APiPS collection:
Cross-curricular STEM challenges

This Assessment and Progression in Primary Science (APiPS) collection includes examples of cross-curricular Science, Technology, Engineering and Mathematics (STEM) challenges. Such challenges provide an opportunity to apply previously learnt skills, and/or focus teaching and learning on the development of particular parts of the enquiry.

This collection aligns with the Teacher Assessment in Primary Science (TAPS) project, which recommends that only **one part of each enquiry (Plan, Do or Review)** is selected as the focus for any pupil recording, with the other parts being more discussion-based. Hyperlinks are included where activities align with TAPS lesson plans. New examples will continue to be added to the SSERC website as they are co-created with teachers from across Scotland.

Thanks go to the teachers and schools involved in the *APiPS SSERC Meets* and those taking part in the *Inspiring a Sustainable Approach to STEM* programme for their support in the creation of this collection.

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For queries or to share further examples, please email
primary.science@bathspa.ac.uk

Escape the ice

The ice escape challenge was about freeing the sea creatures who had got stuck in the ice. We tried a hair dryer (applying heat), salt (lowering water's freezing point), a towel (creating friction and heat by rubbing it) or spoons (breaking up the ice to separate it into smaller parts that would melt more quickly).

Surprisingly in our class the fastest was spoons at 5:38. The group talked about hitting the same area to smash and "mash" the ice.




P1 (age 4-5) class investigation

Paper plate marble run

Children were challenged to design and build a paper plate marble maze using only simple materials (paper plates, straws, tape, scissors, card). They embraced the challenge and enjoyed the freedom to personalise their designs.

They used testing cycles (including testing each others) feedback to refine angles, widen pathways or strengthen joins. Creative problem-solving included adding barriers, tunnels or ramps to control speed.

Their critical thinking was visible: test → adjust → retest.

P6 (age 9-10) Forces topic

Vertical marble run

School 1 example
The children were tasked with designing and building a vertical marble run. This group were quick to identify in the planning stage that they had to have multiple layers and that the angles had to be shallow. They were able to build that design to make a marble run that lasted 8 seconds!

What I found most impressive was the way they went about troubleshooting. Their marble kept falling off when it went down a layer, so they build a wall in front of the corner to keep the marble on the run.

P6 (age 9-10) Forces topic

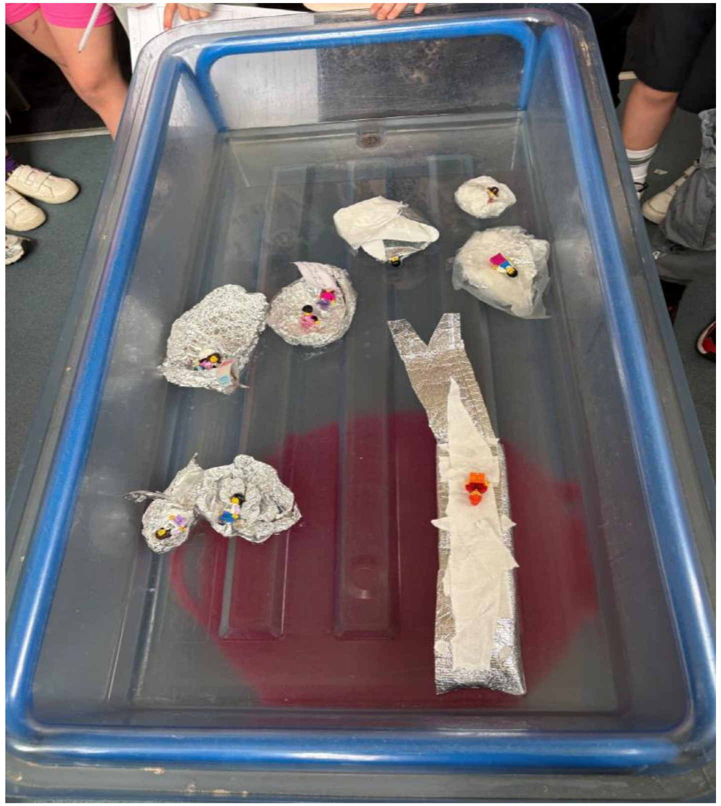
School 2 example

Utilising both science enquiry skills and design technology/ engineering skills, children had to make and improve a marble run.

In week 1, ways of joining card (e.g. slots, tabs, flanges) were demonstrated and they built prototypes in pairs/trios.

In week 2, they improved their designs, repeatedly timing the marble run to see if it was getting slower.

Boat challenge



We used made our own boats. Most of the children chose to use foil.

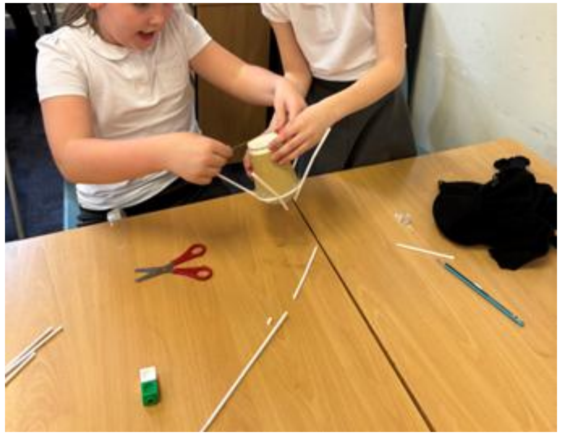
We tested them to see if they floated and could carry some passengers.

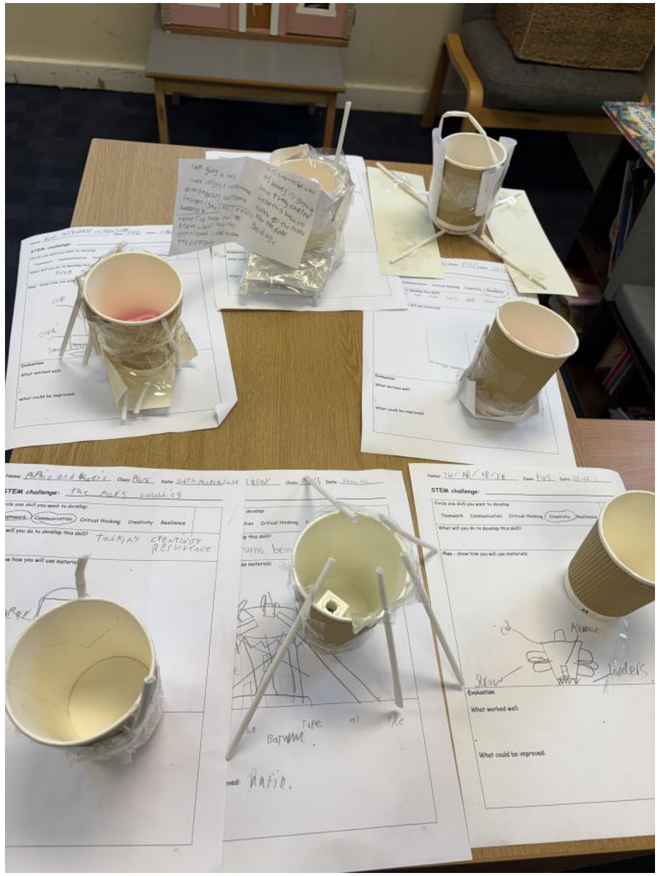
- “When I put the paper towel in the water tray it ‘disappears’”
- “My boat was the best because I had big sides”
- “The boat sank because the water starting coming in the bottom”

Mars landers

Children enjoyed the real-life context of creating a design that could fall a short distance and land upright.

Children were able to plan, test, fail and improve designs. Some creative solutions can be seen e.g. wide base, shock absorbers.





P4/5 (age 7-9) Space topic

Build a park bench or slide

As part of a whole school STEM challenges day, the P6/7 learners were asked to build and evaluate a park bench or slide.

STEM evaluation sheet

Today in STEM, we were challenged to build a bench

What went well with the challenge? What was good about your design?

It stands up

Did anything go wrong? What did you change to improve the design?

It wasnt. Stable

some added card

How could you learn from your mistakes and improve your design even more?

take longer next time

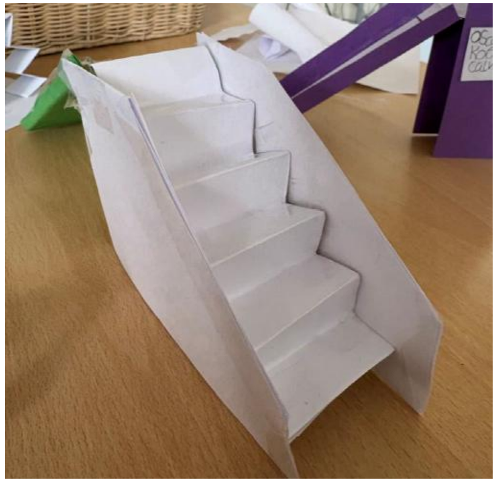
Focus

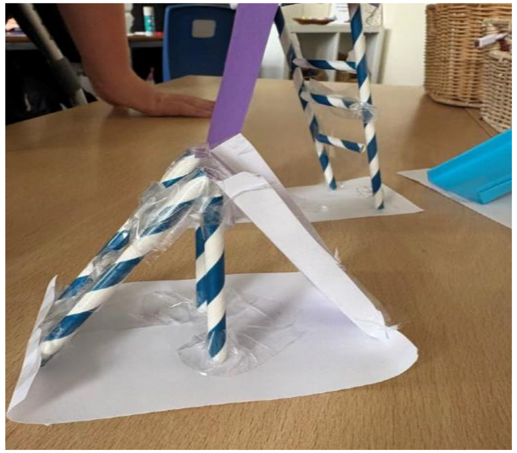
Draw and label your new design here:

folded paper

card inside

cylinder paper





STEM evaluation sheet

Today in STEM, we were challenged to

Build a slide that stands up

What went well with the challenge? What was good about your design?

My design worked well because I used the straws to make the slid strong and I folded the paper into quarters to strengthen it. I then folded the paper into zig zags for the steps

Did anything go wrong? What did you change to improve the design?

At first I couldn't get the slide to stand up so I used the le over straws to stabilise it from underneath. I made a cross design with the straws

How could you learn from your mistakes and improve your design even more?

Maybe spend more time planning before creating.

Draw and label your new design here:

Paper slide

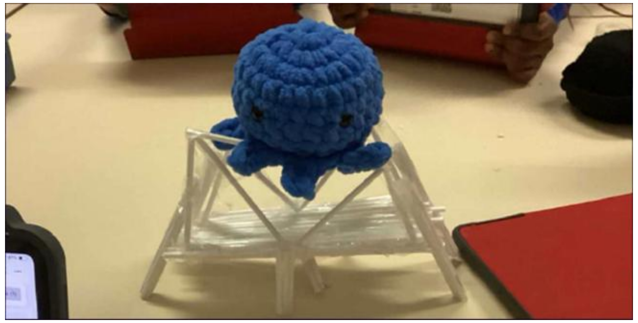
Zig zag paper

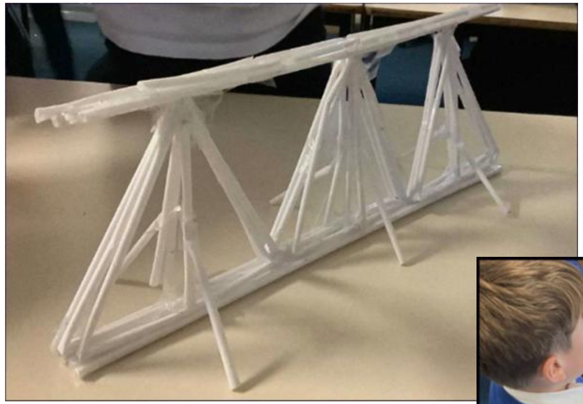
Crossed straws to help stand up

P6/7 (age 9-11) School STEM challenges

Straw bridges

Learners explored the load-bearing capabilities of different bridge types (e.g. beam, truss, cantilever) and discussed these in groups to develop their own straws and sellotape bridge designs. Using Sketches School on their iPads, learners were able to sketch and revise their bridge designs throughout the enquiry process. Bridge designs were to be judged on three factors: span, load-bearing capacity, and whether they were free-standing. Each group therefore had to decide which of these factors would be the priority when designing their bridge.





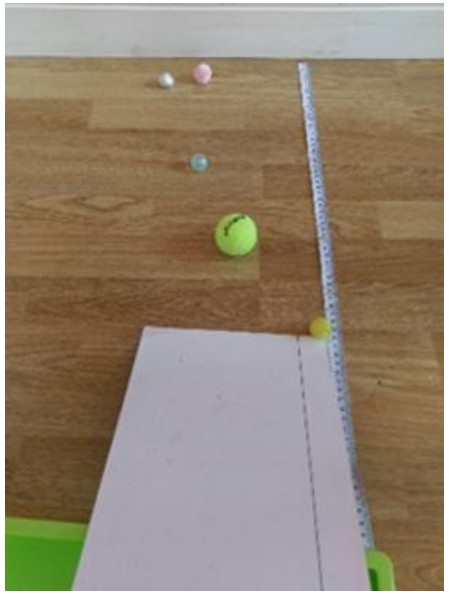
"I think using triangles made our bridge strong but we could have made a bigger structure."

"Our bridge held a lot of weight. It went pretty well but if we had more time I would have made it a little bit wider and added something to support it, but I think it went really well."

P5-6 (age 8-10) Scottish History topic, bridge engineering

Applying maths: recording results focus

For [Dunlop balls](), the class were measuring ball rebound as a test of ‘bounciness’. We focused on recording results, with children repeating their measurements and finding an average to determine which ball was the bounciest.

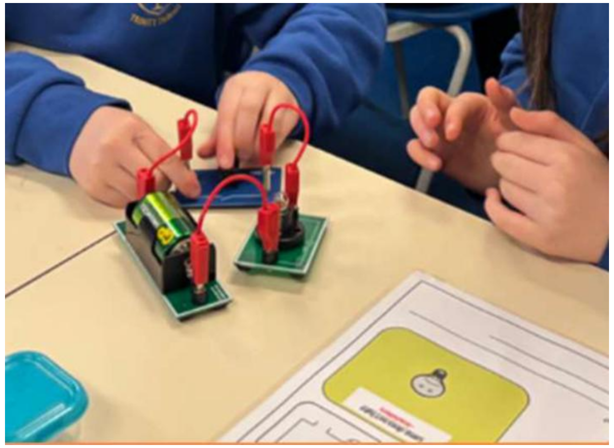


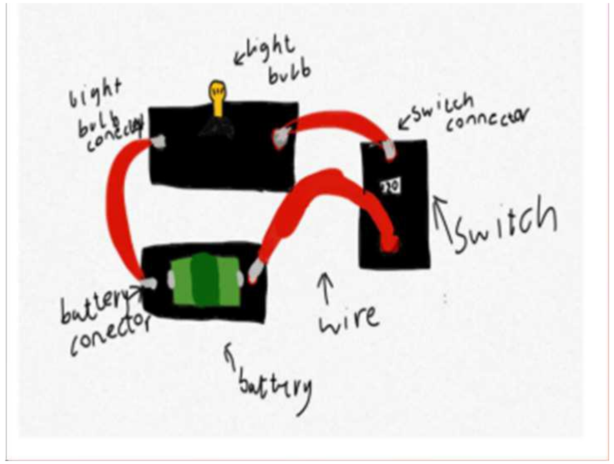
to investigate the distance balls travel off the wall

	1 Attempt (cm)	2 Attempt (cm)	3 Attempt (cm)	Average (cm)
Bouncy Ball	140 cm	143 cm	115 cm	132.$\dot{6}$ cm
Tennis balls	82 cm	58 cm	73 cm	71 cm
Wiffle ball (Big)	45 cm	19.4 cm	28 cm	30.8 cm
wiffle ball (small)	58.5 cm	39 cm	56.7 cm	51.4 cm
Playdoh	31 cm	17cm	27.5 cm	25.$\dot{1}$ cm
Marble	4 cm	4.5 cm	5 cm	4.5 cm
Hockey ball	5cm	4cm	1 cm	3.$\dot{3}$ cm

Cross curricular: science as a context for writing

After making circuits in science, children then used their new knowledge as the focus for a piece of instructional writing, providing guidance on how to create an electrical circuit.





How to make a circuit

Introduction

These instructions will tell you how to make a simple circuit to light up a bulb.

Equipment

What you will need:

. Battery in a battery holder(1.5v battery)

. A light bulb in a bulb holder

. 3 Wires with connector ends

. A switch

Method

1. Firstly, get your equipment. Check if the equipment is not broken or damaged and if it's not follow the steps.
2. Secondly, get one of the wires and put one of the ends into a battery connector and the other end into the bulb connector.
3. Thirdly, get another wire and put one of the ends in the switch connector and the other connector to the end of the other end of the battery connector.
4. After that then put the last wire into the light bulb connector and the other end of the wire into the switch.
5. Lastly turn on the switch and the light bulb should switch on.

How to create a circuit.

Introduction.

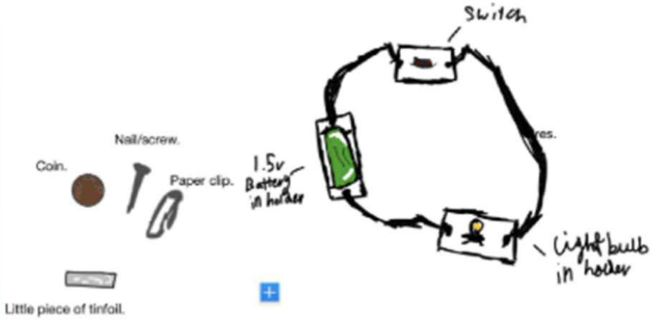
These instructions will help you know how to create a circuit that will light up a bulb. Just follow these steps and it should work.

Equipment:

. A 1.5v battery in a holder.
. 3 wires with metal connectors at the ends.
. A switch to turn it on and off.
. A light bulb in a holder.
. A coin.
. A little strip of tinfoil.
. A nail/screw.
. And a paper clip.

Method.

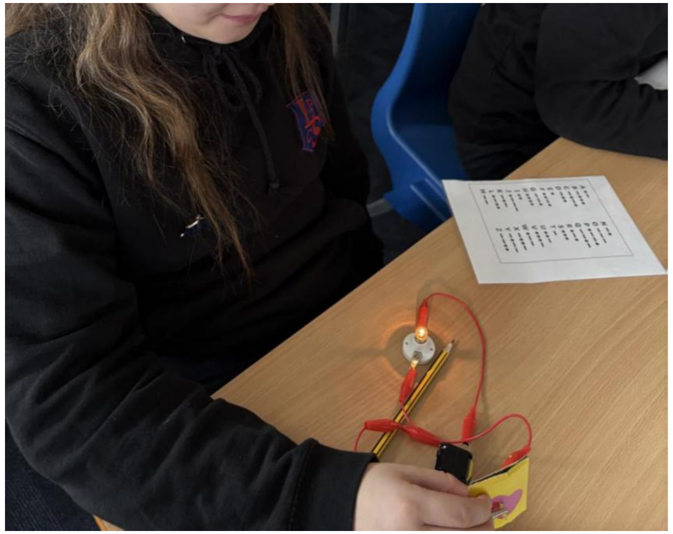
1. Firstly, get your equipment ready to use. (Check that nothing is broken).
2. Secondly, set your circuit up.
3. Next, connect your wires to the metal connectors on each piece of equipment that's electrical.
4. Now, try turning the switch on and see if it does anything. If doesn't check that you have put the stuff in right, or the bulb or battery is in its holder properly.
5. Now that you have done that, try taking out one of the wires from the connectors (not the one on the light bulb though) like the coin or something and put it on there like it's resting.
6. And now you should see it light up.

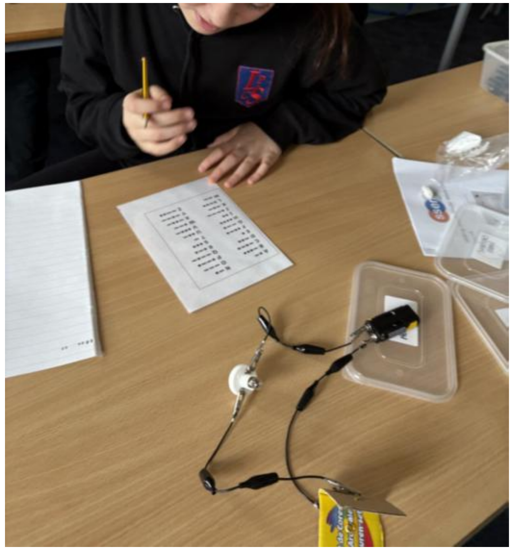


P6 (age 8-10) Electricity topic

Cross-curricular morse code

To link in with our topic on War and Conflict, we have been exploring different types of communication used throughout wars. The children were tasked with using their STEM knowledge to build a Morse code system to include a switch, building on their knowledge of simple electrical circuits and insulators and conductors. Once they had made their system, they had to communicate with each other using Morse code.





P6/7 (age 9-11) War and conflict topic