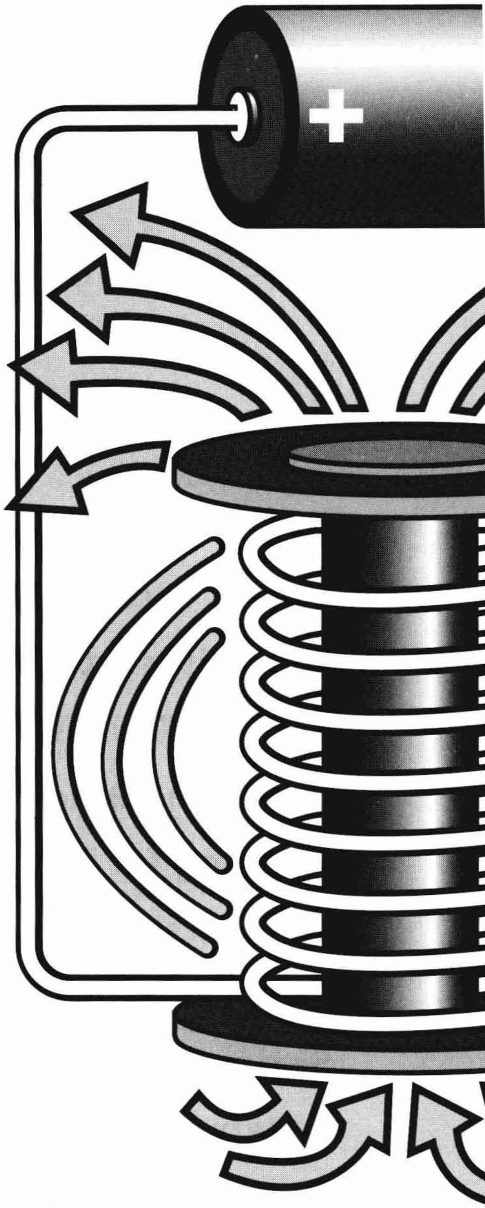
Science experiments can be fun and exciting, but safety should always be considered. Parents and teachers are encouraged to participate with their children and students.

Look over the steps before beginning any experiment. You will notice that some steps are preceded by a caution symbol like the one next to this paragraph. This symbol means that you should use extra safety precautions or that the experiment requires adult supervision.

Materials or tools used in some experiments could be dangerous in young hands. Adult supervision is recommended whenever the caution symbol appears. Children need to be taught about the care and handling of sharp tools or combustible or toxic materials and how to protect surfaces. Also, extreme caution must be exercised around any open flame or very hot surface.

Use common sense and make safety the priority, and you will have a safe and fun experience!

Contents



Definitely a sticky situation!

OPPOSITES ATTRACT

YOUR CHALLENGE

To investigate the conditions that create static electricity and observe its effect on small objects.

Note: Experiments with static electricity work best when the air is dry. Try this experiment on a dry day, then a humid day, and compare the results.

YOU NEED

Hard rubber or nylon comb

Piece of puffed rice cereal

Piece of wool cloth

Wide roll of transparent tape

Length of sewing thread about 2 feet (60 cm) long

DO THIS

1 Wash the comb with warm, soapy water to remove any oil, then shake off any drops of water.

2 Tie one end of the thread to the piece of puffed rice. (Figure 1-1)

3 Tie the other end of the thread to a support so that the cereal is free to swing like a pendulum. (Figure 1-2)

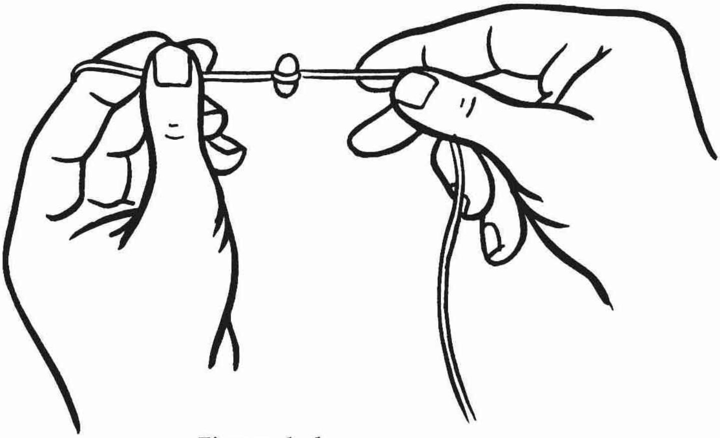


Figure 1-1

Tie the cereal to one end of the thread.

Steady, now. This isn't as easy as it looks!

Suspend the cereal so that it is free to swing.

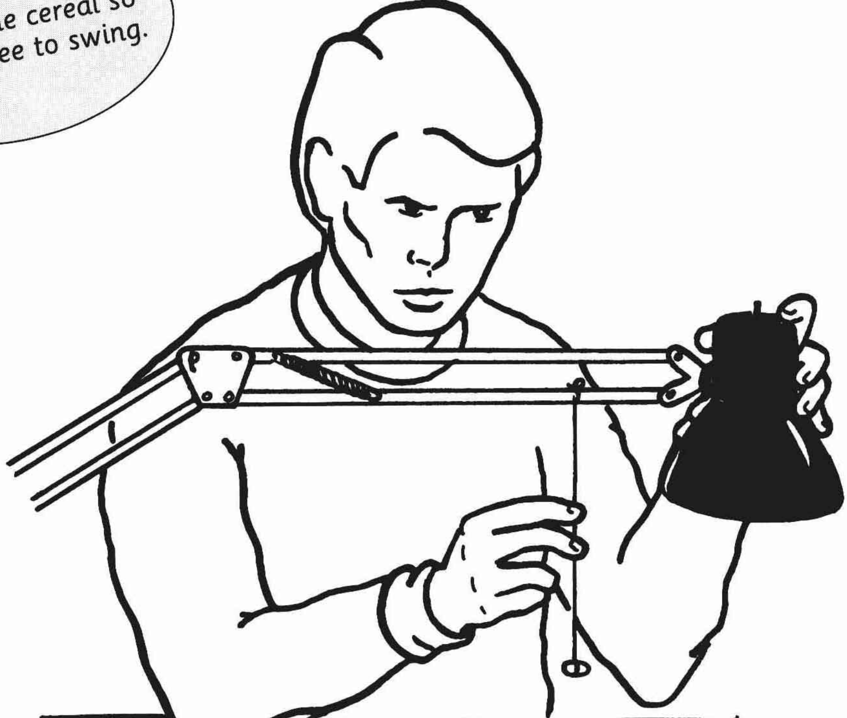


Figure 1-2

4 Rub the comb briskly with the wool cloth, and slowly bring one end of the comb near the suspended cereal. If the comb and wool cloth don't work, quickly pull a short length of transparent tape from its roll, and hold the non-sticky side near the cereal. What happens? (Figure 1-3)

The cereal will be attracted to the comb.

Ever rub a balloon on your head and stick it to the wall or ceiling? This is the same idea.

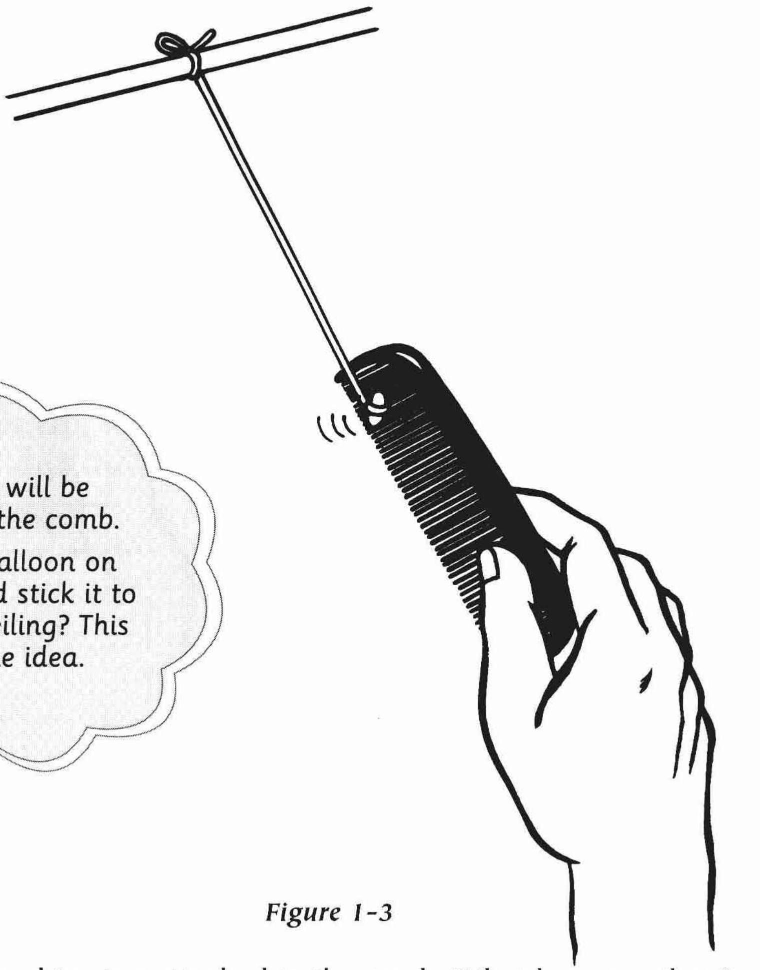
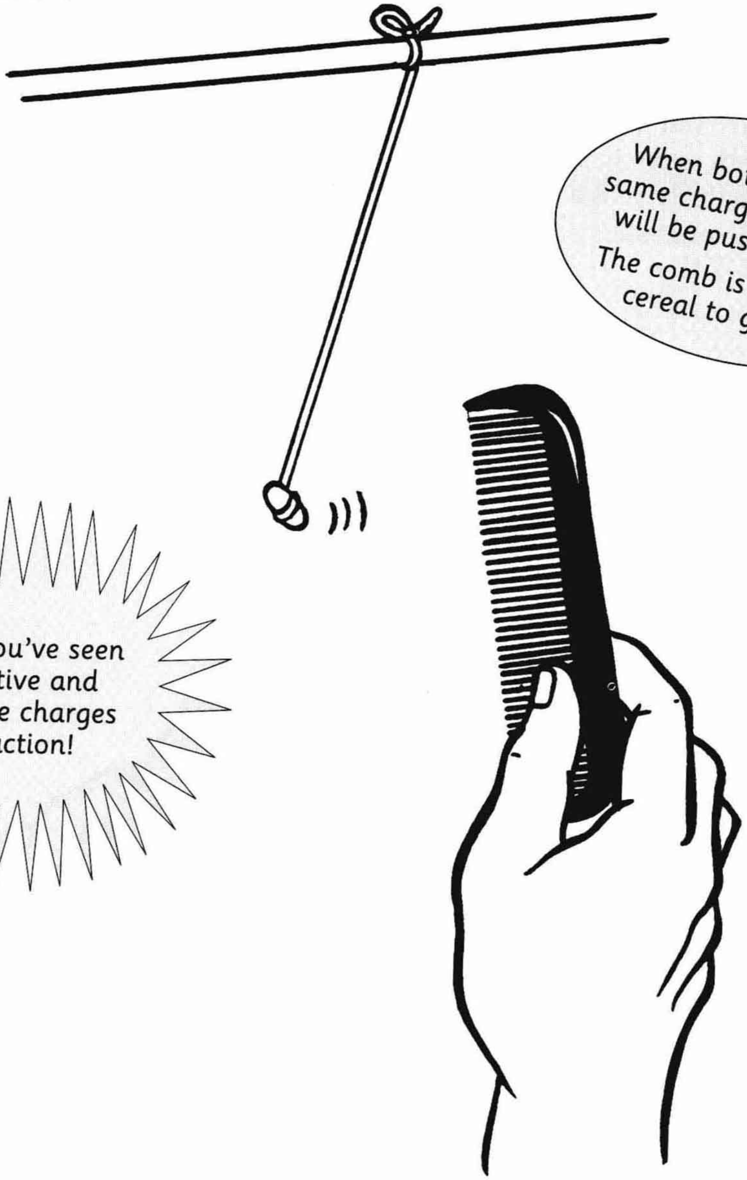


Figure 1-3

5 Allow the cereal to stay attached to the comb. What happens then? Slowly bring the comb near the cereal again. What does the cereal do now? (Figure 1-4)

6 Next, touch the cereal with the tip of your finger, and bring the comb near the cereal. What happens?

Figure 1-4



When both have the same charge, the cereal will be pushed away. The comb is telling the cereal to get lost!

Now you've seen negative and positive charges in action!

Here's something fun to do on a cold winter night: When you're lying in bed, try rubbing your knees against the covers, then quickly separate the blanket from the sheet.

What Happened?

Static electricity is electricity at rest, or a buildup of an electrical charge. Did the comb have an electrical charge? Why?

Objects may carry two kinds of charge: positive and negative. Most objects are made of equal amounts of each. If an object contains more negative charges than positive charges, it will have a net negative charge. Rubbing action can pull negative charges from one object to another. When the comb was rubbed by the wool cloth, the negative charge from the wool was transferred to the comb. The negative charges piled up on the comb, giving it an overall negative charge. The wool was left with an overall positive charge.

A charged object attracts an uncharged object or an object with equal negative and positive charges. When an object has equal negative and positive charges, it is *neutral*. The piece of cereal was neutral, so it was attracted to the comb. However, while the cereal was touching the comb, some of the extra negative charges moved from the comb to the cereal. Soon the cereal also built up a net negative charge.

Because both the comb and the cereal are now negatively charged, they push each other away. When you touched the cereal, the surplus negative charges moved from the cereal to your finger. The cereal loses its net negative charge and is again attracted to the comb.

Use the charged comb to pick up bits of paper. What else is attracted to the comb? Must the comb be near the object to attract it? Do you think that the force of the charge decreases when the distance is increased? Do fabrics from a clothes dryer have an electrical charge?

The electrical charges in this experiment are very small. Can you think of more powerful electrical charges? Do you think static electricity could be dangerous? Could a spark from static electricity start a fire? Is lightning a form of static electricity?

Guess What?

- *If conditions are just right, scuffing your shoes on a carpet can build up a charge of up to 20,000 volts. The charge can produce a painful but harmless shock because of the low current.*
- *The spark plug in powered lawn mowers produces a spark of more than 10,000 volts.*

Guaranteed to give you a charge!

Wacky Water Wonders

Your Challenge

To observe how a small electrical charge affects running water.

You Need

Dry day with low humidity

Clean, dry plastic or nylon comb, or a clear, wide roll of transparent tape

Running water

Do This

1 Turn on the cold water faucet and adjust the flow to a narrow stream of water.

2 Rub the comb briskly with a wool cloth or run it through your hair several times. (Figure 2-1)

3 Now hold the comb near the stream of water. If the comb doesn't work, try pulling a short length of transparent tape from the roll. (Figure 2-2)

4 Hold the tape near the stream of water. What do you see?