GRADES 3–5

TIME
30–45 minutes

BUILDING A BOX KITE

Science

CHILDREN'S MUSEUM INDIANAPOLIS®

BUILDING A BOX KITE

The Children's Museum's lessons are designed to weave classroom experiences and museum education together. All lessons are interdisciplinary and can be used as individual classroom experiences or in combination to create a cohesive unit. Lessons are optimized when used in connection with museum field trips.

Students will investigate how moving air causes a **kite** to fly. Students will construct a paper box kite to investigate **weight** and **lift**.

FOCUS QUESTIONS

- Why do flying objects react to the forces of flight?
- How do different tails change how a kite moves through the air?
- Why do engineers perform many redesigns and retests?

INDIANA ACADEMIC STANDARDS

Science: SEPS.1, SEPS.2, SEPS.3, SEPS.4, 3.PS.1, 4.PS.1, 3-5E.1, 3-5E.2, 3-5E.3

OBJECTIVES

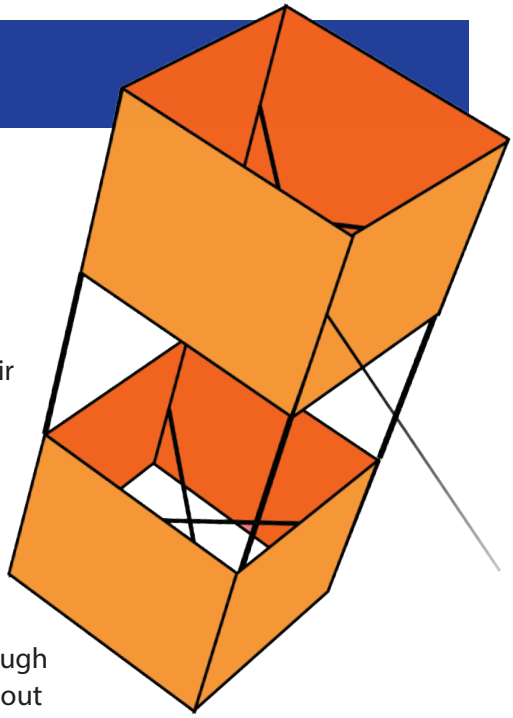
Students will:

- Build and fly a model paper box kite.
- Use the engineering design process to build and modify a kite.
- Test design modifications to a kite and observe changes in the kite's movement through the air.

MATERIALS

- Scissors
- Copy paper
- Tape
- String
- Ribbon
- Ruler

Testing the Tail



PROCEDURES

- Ask students if they've ever flown a kite before. What was it shaped like? Did it have a tail? What do they think kept the kite up?
- Share with students that air, though we can't see it, is matter in the form of a gas. It can exert **force** on other objects. Vehicles that fly, like planes, feel air in the form of drag, or air pushing back against them as they move forward. Explain how objects moving through the air are subject to the four forces of flight: lift, weight, thrust, and drag.
- Share that you are giving students an engineering challenge using a simple kite. Explain the engineering design process: design, build, test, evaluate, repeat.
- Urge students to make careful observations of their kites as they move through the air. How well does it glide? Is the kite stable? Have the students think about their observations and develop a hypothesis about how the shape, length, and material of the kite's tail affects its ability to move.
- Based on their hypotheses, have students modify the kite tails to improve their ability to fly. Test the kites a few more times, and have students make about observations about how the kite flies. What types of tail designs improve the kite's ability to fly?

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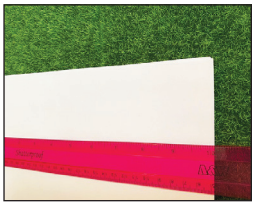
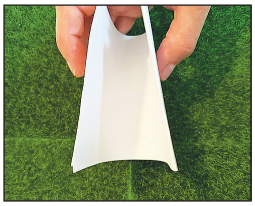
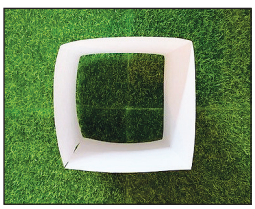
1 Cut a strip of paper that is 3" wide by 10" long.



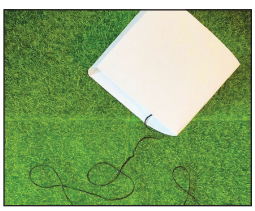
2 Fold the paper in half "hamburger style," then fold in half again, to make four equal sections.



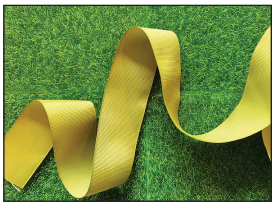
3 Make a box shape by folding along creases you just made and tape it closed.



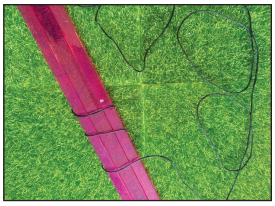
4 Tape 2 feet of string inside one corner of the box kite. This is the kite string.



5 Tape your tail onto the corner opposite the kite string. Create a tail, any length, using different materials such as yarn, ribbon, spirals of paper, fabric. The options are endless!



6 Tape the other end of the kite string to a ruler. This will be the handle of the kite.



7 Take the kite somewhere where there is space to run. Take the handle and lift the kite in the air while running.

Forces of Flight

Any object moving through the air is subject to the four forces of flight. **Gravity** pulls down on the mass of the object, while a well-designed object can generate lift, which counteracts gravity. Thrust is the force of forward motion, provided by engines, propellers, or even a human's arm, and it is counteracted by drag, the force of air resistance pushing backwards. These forces must be in balance for heavier-than-air flight to occur. If the object has too much mass, gravity will counteract lift. If the object isn't aerodynamic enough, drag will keep it from creating suitable thrust to achieve lift.

The shape of any object determines how it moves through the air, whether it generates lift and how much it generates, and whether it can counteract drag. In the case of the box kite, the mass and shape of the tail can dramatically alter its movement through the air.

VOCABULARY

- **Force**
- **Gravity**
- **Kite**
- **Lift**
- **Weight**

KITE PHYSICS

When air moves against the surface of a kite, it exerts a force. When the force of the moving air is greater than the weight of the kite, the kite lifts off the ground and flies. The kite— because it is being pulled with an attached string—exerts an equal but opposite force against the moving air. When the force due to the moving air and the force exerted by the kite string are equal, the kite stays aloft.

KITE HISTORY

There are many different types of kites. Some kites, like the Chinese and Japanese designs, come from hundreds of years of research and flying. People around the world have used kites for hundreds of years for many purposes, including military observation and even to look for fish from a vessel at sea. The Wright brothers used a kite to learn how to control an aircraft. Modern kites are made with special materials for special purposes. Some are enormous and ornamental, while others are sleek and designed for maneuverability and stunts. Regardless of size or type, all kites lift into the sky because of the push of moving air. They make use of the forces of flight similar to a powered, heavier-than-air vehicle.

ENGINEERING DESIGN

There are many types of engineers--electrical, mechanical, chemical to name a few. Engineers who design and build aircraft are called aeronautical engineers. Regardless of an engineer's field, however, they all follow the same process. The first step is to set a goal for their project. Second, the engineers create a design to achieve that goal. Third, they build a basic version of the project based on that design called a prototype. The prototype is tested to see how well it achieves their stated goal. Prototypes may not work as expected on their first test, so engineers redesign, rebuild, and retest until there is a prototype that meets their initial goal as well as it can.

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