ALL THINGS STEM

8 CHALLENGES TO COMPLETE

WHY IS THE SKY BLUE?

WALKING RAINBOW

CREATE YOUR OWN WHIRLPOOL

AVIATION DAY

HOW TO MAKE A PAPER AEROPLANE

CREATE YOUR OWN ENGINEERING SUPERHERO

LEONARDO

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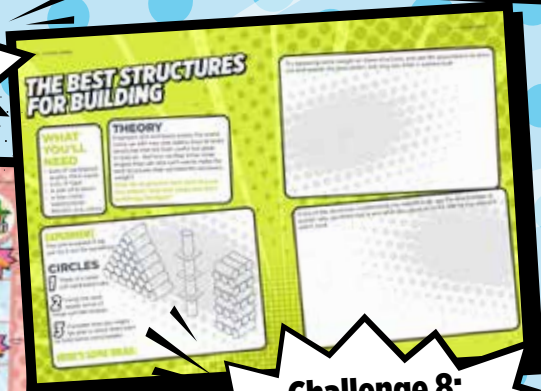

This pack is full of fun and exciting activities for you to complete at home!

Let's get started...

INTERNATIONAL WOMEN In ENGINEERING DAY

23 June

So many incredible women invented technology we use every day. We celebrate International Women in Engineering Day on 23rd June every year.

CAN YOU MATCH THE FEMALE ENGINEER TO HER INVENTION?

Edith Clarke	Hedy Lamarr	Nancy Maria Donaldson Johnson
		

CREATE YOUR OWN ENGINEERING SUPERHERO

Every year International Women in Engineering Day has a theme. This year it is Engineering Heroes. In the box below we want you to create your own Engineering Superhero.

What is their name?

What will their superpowers be?

What sort of things will they make?

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AVIATION DAY

CARGO AEROPLANE CHALLENGE

How much cargo can your plane carry?

For this activity you will need there are 3 different packs:

1. HOW TO MAKE YOUR PAPER AEROPLANE
2. ACCURACY CHALLENGE
3. CARGO CHALLENGE

NAME OF PLANE

Firstly you will need to come up with a great name and logo for your cargo plane. Design your logo in the space below:

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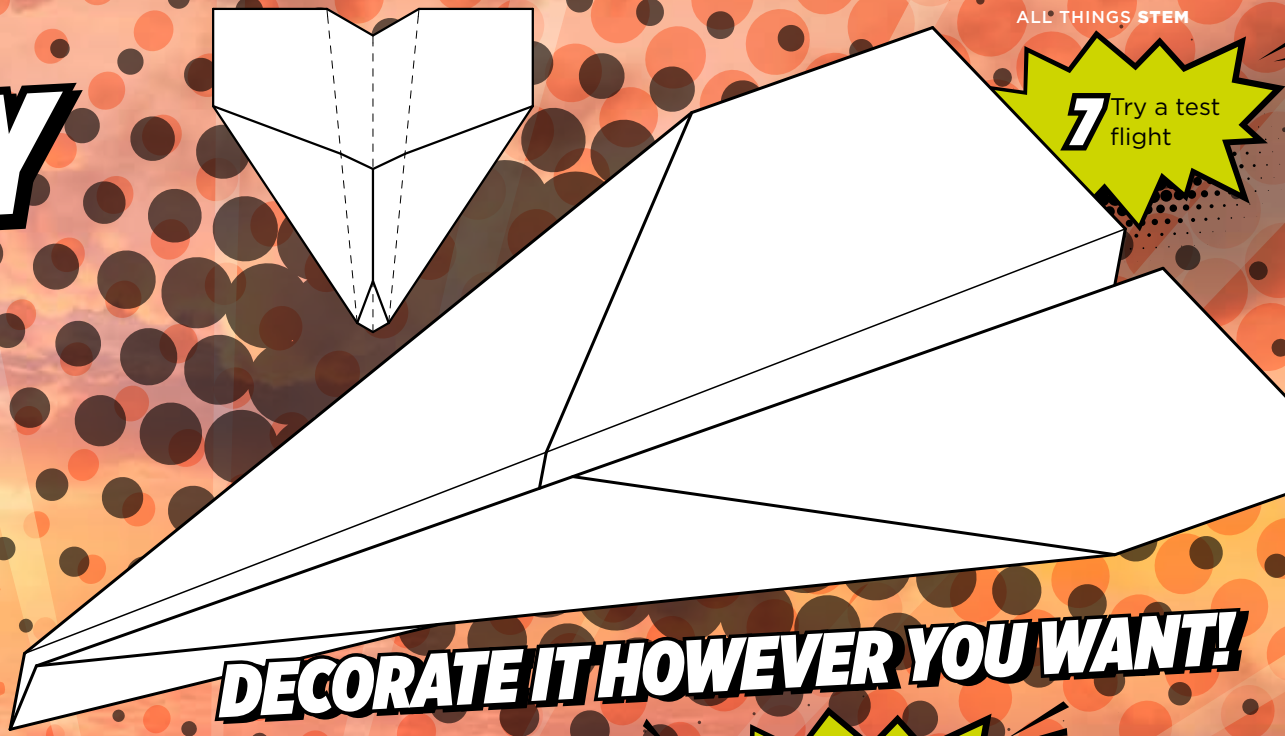
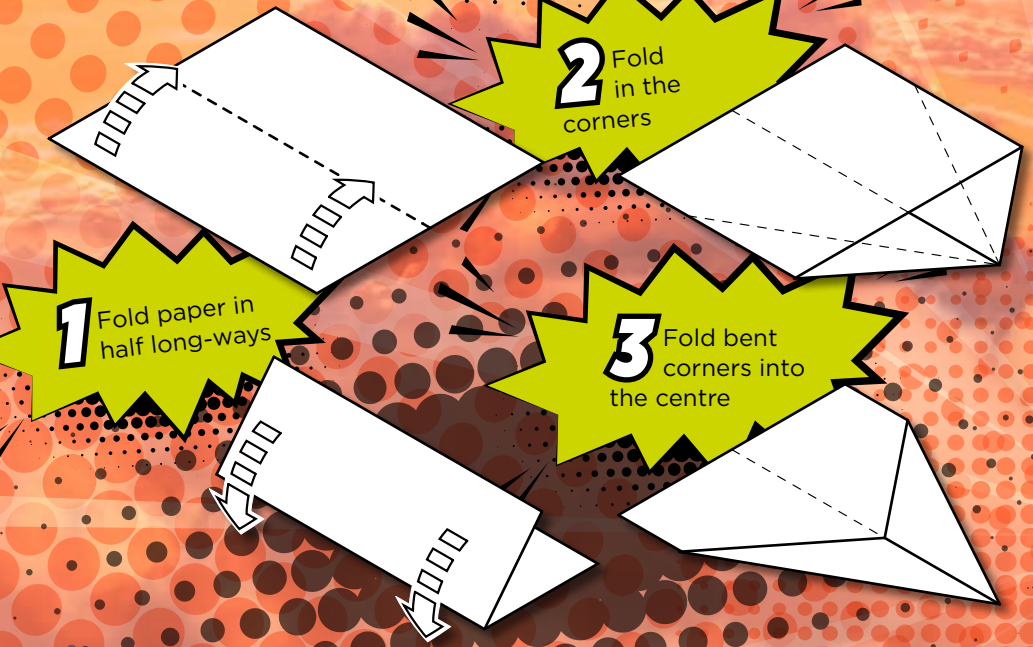
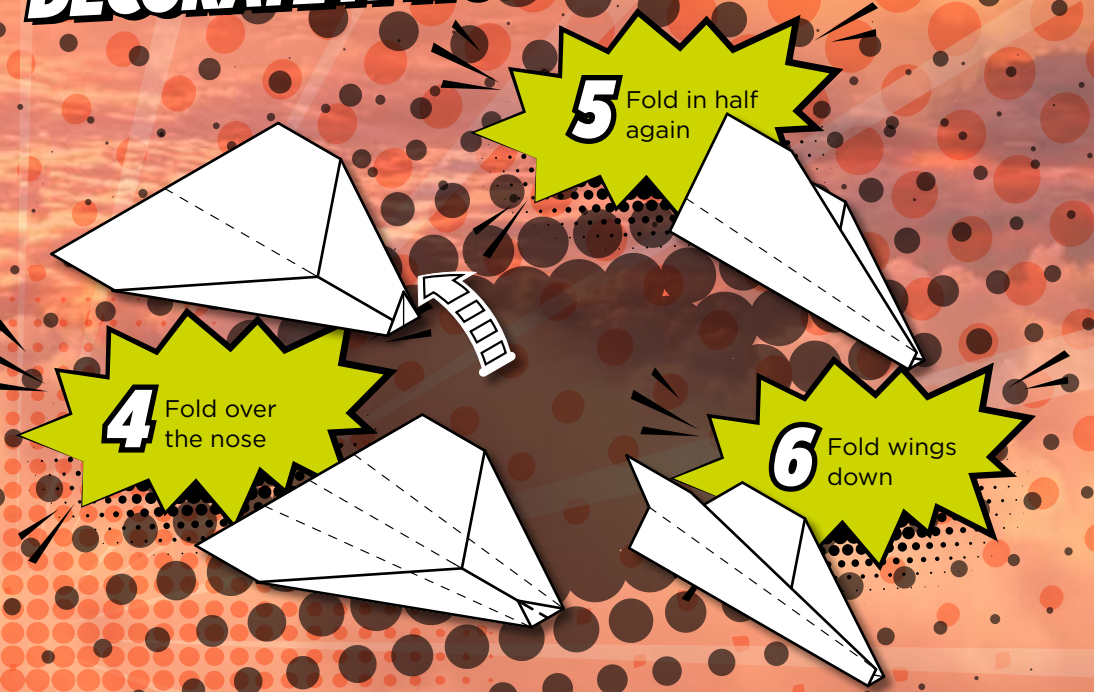
AVIATION DAY

1 HOW TO MAKE YOUR PAPER AEROPLANE



DECORATE IT HOWEVER YOU WANT!





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AVIATION DAY

2 ACCURACY CHALLENGE

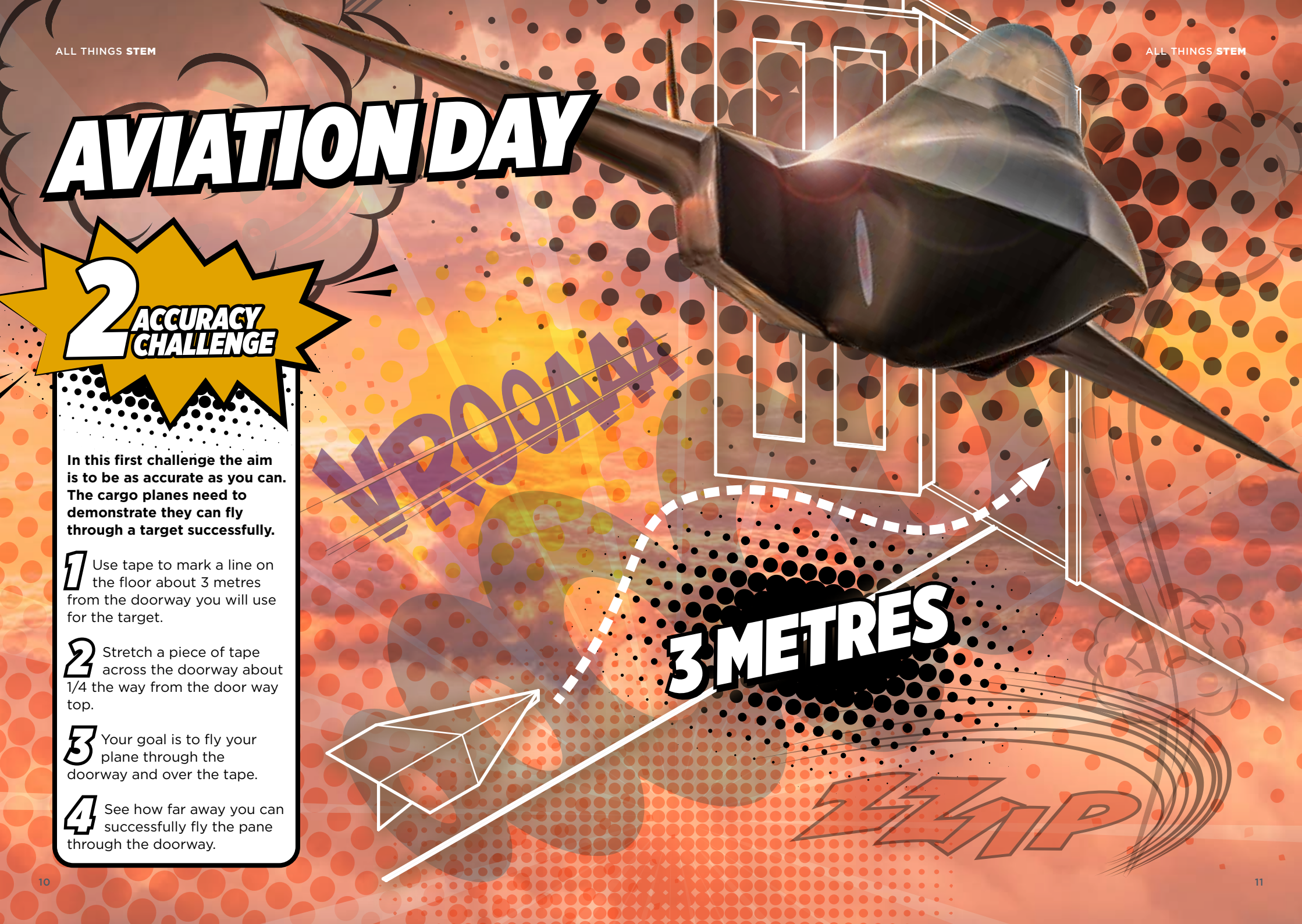
In this first challenge the aim is to be as accurate as you can. The cargo planes need to demonstrate they can fly through a target successfully.

1 Use tape to mark a line on the floor about 3 metres from the doorway you will use for the target.

2 Stretch a piece of tape across the doorway about 1/4 the way from the door way top.

3 Your goal is to fly your plane through the doorway and over the tape.

4 See how far away you can successfully fly the pane through the doorway.



AVIATION DAY

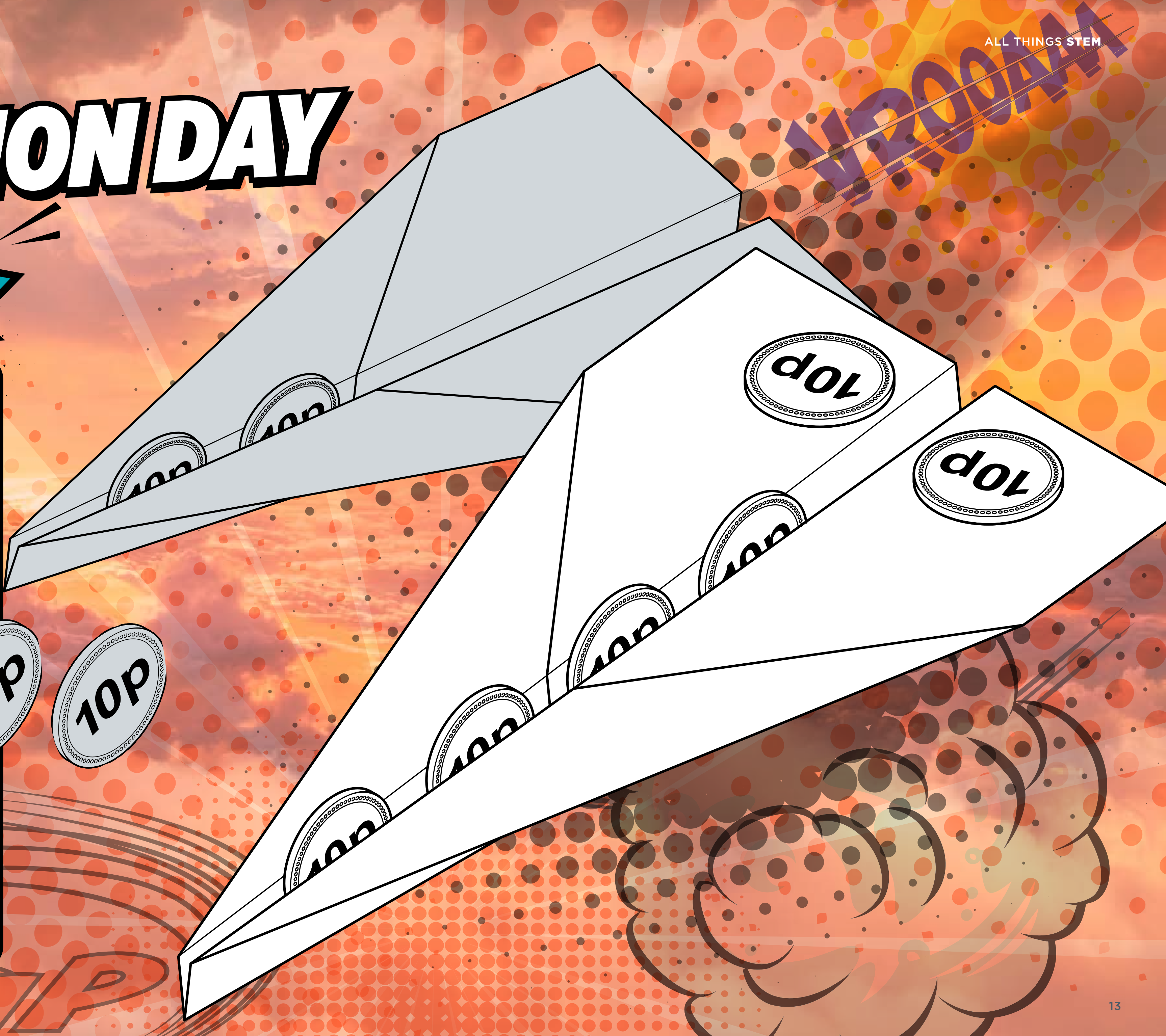
3 CARGO CHALLENGE

Your next challenge is to see how much cargo your plane can carry.

1. Choose how much cargo you want to start with and have a test flight. Maybe 2 x 10p's to start with. Increase the cargo each time until your plane can no longer fly.

2. How much cargo did your plane manage to carry?

3. Think about where you want to attach your cargo. Will it be easier for the plane to fly with heavy things in the centre or far out on the wings? Try experimenting with different cargo placement positions.



ALL THINGS **STEM**

WALKING RAINBOW

How to make your own walking rainbow

WHAT YOU'LL NEED

- Kitchen Roll
- Food colouring
- Water
- 6 glass mugs

STEP 1

Add a few drops of different coloured food colouring to 3 glasses only.

STEP 2

Fill the 3 jars, with food colouring in, with water until they are about three quarters full.

STEP 3

Place the jars in a circle and alternate them so you have a jar with coloured water and then an empty one.

STEP 4

Take 6 pieces of kitchen roll. Fold each piece in half and then in half again so you have created a long strip. Then dip each paper towel strip into one of the colours and the connecting empty jar.

STEP 5

Now this is the fun part! Watch closely to see the coloured water being absorbed by the kitchen roll pieces. The coloured water will start travelling up the kitchen roll quite quickly and after a while the empty jars will start filling with coloured water.
Try different colours and add more glasses to see what other rainbows you can make!

WALKING RAINBOW

Some questions to ask yourself while you're doing this experiment....

1. What do you think will happen to the water?
2. Why do you think the colours are changing?
3. Why might the water be able to move up against gravity like that?

EXPLAINED

HOW THIS EXPERIMENT WORKS

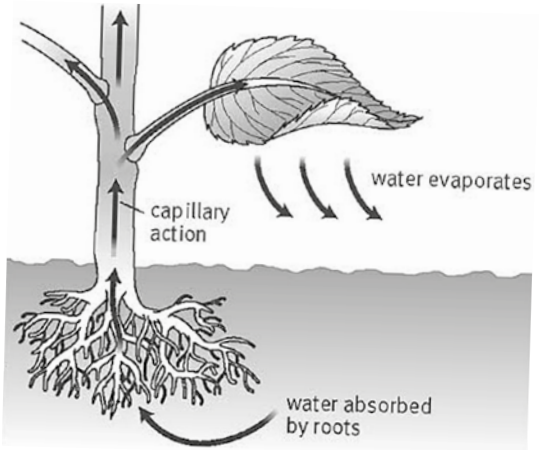
The water moves up the paper towels through a process called capillary action.

The paper towel is made from fibres and the water is able to travel through the gaps in the fibres.

The gaps in the paper towel act like capillary tubes and pull the water upward.

This is what helps water climb from a plant's roots to the leaves at the top of the plant or tree.

The water is able to move upward against gravity because of the attractive forces between the water and the fibres in the paper towel.



Ada Lovelace Day

CELEBRATING WOMEN IN SCIENCE

Ada Lovelace was born in 1815 and has been called the first computer programmer.

As well as contributing hugely to maths and science throughout her life, at the age of 12 she loved studying the anatomy of birds and designed her very own flying machine.

Her steam-powered aeroplane design was finished 15 years before the first aerial steam carriage was made in 1842. This shows just how forward-thinking and creative her young mind was.

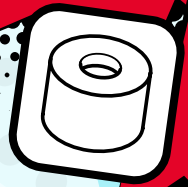
CREATE YOUR OWN WHIRLPOOL

WHAT YOU'LL NEED

- 2 large plastic bottle & their caps
- Water
- Lots of tape!
- Optional: food colouring or glitter
- Scissors or a knife

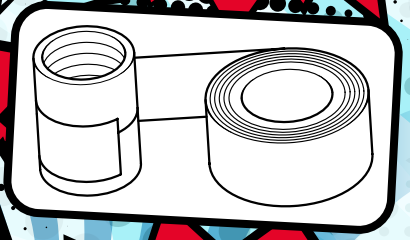
REMEMBER TO ASK AN ADULT FOR HELP!

STEP 1
Remove labels from bottles



STEP 2
Poke a hole in the middle of both of the bottle caps

STEP 3
Put the two tops of the bottle caps together and secure with tape. Make sure the inside of each cap is facing outwards



STEP 4
Fill one of the bottle with about two thirds of water. If you want to you can add food colouring or glitter at this stage.

STEP 5
Attach the bottle caps to the filled bottle and then carefully attach the empty bottle on top.

STEP 6
Turn the bottles upside down and you will see your whirlpool start to appear!

HOW THIS EXPERIMENT WORKS

When the water is still it creates a skin-like layer of water across the small hole in the centre of the cap connector.

If the top bottle is full of water then the water can push through the surface which forms a drop which will then drip into the lower bottle. As water drops into the lower bottle, the pressure in the lower bottle builds until air bubbles are forced into the upper bottle. The water surface can no longer hold back and stop the flow completely.

If you spin the bottles around a few times, the water in the upper bottle starts rotating. As the water drains into the lower bottle, a vortex forms. The water is pulled down and forced towards the drain hole in the centre by gravity.

WHY IS THE SKY BLUE?

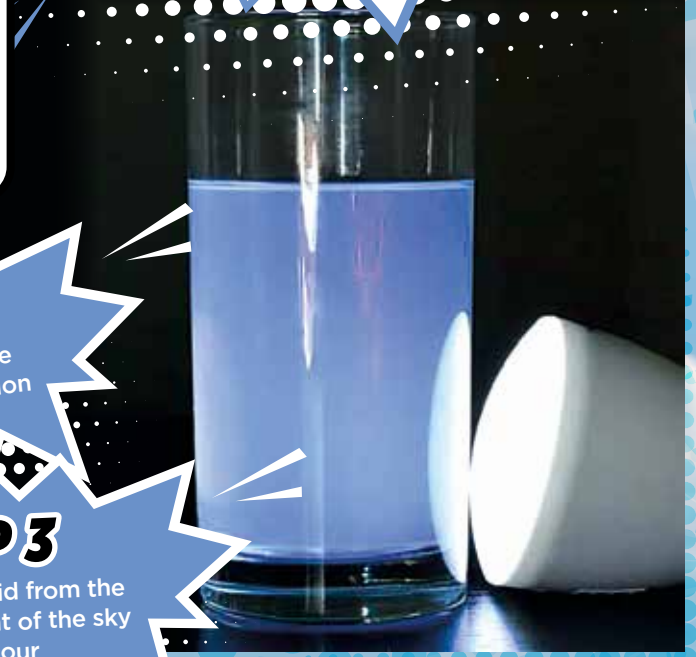
WHAT YOU'LL NEED

- Glass of water
- A bar of soap or milk powder
- Torch (LED/white light emitting)
- A dark room

REMEMBER TO ASK AN ADULT FOR HELP!

STEP 1

Dissolve a bit of soap into the glass of water to get a cloudy solution by submerging the bar into the water and rubbing the surface until the water turns to a whiter solution. Alternatively, dissolve 1 teaspoon at a time of milk powder until this achieves a white cloudy solution.



STEP 2

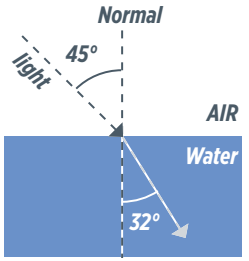
In a dark room, point the torch at the cloudy solution from the side

STEP 3

Observe the fluid from the side to see a hint of the sky blue colour

THEORY

If sunlight is colourless, then why does the sky look blue? Part of the reason the sky is blue is due to the scattering of light by tiny particles in the Earth's atmosphere.



LIGHT REFRACTION

The sunlight that we see as colourless, is actually what is known as 'white light', which means it is made up of all of the colours of the rainbow (red, orange, yellow, green, blue, indigo and violet) mixed together. When this light passes from one medium to another (medium = air or water for example), the light bends, and this phenomenon is known as refraction.

Refraction of white light occurs at different angles because each colour of the rainbow has its own wavelength. So when white light is refracted, it is separated out into different colours; a phenomenon known as dispersion.

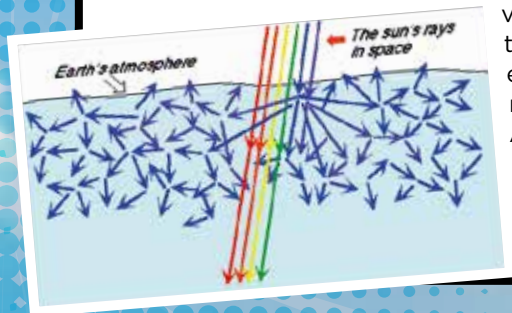
Consider a rainbow. During rainfall, if the sunlight hits the water droplets in the aid at the right angle, you can see a rainbow. Or another way to see the spectrum of colours is through a glass prism using strong white light.

RAYLEIGH SCATTERING

The air is a gas and is full of billions and trillions of tiny molecules that, with just our eyes, we cannot see. On a clear day, the sunlight passing through the air is scattered by these molecules and this is known as Rayleigh Scattering.

Scattering is stronger at shorter wavelengths and, among the colours of the rainbow (or visible colours), the blue-violet end of the colour spectrum has the shortest wavelengths. Therefore, this end of the colour spectrum is scattered more than the red-orange end.

Although the most scattered light is violet, our eyes are more sensitive to blue lights, and so this is part of the reason why we see the sky as blue during the day.



THE WATER CYCLE MINI MODEL

WHAT YOU'LL NEED

- Small dish of water
- Blue food colouring
- Ziploc bag
- Felt-tip pen

STAGE 1: PRECIPITATION

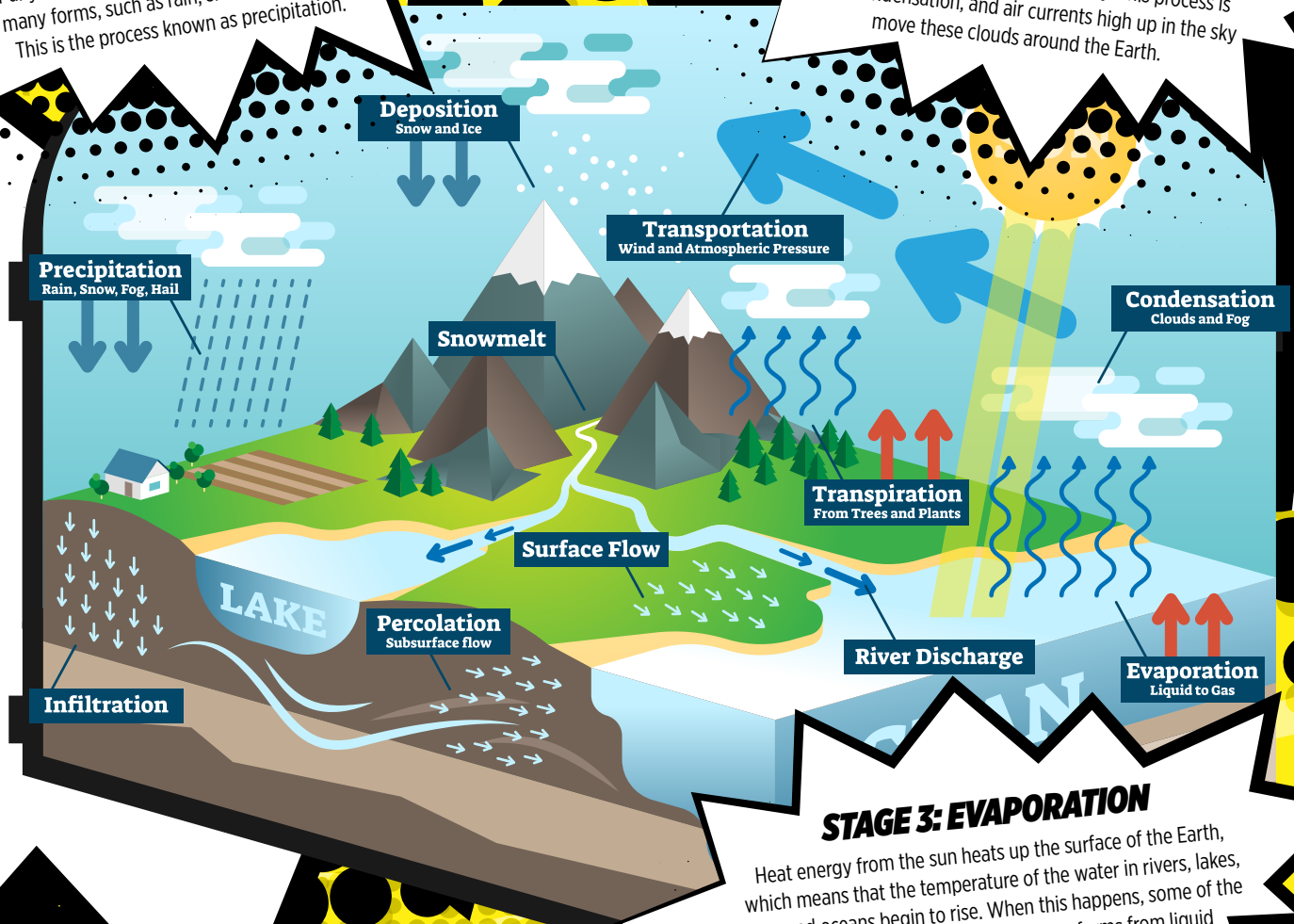
When too much water has condensed into clouds, they become too big and heavy to be held up in the air any longer, so they fall back down to Earth in many forms, such as rain, snow, sleet or hail! This is the process known as precipitation.

STAGE 2: COLLECTION

Fallen rain/snow is 'collected' into bodies of water (rivers, lakes, oceans etc.) and it will then, eventually, be heated up and the cycle begins again. How it is collected depends on where the precipitation lands...

Some will fall directly into bodies of water, so the cycle begins from there. The water might, however, fall onto vegetation and evaporate straight from the leaves, or some of the water may go into the earth to be taken up by the roots of plants.

In cold climates, the precipitation may build up as snow or ice, so before the cycle can begin again, the solid forms of water must first be heated up to become liquid before evaporation can occur.



STAGE 3: EVAPORATION

Heat energy from the sun heats up the surface of the Earth, which means that the temperature of the water in rivers, lakes, seas and oceans begin to rise. When this happens, some of the water – using the heat energy – transforms from liquid into gas 'vapour' and this is known as evaporation.

STAGE 4: CONDENSATION

As the water vapour rises up into the sky, it starts to cool down and the gas transforms back into liquid water and forms the clouds in the sky. This process is called condensation, and air currents high up in the sky move these clouds around the Earth.

EXPERIMENT

1 On your Ziploc bag using your felt-tip pen, draw a sun in the top left corner, a cloud in the top right corner and some water waves along the bottom of the bag.

2 Fill a small dish with ¼ cup of water

3 Carefully add 3-4 big drops of blue food colouring into the water and stir

4 Carefully tip this water into the Ziploc bag and seal the bag well

5 When you are certain it won't leak, use tape to hang the bag on a window that gets a little bit of sunlight. Watch as the temperature during the day causes some of the water 'evaporate' and 'condense' as water droplets up the sides of the bag, and as the temperature drops in the evening, watch the 'precipitation' and 'collection' occur ready for the cycle to start again!

ALL THINGS **STEM**

JELLY BEAN CODING

STEP 1

SORT YOUR MATERIALS

You will need 4 different colours of jelly beans

STEP 2

ASSIGN CODE VALUES

Assign a colour to four directions, up, down, left and right

STEP 3

CREATE YOUR CODE

The aim is to create a jelly bean and number code that directs the beach ball to the beach.

FOR EXAMPLE:

Up =

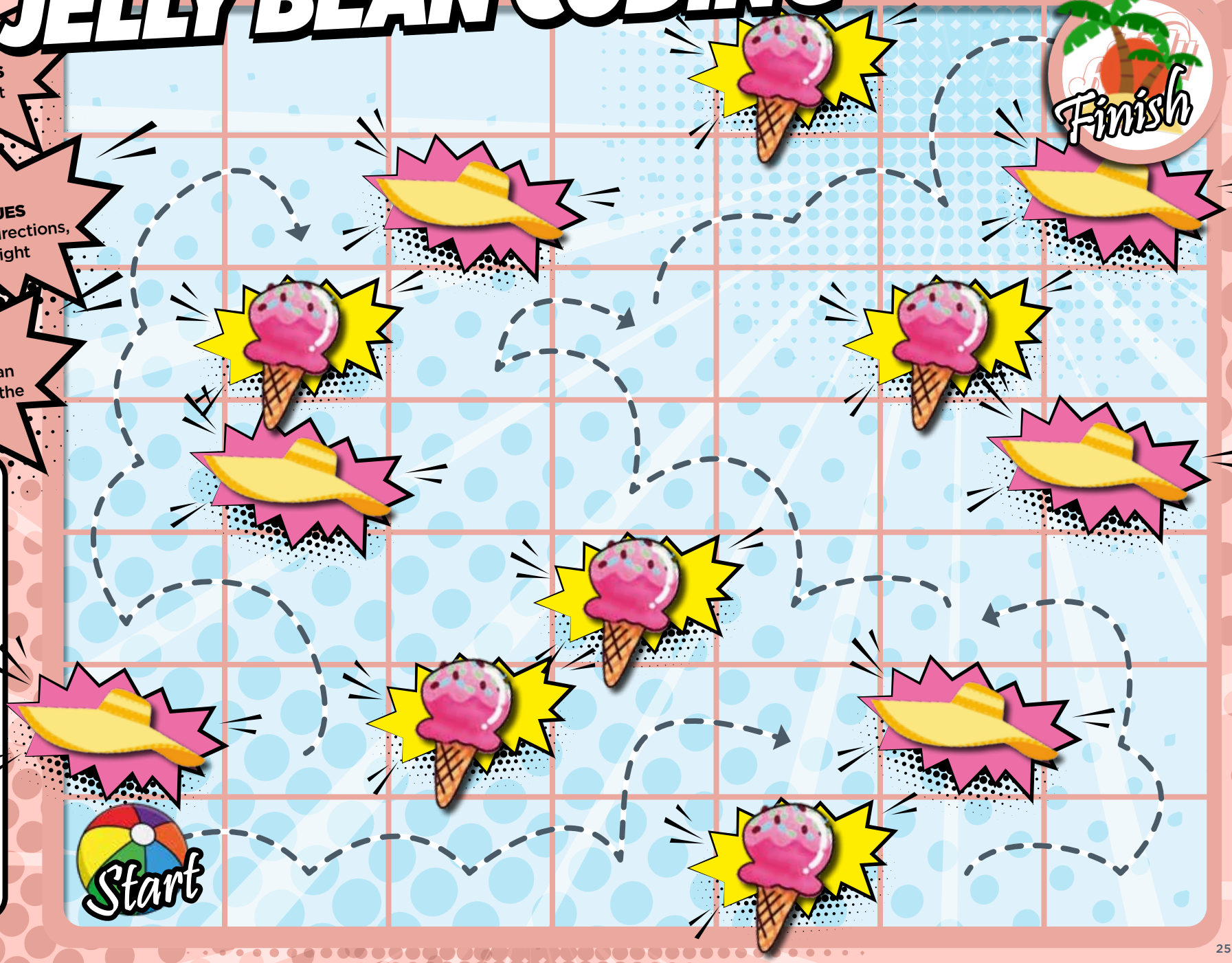
Down =

Right =

Left =

So your code could be:

Which would mean Move right by 3, up by 1, and then right by 1 again. See how many different codes you can make to help the beach ball to the beach. Be careful to avoid ice creams and sun hats!



THE BEST STRUCTURES FOR BUILDING

WHAT YOU'LL NEED

- Lots of card/good quality thick paper
- Lots of tape
- A pair of scissors
- A few coins/ sweets/small biscuits (e.g. oreos)

THEORY

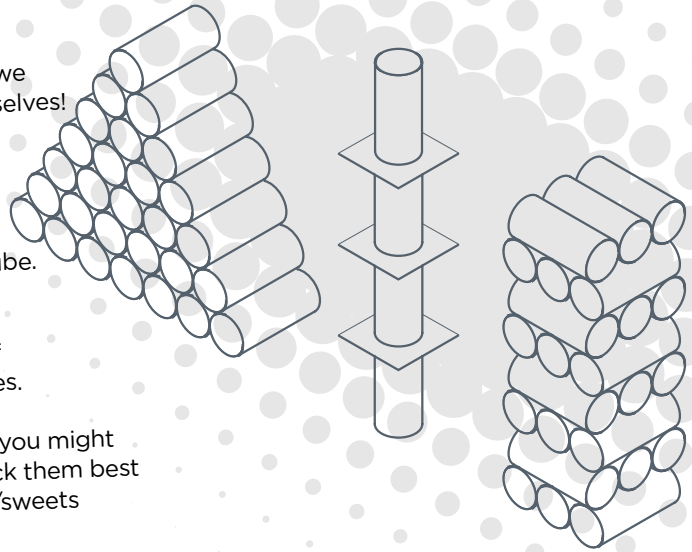
Engineers and architects across the world come up with new and wacky ways to build structures that are both useful but great to look at... but how do they know what shapes they can and can't use to make the best structures that will hold the necessary weight?

How do engineers test and choose the shapes that will make the best buildings/bridges?

EXPERIMENT

This one is easiest if we just try it out for ourselves!

CIRCLES



1. Think of a toilet roll cardboard tube.
2. Using the card, create some of these cylinder shapes.
3. Consider how you might be able to stack them best to hold some coins/sweets

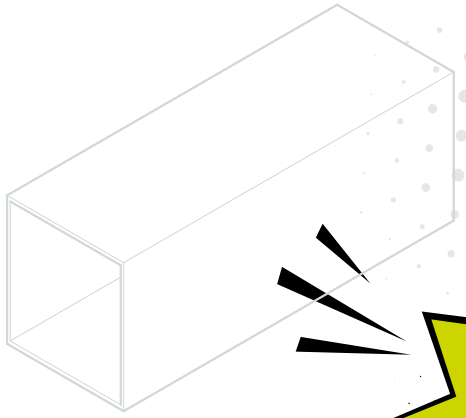
HERE'S SOME IDEAS:

Try balancing some weight on these structures and use the space below to draw out and explain the best option, and why you think it worked best.

If any of the structures couldn't hold any weight at all, use the space below to explain why you think that is and what you could do to try and fix the reason it didn't work

SQUARES

Now we try the same again for squares, so using your card, make some square tubes and see how these stack best when you try to put some weight on them!



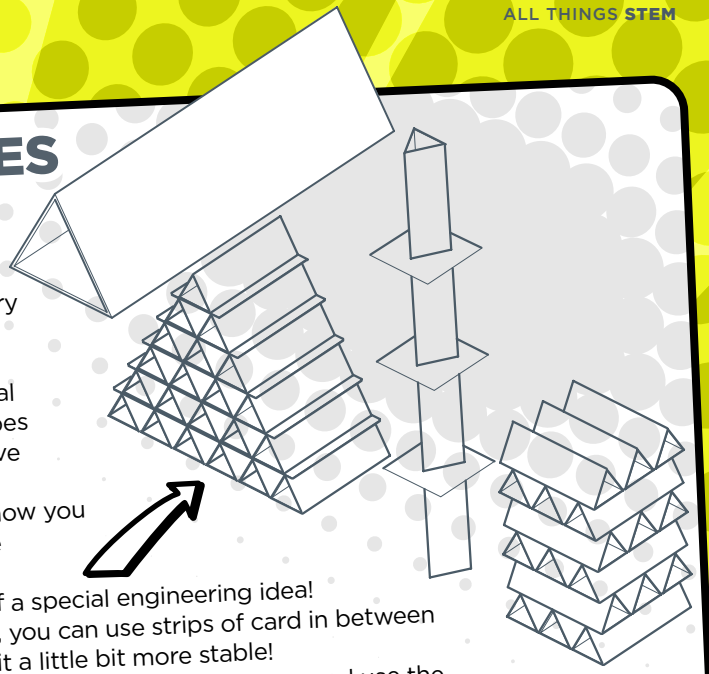
HINT: see the Circles section for some ideas on how to stack these too! Try balancing some weight on these structures and use the space below to draw out and explain the best option, and why you think it worked best.

If any of the structures couldn't hold any weight at all, use the space below to explain why you think that is and what you could do to try and fix the reason it didn't work

TRIANGLES

Finally, engineers and architects use triangles often... so we should probably try to find out why!

1. Create some equal sided triangle tubes with the card you have
2. Consider now how you can stack these



Here's an example of a special engineering idea! As you can see here, you can use strips of card in between layers to help make it a little bit more stable! Try balancing some weight on these structures and use the space below to draw out and explain the best option, and why you think it worked best.

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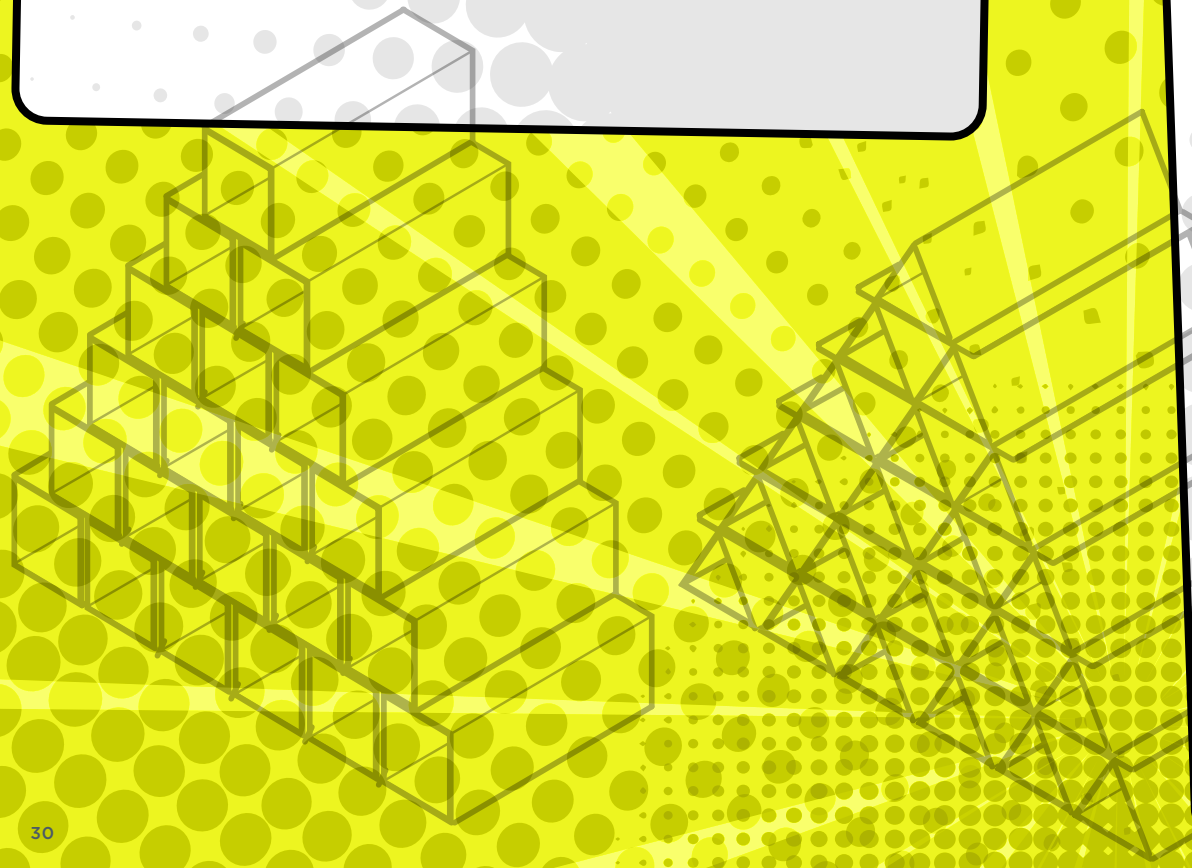

ALL THREE?

For fun, using all the shapes you have created so far, why not try and put all of the shapes together and get the tallest stack possible. Be sure to draw out your stack below and record it's measurement in centimetres!

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