



SIS-STEM challenge

Welcome to SIS-STEM, a challenge helping to explore STEM subjects (Science, Technology, Engineering & Maths) in a fun way. It introduces some basic principles within playful activities that may help members see the STEM subjects in a different light, or at least help them learn a few clever tricks.

It has been designed to fit in with the programme in that some of the activities may link up with Skills Builders, unit meeting activities and even interest badges which may spur the girls to further their interests. The links boxes have been left blank for each leader to choose where these activities can complement the programme. However, there are also standalone activities, there just for the fun of it.

There are activities for all ages, Rainbows to adults – the age range noted is only a guide, as any activity can be adapted to the needs of your unit. As with any other activity, it is always more exciting if the girls help choose, but it still relies on a test one being made beforehand to assess where you may need to help or pre-prepare areas, assess the time it takes and to risk-assess the activities.

SIS-STEM not only introduces the four STEM subjects by focusing on practical skills, it also covers aspects of the six programme themes, and the Five Essentials, by having outdoor activities, encouraging problem solving skills, team building and much more.

The sections to explore are:

LOCOMOTION (Experiments in moving toys)

SHAPE & STRUCTURE (Experiments in Engineering & Geometry)

FLIGHT & FIREWORKS (Experiments with Fizz & Flight)

GET THE MESSAGE (Experiments in Sound & Communication)

ILLUMINATING COLOURS (Experiments with light & colour)

WONDERFUL WIND & WATER (Exploring the properties of air & water)

There are activities using materials that you would generally put in your recycling bin, simply to encourage up-cycling and reduce costs. When you have finished the activities, then many materials can be re-used or sent for recycling. It's also a great way of getting the members' families involved by collecting their 'rubbish' at no cost to themselves, so start collecting now!

Completing the SIS-STEM challenge badge

We suggest that you aim to do at least one activity from each section – many of the activities do not take long and so a few can be done within a meeting. The most important thing is to have fun with this resource, so do as many as you wish and keep it for future reference.

When you feel the members have done enough activities to earn a badge, then you can order these from the county badge depot.

Please email badges@girlguidingshropshire.org.uk giving your name, unit, address & number of badges required. You can arrange to pay by BACS or send a cheque (badges are £1.00 each + P&P).

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Gyrocopter

R/B

This only takes a few minutes to make but it certainly creates a great effect. These gyrocopters spin smoothly as they plummet to the ground. Perhaps you can see who can keep theirs in the air the longest, or which one travels the most from where it was dropped.

What to do:

- 1) Create the first slit in the paper, cutting parallel to the top of the rectangle from about a third of the way down the side edge stopping about 2cm before reaching opposite side edge (see diagram below).
- 2) Turn the paper around 180 degrees and do the same cut again. You should now have a central bar with a top flap finishing one side and the bottom flap finishing on the other.
- 3) Clip the two flaps together beneath the central bar. Launch your gyrocopter holding the central bar aloft and let go.

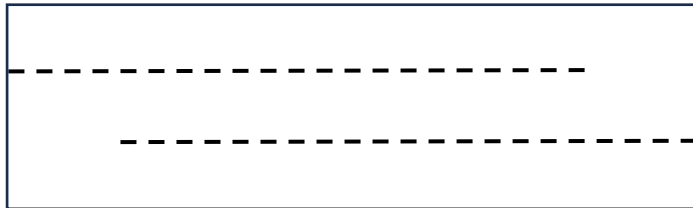


You will need:

1 rectangular piece of paper

1 paperclip

Scissors



STEM info

The paperclip on the gyrocopter makes the base heavier and helps it fall to the ground, but each blade is angled which makes it spin as it falls.

Safety advice

Take care that girls do not climb any unsafe structures in order to release the gyrocopter from greater heights.

Links to UMA/ SB/ Badges

Human cannonball

R/B/G/R

Your pneumatic flyer is launched by squeezing the plastic bottle to compress the air inside it. The air is pushed along the straw and launches your tiny flyer like a human cannon ball! It doesn't have to be a person you can launch a bird, a superhero, or anything you like!

What to do:

- 1) Draw and cut out a flyer from the light card, decorate if you want.
- 2) Seal one end of the thin straw with the tape and stick your flyer to this end.
- 3) Push the wider straw onto the nozzle of the washing-up liquid bottle. Use glue or tacky putty to create an airtight seal. If the nozzle is too small, carefully enlarge it with the blade of a craft knife.
- 4) Slide the thin straw into the wider straw.
- 5) Stand in a clear space and point your launcher up and away from anyone else.
- 6) Now launch your flyer, squeeze the bottle sharply and watch them go! As you squeeze the bottle the air compresses as it tries to get out. It pushes against the sealed end of the wide straw and launches the flyer.

Can you make a parachute for your flyer? You could cut the canopy from an old plastic bag and use cotton thread for the lines.



You will need:

Washing up liquid bottle (or any plastic bottle with a similar nozzle)

Thin straw

Wider straw

Tape, glue, tacky putty or similar

Light card

Pencil, crayons, etc.

Scissors/craft knife

STEM info

Pneumatic machines use the power of compressed air (air that has been squashed tightly into a space) to move things. Compressed air or gas is used to move motors, cylinders and a variety of mechanical parts. Pneumatics are found in car brakes and everyday tools (e.g. drills and power washers).

Safety advice

Use scissors/craft knife with care.

Take care when launching your flyer.

Links to UMA/ SB/ Badges

Wobbly characters

R/B

These characters are great at wobbling, but they can't fall down. Put them together in families, give them a nudge and they appear to dance or chat.

What to do:

- 1) Drop the marble inside the balloon.
- 2) Wind the elastic band several times around the balloon encased marble within the base of the balloon, then turn the balloon inside out.
- 3) Blow up the balloon, knot it and draw a face on the balloon.



You will need:

1 balloon

1 marble

1 elastic band

Permanent marker

STEM info

Although rounded smooth shapes roll freely when pushed, here the weight of the marble always brings the marble back to the centre.

Safety advice

Use plastic-based balloons if someone has a latex allergy.

Links to UMA/ SB/ Badges

Colour spinner

R/B

Create your own disc that can be wound up and sent spinning so fast that the colours all mingle together. Just hold both ends of the wool with arms outstretched, flip the disc over several times twisting the wool, then pull the wool tight watching the colours mix as the disc spins furiously.



What to do:

- 1) Use the template to draw 4 swirls on each card disc and colour them in or alternatively create the swirls on coloured paper and then glue into place.
- 2) Stick the decorated discs on both sides of the reel or heavy card.
- 3) Thread the wool onto a darning needle, pass the needle and wool through the front of the disc about 2mm away from the centre, then return bringing needle and wool through the back of the disc again 2mm from centre on the opposite side.
- 4) Tie the ends of the wool together creating a loop both sides of the disc.
- 5) Flip the disc several times to wind the wool, then pull the wool tight to watch the disc spin.

You will need:

2 card discs (approx. 10cm diameter)

1 ribbon reel or heavier corrugated card disc (10cm)

Stick on paper or Felt Pens

Glue

1 swirl template 5cm radius

80cm wool

1 Darning needle

STEM info

This is a fun way of creating tension by twisting the wool, then allowing it to recoil, causing the colours to look like they are mixing.

Safety advice

Take care with using darning needles. Plastic children's needles can be used, especially if an adult creates the holes to be threaded through.

Links to UMA/ SB/ Badges

Reinventing the wheel

G/R

Could you make a rolling wheel using just paper & paperclips?
The challenge requires you to build something with strength, yet smooth enough to roll on the ground.



What to do:

- 1) Cut all the sheets in half lengthways, then fold each one in half lengthways and half again, forming a strip 30cm x 2.5cm.
- 2) Fold each strip at 8.5cm, then after another 8.5cm, then after 4.5cm, leaving another 8.5cm. Create a triangle by tucking the first 8.5cm length into the folds of the final one. Repeat with all 16 strips.
- 3) Lay 2 triangles next to each other. Fix one triangle to a second beside it, securing with a paperclip near the points of the triangles and a second where they meet at the base.
- 4) Continue adding further triangles until they meet up as a wheel (14 – 16 triangles). Shape each base into a curve shape to make the outer ring a smooth circle. Roll away!

You will need:

8 sheets A4 paper

32 paperclips

STEM info

A wheel often contains spokes to add strength and support to the rolling surface. Triangles are a strong supportive shape and at the same time, the hole in the centre gives some flexibility for the outer rim as the wheel travels.

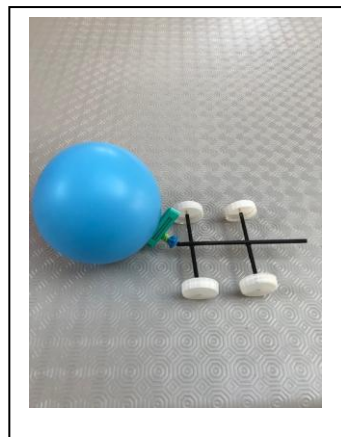
Safety advice

Links to UMA/ SB/ Badges

Air-powered vehicle

R/B/G/R

A brilliantly simple way to create a moving vehicle powered by air. You could have races or compete to see who can get their vehicle to travel the furthest. The ultimate in eco-travel!



What to do:

- 1) Cut off 9cm of straight straw from 2 of the straws and cut 2 10cm lengths of skewer.
- 2) Glue one end of the skewers onto the centre of the inside of 2 bottle tops. When dry and stable, thread the skewers through the cut straws and glue the bottle tops to the other end of the skewers.
- 3) Glue the two sets of wheels onto the third straw. Bend the end upwards and connect a balloon securing with an elastic band.
- 4) Blow up the balloon by blowing through the straw at the back. Peg the base of the balloon until you are ready to race, then undo the peg and watch it go! This works best on a hard floor (e.g. tiles) rather than carpet.

You will need:

1 balloon
1 wooden BBQ skewer
1 elastic band
3 bendy straws
4 plastic bottle tops
Peg / food bag clip
Hot glue

STEM info

The balloon acts as a fuel tank of air and, when released, the air rushes through the straw, causing the vehicle to be propelled.

Safety advice

Take care with using a hot glue gun, they can cause severe burns. The members should be closely supervised if near the glue gun.

Use plastic-based elastic bands & balloons if someone has a latex allergy.

Links to UMA/ SB/ Badges

Gyro toy

R/B

The gyro toy allows you to wind it up, then release allowing the gyro to rotate rapidly. You then get a rebound action with the gyro in reverse, rather like a yo-yo.

What to do:

- 1) Create a hole in the lid of the bottle to thread the skewer through, and a hole in the side of the bottle to accommodate the string.
- 2) Thread the string into the bottle and temporarily out through the top to tie it onto the skewer. Hot glue the string to the skewer so that the knot does not slip.
- 3) Thread the skewer through the lid and into bottle. Screw lid into place (keep end of string coming out of the bottle). Pierce a hole in the centre of both lollipop sticks.
- 4) Place lollipop sticks (at right angles) onto skewer protruding through bottle lid. Glue into place. Finally glue a bead onto skewer point to cover the point (whittle with a knife if necessary to fit into bead).
- 5) Lightly hold the string whilst rotating the blades and the string will wind around the skewer. Pull the string to see the gyro blades spin fast and then rewind the string back onto the skewer.



You will need:

1 BBQ skewer
1 500ml plastic bottle
2 lollipop sticks
String
Punch tool
Knife
Wooden bead
Glue gun

STEM info

This is a great example of Newton's Third Law of Motion – "For every action, there is an equal and opposite reaction".

Safety advice

This toy maybe enjoyed by younger girls, but it will need adults to operate the glue gun, punch tool and whittling.

Links to UMA/ SB/ Badges

Snake twister

R/B

This is a great way of cutting a spiral with an eye-catching design. It is also an easy way of getting movement into a mobile using heatwaves rising from a heater. This spiral design can be used as an effective party, Christmas or firework decoration.



What to do:

- 1) Mark the centre of the circle with a dot, then draw a spiral from the centre to the edge in pencil.
- 2) Decorate the back of your card with paper, ribbon, glitter, stickers or felt pen.
- 3) Cut out the spiral from the edge to near the centre leaving a 'snake's head' shape around the centre spot.
- 4) Create a hole in the centre & thread the wool through, securing with a knot.
- 5) Glue an eye in place if making a snake.
- 6) Dangle over a heat source and watch the spiral twist.

You will need:

1 card disc (approx. 15cm wide)

30cm length wool/string

Decorating paper or ribbon/felt pens/glitter/stickers

Scissors

Glue

Googly eye

Pencil

Heat source (e.g. heater)

STEM info

This is a fun way of showing how heat rises in waves, getting caught in the spiral and causing it to spin.

Safety advice

Take care that you do not use a flame for heat, as your twister is flammable.

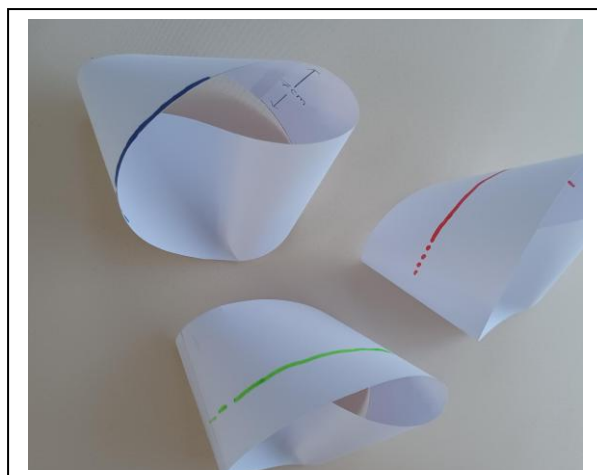
Do not use excessive heat as this may cause burns.

Links to UMA/ SB/ Badges

Möbius Strip

B/G/R

Have fun with a Möbius strip, the mind-bending creation that may make you rethink what you know about shapes and surfaces! You could add a pattern along the strip before taping it together. Younger members may just want to try the first example.



What to do:

- 1) Cut the A4 sheet of paper into 3 strips [7cm by 30 cm]. Next make these into 3 Möbius strips by placing a half twist in each strip of paper and taping it to itself.
- 2) On the first one draw a line right down the middle. *See our example of the one with the red line to show you how to do this.* What do you think will happen?
- 3) Now cut along this line. *[Hint – make a small fold in the paper to start the cut].* What do you think will happen once you cut all the way along the line?
- 4) Count the half-twists. Predict what will happen if you cut the strip in half again?
- 5) On the second Möbius strip draw your line *[green in our example]* about a third of the way across the strip. What do you think will happen?
- 6) Now cut along this line. What do you think will happen? Are there the same number of loops in both?
- 7) On the last Möbius strip draw your line [blue] along the edge. Möbius strips have only one edge, too. What do you think will happen?

You will need:

A4 sheet of paper (squared paper makes it easier)

Pencil

Ruler

Scissors

Sticky tape

3 different coloured felt pens

STEM info

The Möbius strip is an example of a non-orientable surface. Are there others?

Integrating art into STEM enhances creativity.

Safety advice

Take care with the scissors when the cutting the paper.

Links to UMA/ SB/ Badges

Tangrams

R/B/G/R

Tangrams originated in China over 200 years ago. They are mathematical puzzles that take advantage of the simple concept of using basic shapes to create larger, or more intricate shapes and objects.

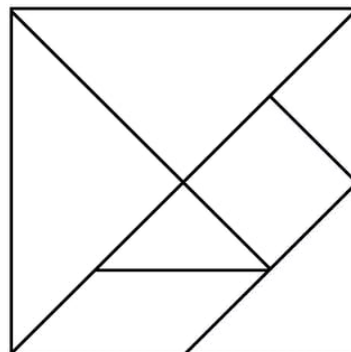


What to do:

- 1) Traditionally, the Chinese puzzle was a square divided into seven pieces called Tans. Each of the pieces had a different shape (see picture below). Take a square of paper, and using your ruler and pencil, draw these shapes onto your paper. Or try some different shapes if you like!
- 2) If you want to make it more durable, stick your paper to some thin card.
- 3) Cut along the lines you have drawn so you have seven pieces.
- 4) After taking the original shape apart, you can flip them, turn them, and rearrange them into a plethora of unique and dynamic shapes. Some of the most fascinating and creative builds turn tangram puzzles into animals, everyday objects, or even rockets!

You will need:

Ruler
Pencil
Scissors
Paper
Thin card (optional)



STEM info

There are many benefits to playing with Tangrams. They can be used to develop problem-solving and logical thinking skills, perceptual reasoning (nonverbal thinking skills), visual-spatial awareness, creativity and many mathematical concepts such as congruency, symmetry, area, perimeter, and geometry.

Safety advice

Links to UMA/ SB/ Badges

Tube step

R/B/G/R

Could a collection of toilet roll tubes hold your weight? Try it! Follow the safety instructions carefully so that hopefully everyone can have a go.

This exercise could be combined with the 'Strongest column' activity.

What to do:

- 1) Attach the inner tubes, one at a time to each other by winding Sellotape around them.
- 2) Create the honeycomb of tubes to fit into the cardboard tray.
- 3) Try standing on the honeycomb platform following the safety instructions.



You will need:

Toilet roll inners

Small shoe box size cardboard tray

Sellotape/ parcel tape

STEM info

A cylinder can support a good amount of weight on its edge as the weight gets evenly distributed. This can be multiplied by putting lots of cylinders together if they are packed together and cannot tumble.

Safety advice

Place the toilet roll platform next to a step, so that you can put your foot on it from above with the step initially taking the stress. Do not step onto it from the side edge, as it can collapse causing a shock to the ankle.

Links to UMA/ SB/ Badges

Step through a piece of paper

G/R

Using one piece of paper and a pair of scissors, can you make a hole in the paper that is large enough to walk through? Try to figure it out before reading the solution.



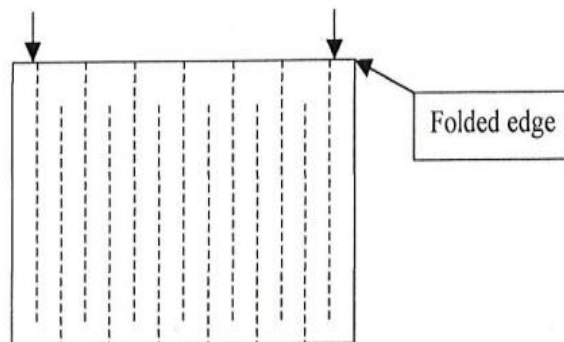
What to do

- 1) Fold paper in half (width-wise is easiest).
- 2) Cut a slit in the paper, starting from the folded edge about 1cm in from short edge until you almost reach the other end.
- 3) Alternate along your paper, cutting from the folded edge and then cutting from the unfolded edge (see picture below).
- 4) Make sure the end cut also starts from the folded edge.
- 5) Finally cut through the folds EXCEPT FOR THE FIRST & LAST and you should have created a loop.

You will need:

A4 paper

Scissors



STEM info

Even though the area of your piece of paper has not changed, you've now increased the perimeter of the shape that you're trying to step through.

Safety advice

UMA/SB/badges link:

Egg drop challenge

B/G/R

You are going to design a reusable device to protect a raw egg from breaking when dropped from an agreed height. It can be used as a group competition or team-building challenge. If it is a competition, marks can be given for design, style etc. as well as a successful outcome.

What to do:

- 1) Decide where the eggs are going to be dropped from, it must be the same for all the devices. Choose an area that will be easy to clean in case an egg breaks. Make sure it will be safe.
- 2) Make a quick plan of what you plan to make. Remember it must be reusable. Collect the materials you will need.
- 3) Now build your device. Think about using soft materials around the egg, why will this be a good idea? What can you add to slow the egg's fall?
- 4) Predict the outcome. Do you think your design will protect the egg? Why?
- 5) Drop each one of the egg protection devices from the agreed height and watch what happens. Check your egg. Can you repeat the test at a different height or with modifications to your device?
- 6) Did the egg survive? Can you say why or why not? What worked well, and what could you improve?
- 7) Can you think of any real-life applications, such as airbags, packaging, and spacecraft landings where scientist have used similar designs?



You will need:

Raw eggs – one per person/group

Paper towels for cleaning up

Scrap paper & pencils

Scissors

Padding materials, e.g. cotton wool, sponge, recycled packing etc.

Structural materials, e.g. cardboard, paper cups, tubes, etc.

Something to slow the fall, e.g. coffee filters, plastic bags, fabric, etc.

Tape and closures, e.g. assorted tapes, rubber bands, string, etc.

Optional – decorative materials.

STEM info

The egg drop challenge is a well-known STEM activity that encourages creativity, engineering, and physics.

Safety advice

Take care when using scissors.

Plan in advance from where the drop will take place.

Links to UMA/ SB/ Badges

Spoon reflection

R

This simple reflection experiment is a great way to teach us about mirrors and all you need is a range of spoons. So, this can be a great time filler.



What to do:

- 1) Hold the back of the spoon towards you. Can you see your reflection in the spoon? It may seem a bit distorted/fuzzy. Now move the spoon closer to your face and then further away. What happens to your reflection? It gets larger and then smaller.
- 2) Next turn the spoon around so that you are looking into the bowl of the spoon. What has happened to your reflection? It is upside down!

Curved mirrors produce distorted reflections. Have you been into a 'Hall of Mirrors' at the fair? Here they have large, curved mirrors which make our reflections look very strange.

In this spoon experiment you have been investigating two types of curved mirror.

Convex mirrors - ones which bulge out in the middle, the back of the spoon. In a convex mirror the reflection is always the right way up.

Concave mirrors- ones which form a dip in the middle [or cave!], the bowl of the spoon. When you are close to a concave mirror, your reflection is the right way up and is magnified. But if you move further away from a concave mirror, your reflection turns upside down.

Why not try looking at your reflection in different sized spoons, other curved reflective surfaces, or making your own curved surfaces out of tin foil?

You will need:

Dessert sized spoons

Cloth – for polishing the spoons

Other different sized spoons

Aluminium foil (optional)

STEM info

Convex mirrors are used for car rear view mirrors and shop security mirrors.

Concave mirrors are used for shaving and make-up mirrors, dentist mirrors and in torches.

Safety advice

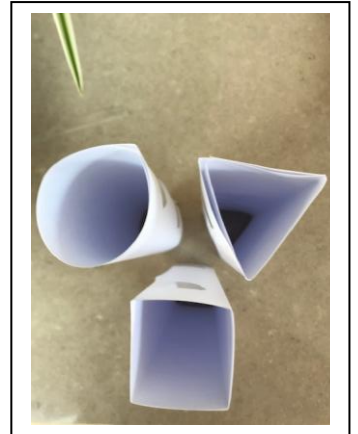
Links to UMA/ SB/ Badges

Strongest column

R/B/G

This activity looks at the basics of construction. It is an experiment discovering whether a square, triangular or circular column can support the most weight before being crushed by the weight.

Try to deduce which shape will be strongest and why.



What to do:

- 1) Fold one sheet of paper in half. Create a tube with the first half and then wrap the second half around it creating a double layered circular column.
- 2) Fold another sheet in half, then create 2 equal folds within one half to form a triangular prism, then wrap the second half around again to make a double layered triangular column.
- 3) Fold the third sheet in half, then create 3 equal folds within one half to form a rectangular prism, then wrap the second half around again to make a double layered rectangular column.
- 4) Take each column at a time, placing the weighty objects on top, one at a time. Record how many objects each column supports before it crumples.

You will need:

3 sheets A4 paper

Sellotape

Set of weighty objects to stack on top e.g. wooden blocks, books

STEM info

Generally, weakness can occur at the points furthest from a corner where 2 sides are supporting. A circle in essence is a set of continuous 'corners' and should be the strongest. Buildings often use materials where linear columns are easier, and they can still be very strong.

Safety advice

Links to UMA/ SB/ Badges

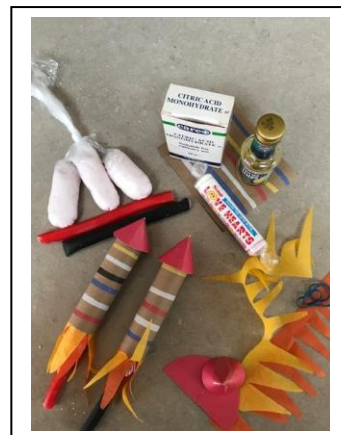
Sherbet dip rocket

B/G/R

This is a way of replicating sherbet dips from days of yore! Presented in a rocket form makes it a good party treat, but this could also be adapted for other festivals.

What to do:

- 1) Create the sherbet by crushing sweets (Love hearts/swizzels) in a plastic bag creating colourful dust. Add this to 50g icing/caster sugar & a little lemon flavouring. Half fill the fingers & thumb of the glove, with the sherbet using a funnel.
- 2) Cut out 2x10cm strip of tissue paper flames and tape to bottom edge of inside of coloured paper. Roll the coloured paper into a tube sealing with tape.
- 3) Cut a 'finger' of sherbet off the glove (with plenty of excess plastic to seal the end.
- 4) Put the liquorice stick into the sherbet finger and place inside tube. Seal the plastic pouch around the stick by twisting an elastic band around it several times.
- 5) Create a nosecone by cutting a 6cm circle, create a slit into the centre, slide 1 edge beneath the other to form a cone. Tape to seal the cone and glue it onto the rocket.



You will need:

Plastic bag-type glove

Patterned paper (10x10cm)

Nose cone card

Red & yellow tissue

Liquorice or strawberry stick

Fizzy sweets & lemon flavouring

Caster or icing sugar

Glue & sellotape

Plastic bag

Elastic band

STEM info

Fizz is created in sweets as they contain tangy acids and alkaline sodium bicarbonate. These are activated when in contact with water in the mouth.

Safety advice

Emphasise that sugary and acidic substances put directly on the teeth should only be an occasional treat.

Links to UMA/ SB/ Badges

Fizzy firework lolly

R/B/G/R

These fun lollipops make an impact when they pop as you eat them as well as being a joy to make. They take about 15 minutes to set in a fridge, so that needs to be considered within a unit meeting.

What to do:

- 1) Break up the chocolate and melt in a bowl suspended over a bowl of boiled water.
- 2) Put a teaspoon of melted chocolate in each circle mould, slide the stick down the slits of the mould into the chocolate.
- 3) Put the spare chocolate into a food bag, add some food dye and squidge the bag to mix it in. Snip off a tiny corner of the bag and pipe a little contrast chocolate onto lollipops and streak it using a cocktail stick.
- 4) Add the sprinkles to the surface and refrigerate until set.



You will need:

50g White Chocolate

3g Popping Candy

Red food dye

Plastic biscuit tray (Slits cut down one side)

Coffee stirrers (halved)

Sprinkles

STEM info

Popping candy contains both acid and alkaline ingredients set in the candy. It pops in your mouth when it is exposed to moisture.

Safety advice

Take care with the base bowl remaining hot or releasing steam.

The coffee stirrers can be halved with scissors, but smooth the cut edge with a nail file to prevent splinters.

Links to UMA/ SB/ Badges

Cotton bud bow and arrow

R/B/G/R

This is a very simple and safe way of making a shooting game. Choose a target board or picture to try to land your arrow in a safe area. Maybe shooting one of these arrows onto a chart could be a novel way of making a decision.



What to do:

- 1) Create the bow by fixing 2 buds together by twisting elastic bands to top and bottom.
- 2) Then separate the cotton buds by forcing a piece of skewer between the 2 buds both top and bottom. Complete the bow by putting a slightly larger elastic band through the ridges between the 2 buds.
- 3) Decorate your third cotton bud with felt pens so that it can be identified once it's landed.
- 4) Place your third cotton bud (the arrow) across the other cotton buds. Place the base of the arrow in the middle of the elastic band, and pull the elastic band back towards you.
- 5) Aim and fire!

You will need:

1 BBQ skewer (cut approx. 2cm lengths)

3 cotton buds

3 elastic bands

Felt pens

STEM info

As well as testing the power of elastic tension, you can also experiment with the angle of flight and how it affects the distance the cotton bud travels.

Safety advice

Take care with shooting the arrows, do not let anyone into the target field until all have fired (good practice in all target sports).

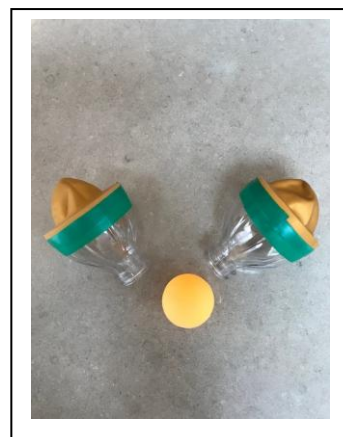
Use plastic-based elastic bands if someone has a latex allergy.

Links to UMA/ SB/ Badges

Air shooter

R/B/G/R

How do you move an object on a flat surface without touching it? You can blast it with air! This gizmo allows you to shoot air to move a ping pong ball. You could play air football on a table with 2 teams, race with each other, or challenge yourself to get the ball around a maze.



What to do:

- 1) Cut the bottle into two, just below where the neck meets the main body, creating a beaker & a funnel.
- 2) Cut the balloon into two, removing the neck end about one third along its length.
- 3) Stretch the round end of balloon over the open end of the funnel and tape edges in place.
- 4) Remove bottle lid, pinch the balloon pulling outwards, release quickly and air will gush from the top.

You will need:

1 strong plastic bottle per shooter e.g. squash bottle

1 large balloon per shooter

Tape

Something to move e.g. ping pong ball

STEM info

Pulling the balloon back causes more air to move into the bottle, then the elasticity of the balloon expels the air quickly with force.

Safety advice

Take care with cutting the bottle: form a slit using a serrated knife or a hack saw, then use scissors to continue the cutting.

Use plastic-based balloons if someone has a latex allergy.

Links to UMA/ SB/ Badges

Darts

B/G/R

Though these darts are easy to make, they are also reasonably robust. They are much lighter than sports darts and are designed to be thrown on to packing plastic. You can design your board in any way you wish, creating your own game and scoring system.



What to do:

- 1) Create the flights by folding a strip of paper (6 x 30 cm) in half lengthways. Along the folded edge cut to the flap edge at a 45 degree angle every 3 cm. This should give you 9 'v' shape flights.
- 2) Bundle the 4 cocktail sticks together and fix with an elastic band at one end. Pull the central stick out by about 3 cm to form the sharp point.
- 3) Slip the fold of a flight beneath each of the 3 outer cocktail sticks, then bind the 3 sticks together at the base of the dart.
- 4) Colour in your dartboard as required, make up the rules and off you go.

You will need:

7 cocktail sticks

1 plastic packing board

2 Elastic Bands

Permanent felt pens

Paper for flights

STEM info

The flights on darts help to keep them stable as they fly through the air, so that the point hits the board first.

Safety advice

Take care with shooting the darts, do not let anyone into the target field until all have fired. This is good practice in all target sports!

Use plastic-based elastic bands if someone has a latex allergy.

Links to UMA/ SB/ Badges

Bottle shooter

B/G/R

This is a very simple but effective way of shooting a chopstick! They can travel quite a distance, so you might want to compete to see who can shoot the furthest, or maybe try to knock over stacked empty cans.

What to do:

- 1) Cut a window (approx. 4 x 10 cm) from the front of your bottle, then repeat with the back, leaving 2 side panels on the bottle. Older girls should be able to cut the windows, but putting in the 4cm cuts on top & bottom of window would assist younger girls.
- 2) Introduce a balloon through the top of the bottle then stretch the neck of the balloon over the neck of the bottle.
- 3) Put the chopstick into the balloon (thicker end first), then hold the neck of the bottle with one hand and pull back the chopstick holding it in the balloon and with finger and thumb coming through the windows.
- 4) Aim & fire!



You will need:

- 1 water bottle
- 1 chopstick
- 1 balloon
- Scissors
- Empty mixer drink cans

STEM info

This is a fun way of exploring the elastic power of a balloon.

Safety advice

Take care with shooting the chopsticks, do not let anyone into the target field until all have fired (Good practice in all target sports)

Use plastic-based balloons if someone has a latex allergy.

Links to UMA/ SB/ Badges

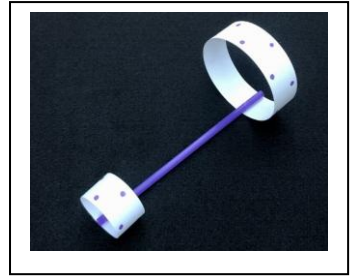
Hoopsters

R/B/G/R

This straw and paper airplane is easy to make and flies well. "Hoopsters" are easy to throw, and they fly in straight lines.

What to do:

- 1) Cut the card/paper so you have 1 strip that is 10"x1" and 2 strips that are 5"x1".
- 2) Curl the 5"x1" strip into a hoop and tape the ends together.
- 3) Repeat with the 10"x1" strip.
- 4) Tape the hoops to the two ends of the straw. Make sure the straw is on the inside of the hoops and lined up.
- 5) Hold the hoop glider in the middle of the straw with the little hoop in the front and throw!



You will need:

Card or thick paper (8"x11")

Ruler

Scissors

Drinking straw (if you have a bendy straw, cut the accordion part off)

Tape

STEM info

The thrust is the force that pushes the straw glider forward. When you launch the straw airplane with your hand, you are generating enough thrust that allows the plane to move through the air.

Drag, or air resistance, is the force that acts in opposition to the thrust. Drag is what slows the airplane down.

Air moves through the hoops and provides lift, or the force that keeps the airplane up. Gravity is the force that pulls the hoop glider downward and acts against the lift. As the airplane slows down due to drag, the strength of the lift lessens, and gravity pulls the glider down.

Safety advice

Links to UMA/ SB/ Badges

Make your own panpipes

B/G/R

Make your own panpipes using straws. This is a way to use up plastic straws you may still have. If using paper straws, do not use flames! Use tape to completely seal one end of the paper straw instead.



What to do:

- 1) Take your first straw and hold one end together using the pliers.
- 2) Carefully hold the end in a flame from the lighter or candle until the end is melted together, sealing the straw.
- 3) Blow across the top of the straw to check the note.
- 4) Seal the end of another straw the same way, then cut the other end so this straw is shorter than the previous one. Blow across the top to check the note – can you hear the difference?
- 5) Repeat with another 6 straws – you should end up with 8 straws of different lengths, which all play different notes. Put these in size order, with the open tops level with each other.
- 6) Cut another one or two straws into small pieces – you will need 7 of these small pieces.
- 7) Put one small piece in between each of the sealed straws about 1cm from the top to act as spacers.
- 8) Cut a strip of tape at least twice as long as the width of the straws when they are laid out together.
- 9) Lay the tape across one side level with the spacers, making sure it sticks to every straw. Carefully turn the straws over and tape the other side. Ensure all of the tape is stuck down.
- 10) See if you can play a tune on your panpipes!

You will need:

9–10 straws

Sellotape

Scissors

Pliers

Lighter/tealight and matches

Phone app to check pitch
(optional)

STEM info

The sealed straw allows the air to vibrate to produce the sounds. Members can change the lengths of the straws to change the pitch. For an additional challenge, use a phone app (or just sing!) to produce a pitch and see if they can match it!

Safety advice

Members should be supervised when using a flame.

This should be done in a well-ventilated area due to melting the plastic.

Links to UMA/ SB/ Badges

Make your own castanets

R/B

Make your own castanets using bottle caps.

What to do:

- 1) Fold each paper plate in half, then open up again.
- 2) Glue three bottle caps on the top half of the rim, gluing the outside edge of the cap to the plate. Alternatively, you could use buttons.
- 3) Glue three bottle caps (or buttons) on the bottom half of the rim so that when the plate is folded in half, the caps will touch.
- 4) Decorate your castanets if you want to (this step is optional).
- 5) Fold the plate in half and hold it in your hand with the fold in the palm, fingertips out towards the edges of the plate – use your hand to close the plate to make a noise! Can you play in time with a song? Can you use your castanets in a dance?



You will need:

2 small paper plates

12 bottle caps (or buttons)

Glue gun (or glue dots)

Ruler or tape measure (optional)

Pens/crayons/glitter etc. to decorate (optional)

STEM info

This is teaching engineering skills, putting together the items to create a functioning instrument. Members will need to use their skills to glue the caps in the right place. You could use a ruler or tape measure to make sure they match up on both sides of the plate.

Safety advice

Please supervise members when using a glue gun to reduce the risk of burns.

The bottle cap edges can be sharp.

Links to UMA/ SB/ Badges

Make your own tambourine

R/B/G/R

Have a go at making your own tambourine using bottle caps.



What to do:

- 1) First you will need to make holes in the bottle caps – place the cap top-side down on the block of wood, hold the nail in the centre of the cap, then use the hammer to make the hole. You decide whether your unit members can do this themselves, or if this needs to be done by an adult before the activity.
- 2) Thread your bottle caps onto the wire.
- 3) Join the two ends of the wire together with tape, ensuring the ends are fully covered.
- 4) Use tape wrapped around the wire to divide the bottle tops – 2 or 3 bottle tops together works well, but see what you think!
- 5) If you want to decorate your tambourine, add ribbons (this step is optional).
- 6) Sing or play a song and join in with your tambourine!

You will need:

40cm thick wire (3mm works well)

6-12 metal bottle caps

Hammer

Nail (bigger than your wire)

Block of wood

Masking tape / electrical tape

Ribbons to decorate (optional)

STEM info

This is teaching engineering skills, putting together the items to create a functioning instrument. Members will need to decide how many caps to use to produce the sound they want, and how to space them on the wire.

Safety advice

If your members are making the holes in the bottle caps themselves, they will need supervision.

The bottle cap edges and ends of the wire can be sharp.

Links to UMA/ SB/ Badges

Make your own kazoo

R/B/G/R

Have a go at making your own kazoo – you can leave it plain, or decorate it if you like! Can you join with your friends to play a song together?



What to do:

- 1) If you want to decorate your kazoo/harmonica, then decorate the lolly sticks first. This step is optional.
- 2) Take one elastic band and wrap it lengthways around one lolly stick.
- 3) Take each piece of paper and fold in half, then half again, then half again
- 4) Put one folded piece of paper at one end of the lolly stick with the elastic band, about 1cm in from the edge. Put the other lolly stick on top, and secure with another elastic band.
- 5) Repeat at the other end of the lolly stick with the other folded piece of paper and the other elastic band.
- 6) You've made your kazoo! See how many sounds you can make – you can try humming, singing, speaking, or blowing into it.

You will need:

2 lolly sticks

3 elastic bands (thicker bands work best)

2 pieces of paper approx. 5cm x 5cm

Felt tip pens to decorate (optional)

STEM info

What you can hear is the elastic band vibrating. Try using different thicknesses of elastic band, or different sized lolly sticks. If you move the paper closer to the centre of the sticks, does it make a difference?

Safety advice

If you decorate it, make sure to use non-toxic pens as it will be going in your mouth!

Use plastic-based bands if someone has a latex allergy.

Links to UMA/ SB/ Badges

what3words treasure hunt

G/R

Use the app what3words to create a treasure hunt! This could be a virtual hunt, or you could do it in real life. The app divides the entire world into 3 metre squares, which means you could even navigate to individual tents on a campsite!



What to do:

- 1) There are two ways to search on what3words – you can either search for a location to find out what the three words are for that place, or use the three words to find a specific location.
- 2) If doing a virtual hunt, you might search for your locations then make a note of the three words for each one. Ask members to search the three words on the app to find out what the location is. This might give them a letter for each location that they can use to make a word, or take them to a tourist attraction they could then do a virtual tour of.
- 3) If doing an in-person activity, you could use the three words to take them to various locations where there are hidden clues or tasks to complete.
- 4) How about asking groups to create a trail for each other?

You will need:

Phone for each group with the what3words app downloaded onto it

Prepared treasure trail (see left for suggestions)

STEM info

Technology can take your wide games to a new level! You can also use technology to explore places that you may find difficult to visit in person.

Safety advice

Be mindful when using mobile phones – if using a phone that isn't their own, ensure that the user cannot access other apps or personal data.

Links to UMA/ SB/ Badges

Smart phone speaker

G/R

It's a great tool to show just how simple it can be to project sound.



What to do:

- 1) **With the Pringles Can** – Use a serrated knife to cut a slot for your phone to rest in. you don't want to cut it too big, just big enough for your phone to rest inside. Use scissors to cut the remaining cardboard out of the Pringles can. Double check to make sure your phone will fit into the slot. You can widen the hole at this time if needed.
- 2) **Decorate** – Now you can choose to paint your Pringles can, or leave it plain. It works the same either way.
- 3) **Make it stable** – Finally, glue the beads onto the base of the speaker with a hot glue gun. Make sure to make them even so that your speaker won't tip over and has a sturdy base. Wine bottle corks, lolly sticks, or bottle caps can also be used to glue on and stabilize it.
- 4) **Finish off** – Before you use the speaker, put about 5 sheets of toilet paper into the tube. This will help the music sound better.

You will need:

Pringles tube

Serrated Knife

Scissors

4 beads or bottle tops

Smartphone

STEM info

This is a fun way of exploring sound.

Safety advice

Take care with the sharp points on the scissors and knife.

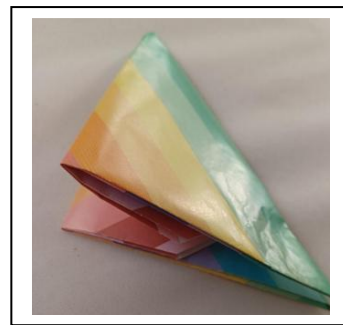
Be mindful when using mobile phones, making sure user cannot access apps on other people's phones.

Links to UMA/ SB/ Badges

Origami banger

B/G/R

A simple, folding paper activity that's sure to go down with a bang! You can make your own bangers for Bonfire Night or to welcome in the New Year. Why not experiment with different weights of paper or other styles of bangers/poppers? YouTube have excellent instruction clips.



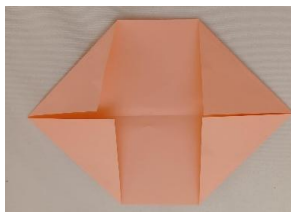
What to do:

You will need:

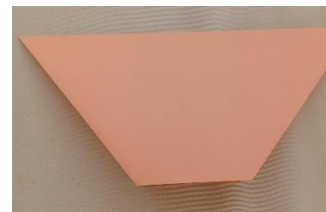
Sheets of A4 paper.
We found wrapping paper worked well.



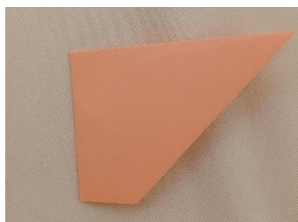
Fold the paper as shown and open out.



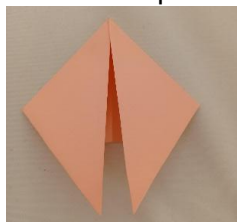
Fold each corner into the centre fold.



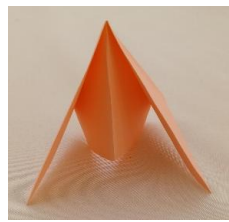
Fold the paper in half along your first fold.



Fold it in half again.
And open out this second main fold.



Now fold down the two sharp corners.



Fold the paper back along the second main fold to make a triangle.



Hold the banger as shown and make a quick downward movement.

STEM info

The banger produces a fast and large movement of air which gives a sudden and powerful sound wave. The same thing happens when we hear a clap of thunder. Lightning heats the air making it expand suddenly; this expansion of air creates a sonic shock wave.

Safety advice

Links to UMA/ SB/ Badges

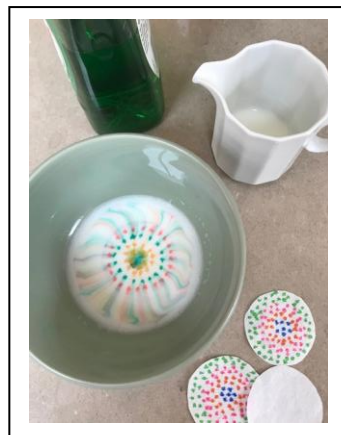
Colour run

R/B/G/R

Watch streaks of dye race to the edge of the bowl making a beautiful pattern. Great for an indoor fireworks party.

What to do:

- 1) Place the wet wipe disc on a folded kitchen towel and create a pattern of dots on the disc using felt pens.
- 2) Put enough milk into a bowl to allow the disc to float and put a drop of washing up liquid in the centre of the disc.
- 3) Float the fabric disc on the milk and watch the colour run.



You will need:

1 disc of wet wipe fabric (8cm)

Kitchen towel

Felt pens

Milk

Washing up liquid

STEM info

Washing up liquid disperses fat and so when the disc hits the milk, the washing up liquid disperses the fat in the milk from the centre outwards.

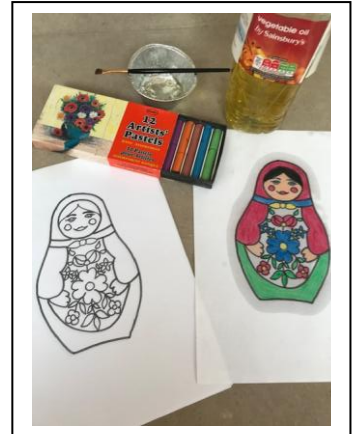
Safety advice

Links to UMA/ SB/ Badges

Stained glass art

R/B/G/R

It is wonderful to see your pastel picture brightening and becoming translucent enabling you to display it in a window. It only needs a little oil painted on the back as it disperses easily. The pictures can be cut out to avoid the grease marks on the edge.



What to do:

- 1) Colour in your picture using pastel crayons. Rubbing each area of colour with a cotton bud can fill in any gaps.
- 2) Place your picture on folded kitchen towel face down and paint the back of the coloured area sparingly with oil.
- 3) Dab off excess oil with kitchen towel and cut out design.
- 4) Stick onto a window or put in a transparent frame.

You will need:

1 printed picture blank

Pastel crayons

Cotton buds

Kitchen towel

Vegetable oil

Paint brush

STEM info

The oil makes the paper translucent, but the wax of the pastel crayons makes them greaseproof on the other side of the paper, so the colours do not run.

Safety advice

Links to UMA/ SB/ Badges

Rainbow tipped flower

R/B/G/R

This shows how water can carry colours through the toilet paper, which acts as a filter. If you don't want to try all the colours, use whichever colours you like!

What to do:

- 1) Fold the paper in half, then half again and half again. Cut the end of the folded strip to round it off then unfold the toilet paper.
- 2) Carefully colour in a band below each rounded petal end following the spectrum of the rainbow.
- 3) Gather the paper around the cotton bud holding it in place at both the base and near the top with elastic bands.
- 4) Sit the base of the 'flower' in a glass of water and watch the colour travel to the petal tips. Remove flower from water and leave to dry.



You will need:

2 joined sheets of toilet paper

2 elastic bands

1 cotton bud

Felt tip pens (not permanent markers)

Small glass of water

STEM info

The toilet paper acts as a filter - the water enters the base of the flower from the glass and travels up through the stem to the petals. As it passes through the coloured band, it carries the colour until it reaches the edge of the petal.

Safety advice

Links to UMA/ SB/ Badges

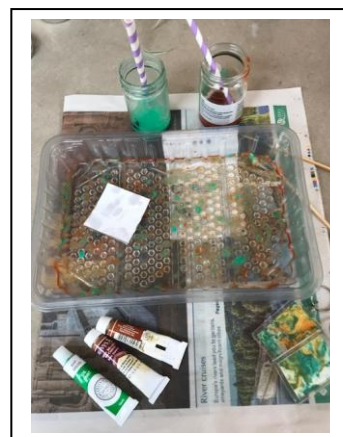
Paper marbling

B/G/R

This is an ancient Italian art, which captures the pretty patterns of oil floating on water, similar to those seen in puddles on roads. It is possible to capture large patterns on large sheets of paper for notebook covers or wrapping paper, but it can also be very messy, so this starter with tiny sheets for keyrings, is a good place to start.

What to do:

- 1) Put about a 5cm stream of oil paint in a jar, add 20ml paint thinner, and mix together with a straw. Repeat for other colours.
- 2) Fill the meat tray with water until the base is well covered. Put a straw in a paint jar, cover over the top of the straw with finger. Keep the straw upright and let go with finger when the straw is over water, dropping the paint on the surface. Repeat with another colour.
- 3) Gently pass a skewer through your colour oil slicks, causing them to blend slightly. Put a piece of paper over the oil pattern you like, then immediately remove paper with tweezers.
- 4) Turn the paper over to see the marbling and let it dry on newspaper before framing.



You will need:

Newspaper to protect table

Oil paints

Paint thinner

Small bottles & straws

Watercolour paper (3x4 cm)

Tweezers

Plastic meat tray

STEM info

The paint thinner acts as a solvent, making the thick oil much more liquid. It still acts as oil within the water, floating on the top giving the liquid marbling design.

Safety advice

Take care with the girls handling oil paint and solvent. It can both stain and be hazardous if put in the mouth.

Links to UMA/ SB/ Badges

Colour change ring

B/G

This is a very simple ring that is half covered with a second colour. With practice, you can turn the ring in your fingers, and it appears to completely change colour.

What to do:

- 1) Create a ring with the long strip overlapping the last cm, sticking with glue.
- 2) Glue a contrast strip to the inside of the ring.
- 3) Glue the second strip to the outside ring, completely opposite to the first.
- 4) Hold the ring between fingers and thumbs covering the joints where the colours change. You will see the ring as one colour or the other as you twist it.



You will need:

1 strip paper or ribbon (10x1cm)

2 strips contrast colour paper or ribbon (4.5 x 1cm)

NOTE: the paper or ribbon needs to be the same colour on both sides

Pritt stick

STEM info

This activity is a study in perception. We often see rings from half of the outside and then from the opposite inside. If both are the same, you assume the whole ring to be one colour, when it's twisted around you find it's another.

Safety advice

Links to UMA/ SB/ Badges

Kaleidoscope

R/B/G/R

It's a great tool to remind you just how simple the principles of reflection are.

What to do:

- 1) Roll a piece of shimmery silver paper and put it inside the can and cut off any excess.
- 2) Cover the outside of the can with a coloured paper and secure it with tape, or you can paint it. Decorate if you like with markers, stickers, tape, and other embellishments!
- 3) Use a pin to punch an eye hole in the sealed end of the can.
- 4) Glue sequins on the inside of the Pringles can lid. Then add glitter and colourful paper or other embellishments.
- 5) Your simple kaleidoscope needs one more thing, A second colourful lens! For this you want to use something clear, like a plastic wallet or acetate. Cut a square, add as many sequins and glitter as you like, then press another piece of clear material over the top and seal it.
- 6) Use scissors and cut the contact paper to fit your can. You will be putting the lid on over this, so make sure it is a close fit.
- 7) Next you want to glue it to the top of can.
- 8) It's very important to let everything dry really well. Put the lid on your simple kaleidoscope and point it towards a light source to see your creation!



You will need:

Pringles tube

Shimmery scrapbook paper

Scissors

Tissue paper

Clear material, e.g. plastic wallet or acetate

Sequins

Glitter

PVA glue

Pin

STEM info

This is a fun way of exploring the reflection of light.

Safety advice

Take care with the sharp points on the scissors and pin.

Links to UMA/ SB/ Badges

Silhouette portraits

R/B/G/R

Take inspiration from Queen Victoria's album and try making a silhouette yourself. You may wish to cut out a silhouette profile using just scissors and paper, or you might prefer to try making a portrait with black paint on a clear or white surface.

Alternatively, you can use the instructions below to cast a shadow onto a wall using a torch or another strong source of light, and draw around the shadow to create the basis of a silhouette.



What to do:

- 1) Position your subject in profile in front of a blank wall.
- 2) Using a torch, at eye level shine a beam directly towards the subject's profile, creating a shadow on the wall behind. Be sure to ask them to close their eyes!
- 3) Take a piece of blank paper and tape or tack it onto the wall, directly onto where the shadow or the profile falls.
- 4) Using a pen or pencil, draw carefully around the shadow, leaving you with the outline of the profile.
- 5) You can then cut this outline out to use as a template for a cut silhouette on black paper.

You will need:

A subject

Torch or lamp

Piece of paper

Pencil or pen

Black paper

STEM info

Light travels in straight lines – when you put a solid object in between the light and the wall, it casts a shadow.

Safety advice

Links to UMA/ SB/ Badges

Camera obscura

R/B/G/R

It's a great tool to remind you just how simple the principles of photography are, and to get you back in touch with moving subjects into and out of focus.



What to do:

- 1) **With the Pringles Can** - Draw a line around the tube, about 6cm or 2½" up from the base. Using a craft knife, or in my case, a bread knife, cut through the tube so that you're left with two pieces. The shorter section will be from the bottom of the can, and the longer section from the top.
- 2) **Make a screen** - You need to make a screen onto which your image will be projected inside the can. The cheapest and most readily available means to make one is from tracing paper. Place the lid of the Pringles can on a sheet of tracing paper, draw around it, and then cut it out. Secure the tracing paper on to the top of the tube using the lid.
- 3) **Put the can back together** - Rather than reconstruct the can with the two cut ends meeting again, you want the cut end from the bottom section of the can meeting the lidded, tracing-papered end from the upper section. Secure them in place using gaffer tape or electrical tape. No light should be able to pass through the join.
- 4) **Pierce a hole** - In order for the light to pass into the can and create an image, pierce a hole using a drawing pin in the base of the can.
- 5) **Finish off your camera obscura** - To make sure that you don't end up with spurs of cardboard poking into your face when you hold your camera obscura to your eye, tape up the cut surface with some electrical tape. And if you don't want it to resemble a Pringles can that you've hacked up, wrap some coloured paper around it.
- 6) **Head out into the light** - The brighter the day, the better the image you'll be able to render on your screen. Just remember that everything will appear upside down. And then it will be a case of moving nearer and farther away from your subject to get it in focus.

You will need:

Pringles tube

Electrical Tape

Tracing paper

Serrated Knife

Scissors

Pencil

Pin or something to make a hole with

Ruler or tape measure

STEM info

This is a fun way of exploring photography.

Safety advice

Take care with the sharp points on the knife, pin and scissors.

Links to UMA/ SB/ Badges

Shadow puppets

R/B/G

This method allows a light to be shone in a tube, concentrating the light leaving the tube. The shape of a character is placed on a transparent lens at the end of the tube. The light then casts a shadow of the character on a wall/screen. You can create a scenic backdrop for your characters, maybe setting it to a song, poem, or story.



What to do:

- 1) Tape the ends of the tubes/boxes to seal. Create a slit in tape large enough for torch.
- 2) Cut out drawn characters or use stickers with a good profile. Stick on to clear plastic or laminate them (leaving plenty of space around them).
- 3) Put the 'character lens' on the other end of the tube, cutting the plastic larger than the tube, then taping the excess around the sides.
- 4) Create a scene inside a box lid.
- 5) Present your story in low light, turning on the torches to make characters appear in the scene.

You will need:

Character silhouettes (smaller than the diameter of tubes)

Cardboard tubes/boxes

Tape

Clear plastic or laminator

Box for scenery

Small torches

STEM info

Light beams radiate outwards, increasing the area covered but weakening in intensity. The light cannot travel through a solid, and so the light around the edges of the solid give a silhouette.

Safety advice

Links to UMA/ SB/ Badges

Star sign projector

G/R

Project your star sign onto a screen or wall in a darkened room showing the brightest and minor stars that make up the constellation. Try finding out where your constellation can be seen and at which time of year.



What to do:

- 1) Using the star sign constellation resource, draw your star sign on the cardboard base of your tub. Differentiate between the larger and smaller stars.
- 2) Lightly punch through the stars drawn using a suitable tool. Expand the holes with cocktail sticks and skewers depending on size.
- 3) Cut a hole in the plastic lid using a craft knife, appropriate to the size of the torch. Insert light end of torch into hole.
- 4) In a room with dim light, switch on the torch and shine against a wall to see the representation of your constellation.

You will need:

Cardboard container with plastic lid (e.g. gravy, cornflour tub)

Mini torch

Pen

BBQ skewer, cocktail stick

Fine punch tool

Craft knife

STEM info

The container helps to condense the light rays onto a small area which gives enough light coming through the holes to project them.

Safety advice

Take care with the initial punching of the holes. An awl or the point of a pair of compass' are slightly easier and safer than a darning needle, but all are possible.

Leaders should risk assess if girls can use a craft knife supervised, or if they need to pre-cut the lids.

Links to UMA/ SB/ Badges

Paddle boat

R/B/G/R

This little boat is a swift mover! Just twist the paddle at the back several times, hold in place and then release it on the water. A few tweaks and you can make it go in different directions. How about seeing if you can get it to navigate a course in a paddling pool?



What to do:

- 1) Put the lid on the bottle or seal off the top with cling film and tape. Secure 2 elastic bands to the bottle and thread the lollipop sticks through them (1 each side).
- 2) Loop a small tight elastic band over the ends of the 2 sticks at the back of the boat. Slide the plastic paddle between the 2 sides of the elastic band at the rear.
- 3) Rotate the paddle several times, hold in place and then launch on the water.

You will need:

1 small plastic bottle with lid
(or cling film and tape if no lid)

2 lollipop sticks

3 Elastic Bands

Plastic 4x3cm (from water bottle)

STEM info

By rotating the paddle and elastic band you create tension. When set free, the band unwinds, spinning the paddle with it. This action propels the boat much like legs kicking in swimming.

Safety advice

Only use these boats in shallow water and with supervision.

Use plastic-based elastic bands if someone has a latex allergy.

Links to UMA/ SB/ Badges

Diving jellyfish

B/G/R

A fun way to learn about buoyancy and density with your very own Jellyfish Cartesian Diver. Can you make the jellyfish do tricks?

What to do:

- 1) Cut a 6cm length from a paper straw.
- 2) Next cut a 12cm length of string and thread it through the straw, fold it all in half.
- 3) Slide a paperclip over the open ends of the straw so that two ends of the paper clip go inside two ends of the straw.
- 4) Tease out the ends of the string to make the jellyfish's tentacles. Use the permanent marker to colour the straw and the string.
- 5) Almost fill a plastic bottle with water, leaving a small amount of air.
- 6) Put your jellyfish in and close the cap.
- 7) Now squeeze the bottle to make the jellyfish sink and release to make it rise. You may need two pairs of hands to provide enough pressure.



You will need:

Paper straw
Paper clip
Empty plastic bottle
Cotton string
Water
Scissors
Permanent markers
Ruler

STEM info

This is a version of the Cartesian diver experiment. When you squeeze the bottle, you increase the pressure on the water and the air inside the jellyfish straw. This increased pressure compresses the air, reducing its volume. Because water is a liquid, it does not experience the same compression, so its volume stays the same.

Safety advice

Take care when using the scissors.

Links to UMA/ SB/ Badges

Simple wind meter

R/B

This is an experiment to make a simple anemometer [a device to measure the wind's strength] that can use recycled materials. If you want to add patterns and designs to the strips; these could be linked to a meeting/holiday/camp theme.

What to do:

- 1) Cut equal sized strips of tissue, paper, foil, thin and thick card. If you make the card one first, you can use this as a template.
- 2) Punch a hole near one end of each strip.
- 3) Tie a length of string to each strip and then attach the other end of the string to the stick. Leave as much space as possible between each. Trim any excess string.
- 4) Now take your wind meter outside and hold it as high as you can. Which strips are being moved by the wind?
- 5) Can you find areas that are windier or less windy? Do buildings, trees, etc. shelter you from the wind or funnel it?



You will need:

Per person:

Stick – bamboo cane, foraged stick etc.

Range of different weight paper e.g. tissue, printer, thick & thin card, foil etc. – try to use recycled materials

5 x 20cm pieces of thin string or cotton (length dependant on width of stick)

Shared:

Ruler, pencil, scissors & hole punch

STEM info

Why not find out about the Beaufort Scale which is used for measuring wind speeds and is based on observation rather than accurate measurement? The scale was developed in 1805 by Francis Beaufort.

Safety advice

Take care with the scissors and the pointed ends of the stick. Don't stand anywhere that may be of danger (e.g. branches falling from a tree).

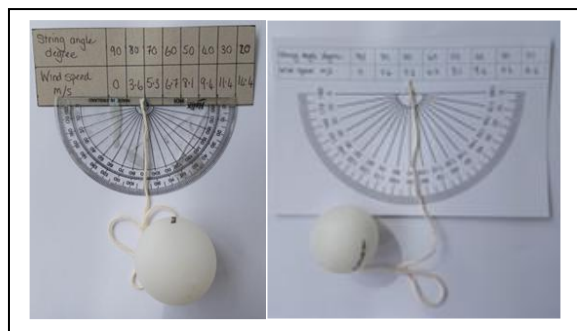
Don't go outside in high winds.

Links to UMA/ SB/ Badges

Anemometer

G/R

For many reasons, including our wellbeing, leisure activities and even general interest, knowing the speed of the wind is useful. An anemometer is a device to measure wind speed, and there are many different types available – here is one that you can make yourself.



What to do:

1) Cut the card into a rectangle about 14x5 cm and copy this table onto it.

String angle degree	90	80	70	60	50	40	30	20
Wind speed m/s	0	3.6	5.3	6.7	8.1	9.4	11.4	14.4

m/s stands for metres per second

- 2) Stick the protractor to the cardboard with glue dots or tape with the straight edge at the top of the card. Line up the two straight edges precisely.
 - 3) Attach one end of the string to the ping pong ball with tape or a glue dot. Attach the other end to the centre of the top edge of the protractor (see the picture).
 - 4) Hold the cardboard at arm's length so that if there were no wind at all the string would lie along the 90-degree line. Now let the wind catch the ball. The thread will make an angle against the protractor.
 - 5) Read the angle. Use your chart to convert this angle into an approximate wind speed.
 - 6) Now compare your findings with the Beaufort Scale which uses your observations of the wind. Which do you think is more accurate? The Beaufort scale is not a very precise measurement because it relies on personal opinion.
- * If you use the card method, make sure the string hangs freely, away from the card.

You will need:

30 cm strong thread, thin string etc.

1 ping pong ball

Glue dots or clear tape

Card

Protractor (or use the printable one & stick onto card*)

Copy of the Beaufort Scale

STEM info

Most wind is caused by different parts of Earth's surface absorbing different amounts of heat from the sun. Hotter air tends to rise while cooler air sinks, leading to exchanges of air between neighbouring regions of air with different temperatures.

Safety advice

Take care with scissors. Don't stand anywhere that may be of danger (e.g. branches falling from a tree).
Don't go outside in high winds.

Links to UMA/ SB/ Badges

Rain gauge

B/G/R

Have you ever wondered just how much it's raining? Here's a way to make a device to measure how much rain has fallen.

What to do:

- 1) First make up the jelly mix, a packet should fill about three rain gauges.
- 2) Carefully cut off the top, below the neck, about a quarter of the way down. Use the ruler and marker pen to give you a line to follow.
- 3) Turn the top of the bottle upside down and place it back in the bottom part of the bottle. It should fit snugly, use paper clips or the tape to hold it in place. This will reduce the amount of water that evaporates.
- 4) The bottles are usually shaped at the bottom, but you need a uniform cylinder to measure the depth accurately to achieve this pour in some on the jelly mixture and let it set in the bottom of the bottle. *Jelly may attract slugs and will eventually go off.* Rain fall will be measured from the top of the jelly.
- 5) You can measure the rainfall in the following ways:
Either attach a ruler to the side of your rain gauge to measure the amount of water collected. Remember '0' on the ruler needs to line up with the top of the jelly, not the bottom of the bottle.
Or you can use a permanent marker to draw a scale on the bottle, again remember '0' is the top of the jelly.
- 6) Place the rain gauge outside. You may need to put stones or soil around the base to give it extra stability.
- 7) Every day read and record the depth of water against the scale and empty it. You'll also need to clean it out every now and again.



You will need:

Empty, clean 2 litre plastic bottles

Scissors

Jelly - 1 pack will make about 3 rain gauges. You can use vegan jelly if required.

Paperclips or waterproof tape

Rulers

Permanent markers

STEM info

If rainfall is long and heavy, it can lead to rapid flooding; lack of rain can lead to drought. Rainfall is necessary, providing water to plants and filling our rivers. As rainfall is both a potential threat and an essential resource, we need to understand this natural phenomenon.

Safety advice

Take care with boiling water when making up the jelly and cutting the bottles.

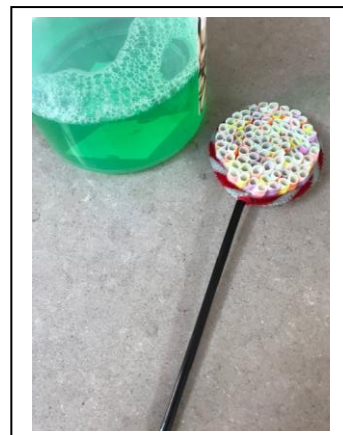
The jelly will eventually go off and should be thrown away.

Links to UMA/ SB/ Badges

Multi bubble wand

B/G

This is a great outdoor fun activity creating clouds of miniature bubbles. Rainbows would also love making bubbles but may find the wand a bit fiddly to make. The wand will drip solution, so it may be best to leave it for outdoor fun.



What to do:

- 1) Cut a slice from the plastic bottle (2cm wide) creating a plastic ring.
- 2) Cut up to 2 straws into 2cm pieces then mount them onto a length of double- sided sticky tape. Carefully remove a little of the backing tape a bit at a time as you roll the linked straws into a spiral, until the spiral will fit into the plastic ring.
- 3) Put the pipe cleaner around the bubble straw disc, secure it by twisting the ends together and slide a straw over them as a handle.
- 4) Create the bubble solution, gently mixing the water, washing up liquid & sugar.
- 5) Dip the wand in the solution and blow into wand, hold into the wind or spin on the spot.

You will need:

Old plastic or paper straws

Double sided tape

500ml plastic water bottle

Pipe cleaner

20ml washing up liquid

2 tsp caster sugar

100ml water

STEM info

The sugar slows down the evaporation of the water in the bubbles, helping them last longer & increase strength.

Safety advice

This solution can become slippery, so best to use it in grass/gravel.

Links to UMA/ SB/ Badges

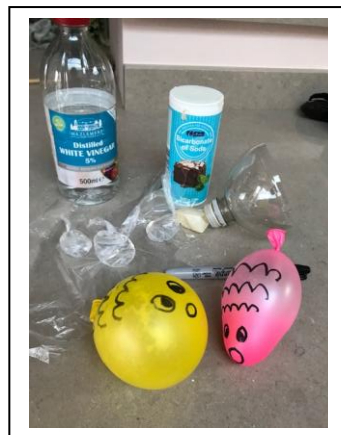
Puffed blowfish

R/B/G/R

Create a blowfish that puffs up instantly with one blow.

What to do:

- 1) Draw the face & scales onto an uninflated balloon.
- 2) Cut the finger off a plastic bag glove and fill with 1 tsp Bicarbonate of Soda (the top of a 2 litre plastic bottle makes a great funnel). Tightly tie the top of the plastic finger to seal the bicarbonate of soda in a pouch.
- 3) Squeeze the pouch into the balloon, then pour in the vinegar.
- 4) Slightly inflate the balloon (it still needs to be able to be flattened when hit) and tie the neck.
- 5) When you are ready, hit your fish with a book or rolling pin and it should puff up like a blowfish.



You will need:

- 1 balloon
- 1 plastic bag type glove
- 1 tsp bicarbonate of soda
- 1 Tbsp vinegar
- Permanent marker pen

STEM info

By hitting the fish, you cause the pouch with bicarbonate of soda to burst into the vinegar. As the vinegar is acid and the bicarbonate of soda is alkaline, they react creating gas, which inflates the balloon.

Safety advice

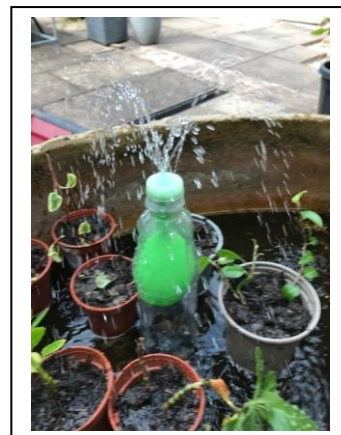
Use plastic-based balloons if someone has a latex allergy.

Links to UMA/ SB/ Badges

Water fountain

R/B/G/R

This is a great way to have fun with water, creating a self-propelling water fountain. This is definitely an outdoor activity, as the best way to fill it with water first is by using a hosepipe directly into the neck of the bottle.



What to do:

- 1) Place the bottle top on a flat surface. Create many sprinkler holes in the lid with an appropriate piercing tool.
- 2) Create a further hole towards the base of the bottle, similar size to a hole found in filing paper.
- 3) Feed a balloon inside the bottle fixing it up and over the neck of the bottle.
- 4) Fill the balloon within the bottle using a hose, then seal up the hole in the bottle with a finger, whilst screwing on the lid. Place your bottle into a bowl or on the garden, remove your finger from the hole and away it goes.

You will need:

1 500ml bottle

1 balloon

Piercing tool

Hose pipe with water

STEM info

The pressure of the water allows the balloon to expand holding the water, pushing air out of the bottom of the bottle. Closing the hole in the bottle keeps the pressure relatively static. Allowing air back in through the hole allows the balloon to contract into its natural state, pushing water through the sprinkler.

Safety advice

Take care with the initial punching of the holes. An awl or the point of a compass are slightly easier and safer than a darning needle, but all are possible.

Use plastic-based balloons if someone has a latex allergy.

Links to UMA/ SB / Badges

