A bundle of bubbles

Figure 1a - Science Inquiry – Investigating how different concentrations of washing up liquid affect bubble size.

What is a bubble?

We all recognise bubbles when we see them, but can you describe one? A bubble is a sphere of liquid filled with gas - in this article we are going to focus on soap bubbles. A soap bubble is a thin, sphere-shaped film of soapy water that is filled with gas [1].

How do they form?

The film of a bubble is formed by a thin layer of water sandwiched between two thin layers of soap. This film then encloses gases (usually the gases in the air). The bubble may pop when it hits or is hit by an object, or when the water in the film evaporates.

In the SSERC Primary Bulletin 76 article Walking on water [2], we looked at the effect of soap on water surface tension.

Why use bubbles in class?

Bubbles provide excellent opportunities for addressing a wide range of Es & Os in sciences, mathematics, technology and expressive arts, as well as for developing science inquiry skills.

Best bubble brew

Bubbles offer a range of opportunities for setting up science inquiry in class. Within CfE the main approaches to science inquiry are:

- **Observing and exploring** - careful observation of how something behaves, looking for changes over time and exploring 'what happens if...?' and 'how could I...?' questions.
- **Classifying** - through identifying key characteristics.
- **Fair testing** - through identifying all possible variables and then changing only one while controlling all others.
- **Finding an association** - linking two variables to determine relationships.

Here are just some of the questions that could be investigated:

- Which brand of washing up liquid makes the largest bubbles?
- Does a more concentrated soap solution make longer lasting bubbles?
- If we add glycerine to the soap solution, will the mixture make larger or longer-lasting bubbles?
- If we keep the same soap solution recipe but change the size of the wand, will that affect the size of the bubbles produced?

When taking part in bubble science inquiry activities, learners may need to decide how to measure bubble size or bubble lifespan.

Photographing bubbles against a brick wall allows the opportunity for relative measurement of bubble size.

This is a good opportunity to show the need for repetition of an experiment or activity to ensure a large sample size and a more accurate result. It also provides optional maths extensions for calculating mean bubble size (diameter), mean bubble lifespan as well as the practical skills of measuring or using a stopwatch and recording results accurately.

For all the other activities described here, we used our 'Best Bubble Brew' recipe, which is given at the end of this article.

Bubble shapes

What shape is a bubble?

Bubbles are usually spherical. This is because the shape of a sphere uses the minimum surface area to enclose the maximum volume. Try using different shaped wands to test whether or not the resulting bubble is always spherical (Figure 2). >>

Figure 1b - Science Inquiry – Blowing bubbles at a set distance from a brick wall so that photos of bubbles can be compared to compare bubble size.

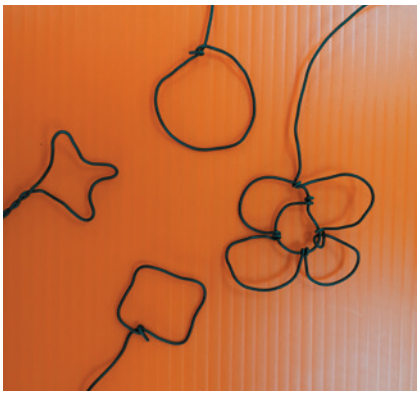

Figure 2 - Different shaped wands made from garden wire.

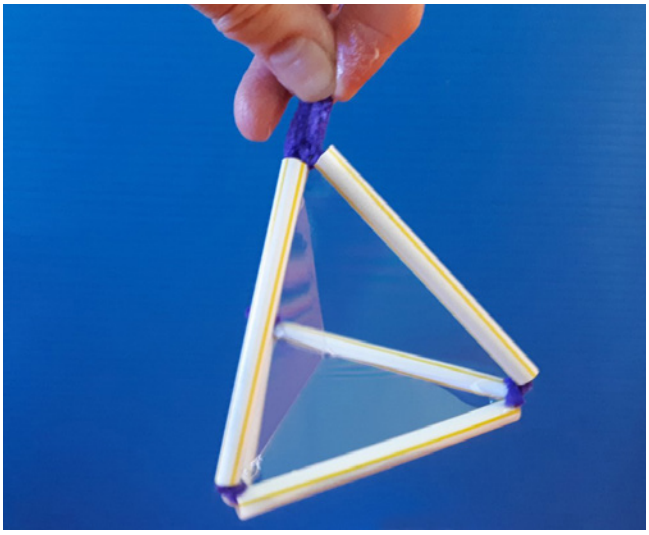

Figure 3a - Pyramid.

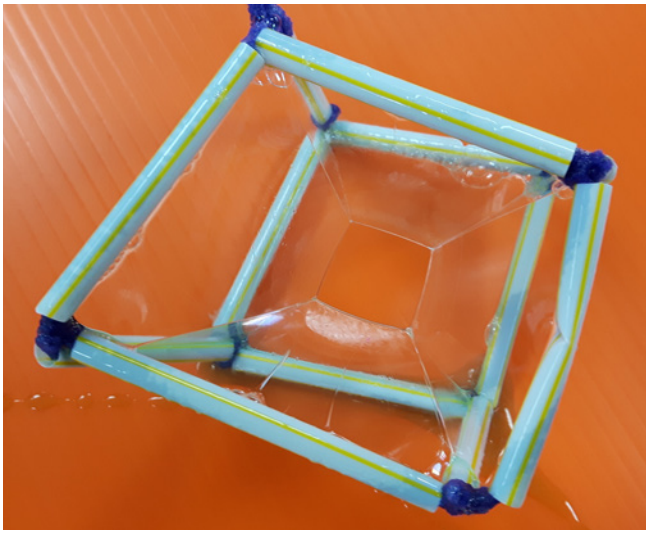

Figure 3B - Cube.

What happens if we build 3-D geometric shapes with pipe cleaners and use them as “bubble” scaffolds?

You will need:
- Straws
- Pipe cleaners
- Soap solution

We constructed 3D shapes using pipe cleaners and lengths of drinking straw. Again, the soap solution forms a film with the smallest surface area possible, but this time, the shape of the frame means that a sphere is not an option, so we get the results shown in Figures 3a and 3b.

Do bubbles change colour over their short lifespan?

Watch one bubble from its formation until the time at which it pops. Do you notice any change in the colours visible in the bubble over time?

At the time the bubble is formed the soap film is at its thickest. Over time, the water in the soap solution evaporates and the two layers of soap film become thinner, reflecting less of one colour and more of another up to the point at which the films are so thin that the bubble pops. We found the simplest way to do this was to cover a table with a black bin liner, then blow a bubble ‘dome’ onto the table. In order to see the contrast clearly, we laminated a sheet of white A3 paper and taped it to make a cylinder. We then placed this cylinder over our bubble dome to minimise reflections of objects in the bubble and make it easier for us to see the colour changes. Figures 4a to 4c show our observation of one bubble dome over time.

Torch lit bubble

This is another way to observe changes in a bubble over time.

You will need:
- A torch
- Soap solution
- A piece of cellophane or clear plastic
- Tape
- A straw

Fix the cellophane or clear plastic lid to the torch so that the torch light shines clearly through it.

Dip one end of the straw in the soap solution and touch the straw to the cellophane covering the torch. Gently blow through the other end of the straw until you have a hemi-spherical bubble on the torch.

Turn out the lights and turn on the torch. Hold the torch so that the base of the bubble is approximately level with your eyebrows and look up at the bubble. What do you notice? >>

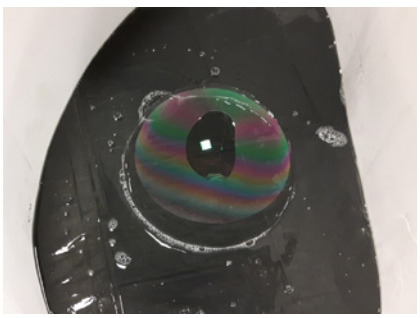

Figure 4a - Pyramid.

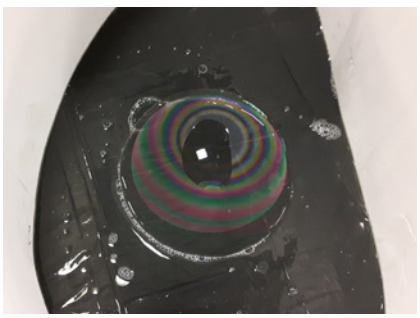

Figure 4a - Pyramid.

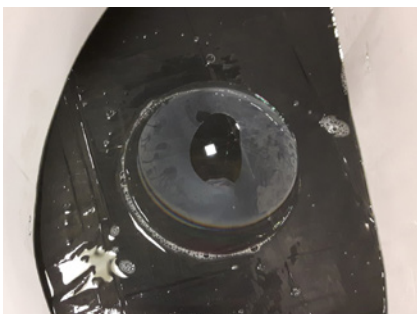

Figure 4a - Pyramid.

Figure 5 - Torch lit bubble.

Soap solution cylinder

You will need:

- A tough spot/builders' tray.
- At least one child's step, with grips on step surface (preferably two).
- A hoop (from your PE store)
- Lots of soap solution (we used three quantities of the recipe given below).

Our Best Bubble Brew recipe:

- 5700 ml water
- 250 ml washing up liquid
- 25 ml glycerine

Set up the equipment as in the photo in Figure 6. We found this works best if the soap solution is given time to settle in the tray (ideally overnight).

Other bubble ideas…

Use bubbles to explore wind direction and wind speed: https://primarylibrary.crestawards.org/all-superstar-challenges/61747644/208. However, this links to an Opal Explore climate survey which is now closed.

Thank you to Ginger Franklin at Royal Botanic Garden Edinburgh for sharing her bubble ideas and acting as a sounding board for ours.

Thank you to Bellyeoman Primary School, Dunfermline for helping to test ideas for this bulletin.

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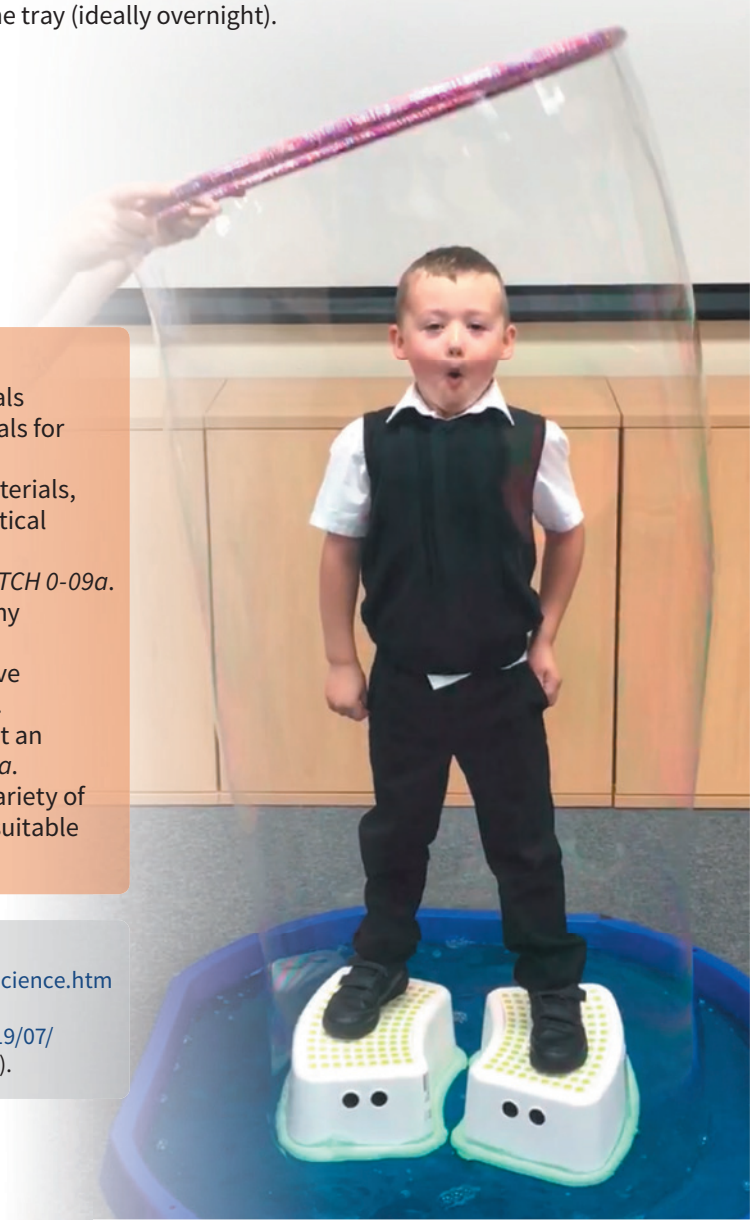
Figure 6 - 'The boy in the bubble'.



Experiences and Outcomes

- Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes - *SCN 0-15a*.
- Through exploring properties and sources of materials, I can choose appropriate materials to solve practical challenges - *SCN 1-15a*.
- I explore ways to design and construct models - *TCH 0-09a*.
- I can design and construct models and explain my solutions - *TCH 1-09a*.
- I can extend and enhance my design skills to solve problems and can construct models - *TCH 2-09a*.
- I can recognise a variety of materials and suggest an appropriate material for a specific use - *TCH 1-10a*.
- I can recognise basic properties and uses for a variety of materials and can discuss which ones are most suitable for a given task - *TCH 2-10a*.

References

[1] http://chemistry.about.com/od/bubbles/a/bubblescience.htm (accessed 24th September 2019).

[2] https://www.sserc.org.uk/wp-content/uploads/2019/07/SSERCP76_web.pdf (accessed 24th September 2019).