

Science of Healthy Skin

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



CRODA



Promoting Science



The Science of Healthy Skin

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

This package was sponsored by CRODA and developed by

CIEC Promoting science at the

Department of Chemistry
University of York
Heslington
York, YO10 5DD

Telephone: 01904 322523

Facsimile: 01904 324460

E-mail: ciec@york.ac.uk

Website: www.ciec.org.uk

ISBN: 978-1-85342-598-2

First published 2012

© The contents of this book have limited copyright clearance. They may be photocopied or duplicated for use in connection with teaching provided that an acknowledgement of the source is given. They may not be duplicated for lending, hire or sale.

Contents

Introduction	1
Summary of activities	2
Curriculum coverage	3
Activities	
From Fleece to Grease	
Activity 1 Oil and water	5
Activity 2 The Pastillator	8
Fun with Foam	
Activity 3 Making foam	13
Activity 4 Comparing bath foams	15
Activity 5 Increasing viscosity	17
Activity 6 Developing a bubble bath recipe	19
Safe in the Sun	
Activity 7 Lumps or powder?	24
Activity 8 Grinding solids	27
Activity 9 Testing sunscreen products	30
Appendices	
1 Role badges	33
2 DIPS discussion strategies	34

Croda UK

Croda is a world-wide company with its head office in East Yorkshire. Croda manufactures speciality ingredients for use in a wide range of applications, from shampoos and moisturisers to plastic bags and engine oils. These ingredients give added functionality and benefits to everyday products and allow claims to be made about product performance.

For more information on Croda please visit www.croda.com

This resource is based upon actual processes used in an industry which researches, develops and produces ingredients for a wide variety of applications such as home care, personal products and health care.

Through the sequence of activities, children explore some of the processes involved and challenges faced within the speciality chemical industry. They have opportunities to develop and implement both creative ideas and innovative solutions to scientific and industrial problems.

The activities focus on innovation in science. Innovation is more than just having an idea; it's about finding a way of turning ideas into reality. Being able to innovate is what makes a company successful.

The timings given for each activity are a guide, and will vary from class to class. They range in length from 1 to 3 hours.

Activities and accompanying website

It is intended that the website <http://www.scienceofhealthyskin.org.uk> is used to introduce each storyline and that the children interact with the web pages throughout their investigations. For ease of reference the web address is printed at the bottom of each page. In particular, questions, animations and other activities used in the plenary sessions will greatly enhance and embed the learning and also provide the stimulus for further investigation.

The activities are organised into three themes:

Fleece to Grease: Extraction of lanolin from wool grease

Fun with Foam: Development of a bubble bath recipe

Safe in the Sun: Exploration of sunscreen ingredients and products

The investigative activities in each theme provide opportunities for the children to explore the varied roles of scientists in industry in practical ways allowing 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. In some activities, a guided enquiry is used to model a specific process. It is intended that children be encouraged to develop their own ideas and methods of recording. Differentiation may be achieved through discussion techniques, rich questioning, presentation of results, analysis of data and in drawing conclusions.



I have not seen much new material for teaching science that has such real application. It is a brilliant resource for Year 6. Once the revision and SATs tests are over, this is an interesting and exciting topic to maintain their science enthusiasm until Year 7.

The children had their eyes opened to science in the real world. I really enjoyed teaching it. Really glad I came across it. Thank you!

(Year 5 teacher, Northamptonshire)



Summary of activities

Theme	Summary of activities
Fleece to Grease	<p>Based upon the extraction of lanolin from wool grease, the activities include testing immiscible liquids using oil and water and investigating the effects of adding detergent to produce emulsions which in turn reduce the efficiency of the separation of oil from water.</p> <p>Products containing lanolin can be manufactured in pastille form. The final activity in this section involves investigating techniques for producing pastilles and testing the effect of viscosity upon the pastilles produced.</p>
Fun with Foam	<p>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.</p>
Safe in the Sun	<p>The children learn that some materials must be physically changed to enable them to be used as ingredients for applications such as sun care products.</p> <p>They learn that different levels of UV protection can be provided by using different types and amounts of ingredients in sunscreen products and go on to test a series of sunscreen products and rank in order of protection level.</p>

England

At the time of publication, the National Curriculum and assessment processes were undergoing review. For updates and information related to the 2014 curriculum and assessment, please visit www.ciec.org.uk.

Science: The activities cover substantial areas of Scientific Enquiry (Sc1) and Materials and their properties (Sc3) in the current National Curriculum for Science. The activities can be used to support levels 3-5 of each assessment focus for Assessing Pupils' Progress and in particular AF2 Understanding the applications and implications of science.

Maths: The activities cover 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.

Literacy and ICT: There are ample opportunities for 'speaking and listening' due to the high levels of discussion promoted throughout the resource. The three themes encourage ICT via interaction with the website and through the preparation of presentations to share results of investigations (Developing ideas and Exchanging and sharing information).

Scotland

Science: The activities cover aspects of Materials: properties and uses of substances. (SCN2 15a). Body systems and cells (SCN2 12a) and Topical science are covered in the Safe in the Sun and Omega 3 themes (SCN 2 20a).

Maths: The themes provide ample opportunities for measurement: Number, money, measurement (MNU2 11b) and handling and analysing data; Information handling; Data and analysis (MN2 20b and MTH2 21a)

Literacy and ICT: All themes encourage children to discuss, share and explain ideas (Listening and talking). They make notes, respond and create text for presentation (Reading). All themes encourage writing for a purpose and in Fun with Foam, they convey information and consider impact and layout (Writing). They use ICT when presenting information in tables or text and in presentation (ICT to enhance learning.)

Wales

Science: The activities provide ample opportunities to carry out different kinds of enquiry, and to compare the properties and features of materials.

Maths: In maths, the children use mathematical skills to solve mathematical problems and communicate and reason mathematically across a range of practical tasks; they use quantitative measurement and use tables, charts and graphs to record their work.

Literacy, and ICT: The themes cover oracy, reading and writing skills. The activities provide opportunities for communicating in groups and for a wider audience, using a range of texts and writing for a purpose. The children use ICT to source information and as a tool to create and communicate information, especially when preparing presentations.

Northern Ireland

Science: All themes provide close links with the World Around Us, Strands 3 and 4 in particular, relating to properties of materials and their uses. Safe in the Sun provides activities within Strand 1 Interdependence.

Maths: The activities encourage the use of mathematical skills in a variety of contexts (Maths and Numeracy).

Language and Literacy, and ICT: All themes provide opportunities for talking, listening, reading and writing. ICT is used to record, organise and present work appropriately.

Activity 1: Oil and water



Objectives

- To describe changes that occur when materials are mixed
- To make systematic observations and measurements
- To know that that some liquids do not mix, can be separated easily and are termed 'immiscible'
- To observe that detergent can cause immiscible liquids to mix, producing an emulsion

Resources

Per group of four children unless otherwise stated

Activity sheet 1
Role badges (Appendix 1)
300 ml water - sample A
100 ml sunflower oil - sample B
50 ml clear detergent - sample C
50 ml water –sample D
50 ml water-sample E
5 clear plastic mini pop bottles or lidded containers
Food colouring – 2 colours
Pipette
Teaspoon or similar for stirring
100 ml measuring cylinder

Advance preparation

One method of organisation is to give children job roles and provide them with corresponding badges. Should the teacher decide to use role badges, a template and explanation for use may be found in Appendix 1.

Add 2-3 drops of food colouring to samples D and E, making each a different colour.

Introducing the activity

Use the website area *Fleece to Grease*. The story of lanolin is the starting point for this activity. In *Fleece to Grease*, the children follow the webpages from the shearing of sheep, cleaning of the wool, and extraction of wool grease, to the stage of separation of the lanolin from the soap layers. They learn that in the tank there are two layers of liquids: an upper layer of lanolin with other liquids beneath. The company needs to separate as much lanolin as possible from the liquids. However, the scientists believe that one of the liquids in the tank may be affecting the separation. At this point the teacher introduces the practical activity.

Activity

This is a guided enquiry activity in which children make predictions, follow instructions and observe changes. It teaches scientific enquiry skills to be used in subsequent investigations in this resource. The children are organised into groups of four and decide upon their roles. Each group is provided with two liquids, water and sunflower oil, labelled A and B, representing the soapy under-layer and the lanolin above. They observe the liquids and, prompted by questions, discuss and predict what they think will happen to the liquids when they add one to the other, invert or shake the container or place it on its side.

The children measure 60 ml of sample A and pour into a container such as a mini pop bottle. 20 ml of sample B are then added and the lid replaced. The volumes may be adjusted to suit the size of the container used, ensuring that the layers of oil and water can be clearly seen. The children explore, observe and discuss the liquids, initially tipping the container on its side, then inverting it, before shaking or stirring it gently for a few seconds and allowing it to stand. The teacher can ask some of the following questions:

Did the liquids mix?

Did shaking make the liquids mix?

Did the shaking time or vigour of shaking affect the mixing?

The teacher then reads an e-mail from a technical manager (Activity sheet 1) explaining that lanolin and water normally do not mix, they need to separate the lanolin but they are experiencing some problems. They think another liquid is affecting the efficiency of the process, and believe it might be one of three samples C-E. The children are to investigate whether adding any of the samples affects the separation of the two liquids.

The children initially should try adding a small volume, e.g. 2 drops of sample C to the water and oil in the container, and observe what happens to the liquids. They should then stir or gently shake the liquids, allow to rest, to observe and consider:

Are the liquids still separate?

If not, do they separate after a time?

How long does this take?

They could try observing the effects of increasing the quantity of sample C before preparing further mixtures of A and B and repeating the test with samples D and E.

Plenary

The children share their observations and conclusions with the class¹.

Did any of the samples affect the separation of the two liquids?

Did all groups have the same result?

What will they report to the company?

¹ If using the roles from Appendix 1, this would be done by the Communications Manager

Extension activity

The children can try investigating what happens if they increase or decrease the ratios of oil and water used or the volume of the samples added, preparing a fresh sample of oil and water each time. Can they discover whether there is a minimum volume of the test sample required to prevent the liquids separating?

Information for teachers

If oil is poured into water, the oil will float on the surface of the water; the two liquids will not mix. An emulsion is a mixture of two or more such liquids that are usually immiscible (cannot be blended or mixed together). Examples include vinaigrette or milk. Common emulsions are unstable and do not form spontaneously but they can be produced by shaking or stirring. In this activity, shaking or stirring the container of oil and water will produce a dispersion of tiny droplets of oil in the water but these droplets will join together, eventually reverting back to their separate constituents. Emulsifiers, including detergents, are substances that can be added to immiscible mixtures to produce a more stable emulsion. Adding a few drops of detergent to the oil and water before stirring or shaking will disperse the oil droplets throughout the water producing a milky emulsion. The results the children obtain will depend upon the ratios of oil and water, volume of detergent added and the amount of shaking or stirring used. Use two bottles to compare emulsions. Add 0.5 litres of water and 5 ml of oil to each bottle. To one bottle add 0.5 ml of washing up liquid. Shaking the bottles for a couple of minutes will produce emulsions of differing stability. The oil droplets will try to reassemble and resurface in each but the one containing detergent will be a longer lasting emulsion. The foam produced following agitation of the container after the addition of detergent may make it difficult initially to identify the layers of oil and water.

Ambassador role

An ambassador could supplement and enhance this activity by showing the children samples of their company's emulsions, surfactants (types of emulsifiers) and immiscible liquids in sealed containers and by giving real examples of when it is necessary to use them in industry. They could also bring photographs showing the laboratory and large-scale equipment used to separate liquids, along with photographs and information/stories about people who work in this area of the business.

Activity 2: The pastillator



Objectives

- To understand that it is important to test ideas using evidence from observation and measurement
- To make a fair test or comparison
- To understand that different liquids have different viscosities
- To discover whether viscosity, dropping techniques or height of drop affect the size or shape of drops (pastilles) produced

Resources

Per group of four children unless otherwise stated

Activity sheet 2

Devices for making drops, e.g. teaspoon, drinking straw, pipette, squeeze bottle from ketchup

2-3 liquids of differing viscosities, e.g. sunflower oil, bubble bath, liquid soap

Advance preparation

100 ml of each liquid in containers labelled 'Test liquid 1, 2 or 3'.

Introducing the activity

Use the website area *Fleece to Grease - Using Lanolin*. The children watch the final stages of the production of lanolin and discover that lanolin can be mixed with other ingredients to make many products. They will see one of the processed lanolin products emerging in the form of pastilles from the pastillator. The lanolin product is runny when it enters the pastillator and falls through a mesh onto the conveyor in the form of drops called pastilles. The pastilles travel along the conveyor, cool, solidify and are bagged to be stored and used as an ingredient in manufacture.

The teacher reads the email on Activity sheet 2 which explains that Sumptuous Skincare Ltd is always seeking to improve the efficiency of its processes. Their scientists think that there may be a way to increase the number and speed of pastille production. They would like the children to investigate techniques for making drops, first using water and then two or three sample liquids, to investigate whether the runniness of liquids affects the quality or size of drops or the time taken for the drops to be made. They should also investigate whether the surface on which the drops land affects the size, shape or number of drops.

Activity

In their groups, the children discuss their ideas for techniques and equipment needed for making droplets of liquids. They test out their ideas using water and the resources they have suggested. The children are then shown the test liquids, samples 1-3, and asked to create and test their own methods for producing drops and recording their findings. They should be allowed time to observe the liquids before carrying out the

activity. Each group could investigate a selection of its own or the following questions, depending upon the ability of the children:

How many ways can you find to make water drops?

Can you find a way to make the drops the same size each time?

Which method is easiest?

Which method would you recommend?

Does your method work as well with the sample liquids?

How can you make your test fair?

Are the drops always the same size/shape?

What happens when you drop the liquid from different heights?

Is it better to make the drops quickly or slowly?

Do the drops always stay the same shape?

How many drops can you make exactly the same size and shape?

Does a runny liquid or thick liquid make better drops?

What is the largest drop you can make?

If you change the surface on which the drops land, do the drops change in size or shape?

Plenary

Each group reports its findings to the class². The teacher could collate the class results on the whiteboard, and lead discussions by asking some of the following questions:

Which technique for drop-making proved most effective?

Which method produced drops that could be replicated most easily?

What did they discover about the runniness or viscosity of the liquids and drops produced?

Did runniness affect drop quality or the number or shape of drops?

Was there an ideal runniness for producing drops?

What recommendations would they make to Sumptuous Skincare Ltd?

The children produce a report, poster or presentation containing their measurements, graphs, conclusions and recommendations for Sumptuous Skincare Ltd.

² If using the roles from Appendix 1, this would be done by the Communications Manager

The teacher returns to the webpage 'Lanolin Uses' in the Fleece to Grease section of the website where the children discover the wide variety of products containing lanolin, such as cosmetics, coatings and health care items.

Extension activity

The groups may like to design, make and test a device or system for producing many drops of the same size and shape in the quickest time possible.

Ambassador role

Ambassadors could support this activity by acting as experts, giving their opinion on the effectiveness, quality and originality of the different designs. They could also show the children samples of pastilles from their pastillator, large A3 photographs of parts of the machine in action, photographs of the operators and answer any questions the children may have.



*I think the lessons are wonderfully explained. The resource list and suggested activities are fantastic and have really taught my children a lot about how to plan an investigation. They understand the nature of a fair test much better and understand what a 'variable' is. The website has also been a useful resource to engage the children and we have loved the idea of working with a local company.
(Year 6 teacher, N Yorks)*



e-mail from **Sumptuous Skincare Ltd**

From: Melanie Williams

To: Science Consultants

Subject: Separating liquids

Dear Science Consultants

I believe your firm knows about the extraction of wool grease from sheep's wool. Here at **Sumptuous Skincare Ltd** we separate 'lanolin' from wool grease. Our operators melt the wool grease, pour it into a tank, add other ingredients and stir the mixture. The liquids are pumped into a second tank and the lanolin floats to the top. Our operators can then pump out the top layer of lanolin, to use in other products.

The company needs to separate as much lanolin as possible from the other liquids. However, we are experiencing a problem. Our scientists believe that one of the ingredients may be affecting the separation.

We have therefore sent you samples of the liquids we believe may be causing the problem. We would like you to observe the effect each of these ingredients has on the separation process.

We would be grateful to receive your observations, conclusions and any advice you may have.

Kind regards

Melanie Williams
Technical Manager, **Sumptuous Skincare Ltd**

Activity sheet 2

e-mail from **Sumptuous Skincare Ltd**

From: Melanie Williams

To: Science Consultants

Subject: The Pastillator

Dear Science Consultants

You have seen on the website how we make lanolin from sheep wool grease. Lanolin can be mixed with other ingredients to make lots of other products. You saw one of our lanolin products on a machine called a pastillator. The lanolin product is runny when it enters the pastillator and falls through holes onto a conveyor in the form of drops called pastilles. The pastilles travel along the conveyor, cool, go solid and then are put into bags.

Sumptuous Skincare Ltd is always trying to improve the efficiency of its processes. Our scientists think that there may be a way to increase the number of pastilles produced and how quickly they are made.

They would like you to help them in their experiments.

1. Would you investigate some different ways of making drops, using sample liquids instead of the real ingredients as the ingredients we use are expensive? Our customers like the pastilles to all be the same size, so you should try to make your drops the same size too if you can.

2. Would you also investigate whether the runniness of the liquids affects the quality or size of drops or how quickly the drops can be made?

3. Finally, they would like to know whether the surface the liquids are dropped onto affects the size or shape of the drops.

Would you record your evidence and report your results to our scientists? We look forward to hearing from you.

Melanie Williams

Technical Manager, **Sumptuous Skincare Ltd**

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/syringe
 100 ml measuring cylinder
 Drinking straw
 Spoon
 Whisk
 Bucket of water (for rinsing between tests)

Introducing the activity

Use the website area *Fun with Foam - A Frothy Question*. The online activity 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 foam.³

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.

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

According to their ability, the children could extend their investigation to discover whether there is a link between the volume of water used and the amount of foam produced.

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. Groups investigating volume of water used and amount of foam produced may record their data in the form of line graphs providing further opportunities for analysis of data and drawing conclusions.

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 may 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. Ambassadors could also explain the difficulties encountered on the plant by excessive foam production, leading to blockage in pipelines or affecting movement of product or ingredients from one vessel to another. They could explain the measures taken by engineers to overcome these problems.

“

Perfect for
Year 5. Very good ideas
to draw children in; all enjoyed and
gave very positive feedback. The resource
notes are very thorough and ensured that
each step was easy to carry out. The resource is
creative and uses literacy and other core subjects
to engage the children. It is appealing to many
types of learner.
(Year 5 teacher, Widnes)

”

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 variable and measuring the effect
- To analyse results using data collected

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', add 50 ml of clear shower gel (e.g. Simple shower gel) to 50 ml sunflower oil and mix gently to minimise air bubbles and foaming.

Introducing the activity

Use the website area *Fun with Foam - Comparison Test*. This web 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

Using the method of foam production previously researched, 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.

Fun with Foam

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 'basic' range creamy foam bath are shown below:

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
Foam bath plus oil			
1	20	50	30
1	40	75	35

The children should be encouraged to display the data collected in the most appropriate way. Measuring the amount of foam against time the foam lasts would enable a line graph to be produced and the more able could be challenged to make predictions using extrapolation.

Plenary

The children are asked to describe the method they used for measuring the foam, and the following questions may be 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 area *Comparison test*, the children are invited to respond to the company by considering 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. They could also bring samples of a variety of anti-foaming agents used in industry, such as oils or powders, or photographs of the effects of adding such agents.

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 and describe changes that occur when materials are mixed
- To use scientific knowledge and understanding to explain observations, measurements and conclusions

Resources

Per group of four children unless otherwise stated

Resources per group of four children

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

Tidy tray

Timer

3 disposable cups

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

Use the website area *Fun with Foam - A Runny Problem*. This web page 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 additional items that might thicken the bubble-making ingredient.

Activity

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

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

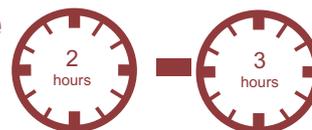
Each team shares its conclusions with the class using 'snowballing', 'envoying' or 'jig-sawing', as described in Appendix 2. Alternatively, each group in turn could demonstrate its most effective method to the class. The webpage area *In the thick of it* offers an opportunity for reinforcing the children's 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's 'BeSafe!' for guidance.

Activity 6: Developing a bubble bath recipe



Objectives

- To understand that scientists choose ingredients because of their specific properties
- To model methods used by 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 or syringe
5ml 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

Use the website area *Fun with Foam - A Recipe for Success*. The email on this page 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

The children are supplied with all the ingredients. The teacher should explain that the moisturising oil helps to soften the skin and helps to prevent it becoming too dry. They should recall from the results of 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. It may be useful for the groups to plan and explain to the teacher the method they will use before proceeding.

Plenary

The Communications Manager from each group describes 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 webpage area *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

Ingredients when mixed using a recipe or 'formula' produce a 'formulation'. Some of these ingredients may give the formulation specific properties, producing effects which cannot be made by ingredients when they are used singly. 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 recipe.

Ambassador role

Ambassadors from industry could participate in the development of the bubble bath, providing support as an advisor or consultant. They may be able to supply a selection of fragrances for the children to use. 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

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
Scientist, Sumptuous Skincare Ltd

Activity sheet 4

e-mail from **Sumptuous Skincare Ltd**

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

To: Science Consultants

Subject: Foaming

Dear Consultants

Thank you for the information you sent to us about **all** 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 in Activity 4 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
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

Activity 7: Lumps or powder?



Objectives

- To recognise that some materials need to be changed physically to make them more suitable for applications such as sun care products
- To predict and test the time taken by a selection of solids to sink in oil
- To compare everyday materials on the basis of their material properties
- To make systematic observations and measurements and use these observations and measurements to draw conclusions

Resources

Per group of four children unless otherwise stated

Role badges (Appendix 1)
Stop clock or stopwatch
4 small transparent pop bottles or cups
Teaspoon of: sugar cubes, granulated sugar, caster sugar, icing sugar
300 ml vegetable oil or sunflower oil
2 teaspoons
100 ml measuring cylinder

Introducing the activity

Use the website area *Safe in the sun - Sun Protection*. This webpage provides the starting point and background for the activities in this theme. A video clip of the industrial scientist in *A Lumpy Problem* is used to introduce Activity 7. The teacher then summarises the problem. The main ingredient for sunscreen comes from the manufacturer in the form of big white lumps of solid material, which need to be changed into a powder. The teacher asks the children why they think this is and takes feedback from the class. The teacher explains that, as the real ingredient is very expensive, they will be testing, in cooking oil, solids which mimic those used in industry. In their groups, the children predict which of the samples is best suited to be mixed into a liquid sunscreen. The children are encouraged to explain the reason for their prediction by responding to questions such as:

Which properties of your chosen solid make it better for mixing into the liquid?

In sunscreens, why do we need to make sure the solids/powders are well mixed in the liquid?

Activity

The children decide upon roles and responsibilities for the investigation (Appendix 1). They add each sugar sample in turn to separate measured volumes of oil and gently shake or stir for 20 seconds; they start the stopwatch and when they believe the

majority of the sugar has sunk to the bottom of the plastic container, the stopwatch is stopped and the time noted. They decide an appropriate way in which to record their results.

It is likely that, in most cases, a timed result will only be possible for granulated and caster sugar. Icing sugar is likely to partially suspend in the oil, demonstrating that this would be the best form of solid to use for mixing into oil. Sugar cubes sink quickly to the bottom of the pot preventing accurate timing. For a readable measurement, taller containers could be used, the sugar cubes slightly broken down, or the time taken for the cubes to drop without any stirring could be measured. Sample results, using 1 teaspoon of each sugar and 75 ml oil each time, are shown below. The table shows the time taken for different sugars to sink in oil (using an 8 cm tall pot).

Sugar Used	Time taken
Granulated	1 min 50 secs
Caster	2 min 35 secs
Cubes	Too quick to measure
Icing	Sugar left in suspension

Plenary

Teacher and children then discuss the results from the class activity:

Which materials mixed best in the liquid?

Are there any unusual results?

Did the groups obtain similar results?

Which of the samples would the children recommend for the sunscreen and why?

The third screen of the website area *A Lumpy Problem* shows the children a selection of solids in liquid and provides an opportunity for the children to compare their results with those demonstrated in the animation on screen.

Ambassador role

An ambassador from a local company could act as an initiator to the activity, by introducing the challenge to the children and showing them a sample of unground ingredient. The ambassador could outline his or her job and explain the skills required to carry out the role, explaining that scientists in industry often have to find solutions to problems. Finally, the ambassador could discuss the children's results in the plenary session and ask for their recommendations.

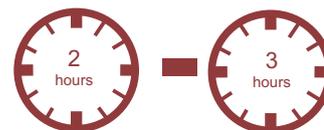
Background information

The classroom activities are based upon processes in which some materials are changed to make them more suitable for applications such as sun care products. The activities focus upon two main areas: Research and development science, involving the break-up of clumps of particles, and 'applications and claims' science, introducing the concepts of formulating products and testing how well they perform.

Industry produces ingredients called metal oxides for use in a number of applications, and particularly in sun care products such as lotions, sprays and sticks.

When the metal oxide is made, it needs to be filtered from water. After filtration, it is a white 'cake', still containing a lot of water. When the cake is dried it forms large solid clumps. These clumps need to be ground into a powder to (i) stop the solids from sinking to the bottom of a bottle of sunscreen and (ii) give an optimum amount of protection against UVA and UVB radiation.

Activity 8: Grinding solids



Objectives

- To recognise that the hardness and size of some solids make them suitable for certain applications such as grinding
- To find an effective method to change solids into a powdered form
- To compare everyday materials on the basis of their material properties

Resources

Per group of four children unless otherwise stated

3 containers with lids

Cup of one of:

1-2 cm pieces of chalk sticks or sugar cubes

Range of spherical grinding materials, hard and soft and of different sizes

e.g. 2 materials from each of the following:

Hard: Marbles, ball bearings, large beads.

Soft: Polystyrene balls, Smarties, Cheese ball crisps

Filter funnel

10 - 25 ml measuring cylinder

Digital weighing scales (0-3 Kg)

Introducing the activity

Use the website area *Safe in the sun - A Lumpy Solution*. The teacher reminds the children of the video clip of the industrial scientist in which he explains that the sunscreen ingredient must be changed from lumps into powder. In groups the class discusses ideas for a suitable method. The teacher explains that in industry, large amounts of the ingredient are needed, so the method used has to be efficient. Returning to the website area, *A Lumpy Solution*, the children watch the video clip of the industrial scientist suggesting that shaking the lumpy sunscreen ingredient with another material may help to change the lumps into powder more efficiently. They would like the children to try out this idea, and report their results to the company.

Activity

The teacher explains that as the real ingredient used in sunscreen is very expensive, the industrial scientists have provided other materials (chalk or sugar cubes) for the children to use for their investigation. They have also suggested a selection of grinding materials to use in the shake tests: marbles, beads, ball bearings, polystyrene balls, Smarties, cheese ball crisps.

The groups are given time to examine the samples and to discuss the properties of the materials. Each group chooses an ingredient and a grinding material and explains the reasons for its choice of type, quantity and size of material. The children should plan how they will ensure a fair test. They may consider controlling factors such as number

of shakes, time or method of shaking. They must also decide how they will measure the amount of ground ingredient produced.

When each 'shaking test' is completed, the children separate the grinding material from the ingredient, remove any un-ground ingredient, collect the ground ingredient and measure and record its weight or volume. To measure volume, the ground ingredient could be poured through a funnel into a measuring cylinder. Results may be recorded in a table, bar chart, line graph or other appropriate format.

Sample results with a variety of grinding materials and ingredients each shaken 200 times are shown on page 29.

Plenary

The children discuss their findings and must decide which grinding 'system' is most effective, taking into consideration the number of pieces and size of the grinding material used. The teacher encourages suggestions as to why some methods were not as effective as others. They could be encouraged to discuss the relative 'hardness' of the materials concerned. Harder materials are better to use for this grinding technique. Grinding material which is too large or too small will work less effectively. They could use photographic evidence to provide a record of their results, displaying samples of the materials used in their investigation. The children decide on an appropriate way of reporting their findings to Sumptuous Skincare Ltd. Returning to the website area, *A Lumpy Solution*, the teacher can show the children photographs of the milling machine used in industry together with the final product.

Ambassador role

Ambassadors could explain to the children the methods used in industry to grind materials. They could enhance the lessons by bringing photographs of equipment and examples of the actual material being ground, before and after grinding, and the grinding materials such as the ceramic beads used in the plant and laboratory. Samples of titanium dioxide dispersions can be used for demonstration purposes, along with raw, unprocessed materials. In addition to these raw materials, sunscreen formulations in different formats may be used for demonstration. The ambassadors could respond to questions from the children, or give feedback on the quality of the class investigation methods and results.

Information for teachers

Chalk and coffee beans give the largest measurable difference between no grinding material and grinding material being present. Chalk and sugar cubes give the most separable ground product from non-ground material, and also can be closely related to the white titanium dioxide powder used in industry.

Smarties and Cheese ball crisps are good materials to use to demonstrate brittleness of certain solids. We need the grinding material to be durable, and not break apart itself. Upon shaking the Smarties with the chalk/sugar cubes/coffee beans, the shell of the Smarties will break off, along with some of the core material inside the Smarties. With the cheese ball crisps, both materials will break apart, rendering the powdered chalk/sugar/beans unusable.

In industry, after filtering, drying and grinding the dried 'cake' of sunscreen ingredient into a powder, the metal oxide particles are still clumped together or 'aggregated'. The powder is mixed with a cosmetic oil (or water) and a 'dispersant'. In order to break apart the clumps of particles, the mixture passes through a 'bead mill' containing lots of tiny, hard ceramic beads. This is the process being modelled in this activity.

Metal oxide ingredients can also be used in plastics to prevent the degradation of food and drink from UV radiation.

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

“

I have just done this activity with a small group of 6-8 yr olds. They loved the science. We have done some real high level thinking. The children worked out that you need to test and the consequences of not doing. So as well as investigative skills they have really developed their thinking. The children loved the UV beads and a year 2 stood in front of the whole school and asked if anyone knew what SPF means. So plenty of real life learning!
(Year 5 teacher, Lancashire)

”

Activity 9: Testing sunscreen products



Objectives

- To understand that different levels of UV protection are achieved by using different types and amounts of ingredients in sunscreen products
- To test and rank a series of sunscreen products
- To understand that some changes are reversible

Resources

Per group of four children unless otherwise stated

Bag of UV-active beads⁵
Small samples (e.g. 5 ml) of factor 5, 15, and 50+ sunscreen
Paper towels
Tidy tray or shoe box
3 plastic cups
Tea spoon
Pipette or syringe
Paintbrush
10 ml measuring cylinder

Advance preparation

Decant the sunscreens into three containers, e.g. yoghurt pots, labelled A, B, C

Introducing the activity

Use the website area *Safe in the Sun - Sunscreen Test*. The teacher introduces the lesson by asking the children what they know about sun protection factors (SPFs) and the importance of sun protection. The children could produce a KWL grid (what they **know**, **would like to know** and **have learned**) which they could complete after their investigations. The teacher explains that some exposure to sun is good for us but too much can cause premature ageing, wrinkling, burning and reddening of the skin.

The teacher reminds the children of their previous investigations and that industry makes ingredients that are used in sunscreens. Once the ingredient has been ground into powder and mixed into the liquid, industrial scientists must test the mixtures to see how effective they are. A high SPF sunscreen is good at stopping sun damage to the skin. Low SPF sunscreens also stop sun damage, but are less effective at doing so. The email on the *Sunscreen Test* website area introduces the activity to the children. The scientists have sent them three samples of sunscreen (A, B, C) and they would like the children to test them to see which one gives the best sun protection. Since we should not use our own skin for these tests, the industrial scientists has also sent some very special beads that change colour in UV light (sunlight).

⁵ Bags containing 100-500 beads, that produce one colour or a variety of colours on exposure to UV light, may be ordered online from several suppliers.

Activity

The children discuss how they might test the sunscreens. They must decide how they might apply the sunscreen to the beads and how they can make sure their test is fair. They may decide to measure the same amount of sunscreen each time using spoons, pipettes, syringes or small measuring cylinders. They could use a brush or a spray to coat the beads or apply the sunscreen by putting a measured amount in their hands and rubbing the beads. The activity should be carried out away from external windows if possible, until the beads are to be taken outdoors. This will minimise any colour changes in the first stage of the experiment. Each set of beads could be placed in a tray or box, should be kept covered until taken outdoors and then exposed to the light for a short time. The children then observe the colour change, place the beads in order of protection afforded by the sunscreen and record their results. They predict which SPF they think matches each sample of sunscreen, by closely observing the degree of colour change produced in each case.

Plenary

Returning to the second screen in the *Sunscreen Test* area, the children choose which sunscreen gives the greatest protection. The results from the class activity are then discussed:

Did all groups record similar results?

Which sample do they think had the highest SPF? Why?

How did they ensure that they carried out a fair test?

How would they improve their test?

How did their test result compare with that in the animation?

Quality control

The subsequent web pages in this section introduce quality control and allow the children to 'test' samples of sunscreen and interpret results displayed in the form of a graph. The children can also learn about the uses of UV protection for various products.

Ambassador role

Ambassadors could enhance and support the classroom activities by providing UV reactive beads, photographs of sunscreen tests from the laboratory, together with simple tables and/ or graphs of actual results. The children might also wish to report the results of their investigation to the ambassador and ask questions.

Background information

Some companies which make active ingredients for sun care products do not sell sunscreens directly to consumers. However, companies have 'Formulation and Claims Testing' departments, in which they prepare sunscreen products to test that they perform as effectively as they should. These formulations are tested for their Sun Protection Factor (SPF) and protection against UVA radiation, amongst other properties.

UV active beads change colour in sunlight because they are made from a special reversible photochromic material. This material changes its chemical structure when exposed to ultraviolet light (like sunlight), allowing it to absorb a coloured pigment or dye. Once out of the sunlight it becomes colourless again.

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 other 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

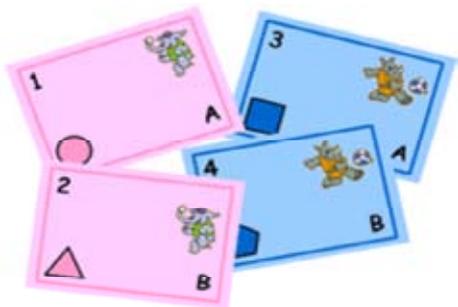
Where groups of 5 are necessary, the following role can be used:

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



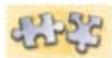
Pupils first talk in pairs to develop initial ideas. Pairs double up to fours to build on ideas. Fours double up to tell another group about their group's ideas.

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.



For more information on the programmes and publications available from CIEC *Promoting Science*, visit our web site at:

www.ciec.org.uk

or contact:

CIEC *Promoting Science*
Department of Chemistry
University of York
Heslington, York
YO10 5DD