

# Science Fun with PHYSICS



Name: \_\_\_\_\_

Age (as of January 1 of the current year): \_\_\_\_\_

Club name: \_\_\_\_\_

Advisor name: \_\_\_\_\_

County: \_\_\_\_\_



**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
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This project book demonstrates adherence to the highest educational standards within 4-H.

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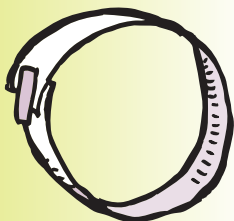
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# Note to the Project Helper

Congratulations! A 4-H member has asked you to serve as a project helper. You may be a parent, relative, project leader, friend, club advisor or another individual important in the 4-H member's life. Your duties begin with helping the youth create and carry out a project plan, as outlined in the Member Project Guide. This is followed by helping the youth focus on each activity, providing support and feedback, and determining what was done well, what could have been done differently, and where to go next.

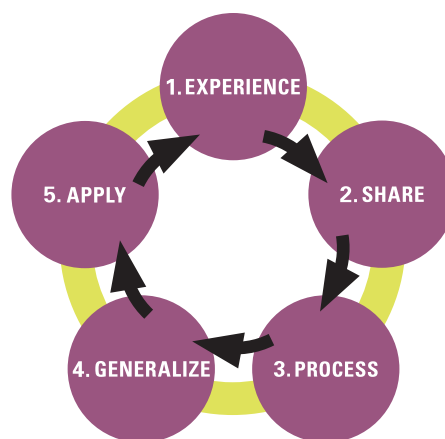
As a project helper, it is up to you to encourage, guide and assist the 4-H member. How you choose to be involved helps to shape the 4-H member's life skills and knowledge of the importance of physics.

## Your Role as Project Helper

- Guide the youth and provide support in setting goals and completing this project.
- Encourage the youth to apply knowledge from this project book.
- Serve as a resource person.
- Encourage the youth to go beyond the scope of this 4-H project book to learn more about physics.

## What You Should Know About Experiential Learning

The information and activities in this book are arranged in a unique, experiential fashion (see model). In this way, youth are introduced to a particular practice, idea, or piece of information through an opening (1) **experience**. The results of the activity are then recorded in the accompanying pages. Youth then take the opportunity to (2) **share** what they did with their project helper, (3) **process** the experience through a series of questions that allow the learner to (4) **generalize** and (5) **apply** the new knowledge and skill.



Pfeiffer, J.W., & Jones, J.E., Reference Guide to Handbooks and Annuals. © 1983 John Wiley & Sons, Inc. Reprinted with permission of John Wiley & Sons, Inc.

## What You Can Do

- Review the Learning Outcomes (project skill, life skill, educational standard, and success indicator) for each activity to understand the learning taking place. See the inside back cover for a summary of the learning outcomes.
- Become familiar with each activity and the related background information. Stay ahead of the learner by trying out activities beforehand.
- Begin the project by helping the learner establish a plan for the project. This is accomplished by reviewing the Member Project Guide.
- After each activity, conduct a debriefing session that allows the learner to answer the review questions and share results. This important step improves understanding from an experiential learning perspective.
- Help the learner celebrate what was done well, and see what could be done differently. Allow the learner to become better at assessing his or her own work.
- In the Member Project Guide, date and initial the activities that have been completed.



# Member Project Guide

Welcome to *Science Fun with Physics*! This project is designed for 4-H members with beginning-level skills with science experiments. After completing this project, you are encouraged to explore other science, technology, engineering and math (STEM) project books.

Check your county's project guidelines (if any) for completion requirements in addition to the ones below, especially if you plan to participate in county project judging or plan to prepare an exhibit for the fair.

## Project Guidelines

**Step 1:** Complete **all 12** experiments.

**Step 2:** Take part in **at least two** learning experiences.

**Step 3:** Become involved in **at least two** leadership/citizenship activities.

**Step 4:** Complete a project review.

## Step 1: Experiments

Complete **all 12** magical experiments. The More Magic activities are optional but help enhance your magical training and understanding of physics. Take good notes and record your experiment results. When you begin an activity, jot down the date you start it. When you finish an activity, review your work with your helper. Then ask your helper to initial and date your findings.

Magical Experiments	Date Started	Date Completed	Project Helper Initials
<b>Beginner Level: Magic for the New Magician</b>			
1. Drops on a Penny			
2. Parachute Away!			
3. Create a Rainbow			
4. Lincoln High Dive			
Conclusions			
<b>Apprentice Level: More Magic that Moves</b>			
5. Now We Mix, Now We Don't			
6. The Loopy Plane			
7. Move It with Magnets			
8. Comeback Can			
Conclusions			
<b>Master Level: You Are Audience-Ready</b>			
9. Egg in a Bottle			
10. Balloon Rocket Dragster			
11. Surface Surfer			
12. Bottle Levitation			
Conclusions			

## Step 2: Learning Experiences

Magical learning experiences are meant to complement your training, providing you with a chance to explore the wonders of physics. What are some learning experiences you could do to show the interesting things you are discovering about physics? Here are some ideas:

- Attend a clinic, workshop, demonstration or speech related to physics.
- Help organize a club meeting based on one of the experiments.
- Go on a related field trip or tour a business that uses magnets, electricity or temperature changes to make a product.
- Write a paper about a famous physicist.
- Prepare your own demonstration, illustrated talk or project exhibit.
- Participate in county judging.

Once you have a few ideas, record them here. Complete **at least two** learning experiences. Then, describe what you did in more detail. Ask your project helper to date and initial in the appropriate spaces below.

Plan to Do	What I Did	Date Completed	Project Helper Initials
Demonstration	Separated the colors of a rainbow on a piece of paper.	4/15/YR	K.B.



### Step 3: Leadership and Citizenship Activities

Choose **at least two** leadership/citizenship activities from the list below (or create your own) and write them in the table below. Record your progress by asking your project helper to initial next to the date each one is completed. You may add to or change these activities at any time. Here are some examples of leadership/citizenship activities:

- Teach someone how physics and magic work together.
- Help another member prepare for his or her project judging.
- Organize a club field trip to a local science center.
- Encourage someone to enroll in *Science Fun with Physics*.
- Arrange for a speaker to visit your club.
- Plan your own leadership/citizenship activity.

Leadership/Citizenship Activity	Date Completed	Project Helper Initials
<i>Organized a club magic demonstration using physics.</i>	<i>5/5/YR</i>	<i>K.B.</i>

## Step 4: Project Review

All finished? Congratulations! After you've completed the activities in this book you are ready for a project review. Completing this review helps you assess your personal growth and evaluate what you have learned.

Use this space to write a brief summary of your project experience. Be sure to include a statement about the skills you have learned and how they may be valuable to you in the future.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Now, set up a project evaluation. You can do this with your project helper, club leader or another knowledgeable adult. It can be part of a club evaluation or it can be part of your county's project judging.



# The Magic of Matter



**March 20, 1924**

I, Franco Newtoni, the most amazing magician ever known, will share the secret of magic with the whole world! No longer hiding in the shadows or tricking audiences. Now, everyone will learn what I have known for years. The secret to magic is ...



Ninety years ago, The Amazing Newtoni mysteriously *disappeared!* A leading magician of his time, Newtoni was working on this powerful book when he vanished. It was never finished. The Illusionist Guild wasn't pleased he was going to break the magician's code of honor by revealing the secret behind his tricks. Thankfully, this book fell into our hands before someone outside our Magical History Agency could decode it.

As junior researcher for our agency, it is your job to determine the secret Newtoni was going to share. This diary is filled with magical experiments designed for new magicians. We can only assume that by testing each experiment you will get closer to the truth behind Newtoni's magic. Use your observation skills, superior knowledge and logic as you explore each level of this guide.

**Ready? Look for these helpful guides along the way:**



**Magic Assistant:** Every magician has a helper. The magical assistant in our guide helps you with important tips and safety information about each trick.



**White Rabbit:** The white rabbit explains how science and magic work together to create illusions.

## More Magic:

Included in each level are a few extra experiments you can try performing in front of an audience, such as your family, friends or club. Practice before you perform so you know exactly what happens in each trick.



# Beginner Level: Magic for the New Magician

To be an outstanding magician, you need to start with the basics. **Matter** surrounds us. It's in the furniture in your house, in the food you eat, and in the air, earth and water. When you learn how to control the elements, you will amaze and astound your audience. I have collected these four experiments to teach you about water, light and an amazing force called **gravity**.

## Senior Researcher Notes

Newton's book states that matter is magic. But there's a little more to it. From what we have learned, there are very specific rules to explain why matter acts the way it does. These rules were discovered after years of studying matter. Try each experiment and see if you can figure out what Newton was trying to teach.

## Experiment 1: Drops on a Penny

### Learning Outcomes

**Project skill:** *Discovering the force of surface tension*

**Life skill:** *Processing information*

**Educational standard:**  
NGSS 3-PS2.B, *Objects in contact exert forces on each other*

**Success indicator:** *Records the number of drops that fit on a penny*

Words in **bold** throughout this book are defined in the glossary.

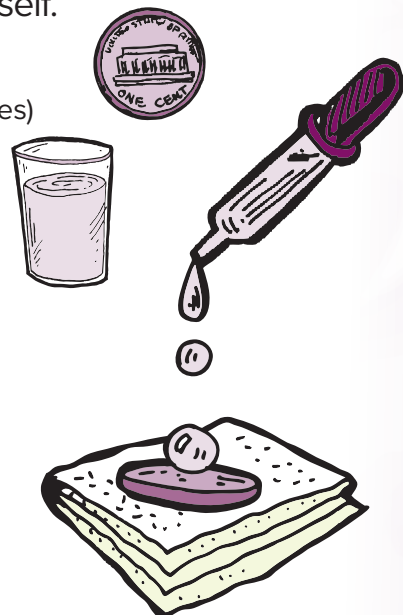
### Supplies

- ☐ eye dropper (available at drug stores)
- ☐ cup of water
- ☐ penny
- ☐ paper towel, folded in quarters

Time needed:  5 minutes

### What to Do

Place the penny on the paper towel. Write down your guess of how many drops of water you can fit on the penny. Now, using the eye dropper, place one drop at a time on the penny, keeping track of the total. Observe the shape of the water accumulating on the penny. Once the water overflows onto the towel, dry the penny and try again. Do this a total of three times, recording your results each time.



### Magic Assistant Tip

Make sure the penny is in the middle of the paper towel square.



## Try It Again

See if using different liquids makes a difference. Estimate how many drops you think will fit on top of the penny. Record each liquid and the number of drops. Were you correct? Will the penny hold the same number of drops for different liquids? Why or why not?

Record your observations:

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### Explanation

The force of surface tension attracts the molecules in a liquid to each other. This makes the water look as if there is a thin elastic “skin” over the surface. This skin is strong—have you ever seen insects “walk” on water? They are supported by the surface tension of the water and by spreading out their weight over the water using their long legs. How does this skin form? Molecules of water attract and are attracted by all of the other water molecules around them. Stronger **bonds** exist on the surface of a liquid because those molecules have no other molecules above them, making the surface bonds even stronger. These stronger bonds provide the effect of surface tension.

**Source:** This experiment is cited in numerous science books and online science resources.



### More Magic

Fill a cup to the rim with water. Tell your audience you are going to make a paper clip float on the water. Challenge an audience member to try it. Most people will drop the clip straight in so it sinks to the bottom. Now, carefully balance the paper clip on the edge of the cup and slowly push it onto the surface of the water, without dipping your finger into the water. Surface tension supports the paper clip, just like magic!

**What's the Trick?** Surface tension helps the paper clip float, just like in the Drops on a Penny experiment. When the paper clip is flat, the water molecules have more **surface area** to support, allowing the clip to stay on top of the water.

**Source:** [coolscience.org/CoolScience/KidScientists/FloatDivePaperClip.htm](http://coolscience.org/CoolScience/KidScientists/FloatDivePaperClip.htm)

