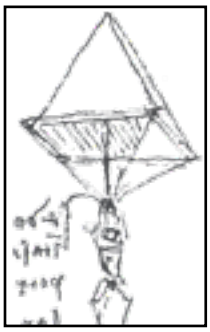
Lesson #4 Parachute Designs



Grades K - 4
Duration 45 minutes
Grouping 2-3 students

Engineering Criteria: Design a parachute that descends as slowly as possible to the ground.
Design Constraints: Materials, parachute must be dropped from 2 meters.

Synopsis

Part 1: Students will initially be given time to experiment with their own parachute designs.
Part 2: Students will conduct fair tests on a standardized parachute design but will focus on determining which material works best as a parachute canopy.

Ask

How can astronauts and spacecraft return safely from space?

Tell the students that they are again going to being examining how to slow the descent of returning spacecraft and astronauts. Have them review some of what they learned from the Wind Tube lesson with an emphasis on how air can cushion objects, especially if they are light enough and if their shape can “rest” on enough air. For older children the term **air resistance** should be used.

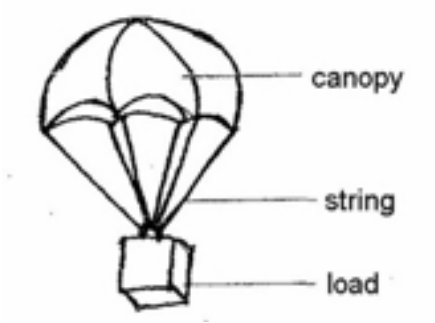
Imagine

Have the students imagine and recall the different ways things fly and float. They will probably think of parachutes, but if not, suggest this possibility.

Plan

Younger Students Show younger students a diagram of a standard parachute with its three main components; **canopy, strings (suspension line)** and **load.** Build and demonstrate how to construct a basic parachute with an emphasis on taping the strings to the four corners.

Older Students Have students sketch and discuss ways they could construct parachutes. Show the materials available to them. There’s a parachute design worksheet available for sketching ideas. They could draw their initial designs on one side and then draw their final, improved product on the back. In their diagrams they can specify the materials being used.



Create

Give students the opportunity to build their parachutes and test them out.

Improve

Encourage students to try out their parachutes and improve their designs in order to create longer "flight times".

Ask / Reflect

Reflect on what they observed and learned. Examine data and have students to determine if their hypothesis was supported by the evidence they collected.

Materials

Per Student or Per Group

- Copy paper / Tissue Paper (25cm squares) or other materials of the same dimensions plastic, construction paper, card stock or cotton cloth could be used as well
- Strings (25 cm in length) or more strings if students are initially designing own
- Roll of tape or stickers (for attaching strings)
- "Load" - A variety of objects could act as the load as long as everyone has the same type, e.g. washers, big paperclips, paper cut out of astronaut (a blackline master of an astronaut image is incl. in this lesson plan. To give the "astronaut" more with one might attach a paperclip to it to give it more weight)
- Scissors
- Timers

Part 1 Experimental Design Step-by-Step

1. Follow guidelines in **Ask, Imagine, Pan** sections

2. Have students sketch some ideas of what their parachute will look like.

3**.** Students follow the engineering design process in building an experimental parachute and testing it's ability to float to earth. .

4. Compare results and designs with the whole class.

5. Highlight the natural inclination students most likely exhibited in following the Engineering Design Process when they "tinkered" with their parachutes to make them work better.
9. In the next session, the experiment will be a more controlled "fair test" in which the material of the canopy is the focus of study.

Part 2 Parachute Canopy Material Experiment Step-by-Step

1. Tell students they will be comparing copy paper vs. tissue paper canopies.
3. Have them write on their worksheet (or indicate with a thumbs-up vote) which material they think will create a parachute with the longest "flight time".
4. Review what a **fair test** is in science. Today's experiment will be fair because the type of strings, their length, the height from which they are dropped and the "load" being carried by every parachute will be the same. Again, this can be written down on their worksheet.
5. Have them identify what today's **variable** will be; the materials for the canopy - copy paper and tissue.
6. Tell students they will be timing their parachutes when they are dropped from a height of 2 meters.
7. They will do four trials and record the results of each.
8. If timers prove too tricky for young ones, simply have them count, "One thousand one, One thousand two, etc.", as their parachutes glide down.
9. Older students can graph their results or calculate the average "flight time" of each type of parachute if they finish before other groups.
10. Distribute materials.
11. Students conduct their trials.
12. Discuss results and determine if hypothesis was supported or not by the data.

Assessment

Younger Students

Use a tally chart to have groups report their results to the class. Discuss their observations and discoveries. Remind them of the Engineering Design Process and have them "walk through" what they've done and what would come next. They brainstormed ideas, built parachutes, tested them and now they can improve them. Have them brainstorms what variables they might try next to slow a parachutes descent. In another session one could have them try out their ideas and watch the results.

Older Students

Students should find the average flight time of each of their parachutes. They can graph their results. As a class, discuss their results, observations and discoveries. Ask, "From an engineering perspective, which material would make for a better parachute?". Another factor one can now bring in is durability. Even if tissue works better it certainly couldn't bear the weight of a sizable object, even if it had a huge surface area. This is known as a **trade off** when making engineering decisions, weighing the benefits or thing versus its drawbacks. Copy paper for instance would have the advantage of being

a bit more sturdy on the other hand, both tissue and copy paper would be difficult to pack and deploy properly on a real space mission.

FAQ

What is the history of parachutes?

Today's lesson will be looking at materials that can be used to make parachutes. During the history of aviation everything from silk to cotton to polyester have been employed in parachutes. The first recorded parachute design was by Leonardo da Vinci in 1495. His design used linen and wood. Astronauts today still use parachutes to slow their craft's descent when they return from the space station. Parachutes were also used to help rovers land on Mars. Currently, NASA is developing a new landing vehicle known as the Low-Density Supersonic Decelerator (LDSD). It also uses a huge parachute that is 100ft. wide, the largest parachute ever used to slow a supersonic craft!

Parachutes

Engineer (s) _____

1. **Question**: What material will work best in allowing a parachute to descend as slowly as possible?

Variables: **Copy paper** or **Tissue Paper**?

2. **Hypothesis**: I think _____ paper will make a better parachute

because _____.

3. **Experiment**

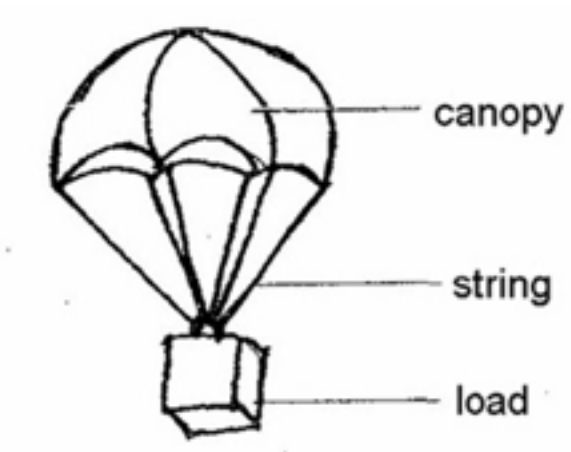
What is the variable we are changing in this experiment? _____

What parts of the experiment will be the same so that it is a “fair test”?

_____

To do . . .

A. Construct a parachute with four strings, one sheet of paper and a load.
B. Take turns dropping the parachute from a height of 2m.
C. Record how long it takes the parachute to reach the floor.
D. Test the parachute four times.
E. Repeat experiment with parachute #2 using a different type of paper.
F. Graph results



4. **Data** **Parachute # 1 Type of Paper** _____

Trial #1	Trial #2	Trial #3	Trial #4
_____ **seconds**	_____ **seconds**	_____ **seconds**	_____ **seconds**

Parachute # 2 **Type of Paper** _____

Trial #1	Trial #2	Trial #3	Trial #4
_____ **seconds**	_____ **seconds**	_____ **seconds**	_____ **seconds**

5. **Analysis** Graph your results and look for patterns

TIME (seconds)	**Trial #1 Copy Paper**	Trial #1 Tissue Paper	**Trial #2 Copy Paper**	Trial #2 Tissue Paper	**Trial #3 Copy Paper**	Trial #3 Tissue Paper	**Trial #4 Copy Paper**	Trial #4 Tissue Paper
10								
9								
8								
7								
6								
5								
4								
3								
2								
1								

6. **Conclusion** Based on the data you collected, was your hypothesis correct?

My hypothesis was _____ by the evidence we
(**supported / not supported)**

collected because it showed that _____ paper created a slower parachute.