

# AIRFOIL LIFT



**GRADE: 3, 8**  
**SUBJECT: SCIENCE**

## STANDARDS

3<sup>rd</sup>: 3.1.a, 3.2.a, 3.2.c, 4.1.a, 4.2.c  
8<sup>th</sup>: 8.2.2

## Disciplinary core:

Life Science, Physical Science,  
Engineering

## Overview:

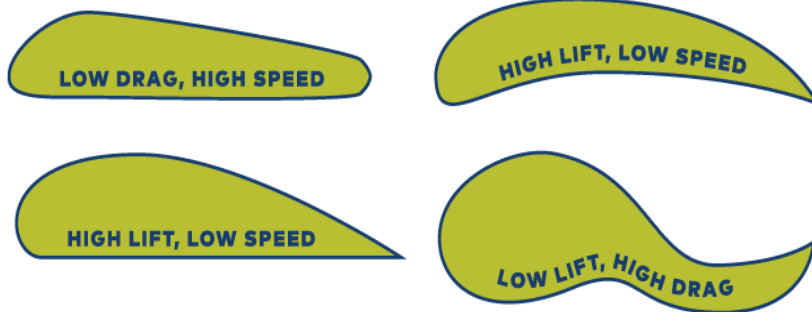
This lesson will explore the pushing/pulling force of lift through airfoil design. Students will explore Bernoulli's principle through hands on experiments. Activity 1 will introduce the concept of lift and allow the instructor to gauge student's previous knowledge. Activity 2 will focus on design and testing of airfoils. Experiments allow for measurable data and comparative analysis. Content will be tied to NASA resources and The Leonardo **FLIGHT** exhibit.

## MATERIALS

- 1.5 Drinking straws per student
- 1 Scissors per student
- 3' length of string per student
- Small desk fans or hair dryers
- Copy paper
- masking tape

## Objectives: Student will be able to:

- Investigate how an airfoil creates lift
- Design an airfoil
- Construct a model of an airfoil from materials provided
- Observe how their airfoil operates
- Explain and demonstrate Bernoulli's Principle
- Explore the action of lift as a force in flight



## Vocabulary:

**Airfoil:** a structure with curved surfaces designed to give the most lift; used as the basic form of the wings, and stabilizers of most aircraft.

**Lift:** force of the air acting on an airfoil, usually upwards and at a right angle to the direction of flight

**Drag:** force of the air acting on an airfoil; usually slowing the airfoil's speed and caused by disruption of airflow by the wing and other protruding objects

## Cross Cutting Science Concepts:

- Patterns
- Scale and proportion
- Cause and Effect
- Systems and system models

## Science & Engineering Practices:

- Asking questions
- Planning and carrying out investigations
- Constructing explanations
- Obtaining, evaluating, and communicating information



# 5E Lesson Plan

## ENGAGE: Access Prior Learning / Stimulate Interest / Generate Questions

1. Ask students: “How do planes fly?”, “How do birds fly?”, “What is similar about the way planes and birds fly?”, “What is different?”
2. Guide students to understand that both planes and birds achieve flight through the use of wings.
3. Tell students that they will be exploring the special properties of wings.

## EXPLORE: Students Experiment / Develop Own Understanding

### Demonstrate and introduce Bernoulli’s Principle.

1. Instruct students cut the strip of paper from their sheet and to tape a drinking straw to it.
2. Ask students what will happen when they blow in to the straw. Will the paper move towards the straw or away from it?
3. Ask students to blow into the straw. (The paper should respond by moving **toward** the stream of moving air.)
4. Ask students to explain why the paper moves as they observe.
5. If students struggle to explain this phenomenon, offer additional examples: Think about a windy summer day. You are sitting in a house and the wind pushed the curtains away from the window. When the wind rushes out of the room the curtains are pulled into the screen and the air leaves the room.

## EXPLAIN: Concepts Explained / Vocabulary Defined

1. When air moves over under and around an object, the air can push or pull the object in different directions.
2. When the student blows into the straw he/she creates an area of faster moving air. The slower-moving air under the paper now has higher pressure, pushing the paper up, towards the area of lower pressure.
3. Describe an airfoil to students. An airfoil is an aerodynamic surface shaped used for testing the reaction from the air through which it moves.
4. Bernoulli’s principle says that high pressure on one side of an object pushes the object away, into the area of lower pressure. For example, if air were to move faster above an object, high pressure below would push the object upward. And high pressure on top of an object moves the object downward Bernoulli’s principle explains how the pressure of gas (or a liquid) decreases as the velocity increases. High velocity then creates low pressure.

## ELABORATE: Applications and Extensions

### Build and Test an Airfoil

1. Instruct students to make an airfoil. Cut out the airfoil template. Cut or punch a hole as indicated. Bend on line and tape both edges together. Line up the holes and thread straw through the holes, then thread string through the straw. Look at airfoils of other students. Do all of the airfoils look alike? Depending on the neatness of the folding and taping, students will have some diversity in airfoil shape, allowing for more testing.
2. Ask students to complete the “Hypothesis” section of the Student Activity Sheet.
3. Model test process of students. Hold airfoil by the end of the strings so that the airfoil is horizontal. Test airfoil by walking fast or running, the airfoil should lift and travel up the string.
4. Extension: The lesson can be extended by marking measurements on string and including a timed race to observe level of lift. Student may record their observations and draw a diagram of the experiment.

## EVALUATE

Formative Assessment: Observe student process and use prompting questions to check for understanding.

Summative Assessment: Instruction students to complete the “Conclusion” section of the Student Activity Sheet.

NAME: \_\_\_\_\_



**HYPOTHESIS**

What do you think will happen when air moves over your airfoil?

-----  
-----  
-----  
-----  
-----

**CONCLUSION**

What did you observe during the experiment?

-----  
-----  
-----  
-----  
-----

Why did this happen?

-----  
-----  
-----  
-----  
-----

Tape Straw Here

NAME: \_\_\_\_\_



TOP



NAME: \_\_\_\_\_

BEND AIRFOIL HERE DO NOT FOLD



BOTTOM

