[ACTIVITY DETAIL]

2 HOUR ACTIVITY

WHAT'S IN A BUBBLE MIXTURE?

Class discussion focuses on the bubble company's Competition Poster and the need for industrial scientists to continuously research and improve recipes for a wide range of products, including bubble formulations. Children are challenged to create their own 'best bubble' mixture by trialling, adapting and evaluating different ratios of liquid ingredients. The activity lends itself to open-ended investigation, with children planning, carrying out and recording in their chosen way.

TYPE OF ENQUIRY

Carrying out comparative and fair tests.

OBJECTIVES

- To suggest improvements to the effectiveness of a mixture
- To take measurements with increasing accuracy and precision, taking repeat readings when appropriate

To be able to:

- To know that a mixture can be made using different liquid ingredients

SCIENCE VOCABULARY

Liquids	Mix	Measure
Investigate	Compare	Ratio
Repeat	Adapt	Improve
Evaluate		

RESOURCES

Per group of 4 children:

- 100-200ml washing-up liquid
  (eg Fairy Liquid for superior bubbles)
- 100-200ml cold water
- 40ml glycerine
  (available from local chemist or online)
- Modelling wire or pipe cleaners
  (wands are made by wrapping these around cylindrical items and twisting the two ends together)
  or wand from commercial bubble mixture
- 6+ bubble mix pots
  (small fromage frais or paint pots are ideal) numbered 1-6
- 3 pipettes, teaspoons or 10ml syringes
- Additional equipment as suggested by children,
  eg: rulers, card, timers
- Commercial bubble mixture (optional)
- Kitchen Chaos cartoon strip (optional)
- Competition poster
- Bubbles planning sheet
- Post-it planning template or **Interactive planning tool**
- Results Table
- Sample Results

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to describe and explore a range of mixtures including solids and liquids. They should understand that mixtures of liquids could be made up of different amounts and types of liquids. An understanding of ratio and average is helpful but not essential.

ACTIVITY NOTES

At any time during the nine activities in this resource, the Kitchen Chaos cartoon strip can be shared with the class on-screen.

The lesson begins with the bubble company's Competition Poster, which invites children to compete to the find the best product. Discuss how different bubble recipes might produce: the longest lasting bubble, the largest bubble, the most bubbles blown... there are many different ways of producing the 'best' bubble!

Explain to children that they are going to work in small 'manufacturing companies' so should discuss and allocate Job Roles and responsibilities within their group. They should work together to develop recipes, using washing-up liquid, water and with/without glycerine in order to create their 'best bubble' mixture to enter into the competition. Each group will have several attempts to perfect their recipe so they should think very carefully about the quantity (or ratio) of ingredients and how to adapt this to improve their mixture after each trial.

A simple Planning Sheet is provided to encourage children to think and make decisions about:

- How much of each liquid ingredient they will use in their recipes and how to measure the quantities. Measurement can be made using teaspoons or pipettes. A good recipe to start with could be one teaspoon or pipette of each ingredient and then evaluate once the first bubbles have been blown. Children may record this using ratio, eg: 1:1:1
- How they are going to define the 'best bubble' and how to measure the bubble effectiveness (including which equipment to use). The longest lasting bubble could be timed from the first bubble blown to the last one to pop. Bubble size could be measured by popping the bubble against a piece of sugar paper and then measuring the diameter of the 'splat' with a ruler. Quantity of bubbles could be observed and counted; this may be made easier by recording the bubbles on an iPad or video recorder and watching the clip in slow motion. Children will have their own ideas and it is important to let them explore these.
- Whether they need to make the test fair. There are lots of variables to be considered, including force, height and direction of blow, type of wand, location of test, measuring technique and whether they are permitted to 'catch' the bubble on their wand or blow to keep it in the air. They should also decide what to do if the bubble pops against a piece of furniture or person or if it lands, unpopped, on the carpet! Alternatively, children might like to use the generic Post-it Planning Template or **Interactive Planning Tool** to aid them in suggesting variables to be controlled.

ACTIVITY NOTES ...continued

- How to record the performance of each recipe they test. Children might decide how to record data from a choice of familiar approaches, however, if this area of Working Scientifically is not the focus skill for the activity then a range of blank Results Tables is provided to aid recording and evaluation. Children should understand that the 'blow' cannot be controlled each time; therefore, it is important to take repeat measurements and calculate an average to improve the accuracy of results. Sample Results are provided below as helpful examples which may be referred to as a prompt, if necessary:

Ingredients (teaspoons)				Description of bubbles
Recipe	Washing up liquid	Water	Glycerine	
1	4	0	0	Pop quickly
2	4	2	0	Pop quickly
3	4	4	0	Last longer and bigger
4	4	6	0	Pop quite quickly
5	4	4	2	Float, last longer, and some bounce on the floor
6	4	4	4	Float, last longer, and some bounce on the floor

Refer to Safety guidance and check for individuals with allergies before Resource Managers collect the equipment required by their group and, with help from the Personnel Manager, children should agree upon the important responsibilities of recipe maker, bubble blower, measurer and recorder – these could be alternated with each trial so that every child has an opportunity to experience the different tasks. By providing numbered pots, groups can carry out several attempts to find the 'best bubble' using their scientific skills to evaluate and adapt the quantities of ingredients in order to improve the mixture each time.

Children should be aware that they are provided with less glycerine than water and washing-up liquid due to its high cost. They should discover that glycerine can improve bubble size and improve the life-span of bubbles whereas the proportion of water in the mixture is important too as the higher the ratio of water, the cheaper the mixture is to produce. The quantities of ingredients must be balanced against both the cost and effectiveness of the mixture. Children could use secondary sources of information to research current prices of each ingredient and then compare the cost of their recipes with commercially produced bubble mixtures. It should be mentioned that this is all part of the commercial development of a product.

Once the bubble blowing investigations are complete, children should have time to discuss and make decisions about their results in terms of 'which was your best bubble mixture?' and 'why do you think this recipe was most effective?' Refer to Questions for thinking to aid and extend class discussion. Communication Officers could share their group's conclusions with the rest of the class and individuals or groups draft letters or emails to the organiser of the competition offering their photographs, results, findings and recipes. Blowing bubbles also provides great opportunities to work outside. Children might wish to share their best recipes with younger year groups in school or make scaled up recipes in giant proportions using hoops, string or wire coat hangers as bubble wands. This scaling up of the recipe production also mimics the 'lab bench to production' scale up in industry.

EXTENSION OR HOME-BASED ACTIVITIES

It is important that children are given opportunities to ask further questions and use test results to make predictions and set up further comparative and fair tests. They might wish to investigate the effect of wand size or shape on the bubbles produced. They could compare home-made and commercial wands or different brands of washing-up liquid used to make the bubble mixture.

QUESTIONS FOR THINKING

- Why do you think there are so many ways of deciding which is the 'best bubble'?
- Which do you think would be the most difficult to judge in the competition? Why?
- How many different ways can you think of to blow or produce bubbles?
- A company has produced a mixture called 'Ultimate Bubbles' which they claim produces bigger and longer lasting bubbles than any other commercial product. What do you think are the ingredients and quantities in their recipe? Can you explain why you think this?
- If you were to do your bubble tests again, what would you do differently and why?

SAFETY GUIDANCE

Please use the following health and safety information to produce your own risk assessment for this activity:

- Prior to this activity, check for individuals who may be allergic to washing-up liquid and/or glycerine. As an additional precaution, children might wear safety glasses to prevent the rubbing and popping of bubble mixture into their eyes. Bubble mixture can be slippery so always clean up any spills immediately.

INDUSTRY LINKS AND AMBASSADORS

The history of bubble making can be traced to the Pears Soap Company in England who was largely responsible for the popularity of soap and bubble blowing in the nineteenth century. Since the 1970s, commercial bubble mixtures have been made in factories for large scale distribution and are reported to be the best selling toy in the world!

The basic recipe for commercial products containing bubbles is usually a specially formulated detergent, additives such as glycerine, and water. Scientists must ensure that the quality of water used in their recipes meet high standards. An interesting story is how one bubble solution manufacturer ships huge containers of water from America to China in order to improve the final bubble product.

It is also vital that soap and bubble mixtures produced in industry are stirred, not shaken, otherwise excessive amounts of suds are created in the manufacturing stage and this, again, will lead to a sub-standard product.

There are excellent links on the **Science of Healthy Skin website** which encourages children to explore ways to make, measure and compare foam in a range of commercial products, such as shampoo, bubble bath and cleaning products.

CROSS CURRICULAR LINKS

English: pupils can develop their composition skills by writing letters and emails to the bubbles competition organiser. They should use organisational and presentational devices to structure text and to guide the reader.

Mathematics: links to using a range of equipment to measure volumes of liquid ingredients, size and time span of bubbles. There is also an opportunity to develop understanding of ratio and average as well as calculate and compare costs of ingredients.

Design and Technology: pupils will develop their understanding of product design which will include them evaluating their own ideas and products and making suggestions to improve their work.

Computing: pupils may choose to select, use and combine a variety of software on a range of digital devices to accomplish given goals, including collecting, analysing, evaluating and presenting data and information.