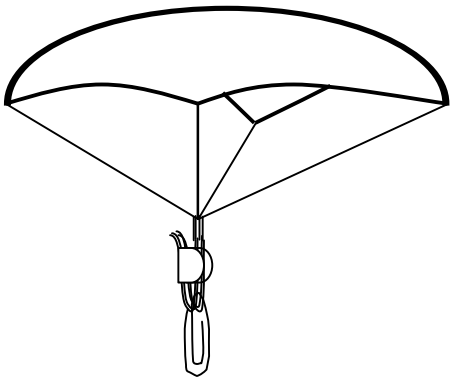
EXPLORATORIUM INSTITUTE FOR INQUIRY

Making, Testing, and Observing Parachutes

Make A Parachute

- Use a 10" (25 cm.) square napkin
- Cut 4 pieces of string 10” (25 cm.) long
- Using a sticky dot, secure a string to each corner
- Bring the free ends of the four strings together and run them through the paper clip
- Fold up the strings to form a loop. The paper clip should hang from the loop
- Wrap a sticky dot around the strings to secure the loop
- Pull the parachute up in the center. Make it as flat as possible
- Fold the parachute twice (as demonstrated)
- Lay the string with paperclip on top of the folded side
- Throw the parachute up into the air (underhanded with paperclip side up as demonstrated)
- Repeat. Try to keep tosses the same



Record your observations and questions in your notebook

Planning and Investigating with Parachutes

IMPORTANT - Consider the following questions:

- What parts of the parachute and the way you launch it will stay the same? What one thing will you change?
- What will you observe or measure to answer your question? (e.g. speed, accuracy, path of descent, etc.)

Investigation Question:

Materials Needed for Investigation:

My first step will be to …

My next step(s) will be …

Preparing to Share Results & Sharing Out

What was your question?

_____

_____

_____

What did you make and do to try to answer your question?

_____

_____

_____

What did you find out?

_____

_____

_____

We think this happened because…

_____

_____

_____

PREPARE TO SHARE YOUR IDEAS WITH THE GROUP

Reflective Prompt about Process Skills after the Parachutes Investigation

Reflect on the investigation you just did and consider:

- What do you think makes a good investigation question?
- What do you think makes a good investigation plan?
- What do you think makes a good investigation presentation?

Facilitator Background

Main Science Ideas about Parachutes

Air exists as a substance and can act against objects (is a force)
The force of air against objects is called air resistance or drag
The faster an object (or the air) goes the greater the drag
The greater the effective area[1] of the parachute the greater the drag
The shape of a parachute as it falls determines its effective area
The forces acting on a parachute are gravity pulling down and drag pushing up[2]

1 The effective area of a parachute is actually the cross sectional area of the falling parachute as seen from below. The effective area is smaller than the surface area of the parachute material.

2 As the parachute starts to fall, the downward force on it (its weight) is larger than the upward force on it (mainly its drag) so it speeds up. As it speeds up, the drag increases (The drag increases as the square of the speed. That means, for example, that if it is going twice as fast, there is four times the drag). When the parachute reaches a certain speed, the downward force is equal to the drag and it continues its fall at a constant speed.

Variables that make a difference:

- Shape of the parachute. *Parachutes that are dome shaped run into more air as they fall. The more air the chute hits, the more the air slows it down.*
- Material flexibility. *Flexible materials fall more slowly become they can become dome-shaped more easily than more rigid materials.*
- Parachute size. *Larger size parachutes can have greater surface area and usually have greater effective area. This makes them fall more slowly. However, increasing the size of the parachute too much without increasing the hanging weight makes the parachute lose its dome shape by flattening out or crumpling and thus reducing the effective area.*
- String length. *If the strings are too long, the parachute becomes teardrop shaped rather than dome shaped and has less effective area so it falls more quickly. More strings can increase the overall effective area of the parachute and make it fall more slowly, however, the additional string also adds weight. If the additional string is heavy, it can make the parachute fall more quickly.*
- Parachute weight. *Increasing the weight makes the chute fall faster, but not as much as one might expect. Adding a second washer does not make it fall twice as fast for 2 reasons. The washer is only a fraction of the weight of the whole chute, so adding one more only increases the overall weight a small percentage. Also, as the parachute falls faster, the air resistance increases and slows down the parachute (think of speeding up in a car with your hand out the window). So it takes a lot of added weight to make a lot of difference.*
- *Parachute stability. Air spills out the edge of a parachute as it falls. This can make it rock back a forth, lessening the effective area and making it fall more quickly as it rocks. Flat shaped chutes rock more than dome shaped chutes and so can fall more quickly. Holes in the center of the chute can make the air spill without rocking, and make the chute fall more slowly.*