### **GRADES K-5**

**TIME** 30–45 minutes

# **BUILD A PARACHUTE**





## **BUILD A PARACHUTE**

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 explore different types of aircraft by examining books and photos. Students will use a **parachute** to explore how **air** pushes up against an object and slows it down as it falls.

#### **FOCUS QUESTIONS**

- How does air exert **force** on objects?
- How are parachutes designed to ensure they fall slowly?
- How does mass affect the movement of a parachute?

#### INDIANA ACADEMIC STANDARDS

Science: SEPS.1, SEPS.2, SEPS.3, SEPS.6, K.PS.2, 3.PS.1, 4.PS.1

#### OBJECTIVES

Students will:

- Brainstorm a list of ways humans travel through the air.
- Build a simple parachute.
- Observe the force of air pushing against an object.





#### MATERIALS

- Paper and pencils
- 10" beverage napkins
- String
- Scissors
- Rulers
- Paper clips
- Small round stickers or tape

## **Test the Parachute**

#### PROCEDURES

- Show the students a video of something that uses a parachute: a skydiver, drag racer, or the space shuttle landing.
- Ask the students to think about the purpose of the parachute in the example. Have them describe what physically happened to the parachute. What might have caused the parachute to behave this way?
- Share that parachutes use one force to counter another in the opposite direction. Explain to students that they will be working in pairs to build and test their own parachutes using the engineering design process: design, build, test, evaluate, repeat. Complete the steps below, then continue the discussion.
- Provide students with time to share their observations about how the paper clips fell with the parachutes.
- Ask students why they think the parachute caused the paper clip(s) to fall more slowly. Share that air is matter, and like all matter, it has mass. A parachute catches air and uses its mass to slow down a moving object, a paper clip in this exercise.
- Remind them that parachutes use one force to counter another. Discuss how the air pushes against the parachute as it falls and causes it to fall more slowly. Parachutes use the force of air resistance, called **drag**, to counter gravity (an object falling) or **thrust** (forward motion, such as a drag racer or the space shuttle.)



Completely unfold the napkin. Cut four strings to the same length (about 6-8 inches).





Using a sticky dot, or small pieces of tape, attach a string to each corner. This will become the underside of the parachute.







One student stands on a chair and releases the parachute, while the group observes as the student drops the parachute.

- What does the parachute do when it is dropped?
- Does the napkin open all the way?
- Why do you believe the paperclip needs to be included in the project for it to succeed?



Modify the design of the parachute by changing the length of the strings. Observe each new drop and compare it to the previous ones. Which length creates the slowest, most stable drop?



OUT!

## **Forces of Flight**

Flight through the air is possible because air is matter, and like all **matter**, air takes up space and has **mass**. The forces of flight result from the interaction of the aircraft (solid matter) and air (gaseous matter). In flight, push forces (lift and thrust) oppose pull forces (**gravity** and drag). A push force creates thrust that moves an aircraft forward, and drag opposes it, slowing down the forward motion. A push force creates lift that opposes the pull weight of an aircraft so that it can rise through the air.

#### PLENTY OF PARACHUTES

Parachutes are used for many purposes and thus come in many different types. A basic half-dome, round parachute is used by military paratroopers and for cargo drops. Its simple shape provides only drag. Holes and shape modifications can be made to allow for limited steering and forward motion. Another example of a round parachute are drogue parachutes. Drogue parachutes are the types deployed by forward-moving objects to help slow them down. Their design is more elongated than a normal parachute, which lowers the drag it can provide, but also allows it to be deployed at much higher speeds. Rectangular canopy-shaped parachutes, usually used by recreational skydivers, are called ram-air parachutes. They are made of a row of "cells" that are open in the front, allowing them to catch the air and form the parachute into an airfoil shape, providing it with life and steerability.

#### **EXTENDING EXPERIENCE**

To extend the experience, students can try adding more **weight** to the parachute. They can test their original designs and make design modifications to handle additional weight. This is also a good time to share that weight is an important consideration when designing parachutes.

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#### VOCABULARY

- Air
- Force
- Drag
- Thrust
- Weight

#### ENGINEERING DESIGN

There are many types of engineers--electrical, mechanical, chemical to name a few." Or "Electrical, mechanical, chemical are only a few types of engineers; there are many more. Engineers who design and build aircraft are called aeronautical engineers. All engineers, in any field, follow the same process. follow the same process. The first step is to set a goal for their project. Second, create a design to achieve that goal. Third, build a basic version of the project based on that design. Once they have built this prototype, it gets tested to see how well it achieves their stated goal. Prototypes never work perfectly on the first test, so engineers go back and start the cycle anew: redesign, rebuild, and retest until there is a prototype that meets their initial goal as well as it can.

Gravity

Mass

Matter

Parachute



#### WATCH IT!

The Smithsonian National Air and Space Museum has a wonderful learner-centered website about "How Things Fly" (<u>http://howthingsfly.si.edu</u>) that teaches about the forces of flight.