Robogals Science Challenge

Minor Challenge Set #2
STEM Field: Physics
Level: Intermediate
Challenge Name: Falling with Style
Project Cost: 0-20 USD
Materials Required:

- Paper
- Scissors
- Ruler
- Paper clips
- Colour pencils to decorate
- Access to a printer to print template (optional)

Safety:

- Adult supervision advised for cutting with scissors

Duration:

- The challenge take approximately 1 hour to finish, however, the time guideline is an estimation only, and students and mentors can complete the tasks around their schedules

Introduction:

How does a helicopter stay in the air? And why do sycamore seeds twirl as they fall to the ground? Let's investigate why things fly and fall in interesting ways!

In this experiment, we will build a **paper helicopter**. When we drop the paper helicopter from a tall height, we can watch how it falls in a unique

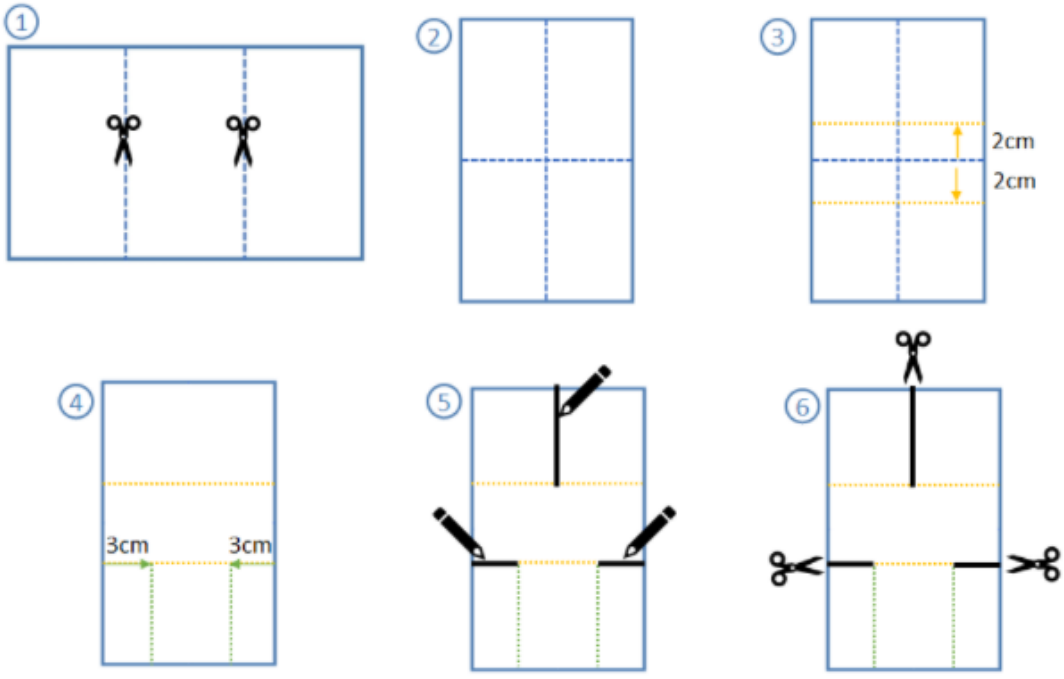
way. The reason our paper helicopter falls in this way is all to do with **forces**.

Instructions:

Part A: Create Your Paper Helicopter

Print and cut out the template provided on page 7, or follow steps 1 - 6 to draw your own.

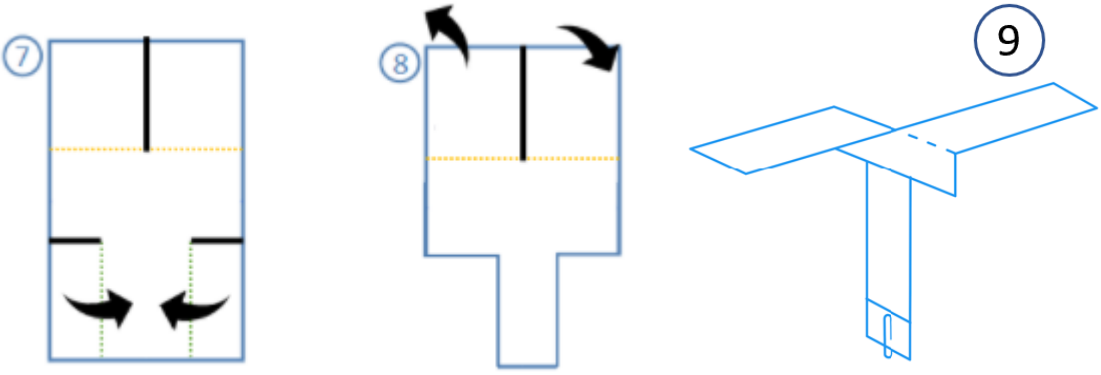
1) Take an A4 piece of paper and cut it into 3 equal parts (diagram 1)
2) Take 1 part and fold it into quarters (diagram 2)
3) Measure 2cm above and below the middle fold and draw 2 horizontal lines (diagram 3)
4) Measure 3cm from the left and right and draw 2 vertical lines (diagram 4)
5) Draw a vertical line from the upper line to the top of the page and two horizontal lines along the lines you just measured (diagram 5)
6) Cut along these 3 black lines as shown in the diagram below (diagram 6)



After you have got a template, continue with steps 7-10 to build your paper helicopter.

7) Fold the bottom sections inwards (diagram 7)
8) Fold the two wings at the top in opposite directions to each other (diagram 8)
9) Add a paper clip to the bottom of the paper helicopter (diagram 9)
10) Now you can decorate using colour pencils!

Tip: Do not use colour pens to decorate, only pencils.



Now you're ready to drop your paper helicopter and watch it fall to the ground. Make sure to stand on your tiptoes to drop it from as high as possible! Ask an adult if you can stand on a chair to reach even higher.

Part B: Twirling in Different Ways
Let's experiment with our paper helicopters and see what happens!

What direction does your paper helicopter spin? (Clockwise or Anticlockwise). What happens when you fold your wings in the opposite direction? Which direction does your helicopter spin now?

What happens when you add more paper clips? Try having 2 paper clips. How does your helicopter fall?

What happens when you add lots of paper clips?

Make another helicopter but this time cut the wings to make them smaller. Does changing the size of the wings change how the helicopter falls?

Your answer:

Extension - Forces at play

A **force** can be a **push** or a **pull**. When you push open a door or pull open a drawer you are using a force.

What is the name of the force that pulls us back to Earth?

This is the force that pulls our paper helicopters to the ground!

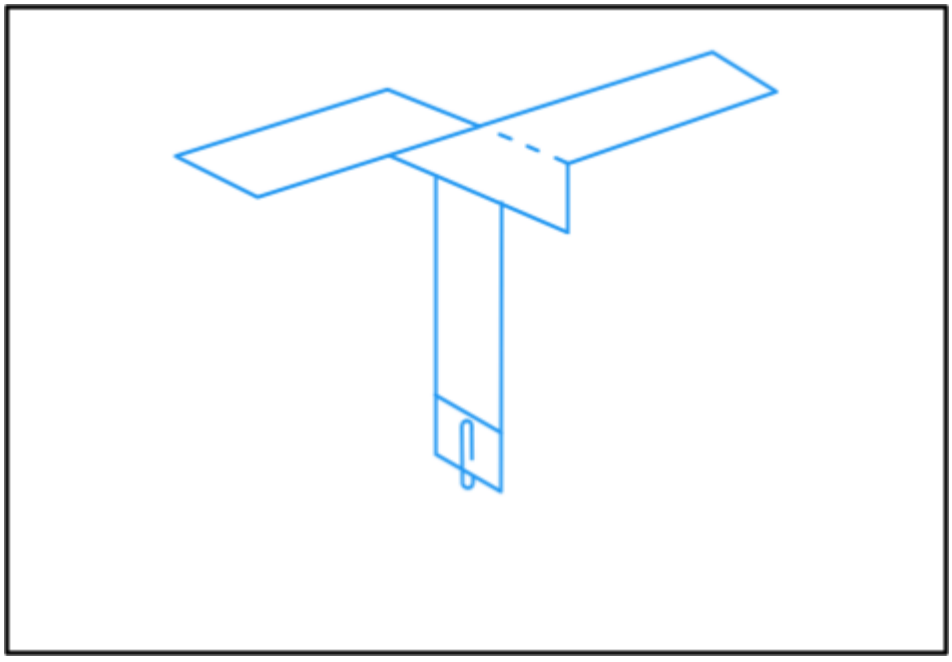
Air resistance is the force that ***slows*** a flying object down. As the paper helicopter falls, air pushes up against the helicopter, slowing it down.

But why does it spin?

Below is a diagram of your paper helicopter. Feel free to colour it in!
Then let's explore the forces acting on it:

1. Draw an arrow showing the direction the force **gravity** has on the helicopter
2. Draw an arrow showing **air resistance** acting on the helicopter.
3. Where does the air go when it reaches the wings? Draw 2 arrows showing the direction of the air along the wings. What do you notice about these two arrows? What direction do they point?

   Your answer:



Gravity pulls down our paper helicopter but air resistance slows it down. Air pushes up and along the helicopter's wings. The two wings are in different directions so they get pushed in opposite directions. This makes our paper helicopters spin as they fall to the ground!

Reflection Questions:

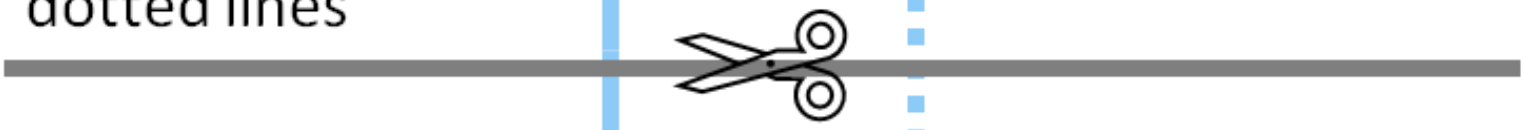
- Are there any improvements you would make to this challenge?
- What real world application/s can you apply this challenge to?
- What are the key science and engineering concepts that relate to this challenge?

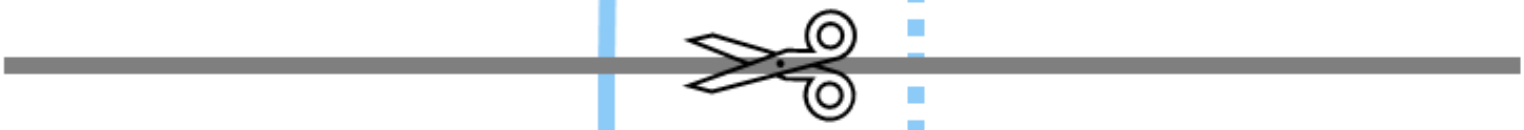
- Scrunch up a piece of paper and drop it at the same time as your paper helicopter. Which one falls faster? Why do you think that is?
- We could only decorate with colour pencils. Why couldn't we decorate with colour pens? Try decorating your helicopter with pens and see what happens
- Helicopters and sycamore seeds can stay in the air because their wings spin round and round. What keeps an aeroplane in the air?

Here is a template of the helicopters

Cut along the solid lines

And fold along the dotted lines





Submission Guidelines:

- Submit photos of the experiment setup, and your answers to questions in the Instructions. 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 parent or guardian 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:

- If you want to explore more aerodynamic concepts, this website provides more explanations on how an aeroplane moves through the air, factors affecting lift, drag, and more! https://howthingsfly.si.edu/aerodynamics/air-motion

- If you are interested in pursuing aerospace engineering, this website provides an overview of what aerospace engineers do: https://careerdiscovery.sciencebuddies.org/science-engineering-careers/engineering/aerospace-engineer

Bibliography:

- Science Museum Group. 2022. Make it fly activity [online] Available at: https://learning.sciencemuseumgroup.org.uk/resources/make-it-fly/ [Accessed 25 Feb. 2022].