



Fun With Foam

A science investigation pack
for teachers of 9-11 year olds

Introduction

Context

This theme is based upon actual processes used in an industry researching, developing and producing ingredients used in a wide variety of applications such as home care, personal products and health care.

Activities and accompanying website

The children develop a method for producing and measuring foam, whilst learning that formulation scientists choose ingredients because of their specific properties. They go on to mimic methods used by these scientists to make and test their own bubble bath recipe. It is intended that the website <http://www.ciec.org/healthyskin> is used to introduce the storyline and that the children interact with the web pages throughout their investigations. In particular, questions, animations, multiple choice and other activities used in the plenary sessions will greatly enhance and embed the learning and also provide the stimulus for further investigation.

Approximate duration

The timings for each activity given are a guide, and will vary from class to class. They range in length from 1½ to 3 hours.

National Curriculum links

The investigative activities provide opportunities for the children to explore the varied roles of scientists in industry in practical ways involving the development of key skills. The children are introduced to a number of different challenges, each requiring the use of enquiry skills, discussion and problem solving, consistent with National Curriculum requirements. It is intended that children be encouraged to develop their own ideas and methods of recording and presenting their results and conclusions.

The theme covers areas of Scientific Enquiry (Sc1) and Materials and their properties (Sc3) in the current National Curriculum for Science, many aspects of Using and applying number (Ma 2), Using and applying measures (Ma 3) and Handling data (Ma 4) in the current National Curriculum for Maths. There are ample opportunities for 'speaking and listening' through discussion promoted in the activities. The theme encourages ICT via interaction with the website and through the preparation of presentations to share results of investigations.

Ambassador role

An ambassador can enhance the theme by initiating these activities, acting as an advisor/consultant if present for the practical sessions, participating in the development of the bubble bath and also playing the part of a judge, providing detailed information for the latter stages of the activities, such as marketing aspects.

Activity 3: Making foam



Objectives

- To develop a method for producing and measuring foam.
- To test ideas using evidence from observation and measurement.
- To use observations, measurements or other data to draw conclusions.

Resources

Per group of four children unless otherwise stated

Activity sheets 3-5
Bowl
2 litre pop bottle
20 ml Creamy foam bath
Pipette
100 ml measuring cylinder
Drinking straw
Spoon
Whisk

Introducing the activity

The online activity 'A Frothy Question' in 'Fun with foam' provides the starting point for this lesson. The children are asked if they can define foam, describe where they see it, and when it might be useful. The children discuss ideas, first with a thinking partner, and then with their group. The teacher gathers ideas from the groups. Returning to the webpage, images of foaming products, such as soap or shaving foam are displayed. The children are asked to take the Foam Challenge, by finding different ways of making and measuring foam¹.

Activity

The teacher explains that the children are to first devise a method for producing and measuring foam using a standard measure of soap to water (e.g. 1 ml creamy foam bath to 300 ml water). Each group is to discuss and test ideas for making foam, which may include blowing through a straw, stirring, whisking, beating or shaking. They decide what to measure and how to record their results. A pipette or syringe could be used to add the soap to water. One method the children may try is to mark graduations of 100 ml up the side of a 2 litre pop bottle. The bath foam and 300 ml of water are added, the lid tightened and the bottle shaken vigorously. Ten shakes produces fairly reproducible foam although other methods also work. The children decide which method is most effective at producing foam and which can be replicated to produce similar volumes of foam each time.

¹ If accessing the internet is not possible, the teacher may use Activity sheets 3-5 to introduce and support the challenges 3-6 to the children. A demonstration by the teacher of foaming, using shaving foam or soap, could also enhance this lesson.

Plenary

The groups share their results with the class. One way of doing this is to ask a member of each group to be the envoy, answering questions and explaining their method to the other groups. An explanation of envying and other discussion techniques may be found in Appendix 2.

A class set of results, such as a bar chart showing method versus volume of foam, could be collected and displayed on the whiteboard.

Returning to the website, the children have the opportunity to interact with the website by inserting their methods of making and measuring foam, and consider:

Which methods were most successful and why?

How did they measure the amount of foam?

Could they repeat their results?

Ambassador role

The ambassador can initiate these activities and act as an advisor/consultant if present for the practical sessions. The ambassador may also play the part of a judge and provide detailed information for the latter stages of the activities, such as marketing aspects.

Activity 4: Comparing bath foams



Objectives

- To use a foaming test to find the difference between two samples of bubble bath.
- To make a fair test or comparison by changing one factor and measuring the effect.
- To compare everyday materials on the basis of their material properties.

Resources

Per group of four children unless otherwise stated

- 1-3 creamy bath foams (e.g. supermarket & branded)
- Sumptuous Skincare Ltd 'test product'
- Pipette
- 2 litre pop bottle marked in 100 ml
- 100 ml transparent tubes or measuring cylinders
- Stop clock

Advance preparation

In a plastic bottle labelled 'A' or 'test product', mix 50 ml of clear shower gel (e.g. Simple shower gel) and 50 ml sunflower oil thoroughly and gently to minimise air bubbles and foaming.

Introducing the activity

The website Fun with Foam 'Comparison Test' page introduces the next activity. Scientists at Sumptuous Skincare Ltd have sent the children a sample of their new bubble bath. They would like the children to use a method of foam production to test the sample and one or more known brands of creamy bath foam. They should compare the quality of foam by considering the amount of foam produced and how long it lasts. They are to report their results to the company.

Activity

The children choose the measurements to take and the method of recording their results, e.g. photographs or a table. A typical result adding 1 ml creamy foam bath to 300 ml water using the 'shake in a bottle' method is shown in the table below:

Sample	Foam Height Achieved* after 10 shakes
Supermarket Creamy Bath foam	550 ml
Test Product (Simple shower gel with sunflower oil)	390 ml

*This includes the layer of water. The children may choose to measure the foam only.

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Measuring cylinders or sealable plastic tubes may be substituted for pop bottles. In this case, the volume of water would need to be adjusted to suit the container, but the same 'shake' method is effective. Typical results using a supermarket value foam bath are shown below:

Value Foam bath (ml)	Water (ml)	Foam height (ml)	Volume of foam (ml)
0.5	20	70	50
0.5	30	80	50
0.5	40	90	50
1	20	80	60
1	30	95	65
1	40	100	60
Value Foam bath plus oil			
1	20	50	30
1	40	75	35

Plenary

The children are asked to describe the method they used for measuring the foam, and the following questions are posed:

What do the results show?

Were there any unusual measurements?

Did the groups draw similar conclusions?

Would you recommend the test recipe?

What advice would you give to the company scientists?

Returning to the website/'Comparison test' plenary, the children are asked to consider whether their tests were fair and which sample produced a good, long-lasting foam.

Information for teachers

The addition of oil reduces the foaming ability of the product and hence the shower gel with oil should foam less. By adding oil, such as sunflower oil, to a clear liquid, the appearance will change from clear to opaque/creamy. It is compared to a creamy foam bath in order to make the two test products look similar.

Ambassador role

An ambassador may be present during the investigations and provide industrial support for the activities, acting as an advisor/consultant. They may assist in the planning and help with problem solving.

Activity 5: Increasing viscosity



Objectives

- To test the effectiveness of a selection of thickening agents to increase viscosity.
- To recognise differences between liquids in terms of ease of flow.
- To describe changes that occur when materials are mixed.

Resources

Per group of four children unless otherwise stated

300 ml clear shower gel
Cup of corn flour
Cup of salt
Cup of hair gel
Teaspoon
100 ml measuring cylinder
Blu-tack
Filter funnel
Laminated card
Tray
Timer

Advance preparation

Mix the shower gel with 200 ml water to produce a thin clear gel solution. Label this 'bubble-making ingredient'

Label the cornflour, salt and hair gel, 'powder', 'granules' and 'gel' respectively.

Introducing the activity

The webpage "A runny problem" introduces the children to the concept of viscosity. The children are asked to consider how they could measure how thick or runny a liquid is. After time for discussion and sharing of ideas, by returning to the webpage, the children learn that Sumptuous Skincare's scientists need to produce a bubble bath of a specific thickness, and their current key ingredient is too runny. The company has provided 500 ml per group of this ingredient for the children to use in their investigations. They have also sent some ingredients that might thicken the bubble making ingredient.

Activity

The teacher should make the children aware that the 500 ml of bubble-making ingredient is provided for all their tests.

Fun with Foam

The groups plan and carry out their investigations, incorporating the principles of fair testing. They need to consider (i) amount of bubble-making ingredient to use each time, (ii) amounts of thickener to add, and whether to add this gradually, and (iii) how to measure the thickness of the liquid.

Ideas for measuring the viscosity include timing:

- (i) the fall of a marble or similar through a measuring cylinder of the sample
- (ii) the flow of the sample through a funnel
- (iii) 'blobs' of the sample moving down a tipped surface (tray, laminated card etc.)

They also consider the appearance, feel⁴ and end use of the product.

Children should be encouraged to find ways of recording their results independently and in a variety of ways such as tables, graphs, posters, diagrams or photographs.

Plenary

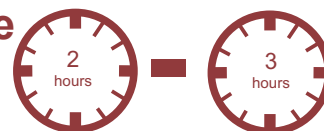
Each team shares its conclusions with the class using methods described in Appendix 2. Alternatively, each group in turn could demonstrate its most effective method to the class. The webpage "In the thick of it" offers an opportunity for reinforcing the children's conclusions from the investigation.

Information for teachers

The salt will cause an increase in viscosity and will result in a clear, viscous, gel like mixture. Flour will give an opaque sticky viscous liquid and hair gel will not produce much thickening until large quantities are added. The addition of too much salt will cause a drop in viscosity so this should be added very slowly in small quantities (pinches) with gentle stirring.

⁴ Teachers should ensure that precautions are taken to prevent allergic reactions to products used. Children could wear protective gloves. Consult ASE BeSafe! for guidance

Activity 6: Developing a bubble bath recipe



Objectives

- To understand that formulation scientists choose ingredients because of their specific properties.
- To mimic methods used by formulation scientists to make and test their own bubble bath recipe.
- To compare everyday materials on the basis of their material properties and to relate these properties to everyday uses of the materials.

Resources

Per group of four children unless otherwise stated

Creamy bath foam (e.g. supermarket brand)
150 ml clear shower gel
Cup of corn flour
Cup of salt
Cup of hair gel
Food colouring
Pipette
20 ml fragranced oil (e.g. Body Shop or similar)
50 ml sunflower oil
Measuring cylinder
Teaspoon

Advance preparation

Mix 150 ml clear shower gel with 100 ml water to produce a thin clear gel solution. This is to be the 'bubble making ingredient' in the bubble bath. Thickeners should be labelled as in previous activity. Label the sunflower oil as 'moisturising oil'.

Introducing the activity

The email on webpage "A recipe for success" explains that the scientists at Sumptuous Skincare Ltd are working hard on their recipe for bubble bath and they would like the children's help. The teacher shows the children a commercially available bubble bath which is thick, has a creamy appearance and is coloured and fragranced. The company scientists have asked the children to use the ingredients provided to design a bubble bath that will have similar qualities and will appeal to their customers. They should use the information they have discovered from their other investigations to help them.

Activity

Children should be supplied with all the ingredients, and the teacher explains that the moisturising oil helps to soften the skin and helps to prevent it becoming too dry. They should recall from the results from previous experiments that salt will give the best thickening performance maintaining a clear mixture but only if added in small amounts. They will discover that adding vegetable oil will give a creamy appearance; the colour and fragrance produce the other more aesthetic properties. They should be able to justify their choice of ingredient type and quantity, based on previous findings. They may also test the foaming of their own formulations and use the data to produce a marketing sheet.

Plenary

The Communications Managers from each group describe their recipes to the class. Recipes are compared and similarities and differences discussed. Returning to the website, the children are encouraged to design and make a poster to inform customers about the quality of their bubble bath. The web page “Marketing the Mixture” provides ideas to support the children in this process.

Each group produces a marketing sheet displaying the key features of the particular formulation. Recipes could be tested by other classes or groups and compared with the claims made on the marketing posters.

Extension activity

An e-mail sent to the children after the experiments (Activity sheet 4), together with a sample formulation recipe from Sumptuous Skincare Ltd (Activity sheet 5) giving details of the ingredients used in the test sample, explains that too much oil may have been added. The children are asked to do further investigations to improve the sample recipe by reducing the volume of oil used, eventually producing their ideal bubble bath.

Information for teachers

The explanation for adding oil (i.e. sunflower oil) to the formulations is that this can reduce the irritation sometimes caused by other ingredients (foaming ingredients) and it also moisturises and softens the skin. In this case, it also gives the formulation a creamy appearance. It should be apparent at this stage that the addition of too much oil is detrimental to the foaming properties of the formulation.

Ambassador role

Ambassadors from industry could participate in the development of the bubble bath, providing support as an advisor or consultant. If marketing leaflets are designed, these could be presented to the ambassador for feedback and a discussion around the claims and formulation can take place. The presentations and marketing sheets could also be taken away by the ambassador and judged. The ambassador could bring marketing materials in various stages of development, to demonstrate and discuss the processes involved.

e-mail from **Sumptuous Skincare Ltd**

From: Mike.Smith@SumptuousSkincareLtd.co.uk

Sent:

To: Science Consultants

Subject: Foaming

Dear Consultants

We are a big company that makes ingredients for lots of every day products such as sun creams, soap, medicines and food. Our scientists are developing a new bubble bath and would value your advice on suitable ingredients and recipes. The bubble bath must produce the right amount of foam, must not be too runny, must be kind to the skin and should look and smell nice to appeal to our customers.

We have sent you a sample of our latest bubble bath to test. We would like you to find a method to discover how well our sample compares with bubble bath from the supermarket. Our scientists need to know whether you think it produces enough foam and whether the foam lasts long enough.

Secondly, the bubble bath must not be too runny. We would appreciate you testing some ingredients that we could use to make the product thick enough for our customers.

Finally, the bubble bath should moisturise the skin and feel creamy.

We would like you to develop and test your own bubble bath recipe using the information you have from your experiments.

Please send us your recipes and any measurements, tables, graphs and other evidence that you think would help our scientists to produce a quality product for our customers.

We look forward to hearing from you.

Mike Smith
Formulation Scientist, **Sumptuous Skincare Ltd**

e-mail from **Sumptuous Skincare Ltd**

From: Mike.Smith@Sumptuous Skincare Ltd.co.uk

Sent:

To: Science Consultants

Subject: Foaming

Dear Consultants

Thank you for the information you sent to us about your investigations. Your ideas for making foam were very interesting and creative. Our formulation scientists here at **Sumptuous Skincare Ltd** were very impressed with the accuracy of the measurements in your foam tests.

We were interested to know that you discovered the test sample of our new bubble bath did not seem to perform very well compared with other well known brands. Our Quality Control scientists believe that we must have added too much oil to our recipe. Oil is essential to provide moisture and to prevent the other ingredients irritating the skin. However, too much oil can reduce the amount of foam that the bubble making ingredient can produce.

We have sent you a copy of the recipe we used in our test sample (Activity sheet 5). We would like you to develop an improved bubble bath recipe of your own, using these ingredients and the information you have from previous experiments. We would particularly like to know how changing the amount of thickening granules and oil affects the quality of the product. Once you have tested the foaming of the bubble bath and you are happy with the improved recipe, our scientists would be grateful to receive the recipe and any measurements, results, photographs or other evidence you may have.

Yours sincerely

Mike Smith
Formulation Scientist, **Sumptuous Skincare Ltd**

Simple Foaming Bubble Bath

Ingredient	Function	Volume (ml)
Bubble making ingredient	Foaming ingredient	54.5
Essential oil	Moisturising/Anti-irritancy	45.0
Thix	Thickener	0.5
Fragrance	Fragrance	As required
Colour	Colourant	As required

Slowly add Thix to Foamer solution until thickened. Then add Essential oil slowly with gentle stirring.

Add fragrance and colour as required.

Appearance: Opaque

Viscosity: Not measured

Role Badges

All of the classroom sessions involve children working together in groups of four.

Each child is responsible for a different job or role within the group and wears a badge to identify this. The images below may be photocopied onto card and made into badges, by slipping them in to plastic badge sleeves. Keep sets of badges in 'group' wallets, to be used on a regular basis in your own science lessons.

Children should be encouraged to swap badges in subsequent lessons; this will enable every child to experience the responsibilities of each role.

Administrator keeps a written and pictorial record for the group

Resource Manager collects, sets up and returns all equipment used by the group

Communications Officer collects the group's ideas and reports back to the rest of the class.

Health and Safety Manager takes responsibility for the safety of the group, making sure everyone is working sensibly with the equipment

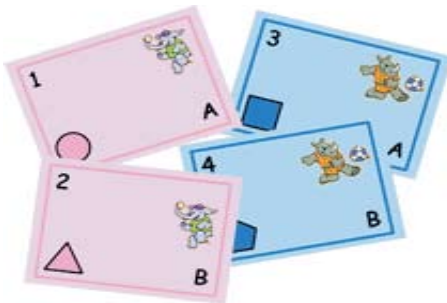
Where groups of 5 are necessary, the following role can be used:

Personnel Manager takes responsibility for resolving disputes within the group and ensuring the team works cooperatively.



Discussion strategies

The following strategies are used extensively as part of the Discussions in Primary Science (DiPS)¹ project, and have been proven to be successful when developing children's independent thinking and discussion skills.



Talk cards

Talk cards support the teacher in facilitating these discussions, with the letters, numbers, pictures and shapes enabling the teacher to group children in a variety of ways.

The example provided here shows one set for use with four children. The set is copied onto a different colour of card and talk groups are formed by children joining with others who have the same coloured card.

Children can then pair up by finding a partner with the same animal or a different letter eg. elephant, rhino or a + b pair. Each TALK pair would then have a card with a different number or shape.

The numbers or shapes may then similarly be used to form alternative groupings and pairings.

Note: The example talk cards are provided in MS Word format so you may make changes if you wish.

ITT (Individual Think Time)



Each child is given time to think about the task individually before moving into paired or group work.

Talk Partners



Each child has a partner with whom she/he can share ideas and express opinions or plan. This increases confidence and is particularly useful where children have had little experience of talk in groups.

¹ For more information go to www.azteachscience.co.uk

A > B Talk



Children take turns to speak in their pair in a more structured way, e.g. A speaks while B listens B then responds. B then speaks to A while A listens and then A responds to B.

Snowballing



Pupils first talk in pairs to develop initial ideas. Pairs double up to fours to build on ideas. Fours double up to tell another group about their group's ideas.

Envoying



Once the group have completed the task, individuals from each group are elected as 'envoys', moving on to a new group in order to summarise and explain their group's ideas.

Jigsawing



Assign different numbers, signs or symbols to each child in a group.

Reform groups with similar signs, symbols or numbers, e.g. all reds, all 3s, all rabbits and so on. Assign each group with a different task or investigation. Reassemble (jigsaw) the original groups so that each one contains someone who has knowledge from one of the tasks. Discuss to share and collate outcomes.

Sample results with a variety of grinding materials and ingredients each shaken 200 times.

Material being ground	Number of pieces used	Grinding material	Number of grinding items used	Volume of ground materials obtained (ml)
Chalk	6	No grinding material	-	0 - 1
Chalk	6	Medium marbles	8	4 - 5
Chalk	6	Large beads	6	0.5
Sugar cubes	6	No grinding material	-	3.5 - 4
Sugar cubes	10	Medium marbles	20	4
Sugar cubes	6	Large beads	6	1
Sugar cubes	6	Small glass beads	20-30	3
Sugar cubes	6	Smarties	10	-
Sugar cubes	6	Cheese ball crisps	6	-
Coffee beans	-	No grinding material	-	0
Coffee beans	8	Medium marbles	10	15

