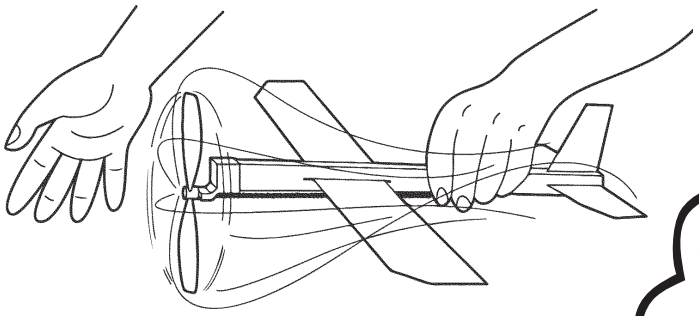
CFAES College *of* Food, Agricultural, *and* Environmental Sciences

4-H 502

Science Fun with *Flight*



Name _____

Age (as of January 1 of the current year)_____

County _____

Club or group name _____

Project helper _____

The Ohio State University
EXTENSION

Note to the Project Helper

Congratulations! A 4-H member or other youth has asked you to serve as a project helper. You may be a parent, relative, project leader, friend, club advisor, or another important person. As a project helper, it is up to you to encourage, guide, and assist. How you choose to be involved helps to shape the learner's life skills and knowledge.

Your Role: Help Youth Thrive

Your contribution is critical to delivery of the 4-H program, which is committed to positive youth development (PYD). The 4-H Thriving Model, the theory of change for positive youth development, connects high-quality program settings to the promotion of youth thriving. That's where you come in.

High-quality 4-H program settings provide youth a place to belong, matter, and explore their personal spark. These components, along with strong relationships with caring adults and supportive peers, help ensure that 4-H programs provide a nourishing developmental context—a place where youth feel a sense of belonging and can grow.

High-quality 4-H programs contribute to PYD through the intentional promotion of social, emotional, and cognitive learning. This process is described by seven indicators of **youth thriving** (see model).

4-H Thriving Model

LONG-TERM OUTCOMES

- Academic or Vocational Success
- Civic Engagement
- Employability & Economic Stability
- Happiness & Wellbeing

DEVELOPMENTAL OUTCOMES
(Positive Youth Development)

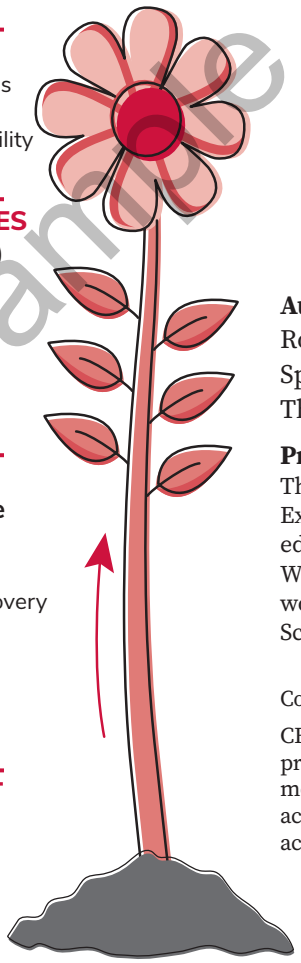
- Positive Academic Attitude
- Social Competence
- Personal Standards
- Connection with Others
- Personal Responsibility
- Contribution

YOUTH THRIVING
(Social, Emotional & Cognitive Learning)

- Growth Mindset
- Openness to Challenge & Discovery
- Hopeful Purpose
- Prosocial Orientation
- Transcendent Awareness
- Positive Emotions
- Goal Setting & Management

DEVELOPMENTAL CONTEXT
(4-H Programs)

- Sparks
- Belonging
- Relationships
- Engagement



Youth who experience program settings with these intentional social, emotional, and cognitive indicators achieve key positive youth **developmental outcomes**. They are then also more likely to achieve **long-term outcomes** marked by academic or vocational success, civic engagement, employability and economic stability, and happiness and well-being.

For more information on the 4-H Thriving Model of Positive Youth Development, please go to **helping-youth-thrive.extension.org**.

What You Can Do

On a practical level, your role as a project helper means you will strive to do the following:

- Review the Learning Outcomes for each activity to understand the learning taking place. See page 29 for the Summary of Learning Outcomes.
- Become familiar with each activity, including the background information. Stay ahead of the learner by trying out activities beforehand.
- Help the learner establish a plan by reviewing the Project Guide. As a resource person, limit your involvement to providing support.
- As activities are completed, conduct debriefing sessions that allow the learner to share results and answer questions. This important step improves understanding. In the Project Guide, date and initial completed activities.
- Help the learner celebrate what was done well and see what could be done differently. Allow the learner to become better at assessing their own work. Encourage exploration of the topic beyond the scope of this project book.

Thank you for supporting positive youth development.

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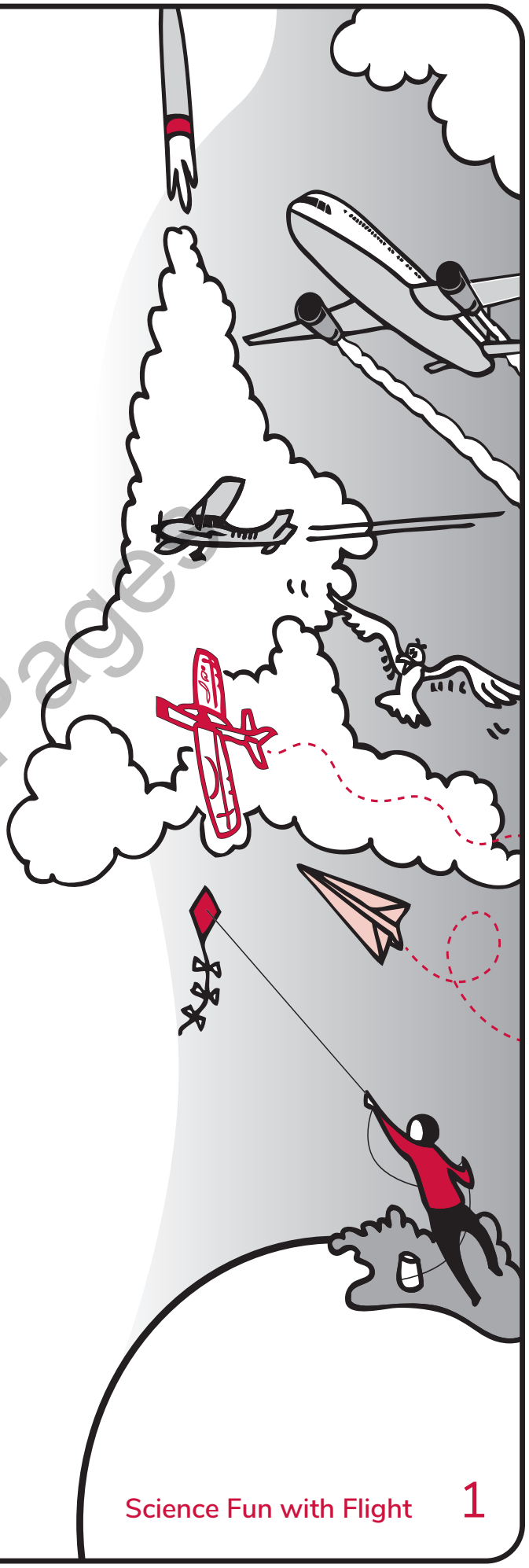
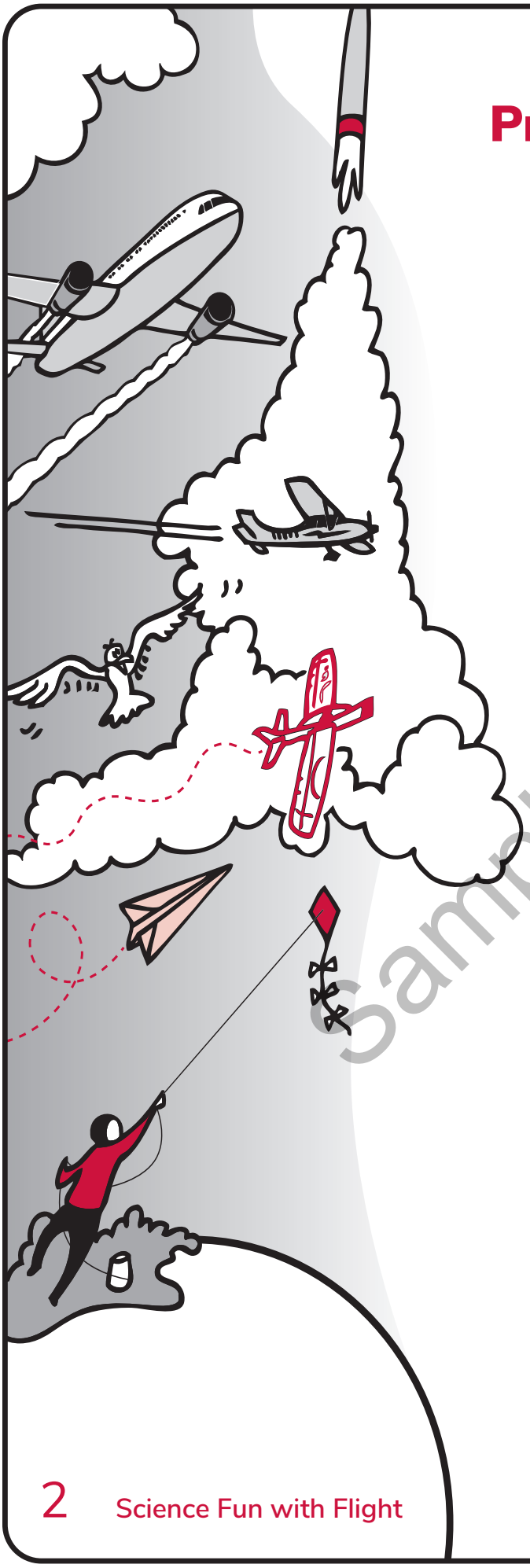




Project Guide

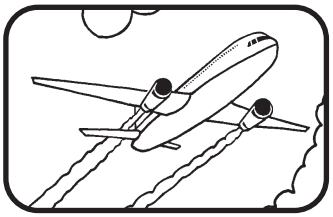
Project Background

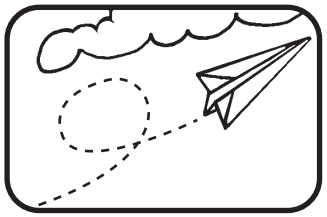
This beginning-level project is designed for 9- to 14-year-old youth. Older youth may wish to specialize in one or more of the project Interest Areas by planning and conducting their own experiments. This project should take no more than three months to complete.

Check your county's project guidelines (if any) for additional requirements, especially if you wish to participate in county project judging or prepare an exhibit for the fair. Youth who complete this project and wish to go further are encouraged to take a self-determined project in model airplanes, control line, or radio-controlled airplanes.

Project Guidelines

1. Complete **all seven** Interest Areas including each experiment. The Digging Deeper activities are optional.
2. Take part in **at least two** learning experiences.
3. Become involved in **at least two** leadership/citizenship activities.
4. Complete a project review.
5. Build a glider or flyer from scratch or a kit. Or, build a model of your favorite jet or airplane.





Step 1: Interest Areas

Complete **all seven** Interest Areas, including each experiment. The Digging Deeper activities are optional. As you begin an area, place the current date (month and year) next to it.

Date Started	Project Helper Initials	Interest Areas
_____	_____	1. Air, pages 6–7.
_____	_____	2. The Power of Air, pages 8–9.
_____	_____	3. Powering Up, pages 9–12.
_____	_____	4. Things That Slow Planes Down, pages 17–18.
_____	_____	5. Center of Gravity and Balance, pages 19–21.
_____	_____	6. Achieving Control and Stability, pages 22–24.
_____	_____	7. Increasing Lift—Wing Shape and Airflow, pages 24–27.
_____	_____	Build your own glider, flyer, or model.

Step 2: Learning Experiences

Learning experiences are meant to provide the opportunity for you to do more in subject areas that interest you. What are some learning experiences you could do to show the interesting things you are learning about? Here are some ideas:

- Attend a clinic, demonstration, speech, or contest related to flight.
- Help organize a club or group meeting, field trip, or tour based on this project.
- Prepare your own demonstration, illustrated talk, or project exhibit.
- Participate in a county fair or other judging event.
- Plan your own learning experience.

When you have a few ideas, record them in the table on page 4. 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 in the table on page 4.

Plan to Do	What I Did	Date Completed	Project Helper Initials
Demonstration	I showed my club how to assemble a balsa wood glider from a kit.	April 10	RZ

Step 3: Leadership/Citizenship Activities

Use what you learn to give back to your community! Choose **at least two** leadership/citizenship activities from the list below (or create your own) and write them in the table on page 5. Record your progress by asking your project helper to initial next to the date as 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 what you learned about airplanes.
- Organize a flight contest in your community.
- Host a workshop to share tips about airplanes and flight.
- Encourage someone to take a flight project.
- Help a member prepare this project for judging.
- Plan your own leadership/citizenship activity.

Leadership/Citizenship Activity	Date Completed	Project Helper Initials
I organized a flight contest for students at my school.	April 10	RZ

Step 4: Project Review

All finished? Congratulations! After you have completed the experiments in this book and built your own glider, flyer, or model, you are ready for a project review. This process helps you assess your personal growth and evaluate what you have learned. On a separate piece of paper, write a short summary of your project experience. Be sure to include a statement about the skills you have learned and how they might be valuable to you in the future.

Next, set up a project evaluation. You can do this with your project helper or another knowledgeable adult. If you are a 4-H member, it can be part of a club evaluation or part of your county's project judging.

Interest Area 1

Air

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

Air is all around us. Our planet is surrounded by a layer of air called the **atmosphere**. Air has substance, though it cannot be seen. We can feel air moving in and out of our bodies when we breathe. Although we can neither smell nor taste air, we can feel it moving past us. Air moves slowly in a gentle breeze and fast in a strong wind. Gentle winds stir up autumn leaves; strong winds can uproot trees; hurricanes can destroy buildings. Air can move up, down, and sideways. In a hurricane, air can even move in circles.

You know that air can hold up kites and airplanes. But although you feel air and can measure certain things about it, including temperature, speed, and moisture content, can you prove that air exists? After all, scientists should not make assumptions, even about the most obvious things.

So before learning about flight, perhaps we should learn a little about air, that is, if it really exists.

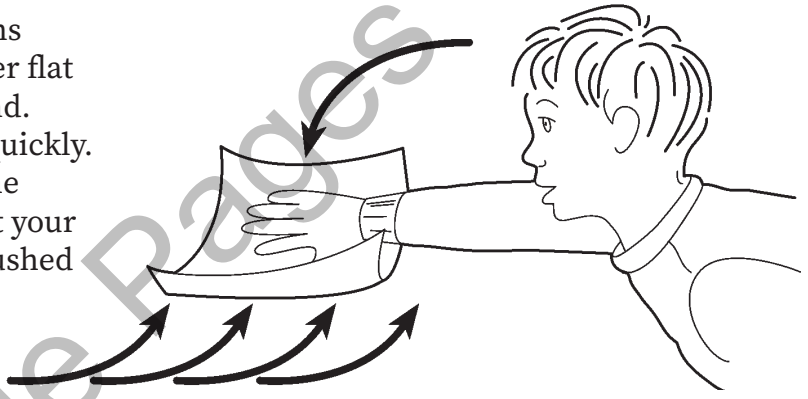
Experiment 1—Air Pressure

Take two sheets of the same sized paper. Crumple one of the pieces into a ball. Hold the crumpled piece and the flat piece high above your head. Drop them both at the same time. The **force** of **gravity** pulls them both downward. Which piece falls to the ground first? What seems to keep the flat sheet from falling the quickest?

Observations

Experiment 2—More Air Pressure

How can you see and feel what happens when air pushes? Place a sheet of paper flat against the palm of your upturned hand. Turn your hand over and push down quickly. You can feel the air pressing against the paper. The paper stays in place against your palm. You can see the paper's edges pushed back by the air.

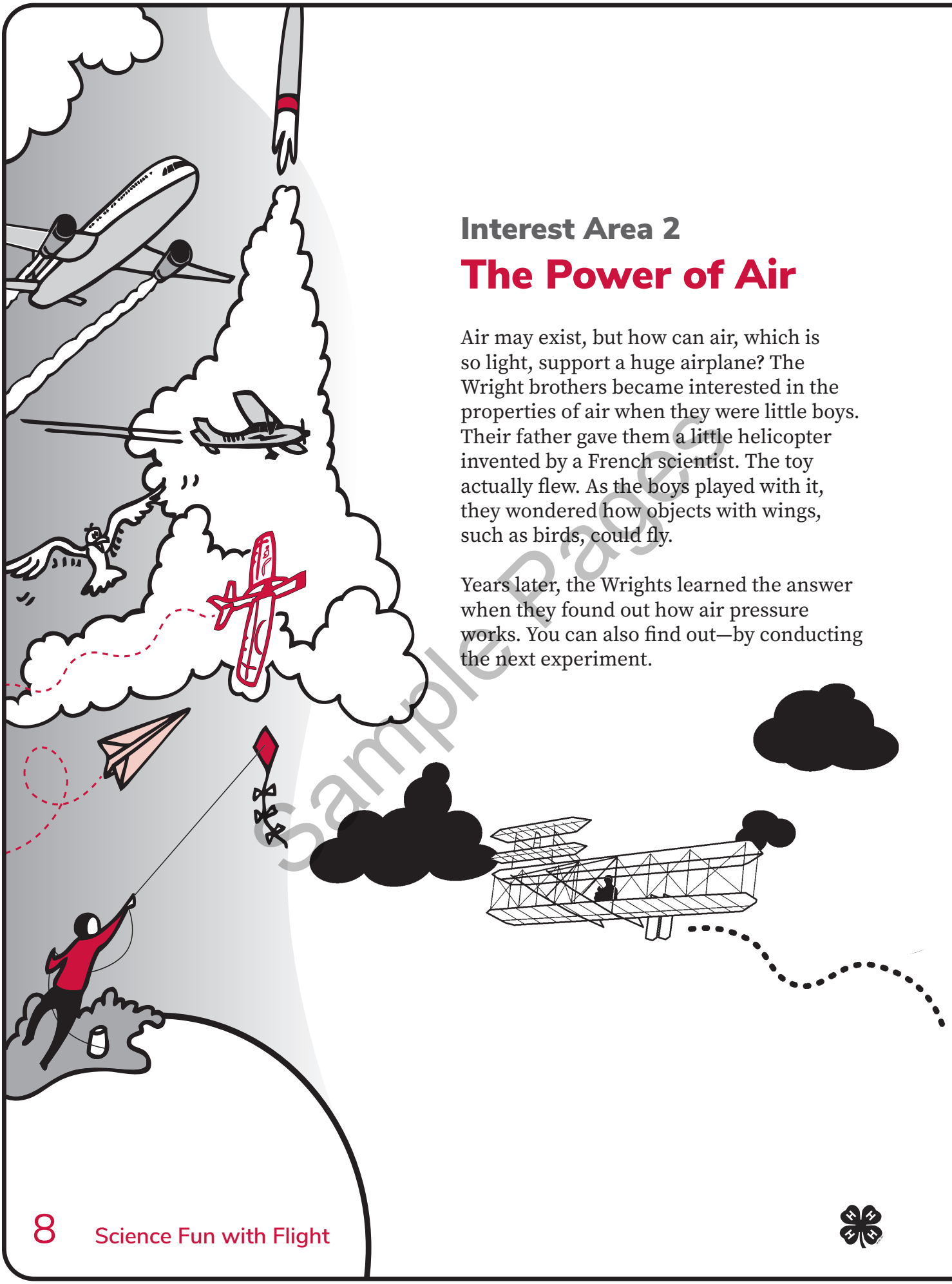


Observations

Digging Deeper—Air Pressure at Work

Have you assured yourself that air is real? If you are not yet convinced, try some additional experiments. Put one finger over the nozzle of a bicycle pump and try to work the pump. What do you feel?

Now, pump up a tire. Do you hear anything rushing into the tire? If air is not real, what caused the tire to inflate? When you are riding your bike, why do the tires not flatten beneath your weight?



Interest Area 2

The Power of Air

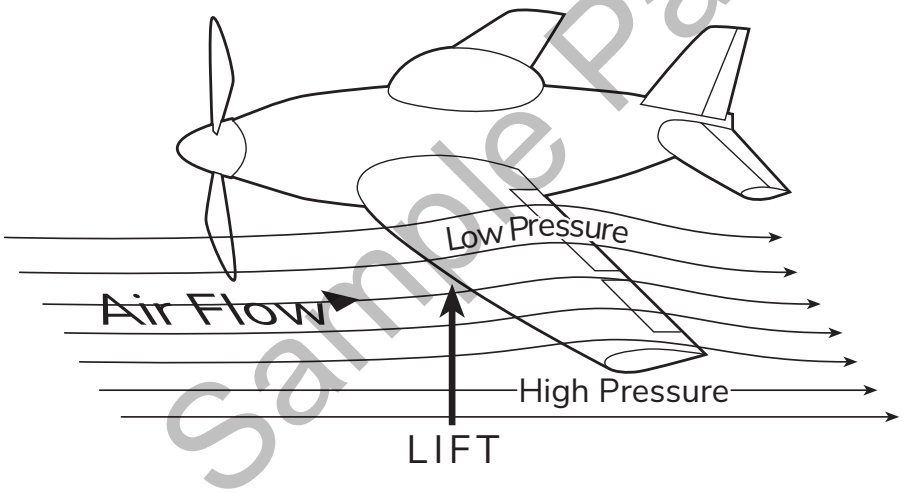
Air may exist, but how can air, which is so light, support a huge airplane? The Wright brothers became interested in the properties of air when they were little boys. Their father gave them a little helicopter invented by a French scientist. The toy actually flew. As the boys played with it, they wondered how objects with wings, such as birds, could fly.

Years later, the Wrights learned the answer when they found out how air pressure works. You can also find out—by conducting the next experiment.

Experiment 3—Lift

You can see that an airstream has lifting power by blowing on a piece of paper. Try this. Cut a strip of paper 2 inches by 8 inches. Hold one end against your chin, and then blow over the strip. An **airstream** forms and the strip flies up. Blow harder, and it flies still higher. Stop blowing and it stops flying.

As air moves in a stream, it loses pressure. Pressure above the strip gets weaker than pressure below. This makes the strip fly up. The faster air moves over a surface, the more pressure it loses. So the harder you blow on the strip, the higher it flies. When an airplane builds up speed on the ground, the air flowing over the top of its wings creates a zone of very low pressure. The force of the atmosphere beneath the wings pushes up on the wings. This causes the plane to take off when the speed is high enough and the pressure is low enough. This force of the air on the wings is called **lift**.



Interest Area 3

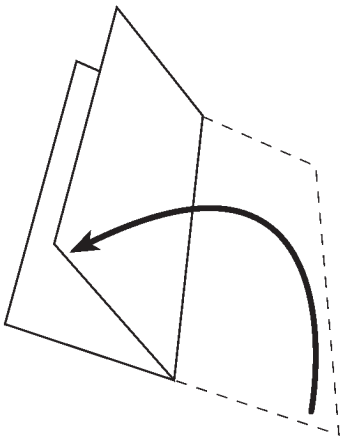
Powering Up

As you just discovered, the lifting force needed to hold a bird or aircraft **aloft** is a result of a moving airstream flowing smoothly over its wings. To generate this moving airstream while in flight, there has to be another force that moves the bird or aircraft forward. A bird usually produces this force by flapping its wings. An airplane, on the other hand, needs an engine to produce the force necessary to get it into the air and keep it aloft.

Experiment 4—Thrust

Thrust is the force that generates lift by pushing or pulling an aircraft forward. To observe this, complete steps 1–6 to build and fly the paper airplane shown. By pushing a paper airplane forward, a lifting force is generated by its wings, allowing it to glide. Lift can also be generated as you pull a kite along by its **towline**. In fact, most kites need a running start to lift them skyward.

Step 1



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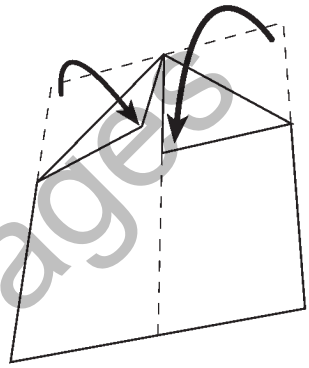

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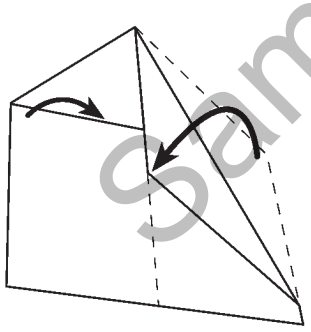
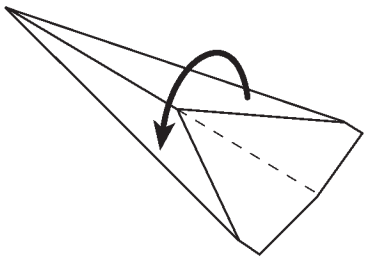
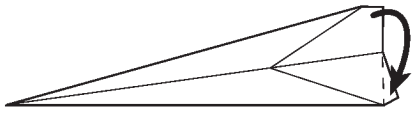


Step 4



Step 5



Step 6