

Robogals Science Challenge



Minor Challenge Set #3

STEM Field: Mechanical Engineering

Level: Intermediate / Senior

Challenge Name: Design A Parachute

Project cost: 0-20 USD

Materials required:

- At least 2 different types of paper, such as:
 - Tissue paper
 - Newspaper
 - Paper towels
 - Normal printed paper
 - Thin cardboard paper
- String
- Tape
- Small, heavy objects to use as weights. For example, coins, marbles, washers
- Measuring tape
- Ruler

Duration:

- The hands-on time for this challenge is about half an hour, however, the time guideline is an estimation only, and students and mentors can complete the tasks around their schedules.

Introduction:

A parachute is an umbrella-shaped device used to make a safe jump from aircraft. Parachutes use a large canopy to increase air resistance during this fall, as air resistance creates a drag force to slow down the motion of the falling body and have a soft landing. Without air resistance, the object would continue to increase speed of the fall until it hits the ground.

Two most common factors that have a direct effect upon the amount of air resistance are the speed of the object and the cross-sectional area of the object. The greater the speed, the greater the amount of air resistance is experienced. The greater the cross-sectional area, the greater the amount of air resistance is experienced.

Instructions:

- 1) Create a circle with a diameter of 12cm or 5 inches on the chosen paper. Cut this circle, then make a hole in the centre of the shape.
- 2) Cut 6 pieces of equal length string and tape them at equal distances around the edge of the shape.
- 3) Combine the other ends of the strings and tape them to a smaller, heavy object that acts as weight. An example is shown below.



- 4) Test the parachute from a specific height. Use a measuring tape and record the height you drop the parachute from, and observe the fall - does it fly slowly and land gently?
- 5) Repeat the process with another type of paper, and record your observations. Ensure the height at which the parachute is dropped is the same as step 4.
- 6) On the same type of paper as your first parachute, vary the size of the shape (i.e. increase or decrease the diameter of the circle). Ensure the height at which the parachute is dropped is the same as step 4. Record your observations.
- 7) Use any parachute and add more weight. Record your observations.

Extension:

Design a new shape for the parachute. For different shapes of equal area, such as a square, rectangle, circle, triangle, which shape would demonstrate the slowest descent rate?

Reflection Questions:

- Are there any improvements you would make to this challenge?
- Summarise your observations - which type(s) of paper make a better parachute? Does the diameter of the circle affect how the parachute falls and lands? How about changing the weight?
- From your own research, what materials are used to make parachutes in real life? What shapes are parachutes? What are some safety features that are designed to keep the parachutist safe?

Submission Guidelines:

- Submit photos of your parachutes. Include a short summary that addresses the reflection questions.

Note: Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your mentor first.

- The submission form is on the Minor Challenges page:
<https://sciencechallenge.org.au/index.php/minor-challenges/>
Fill out the details and make sure you upload your submission.

Learn More! Resources:

- This article explains in-depth how air resistance and drag force work -
<https://www.physicsclassroom.com/class/newtlaws/Lesson-3/Free-Fall-and-Air-Resistance>

Bibliography:

- *Design a parachute - activity* (no date) *TeachEngineering.org*. Available at: https://www.teachengineering.org/activities/view/design_a_parachute (Accessed: May 8, 2023).
- *Free fall and air resistance* (no date) *The Physics Classroom*. Available at: <https://www.physicsclassroom.com/class/newtlaws/Lesson-3/Free-Fall-and-Air-Resistance> (Accessed: May 8, 2023).