AIR PLAYGROUND

Teacher Guide

MUSEUMS VICTORIA

Air Playground

Designed with primary aged students in mind, the Air Playground exhibition is a social and interactive space where students can explore air and all its complex behaviours.

Through open ended tinkering and collaborative play, students develop key STEM skills and dispositions – test, try, fail, iterate. It's a constant experimental process, allowing students to construct their own knowledge of how a gas behaves and how objects move through gases.

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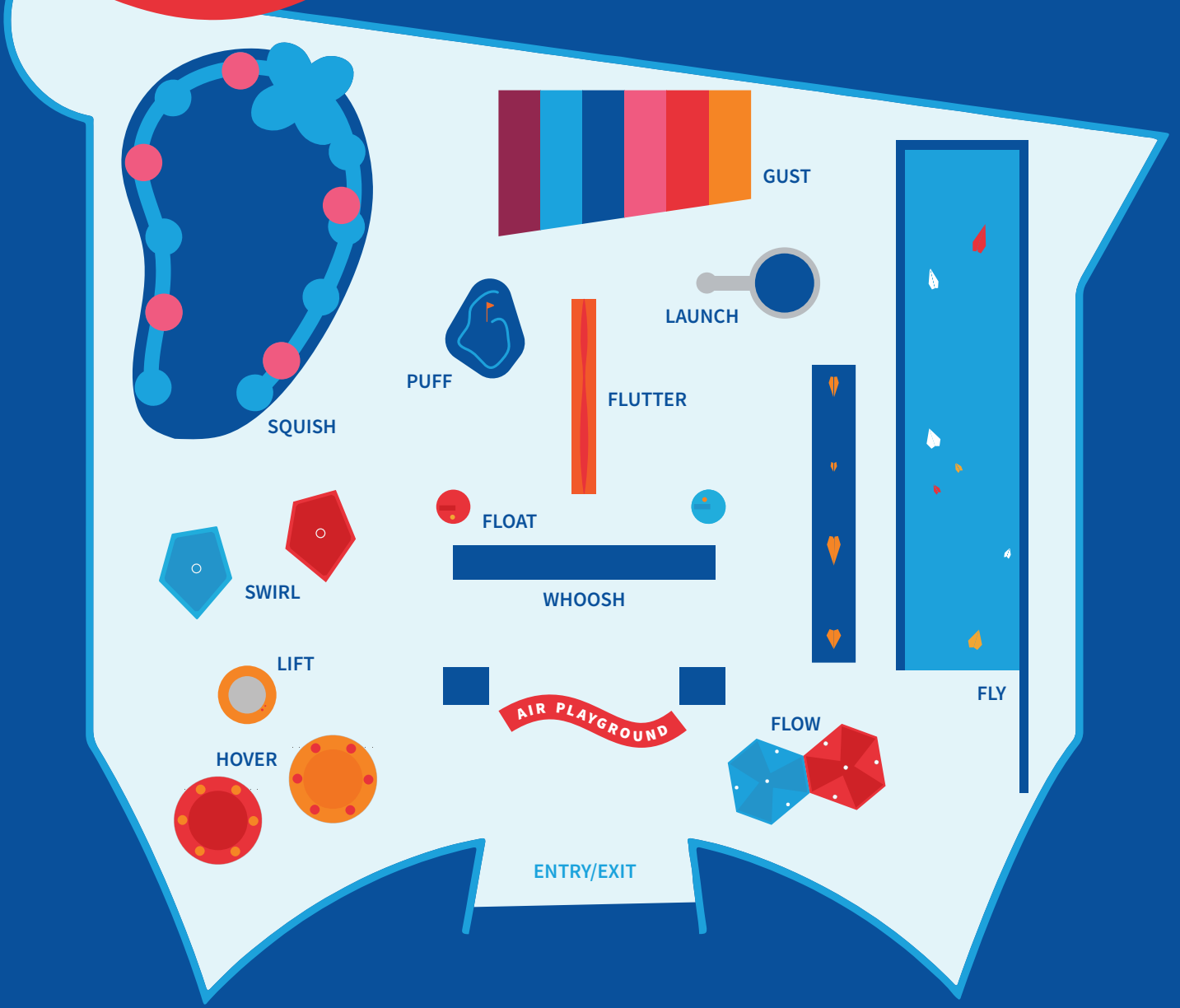
AIR PLAYGROUND



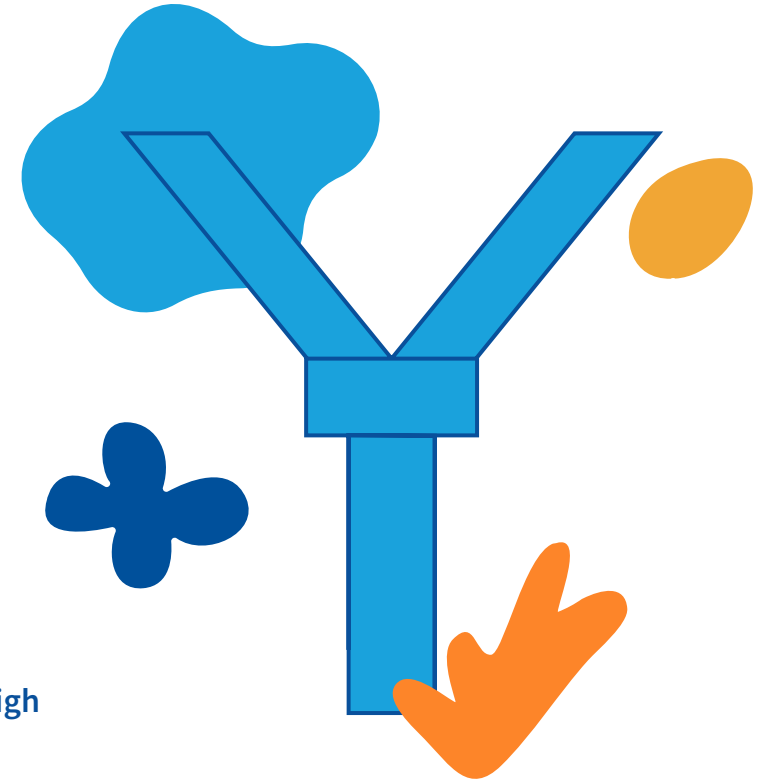
SCIENCEWORKS

PRE-VISIT

SPIN AND FLY

What features help something float or flutter in the breeze?

Make rotocopters with your students to begin their investigation. Use the provided templates and modify their design to test different variables.



As a class, throw the rotocopters up high and watch them spin as they drop.

Ask your students: does its flight change if you modify the

- **Weight** (number of paperclips)
- **Size** (we have provided small and large templates, but you could try to make a tiny or huge one)
- **Material** (thinner or thicker paper, other materials like plastic or thin foam?)
- **Wing shape** (does it matter how the wing is angled, if it's rectangular, curved or pointy?)

PRE-VISIT

SPIN AND FLY

3D Design Challenge

Challenge students to use **TinkerCAD** or **Makers Empire** to design their own spinning flyer.

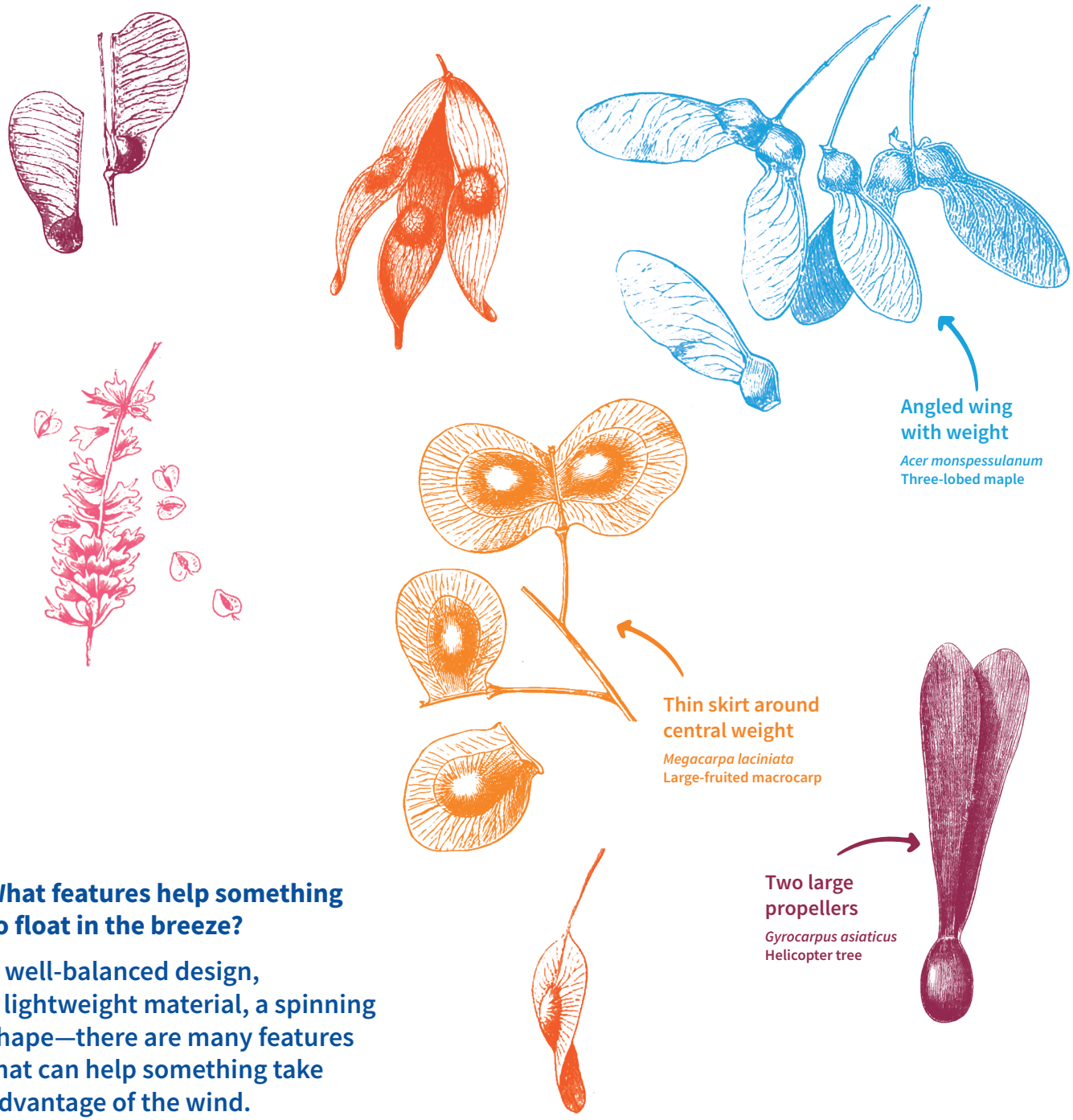
If you have a 3D printer at your school, print a design and test it on the *Lift* air table when you come to the exhibition.

If you don't have a 3D printer, students can design and build a spinning flyer from recycled materials to test on the *Lift* air table.

Seeds

Many modern flying contraptions have been inspired by nature. Ask your students to collect some seeds from the park or the school yard. Throw them up and watch how they flutter.

How does having flying seeds help the plant survive?



What features help something to float in the breeze?

A well-balanced design, a lightweight material, a spinning shape—there are many features that can help something take advantage of the wind.

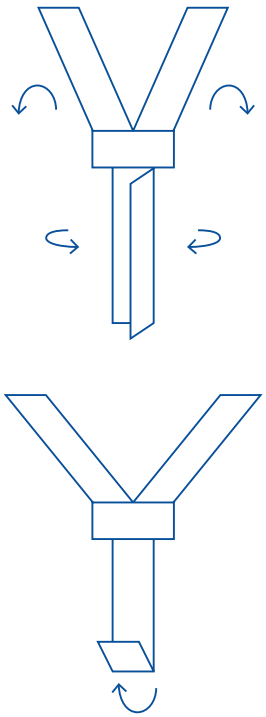
Illustrations: Unknown. Source: Anton Kerner von Marilaun. *The Natural History of Plants, Their Forms, Growth, Reproduction, and Distribution.* London. 1902.

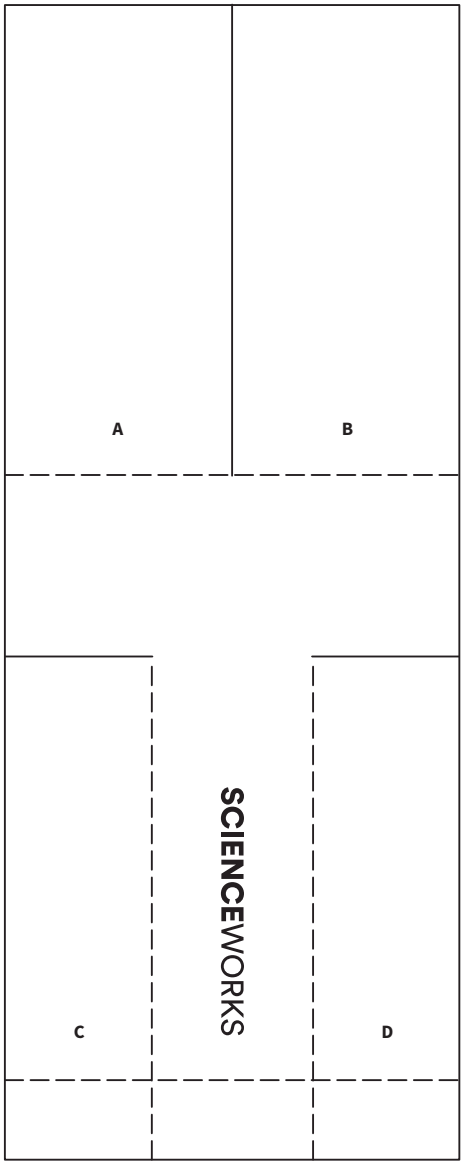
LARGE ROTOCOPTER TEMPLATE

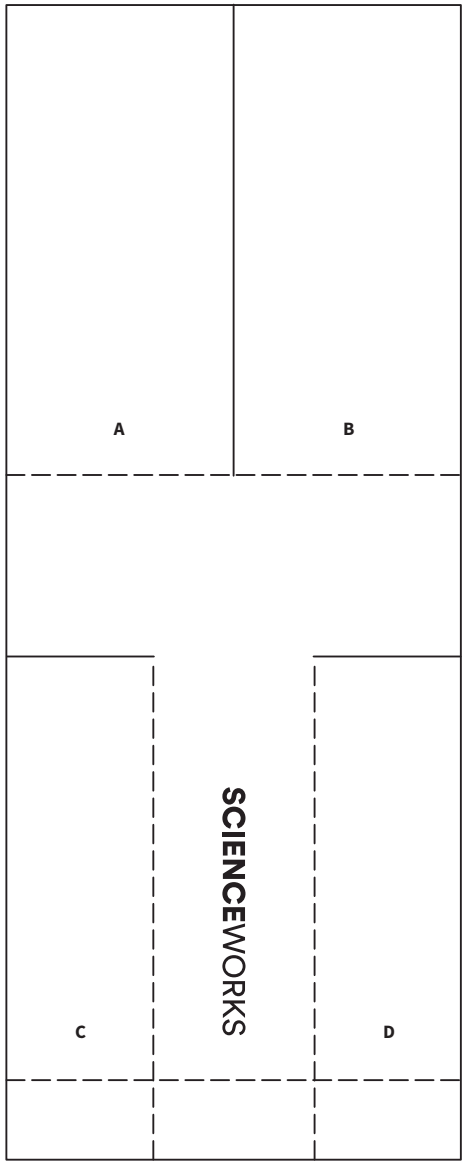
Cut on solid lines, fold on dotted lines.

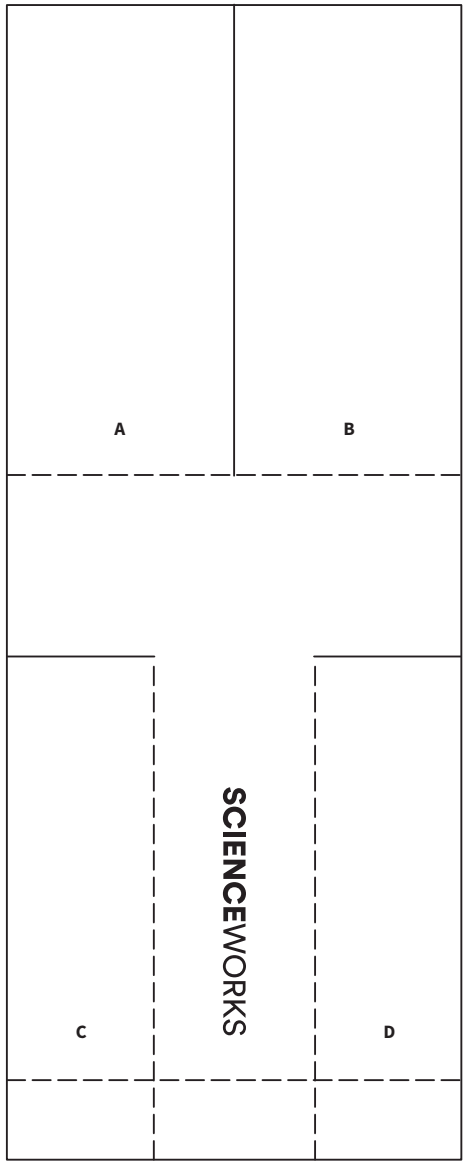
Add paperclips for weight once C and D are folded on top of one another.

Fold back A and B away from each other.







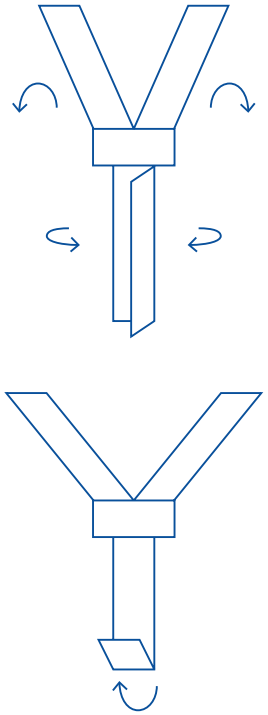


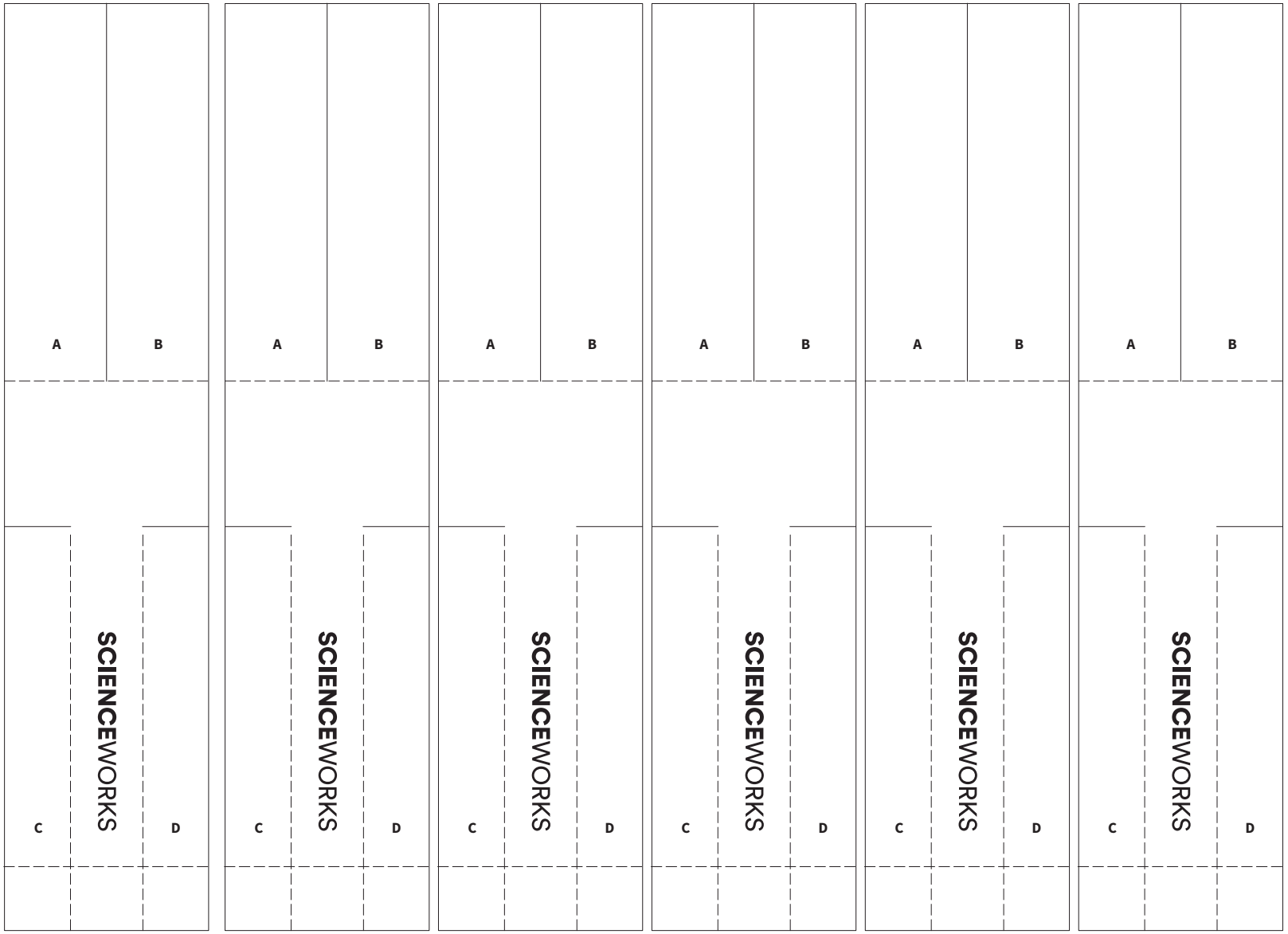
SMALL ROTOCOPTER TEMPLATE

Cut on solid lines, fold on dotted lines.

Add paperclips for weight once C and D are folded on top of one another.

Fold back A and B away from each other.

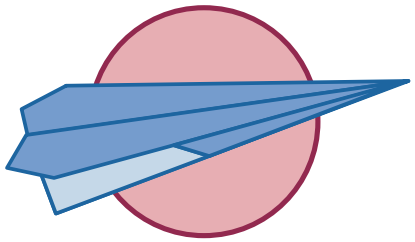




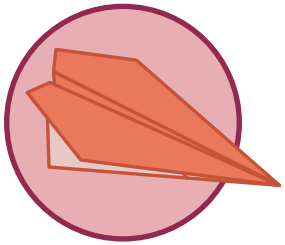
PAPER PLANES

PRE-VISIT

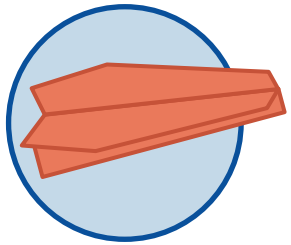
In the *Air Playground* exhibition, visitors are provided instructions to make four different types of paper planes:



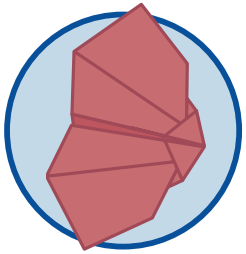
Classic Dart



Suzanne Glider



Blunt Nosed Glider



Flapping Bat

Before you visit Air Playground, ask your students to practise making them with the instructions on the next few pages.

Questions to facilitate student thinking:

Which plane has the most **streamlined** shape?

Which has the **biggest wings** for its size?

Which has a **centre of gravity** (the heaviest part) closest to a quarter of the way from tip to tail?

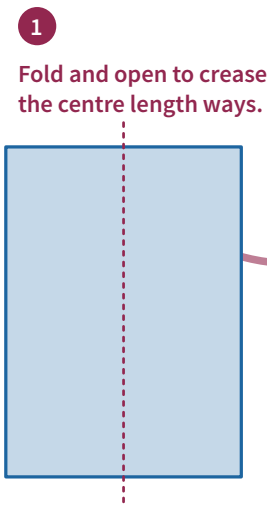
Which one **flies the furthest**?

With how much **force** and at what angle do you throw each design for the best distance?

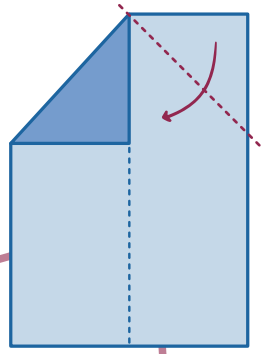
Does **size or thickness** of the paper make a difference?

CLASSIC DART

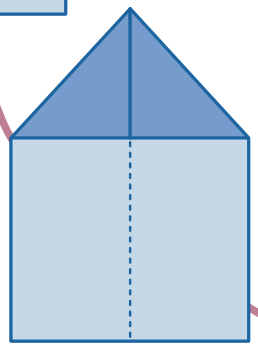
SIMPLE

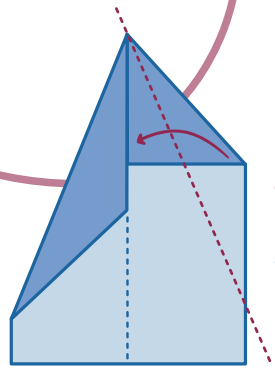


1 Fold and open to crease the centre length ways.

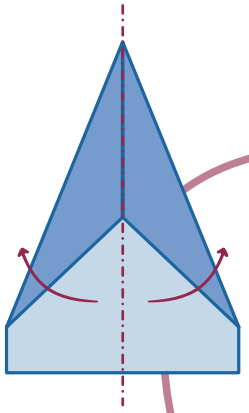


2 Use the crease as a guide to fold the top corners in.

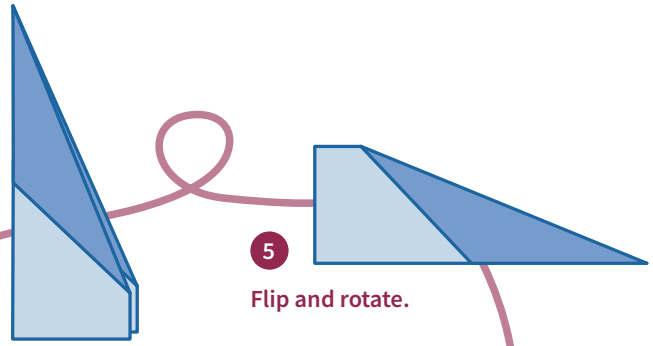




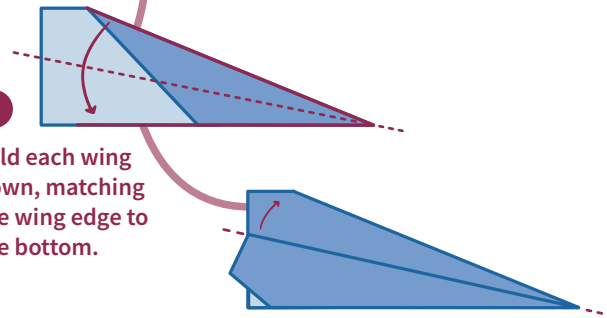
3 Fold the edges to the centre crease.



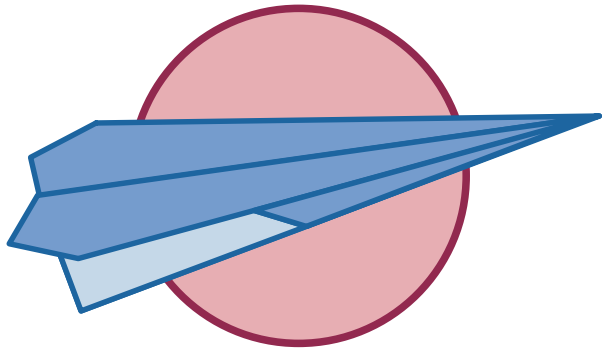
4 Fold in half along the centre crease. The folds should be on the outside.



5 Flip and rotate.



6 Fold each wing down, matching the wing edge to the bottom.



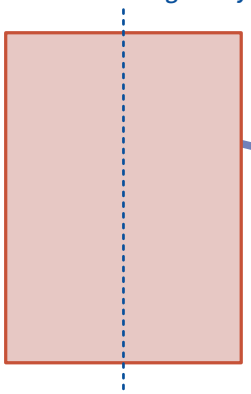
Follow along with our video!

SCIENCEWORKS

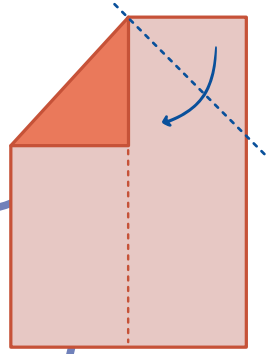
BLUNT NOSED GLIDER

BALANCED

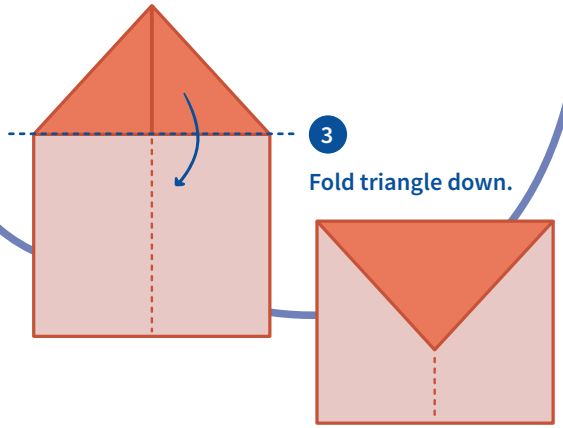
1. Fold and open to crease the centre length ways.



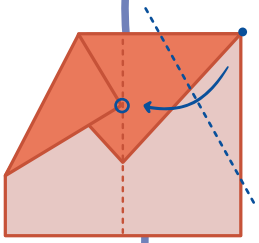
2. Fold edges to centre crease to make a triangle.



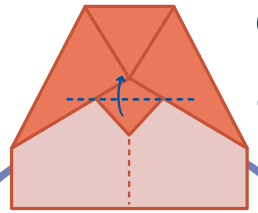
3. Fold triangle down.



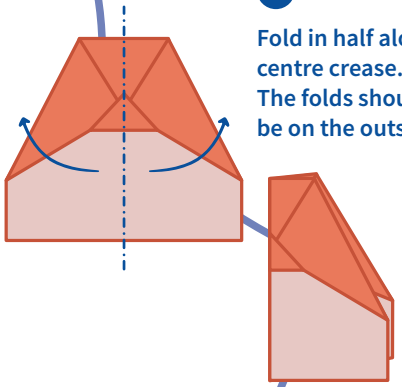
4. Fold corners so that they meet at the centre crease.



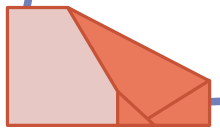
5. Fold the point of the triangle up.



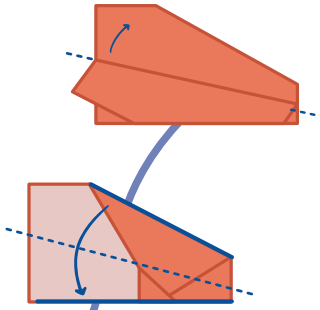
6. Fold in half along centre crease. The folds should be on the outside.

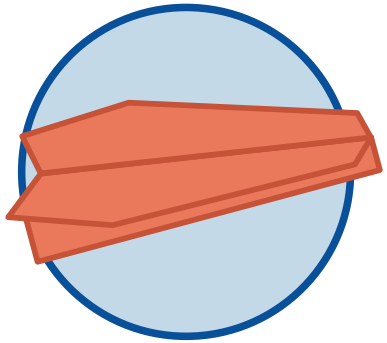


7. Rotate and flip.



8. Fold each wing down, matching the wing edge to the bottom.



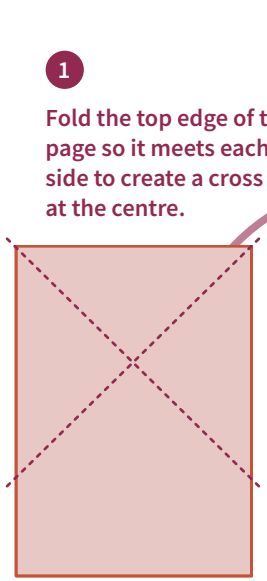


Follow along with our video!

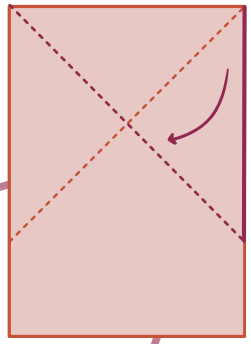
SCIENCEWORKS

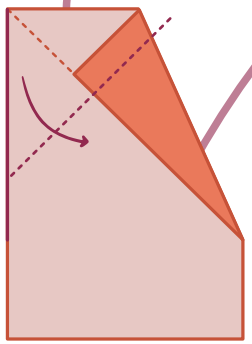
SUZANNE GLIDER

DISTANCE



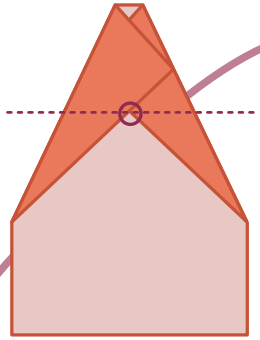
1. Fold the top edge of the page so it meets each side to create a cross at the centre.



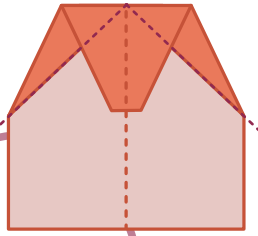


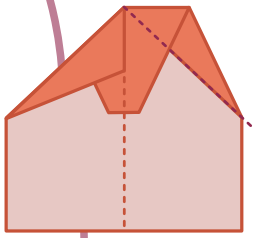
2. Fold the side edges so they meet the **opposite** crease.

   The folded flaps should overlap.

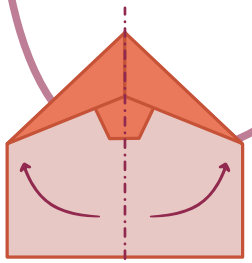


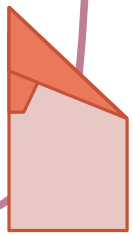
3. Fold the top down where the two flaps meet at a point.



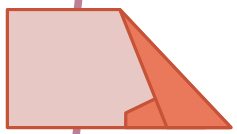


4. Fold top corners to centre crease.

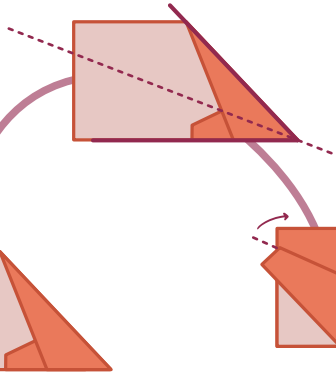




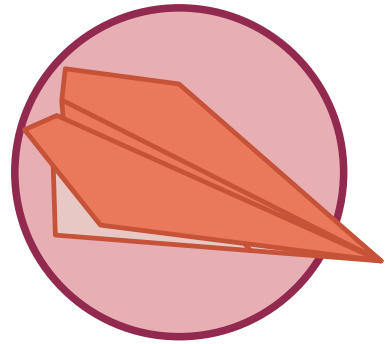
5. Fold in half along the centre crease. The folds should be on the outside.



6. Flip and rotate.



7. Fold the wings down on each side, matching the diagonal edge to the bottom.



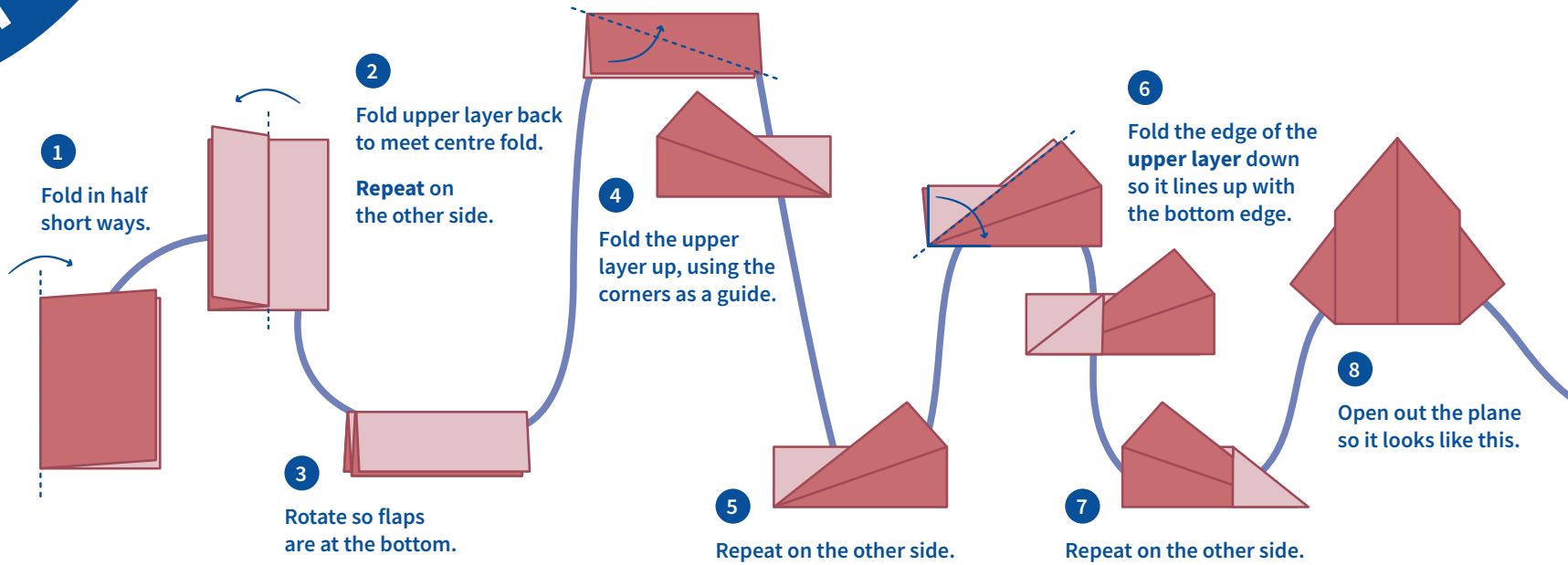
Follow along with our video!

SCIENCEWORKS

FLAPPING BAT

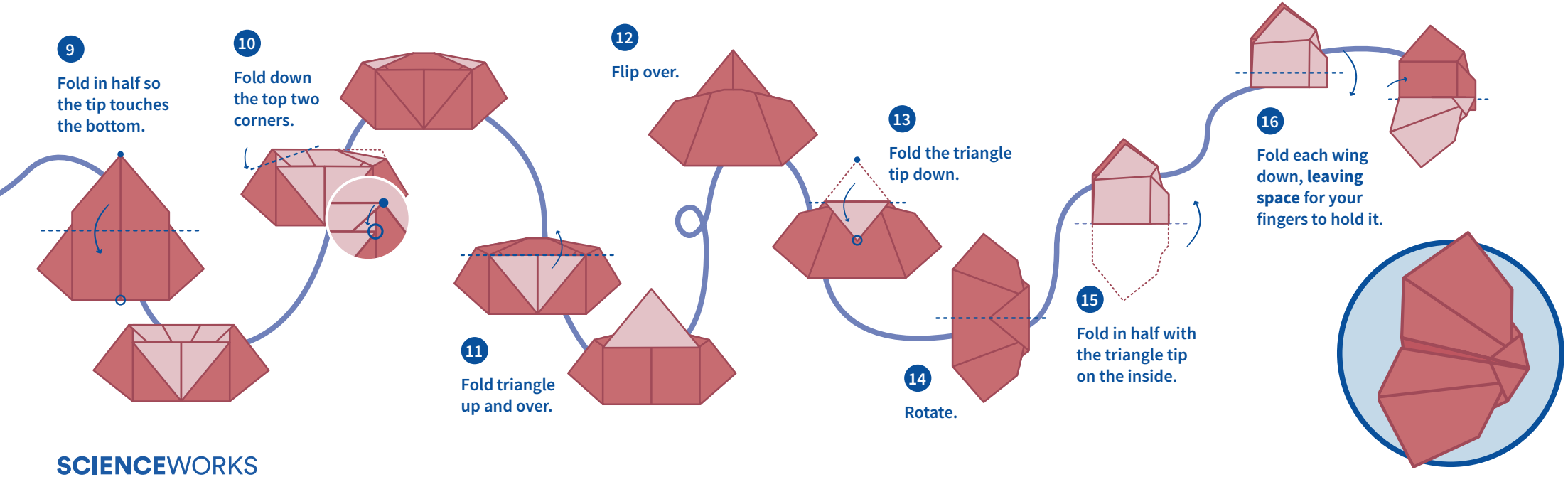
TRICKY

Follow along with our video!



1. Fold in half short ways.
2. Fold upper layer back to meet centre fold.

   Repeat on the other side.
3. Rotate so flaps are at the bottom.
4. Fold the upper layer up, using the corners as a guide.
5. Repeat on the other side.
6. Fold the edge of the **upper layer** down so it lines up with the bottom edge.
7. Repeat on the other side.
8. Open out the plane so it looks like this.



9. Fold in half so the tip touches the bottom.
10. Fold down the top two corners.
11. Fold triangle up and over.
12. Flip over.
13. Fold the triangle tip down.
14. Rotate.
15. Fold in half with the triangle tip on the inside.
16. Fold each wing down, **leaving space** for your fingers to hold it.

SCIENCEWORKS

PAPER PLANES

PRE-VISIT

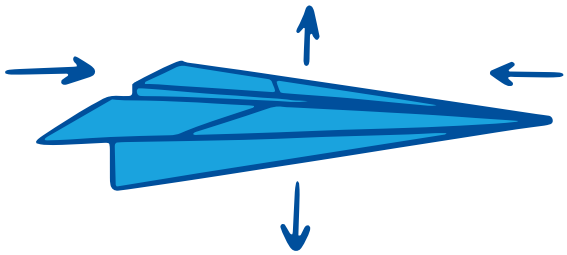
What makes a paper plane fly further than a piece of paper?

A good paper plane is a well-balanced design:

- It is strong enough to survive the initial thrust
- It has big enough wings to maximise drift and floating
- It has its centre of gravity about a quarter of the way from tip to tail
- It is symmetrical so it will fly in a straight line

LIFT
Lift is the force that pushes the plane up. A real plane has curved wings which means that air moving over the top is faster and has less pressure than the air underneath the wing, causing the plane to lift. A paper plane doesn't experience as much lift but a large wing surface area and an angled throw could help maximise air time.

THRUST
Thrust is the forward movement of the plane. The initial thrust comes from the throw as the paper plane is launched. Some plane designs like the Dart requires a powerful throw whereas other designs need only a gentle release to glide.



DRAG
Objects that move through air experience drag, also known as air resistance. A plane which is more streamlined will have less drag. This is why a pointy tipped plane with flat wings flies better than a piece of paper

WEIGHT / GRAVITY
Gravity is a force that pulls objects towards the Earth. When planes are made out of a lighter material, they weigh less and require less lift to overcome gravity. Where the centre of gravity is on the plane (its balance point) also affects how it flies.

AT SCHOOL

AIR CANNON

Push and pull with air!

1. Gather your materials: paper cup, thick pencil, tape, balloon, scissors, something light (feathers, pom poms, confetti, glitter, seeds or small bits of paper).
2. Use the pencil tip to push a hole in the bottom of the cup.
3. Tie the end of the balloon to make something to pull on and cut off the top on the other end.
4. Stretch the balloon over the mouth of the cup, making sure that the balloon handle is in the middle. Tape it to the cup to secure.
5. Point the hole of the cannon towards something light. Hold on to the cannon while you pull back and let go of the balloon handle. Watch the invisible air push things around!

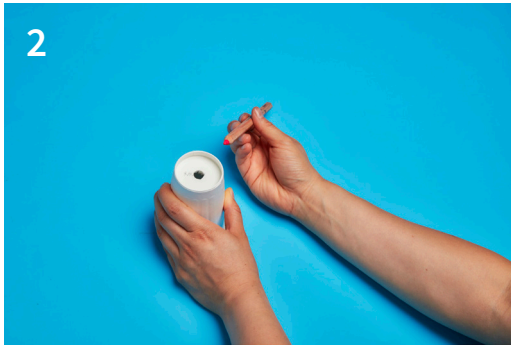
For upper primary and secondary students who might like to improve on the basic design

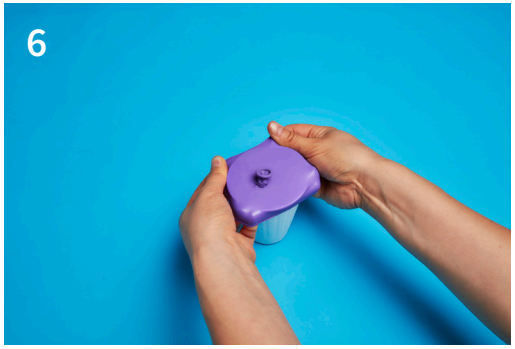
Check out the activity from Science Friday: *Design a Better Vortex Cannon*

https://www.sciencefriday.com/educational-resources/design-a-better-vortex-cannon/

AT SCHOOL

AIR CANNON





DESIGN AN AIRCADE GAME

AT SCHOOL

STEM Design Challenge

As a class, watch *Caine's Arcade* and have a play with the games in the *Air Playground* exhibition when you visit Scienceworks.

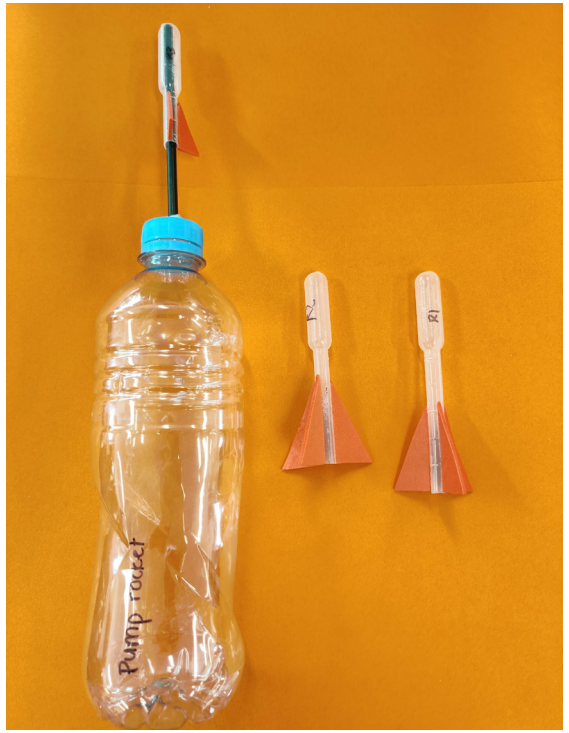
Challenge students to design their own aircade game out of recycled or easily found materials inspired by the *Air Playground* exhibition and *Caine's Arcade*.

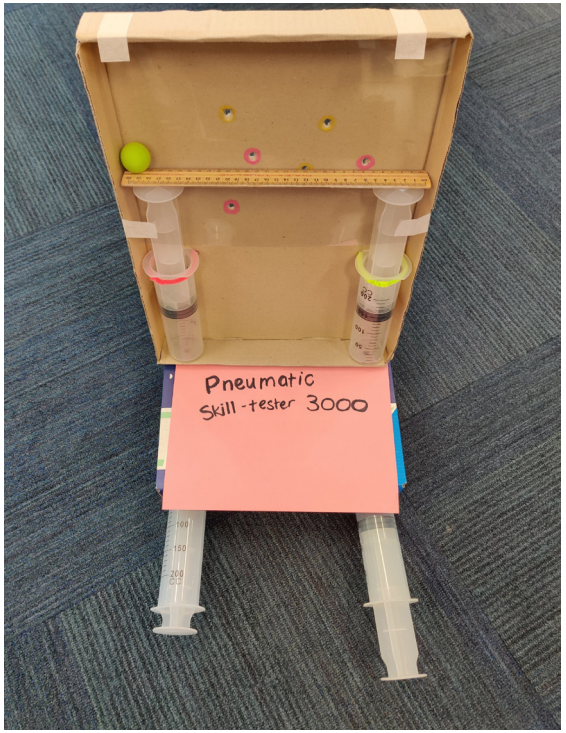
Materials could include: cardboard boxes, balloons, paper cups, bottles, yoghurt tubs, table tennis balls, straws, pipecleaners, foam, bubble wrap, etc.

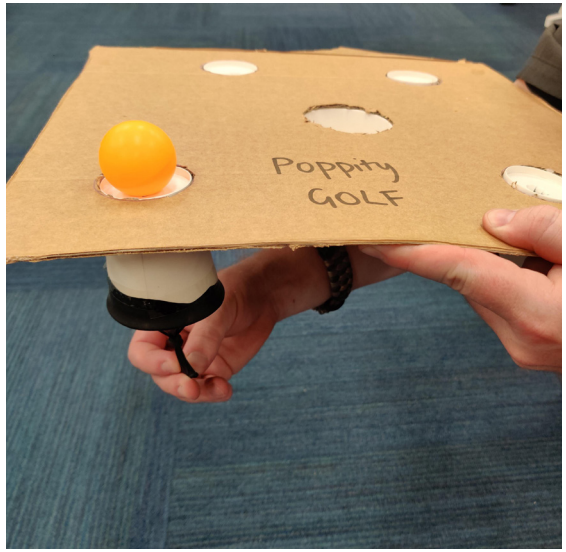
You can also look for ideas online featuring:

- Air cannons
- Pump rockets
- Pneumatics with syringes and tubes
- Fans – make your own with a motor, battery pack and paper for the fan-blades
- Air hockey with a balloon, cork and old CD

A student design brief template has been provided but please repurpose as suits your classroom needs.







LEARNING INTENTIONS

Students become familiar with a STEM design process

Students create designed solutions through an interative process

Students investigate how objects move and the physical properties of materials

Stuck for ideas? Check out the following builds by the Scienceworks team

DESIGN YOUR OWN AIRCADE GAME

What is the aim of the game?

Describe what players have to do:

How many players can play at once?

Do they play collaboratively (with each other) or competitively (against each other?)

How is air used?

List all the materials you might need:

Made something cool in class? Send your designs to museumteachers@museum.vic.gov.au to be featured on the Scienceworks page!

SCIENCEWORKS

DESIGN YOUR OWN AIRCADE GAME

1 Draw your design

Did you test it? What can you change?

2 Draw your improved design

Get someone else to test it.
What can you change?

3 Draw your final design

What's fun or challenging about your game?

Made something cool in class? Send your designs to museumteachers@museum.vic.gov.au to be featured on the Scienceworks page!

SCIENCEWORKS

AIR PLAYGROUND
CURRICULUM LINKS

SCIENCE

F – 6 Science inquiry skills – questioning and predicting, planning and conducting, analysing and evaluating

3 – 4 Physical sciences – Forces can be exerted by one object on another through direct contact or from a distance (VCSSU064)

F – 2 Physical Sciences – The way objects move depends on a variety of factors including their size and shape: a push or a pull affects how an object moves or changes shape (VCSSU048)

5 – 6 Chemical Sciences – Solids, liquids and gases behave in different ways and have observable properties that help to classify them (VCSSU076)

5 – 6 Science – biological science, living things have structural features and adaptations that help them survive in their environment (VCSSU074)

DESIGN AND TECHNOLOGY

F – 6 Technologies and Society – people create designed solution to meet community needs

F – 6 Technologies Contexts – Engineering principles and systems, investigation of forces affecting movement

F – 6 Materials and technologies specialisations – exploring materials and systems

CAPABILITIES

F – 6 Critical and Creative Thinking – Questions and Possibilities

F – 6 Personal and Social Capability – Collaboration