



## GRADE LEVELS

Grades 3-5

## TIME REQUIRED

60-90 minutes

## CONTENT AREAS

- ▶ Science
- ▶ Engineering
- ▶ Math
- ▶ English Language Arts

## KEY WORDS AND CONCEPTS

- ▶ airfoil
- ▶ glider
- ▶ lift
- ▶ pressure

## OVERVIEW

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Using gliders and other materials, students will learn the concept of lift and how Bernoulli's principle makes flight possible.

## STANDARDS ADDRESSED

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### Next Generation Science Standards

- ▶ **3-PS2-1** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- ▶ **3-PS2-2** Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.



## VOCABULARY

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- ▶ **air pressure:** the amount of force exerted by air on objects
- ▶ **airflow:** the air that is moving past a moving object
- ▶ **airfoil:** any surface designed to help lift an aircraft using air pressure
- ▶ **Bernoulli's principle:** the principle that states that as the speed of a moving fluid increases, the pressure in the fluid decreases
- ▶ **fluid:** a substance that can easily change its shape and is capable of flowing
- ▶ **lift:** the force that directly opposes the weight of an airplane

## MATERIALS

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- ▶ Lightweight paper
- ▶ Crayons or markers (optional)
- ▶ Scissors
- ▶ Pencils
- ▶ Rulers
- ▶ Paper clips
- ▶ Tape
- ▶ Tape measure
- ▶ Paper
- ▶ Cardboard
- ▶ Tag board
- ▶ Staplers
- ▶ Aluminum foil
- ▶ Glue

## SAFETY

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Observe standard classroom safety precautions during the construction of the gliders and the carrying out of the experiments.



## TEACHER PROCEDURE

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### *Air Pressure and Lift*

1. You will begin teaching the principles of flight by discussing air pressure. Explain that air pressure is constantly acting on all objects. It presses down, up, and all around, not just in one direction.
2. Draw a picture of a simple airfoil on the whiteboard.
3. Explain that air moving rapidly over an object causes the air pressure to be lower, while air moving slowly under an object causes the air pressure to be higher. Higher pressure causes the object to rise. This is called lift. We will demonstrate lift with a strip of paper.
4. Each student should cut a strip of paper about 1" x 11".
5. Holding the strip of paper close to their lips, students should blow gently across it. The strip of paper should lift.
6. Reinforce the idea that the air's speed and whether the air moves over or under the wing affects air pressure. Reinforce that this is what causes lift.

### *Airfoils*

1. Explain the shape of an airfoil. Have a diagram of an airfoil drawn on the whiteboard. Have the students bend their strips of paper into the shape of an airfoil. Explain that airplane wings are shaped like an airfoil in order to obtain lift.
2. The air splits at the wing's leading edge. The air that flows above the airfoil has lower pressure, and the air that flows under the airfoil has higher pressure.
3. The air below the wing pushes up toward the air above the wing. The wing is then lifted by the force of the air. The faster an airplane moves, the more lift there is.

### *Engineering a Glider*

1. Give each student one sheet of lightweight paper and instruct them to fold their own paper glider design. At this time, they may not use anything except the paper for their glider.
2. After all students have completed a glider, have each student complete three flights. They should record the flight time and distance traveled by the glider on their student page.
3. Ask the students if they believe they could make a better glider if they had more materials. This time, provide other materials such as paper, cardboard, tag board, staplers, tape, scissors, paper clips, aluminum foil, and glue. Give students 20 minutes to complete a new and improved glider.
4. After making the new glider, each student should complete three flights and record the flight data on their student page.
5. Have them discuss why the new design performed differently from the previous design.
6. Have students write a paragraph on why they think their design was an improvement or not.



## TROUBLESHOOTING

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There are bound to be disappointments when designs fail to fly. Explain to the students that most designs are not successful the first time. This is how things are improved. Encourage the students to keep trying until they achieve success with their own design.

## EXTENSION ACTIVITIES

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- ▶ Provide students with interactive websites about Bernoulli's principle.
- ▶ Have students find a different way to demonstrate Bernoulli's principle. They can research online to find examples.

## ASSESSMENT

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1. What causes lift?
2. Why are airplane wings shaped the way they are?
3. Why is air classified as a fluid?