Kitchen Concoctions

Science and technology activities
for 7 - 11 year olds

CENTRE for INDUSTRY EDUCATION COLLABORATION

ROYAL SOCIETY OF CHEMISTRY

CIA Chemical Industries Association

ACKNOWLEDGEMENTS

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[SUMMARY SHEET]

30 MINUTE ACTIVITY

WHAT'S IN MY BREAKFAST CEREAL?

SUMMARY

Children examine the ingredients found in a bowl of breakfast cereal, such as muesli or granola, and their understanding of mixtures is nurtured through class discussion. Following this, they are challenged to separate and sort these ingredients, explaining criteria used for grouping and classifying. Children can take and annotate photographs of the separated ingredients; using cereal box information for identification purposes.

OBJECTIVES

- To explore and describe a mixture made from solid ingredients
- To group, sort and classify solid ingredients in a mixture
- To understand that mixing is a reversible change

To be able to:

- Explain mixing as a reversible change

SCIENCE VOCABULARY

Mixture	Reversible	Change
Identify	Classify	Sort
Solid	Ingredients	Separate
Group		

RESOURCES *(IN BRIEF)*

Per group of 2-4 children:

- Small bowl of muesli
- Hand lens (optional)

Note: Supermarket brands are cheap, but contain fewer ingredients.

- List of ingredients from packaging

PRIOR KNOWLEDGE/EXPERIENCE

Children will have compared and grouped materials, focusing on similarities and differences.

[ACTIVITY DETAIL]

30 MINUTE ACTIVITY

WHAT'S IN MY BREAKFAST CEREAL?

Children examine the ingredients found in a bowl of breakfast cereal, such as muesli or granola, as their understanding of mixtures is nurtured through class discussion. They are challenged to separate and sort these ingredients, explaining criteria used for grouping and classifying. Children can take and annotate photographs of the separated ingredients; using cereal box information for identification purposes.

TYPE OF ENQUIRY

Identifying, classifying and grouping

OBJECTIVES

- To explore and describe a mixture made from solid ingredients
- To group, sort and classify solid ingredients in a mixture
- To understand that mixing is a reversible change

To be able to:

- Explain mixing as a reversible change

SCIENCE VOCABULARY

Mixture	Reversible	Change
Identify	Classify	Sort
Solid	Ingredients	Separate
Group		

RESOURCES

Per group of 2-4 children:

- Small bowl of breakfast cereal with visible varied ingredients (eg: good quality muesli, granola or brands such as Fruit and Fibre)
- Hand lens (optional), list of ingredients from cereal packaging.
- Kitchen Chaos cartoon strip (optional)

Note: Supermarket brands are cheap, but contain fewer ingredients.

PRIOR KNOWLEDGE/EXPERIENCE

Children will have compared and grouped materials, focusing on similarities and differences.

ACTIVITY NOTES

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

Ask children if they can explain to a partner exactly what a 'concoction' is (referring to the title of this resource). Responses might range from something a witch or wizard would brew in a cauldron to simply a mixture of different things.

Play a game of Taboo; one person explaining the secret word 'mixture' to a partner without saying either 'mix' 'mixed' or 'mixing' and children will find that it is trickier than they might think! By definition, a mixture is made where two or more substances are physically but not chemically combined and can be separated again by physical methods such as sieving, filtering, evaporating etc. For the purpose of these activities, we shall simply look upon mixtures as being formed when two or more substances are combined.

Explain that we are going to learn about different concoctions or mixtures that can be found in the kitchen, beginning by examining a simple mixture that children may have had for their breakfast that morning. Refer to Safety guidance and check for individuals with allergies before giving each group of 2-4 children a small bowl of cereal such as muesli or granola to examine and ask "Is your breakfast cereal just one thing or a mixture of things?" Challenge pupils to separate and sort the different ingredients, thus showing that it is made up of a mixture of lots of different things. You can refer to Questions for thinking to aid and extend class discussion.

Encourage children to explain how and why they have grouped ingredients in their chosen ways and whether they can identify any of the ingredients such as rolled oats, grains, fresh or dried fruits, seeds and nuts (using a hand lens and the list of ingredients as a secondary source of information). Children could record their classification of breakfast cereal by annotating and labelling photographs of the separated ingredients, as printed on a cereal box.

EXTENSION OR HOME-BASED ACTIVITIES

Pupils might like to create their own muesli or granola mixtures from a range of solid ingredients such as oats, grains, fresh or dried fruits, seeds and nuts. They could design cereal boxes or recipe sheets to accompany their 'concoctions'.

QUESTIONS FOR THINKING

- What mixtures have you used, or been in contact with, today?
- What mixtures can you find in your kitchen?
- Is your breakfast cereal just one thing or a mixture of different things? How do you know this?
- Is it easy or difficult to separate and sort the different ingredients in your breakfast cereal? Why?
- Can you put all the ingredients back together again?
- What type of scientist do you think would experiment with and explore mixtures?

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 any of the ingredients used in cereals, in particular those with nut allergies.
- Good food hygiene is fundamental in the safe preparation of food whether it be at home or in the classroom. It is essential that teachers are aware of the potential risks associated with the preparation of food in school.

INDUSTRY LINKS AND AMBASSADORS

Links can be made with the food industry via local companies and company websites. The **STEM Directories** is a great place to start looking.

The process of combining ingredients is far more technical than you would first think. Specialist equipment is developed by engineers who need to find solutions to problems such as the ingredients sticking together, contamination of natural ingredients with small stones or grit and incomplete mixing to avoid powdery residue left at the bottom of the cereal box. X-ray machines can be used to detect foreign bodies in mixtures too! Machine operation is often a skilled job, which requires specialist training.

If working with an Ambassador from the cereal manufacturing industry, do ask them to bring relevant images, video clips or artefacts related to the processes involved as well as any products at different stages of manufacturing to show to children.

CROSS CURRICULAR LINKS

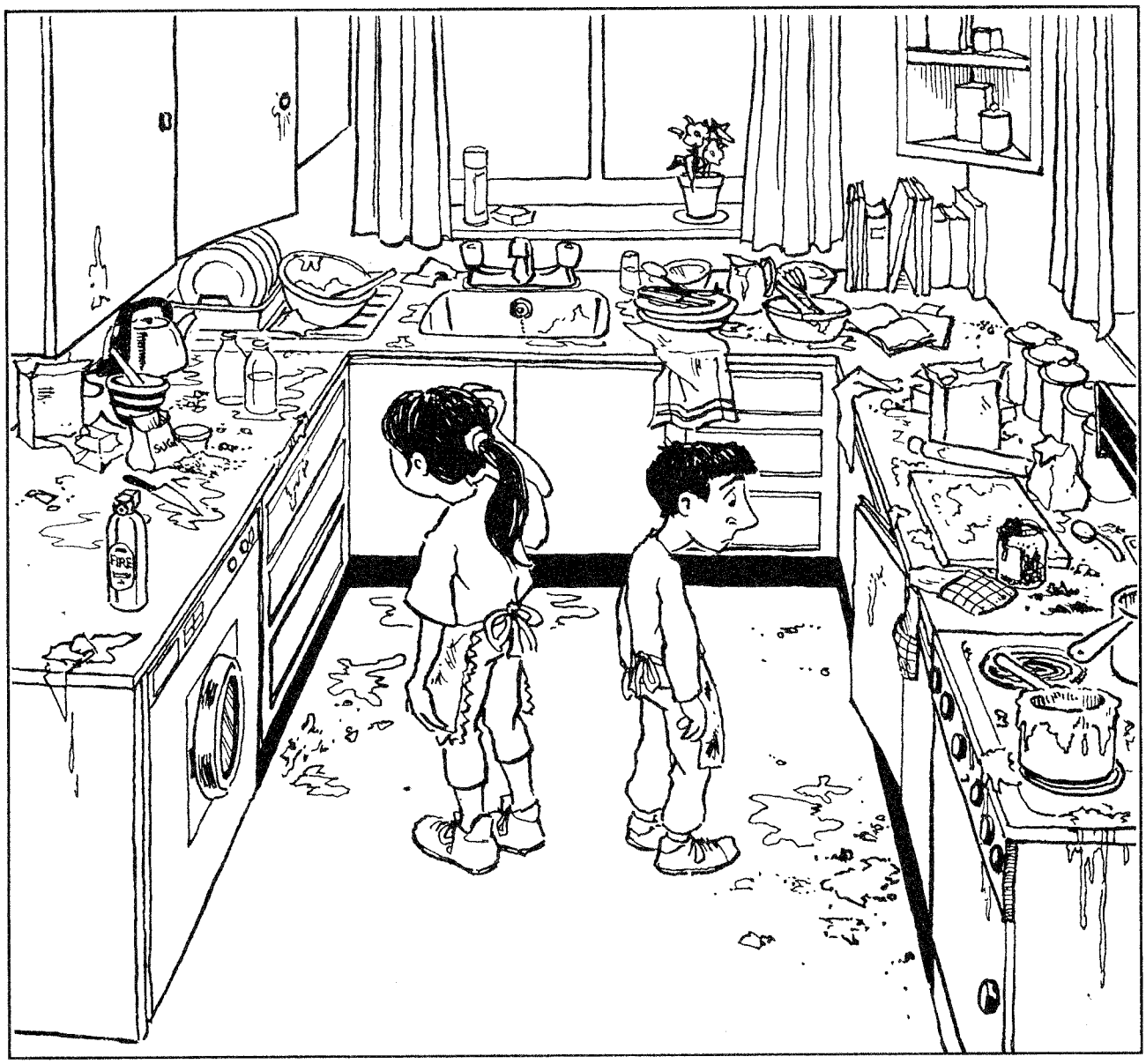
English: opportunities to use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas. Also links to writing whereby pupils identify audience and purpose, as well as selecting the appropriate form.

Mathematics: links to sorting, classifying and grouping.

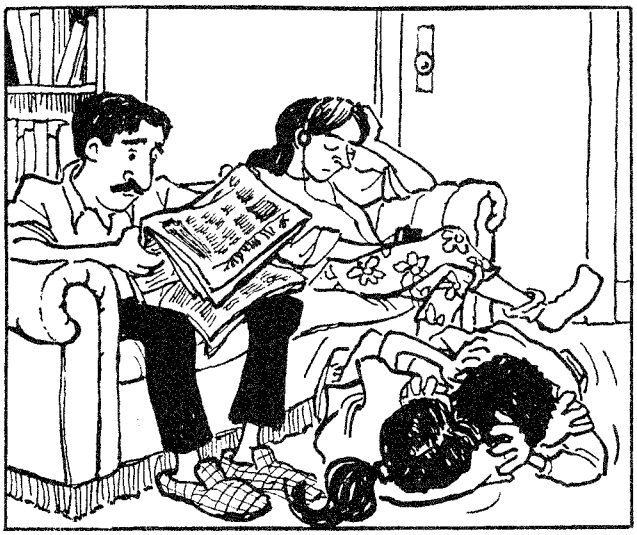
Design and Technology: the extension activity provides links to the planning and preparation of a variety of dishes

Kitchen Chaos!

Written by Joy Parvin Illustrated by Martin Cottam.

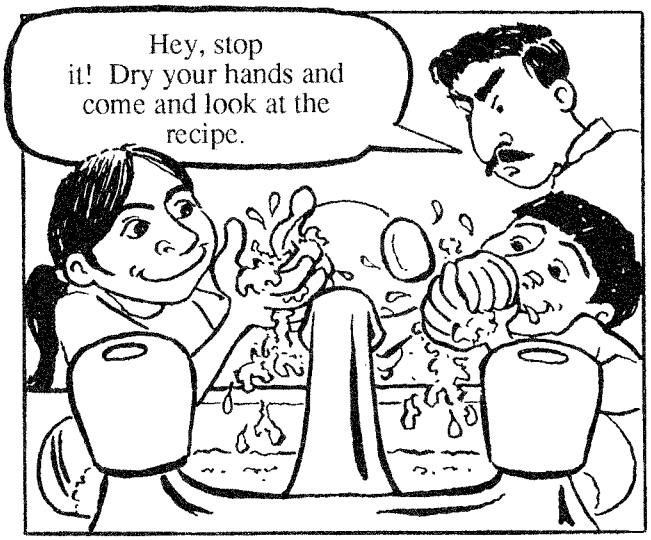


Suprise Pies



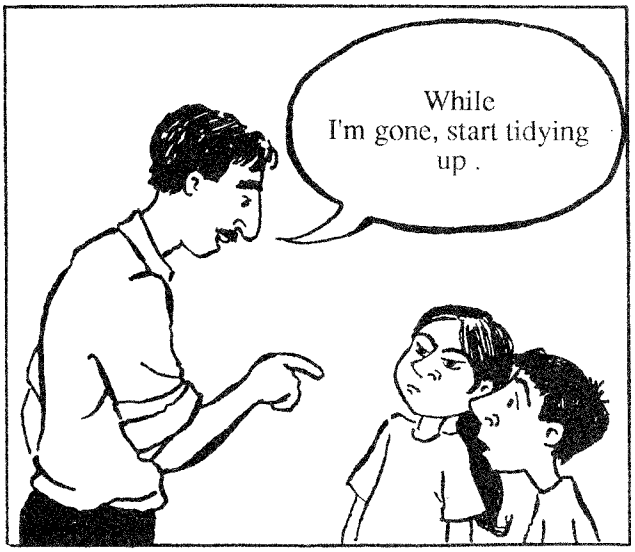
Callum and I were bored.

Dad should have known that nothing would drag Sam from her music.

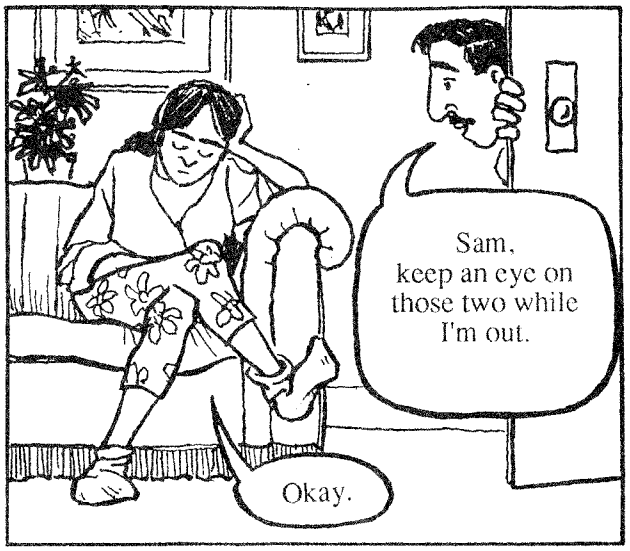


We thought this would be a great day. Dad let us get away with far more than Mum did.

Suprise Pies



There had to be a catch!



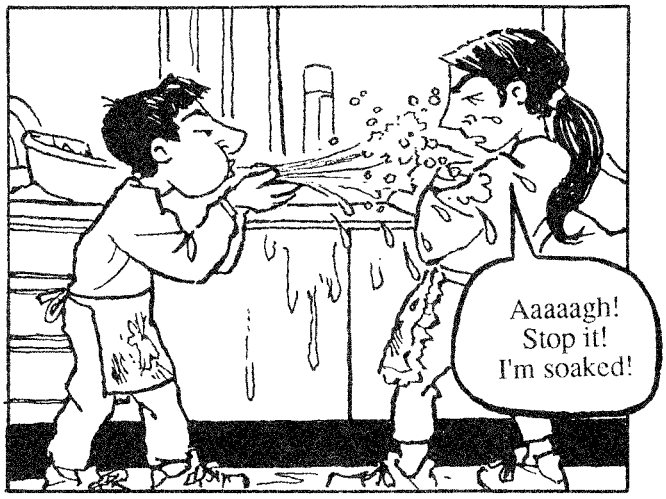
At least Sam wouldn't bother us, but . . . . .

The kitchen looked like a bomb had hit it. Where would we start?

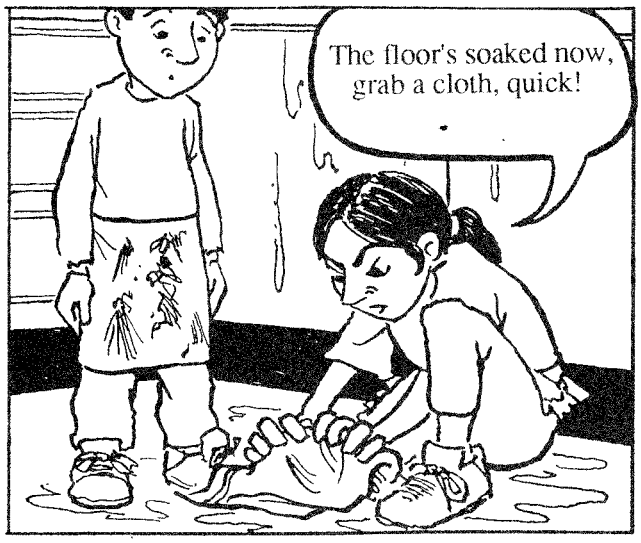
Suprise Pies

What should we use to clean what? Washing the dishes was our safest bet, except . . . . . .

We got carried away squirting the bottle and . .



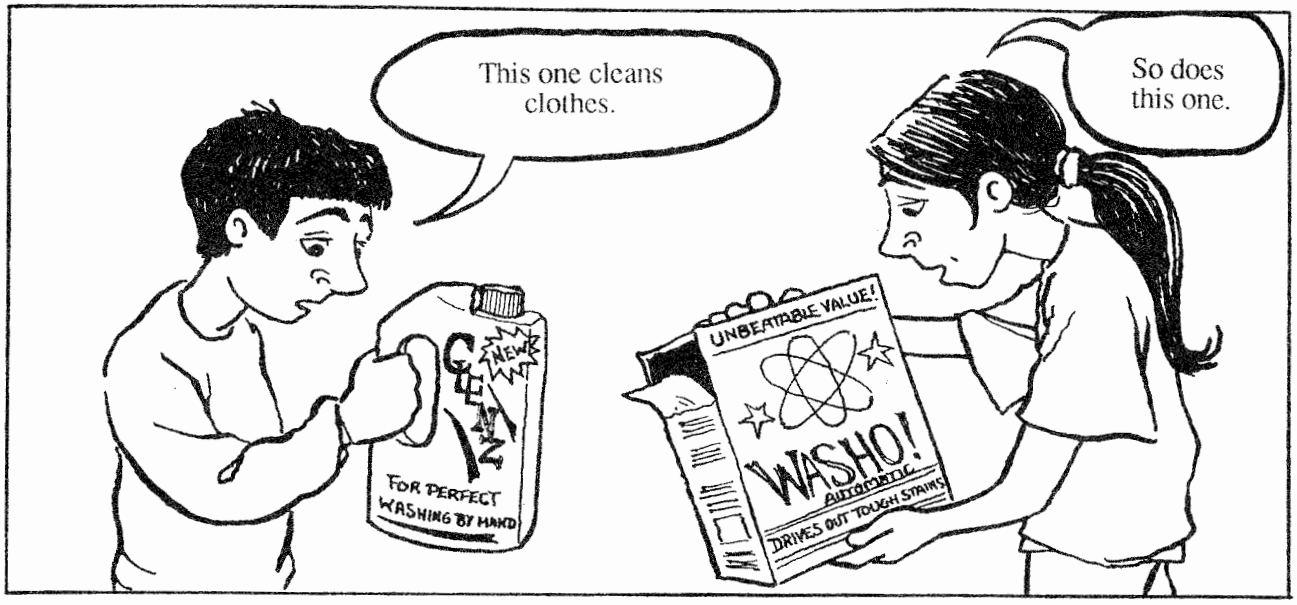
Before we knew it there were soap-suds everywhere!



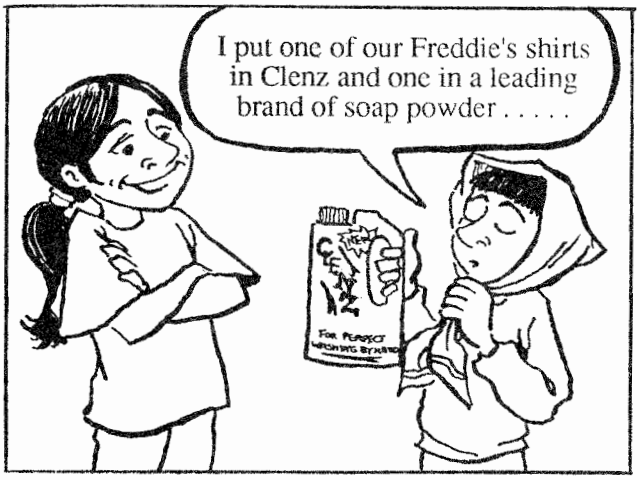
I didn't mean to use tea-towels, I panicked!

We could wash our aprons at the same time.

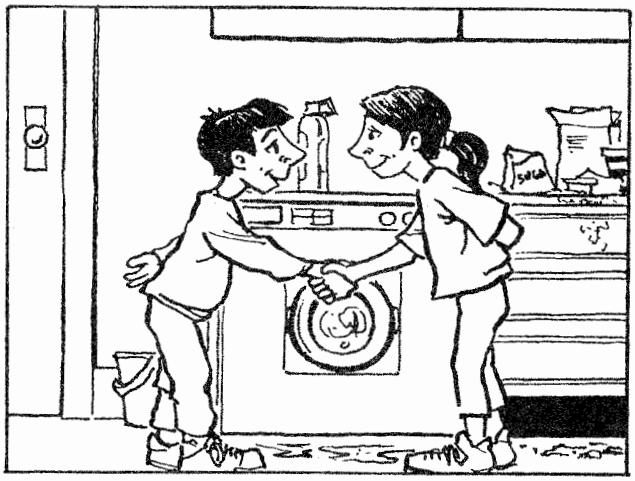
Suprise Pies



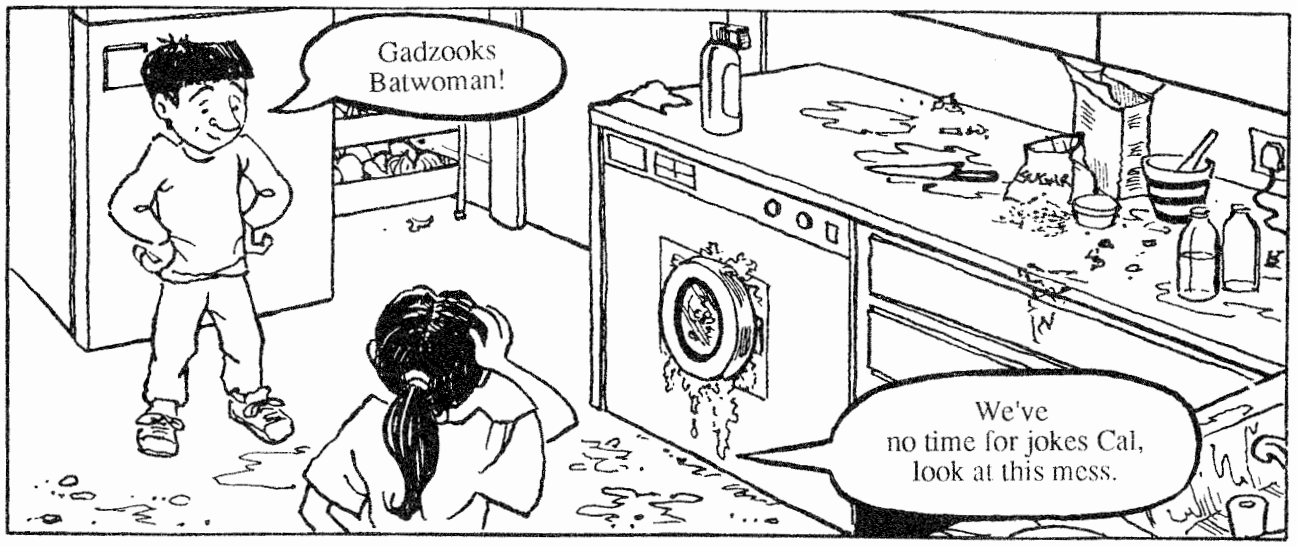
What should we use? The writing on the bottles and boxes said 'the best' - just like on the telly. So we closed our eyes and picked one - "Clenz".



We'd seen the adverts, and Mum washed our jumpers with Clenz, so it must be okay.

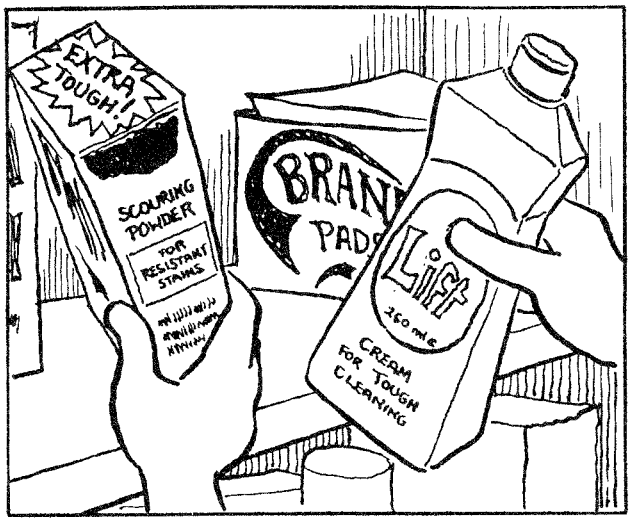


We were pretty pleased with ourselves, we hadn't needed Sam's help once!

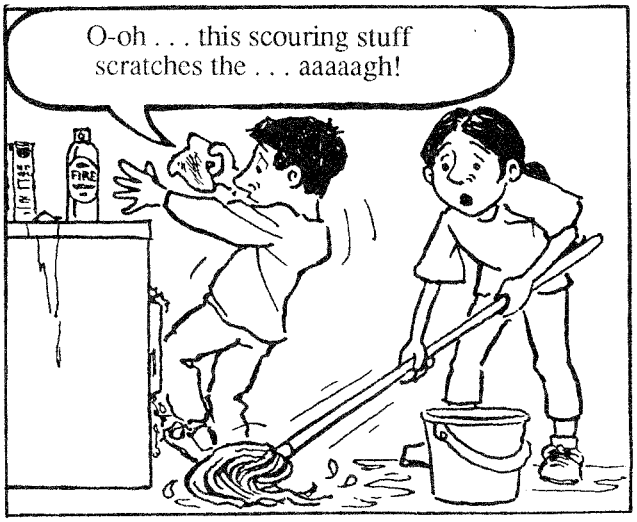


The kitchen floor looked worse than when we started, and the kitchen tops were still covered in flour and mincemeat.

Suprise Pies



We had to be quick, Dad wouldn't be long.



Did Cal have to step back **just** then?

[SUMMARY SHEET]

45 MINUTE ACTIVITY

WHAT'S IN A MINCE PIE?

SUMMARY

Children explore a range of 'mixtures' presented in a shopping bag and focus their attention on a box of mince pies. They should attempt to separate and identify the ingredients in a mince pie, developing their understanding of mixtures and types of change. Pictorial, photographic or written records of findings are all simple ways for children to explain that there are often mixtures within mixtures.

OBJECTIVES

- To explore and be able to describe a mixture made from solid and liquid ingredients
- To gather, record, classify and present data in a variety of ways to help answer questions

To be able to:

- Understand that some mixtures are permanently changed into new things and others can be separated back to the original ingredients
- Appreciate that there can often be mixtures within mixtures

SCIENCE VOCABULARY

Mixture	Solid	Liquid
Ingredient	Separate	Group
Sort	Classify	Identify
Change	Reversible	Irreversible
Permanent		

RESOURCES *(IN BRIEF)*

- Mince pies and a jar of sweet mincemeat (these can be bought throughout the year)
- Shopping bag
- Round edged knives
- Teaspoons
- Cocktail sticks
- Hand lens (if available)

Note: A list of mincemeat ingredients found on mince pie/mincemeat packaging.

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to compare and group materials, looking closely at their similarities and differences. They should also have some understanding of how some materials change when they are heated or cooled.

[ACTIVITY DETAIL]

45 MINUTE ACTIVITY

WHAT'S IN A MINCE PIE?

Children explore a range of 'mixtures' presented in a shopping bag and focus their attention on a box of mince pies. They should attempt to separate and identify the ingredients in a mince pie, developing their understanding of mixtures and types of change. Pictorial, photographic or written records of findings are all simple ways for children to explain that there are often mixtures within mixtures.

TYPE OF ENQUIRY

Identifying, classifying and grouping/Researching using secondary sources

OBJECTIVES

- To explore and be able to describe a mixture made from solid and liquid ingredients
- To gather, record, classify and present data in a variety of ways to help answer questions

To be able to:

- Understand that some mixtures are permanently changed into new things and others can be separated back to the original ingredients
- Appreciate that there can often be mixtures within mixtures

SCIENCE VOCABULARY

Mixture	Solid	Liquid
Ingredient	Separate	Group
Sort	Classify	Identify
Change	Reversible	Irreversible
Permanent		

RESOURCES

Per class:

Jar of sweet mincemeat (available from supermarkets throughout the year), shopping bag containing commercial products such as instant soup, pre-made sandwich and a box of chocolate crispy cakes or muffins

Per group of 4 children:

- Mince pie
- Round edged knife
- Teaspoon
- 2-4 cocktail sticks,
- Hand lens (if available)
- List of mincemeat ingredients from the packaging
- Kitchen Chaos cartoon strip (optional)

PRIOR KNOWLEDGE/EXPERIENCE

Children will have compared and grouped materials, focusing on similarities and differences.

ACTIVITY NOTES

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

Refer to Safety guidance and check for individuals with allergies before presenting a shopping bag containing commercial products that the children might recognise as mixtures. Take out a box of mince pies and give a pie to each group in the class. Ask children, "Is your pie just one thing or a mixture of things?" Children should cut their mince pie in half to reveal the pastry and the mincemeat filling, thus showing that a pie is made up of a mixture of at least two separate things.

Ask, "Can the mixture of pastry and mincemeat be separated?" Discuss children's ideas and suggestions before inviting them to separate the two – this can be done easily by scooping the mincemeat out with a spoon onto a paper towel.

Focus discussion on the baked pastry case of the pie and ask "Is this just one thing or a mixture of things?" Extend children's thinking by commenting how it looks like just one thing and then challenging them to separate the ingredients using equipment provided. Discuss how the mixture cannot be separated easily as the ingredients, which made this mixture, have been changed permanently with heat during baking (this concept can be covered in more detail during the Baking activity).

(Note: the mixed ingredients would be difficult to separate prior to baking, but changes due to heating can be noted, eg colour and texture.)

Repeating the questions again for the mincemeat may lead to disagreement over whether this mixture can be separated. Children are asked to separate a spoon of mincemeat (straight from the jar) placed on a paper towel, using cocktail sticks. Once complete, they can use a hand lens and a list of mincemeat's ingredients as a secondary source of information to identify what they have found.

Give children a list of mincemeat ingredients, and ask them to discuss which they have identified and which they cannot see, or separate, and why. For example, children may notice that this mincemeat looks different to that in the mince pie they explored, as they can no longer see the suet, which has melted during baking. Discussion can now scrutinise the nature of the separated ingredients in a mince pie, i.e. are any of them mixtures? Children could create and present a pictorial, photographic or written record of their findings in answer to "what's in a mince pie?" before disposing of any remaining ingredients.

For a summary of questions asked throughout this activity, please refer to Questions for thinking.

EXTENSION OR HOME-BASED ACTIVITIES

Children could explore the remaining contents of the introductory shopping bag or from their kitchen cupboard at home and think about whether or not products such as instant soup, a pre-made sandwich, chocolate crispy cakes or muffins are made up of mixtures of ingredients, and whether any of these mixtures are made from mixtures of things too. They could also think about whether the ingredients can be separated or if and how they might have undergone some kind of permanent change.

QUESTIONS FOR THINKING

- What mixtures have you used, or been in contact with, today?
- What mixtures can you find in your kitchen?
- Is your breakfast cereal just one thing or a mixture of different things? How do you know this?
- Is it easy or difficult to separate and sort the different ingredients in your breakfast cereal? Why?
- Can you put all the ingredients back together again?
- What type of scientist do you think would experiment with and explore mixtures?

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 any of the ingredients used in mince pies or mincemeat, in particular those with nut allergies.
- At the end of the separation activity, the used mincemeat should not be eaten, but rolled in the paper towels and thrown away.

INDUSTRY LINKS AND AMBASSADORS

Separating ingredients is a core industrial process. Many manufacturing companies use sieves and sieving machines, which apply a simple technique to separate particles of different sizes. Watch a **1-minute video** showing industrial sieves separating cookie sprinkles.

Links with the food industry will be most accessible to children; however, it should not be too difficult for them to appreciate that many non-food industries also need to separate ingredients to make their products. A wide range of companies use sieving techniques to ensure that any oversized contamination (which may have accidentally found its way into the mixture) is removed and the quality of the final product is improved.

Another example of separation can be found at **industry-animated.org**, which demonstrates a filter press separating solid powders from liquids (in this case, the powder is the product – a pigment to add to dyes). More information about sieves and filters can be found at **www.colour-ed.org**.

If working with an Ambassador, ask them to bring relevant images, video clips or artefacts such as sieves and filters to show to children and explain how these are used on a large scale.

CROSS CURRICULAR LINKS

English: opportunities to use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas. Also links to writing whereby pupils identify audience and purpose, as well as selecting the appropriate form.

Mathematics: links to sorting, classifying and grouping, mass and volume.

Design and Technology: thinking about how mince pies have been made and how ingredients change in the baking process provides links to preparing and cooking a variety of dishes using a range of cooking techniques.

[SUMMARY SHEET]

1 HOUR ACTIVITY

BAKING MINCE PIES

SUMMARY

As an optional extension activity, with excellent links to the Design and Technology curriculum, each group of children is given a Mince Pies Recipe and works with adult to make mince pies. They focus on the scientific vocabulary and processes involved in baking to further their understanding of different types of change and make their own decisions about how to record changes over time.

OBJECTIVES

- To experience first-hand changes to ingredients when they are mixed and cooked
- To make systematic and careful observations over a period of time

To be able to:

- Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible

SCIENCE VOCABULARY

Mixture	Solid	Liquid
Ingredients	Change	Reversible
Irreversible	Permanent	

RESOURCES *(IN BRIEF)*

Ingredients and utensils for baking mince pies - see Mince Pies Recipe

PRIOR KNOWLEDGE/EXPERIENCE

Children will have looked at what is in a mincemeat mixture and discovered that they can separate most of the ingredients from the mixture. They will have talked about pastry and that it would be difficult to get flour or margarine, etc. back from the mixture due to the changes that have occurred.

Experience of mixing ingredients and using simple kitchen utensils to cut, mix, roll and cook would be helpful.

[ACTIVITY DETAIL]

1 HOUR ACTIVITY

BAKING MINCE PIES

As an optional extension activity, with excellent links to the Design and Technology curriculum, each group of children is given a Mince Pie Recipe and works with adult to make mince pies. They focus on the scientific vocabulary and processes involved in baking to further their understanding of different types of change and make their own decisions about how to record changes over time.

TYPE OF ENQUIRY

Observing changes over time

OBJECTIVES

- To experience first-hand changes to ingredients when they are mixed and cooked
- To make systematic and careful observations over a period of time.

To be able to:

- Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible

SCIENCE VOCABULARY

Mixture	Solid	Liquid
Ingredients	Change	Reversible
Irreversible	Permanent	

RESOURCES

Mince Pie Recipe
For a group of 4 children to make a batch of 24 mince pies

For home-made mincemeat

- 75g cooking apples
- 40g shredded suet
  (vegetarian alternatives can be used if desired)
- 140g dried fruit
  (such as raisins, currants, sultanas)
- 40g candied mixed peel
- 60g soft dark brown sugar
- ½ orange and ½ lemon
- 10g chopped almonds
- 1 teaspoon mixed spice
- OR 400g jar mincemeat

For pastry cases

- 300g self-raising flour
- 75g margarine
- 75g lard
  (vegetarian alternatives can be used if desired)
- Pinch of salt
- Cold water (to mix)
- Icing sugar (for light dusting)

RESOURCES

Utensils

- Peeler and corer
- Chopping board
- Chopping knife
- Weighing scales
- Grater
- Large mixing bowl
- Foil
- Sieve
- Tablespoon
- Teaspoon
- Rolling pin
- Baking tray
- Oven gloves
- Cooling rack

PRIOR KNOWLEDGE/EXPERIENCE

Children will have looked at what is in a mincemeat mixture and discovered that they can separate most of the ingredients from the mixture. They will have talked about pastry and that it would be difficult to get ingredients such as flour or margarine back from the mixture due to the changes that have occurred during baking.

An experience of mixing ingredients and using simple kitchen utensils to cut, mix, roll and cook would be helpful.

ACTIVITY NOTES

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

Refer to Safety guidance and check for individuals with allergies before children collect the appropriate ingredients and utensils for their baking using the Mince Pie Recipe provided.

When making the pastry, focus discussion on what it looks and feels like and on predicting what will happen to it during baking. Children's descriptions can be compared with observations when the pies are baked and cooled. Keep leftover pastry cuttings and bake some of these alongside the pies so that children can handle and compare both baked and unbaked cuttings. Some children may be able to predict the brittle nature of the pastry once it comes out of the oven and the fact that it browns and the smells of fat and flour are not as distinct. Others (or perhaps all) may only appreciate this on handling both pastry types after baking.

Children should make their own decisions about how to record their mince pie making. Each step of the mince pie making process can be photographed by children and ordered chronologically in a multimedia presentation, flip book or photo album. They should think carefully about what commentary they might devise to accompany each photograph, including detailed descriptions of the changes that are taking place over time.

EXTENSION OR HOME-BASED ACTIVITIES

Children could carry out further research to find examples of the different types of changes that occur when things are mixed, such as:

- A chemical change is one that results in the formation of a new substance. Chemical changes often occur when food is cooked, such as boiling or frying an egg, making toast or baking bread. The changes are usually permanent.
- A permanent change occurs when the original substances cannot be recovered easily from the new substances, eg cooking, rusting, weathering and burning.
- A reversible change means that the original substances can be recovered in some way. Mincemeat is a reversible mixture as even the sugar can be separated from solution by gently evaporating the water. However, recovering the suet, which will have melted and been absorbed into the fruit, is much more complex.

QUESTIONS FOR THINKING

- What does the mincemeat mixture look, feel and smell like before it is cooked?
- How do you think the mincemeat will change when it comes out of the oven? Why?
- What does the pastry mixture look, feel and smell like before it is cooked?
- How do you think the pastry will change when it comes out of the oven? Why?
- What does the pastry mixture look, feel and smell like now it has been cooked?
- Can you describe the changes in as much detail as possible?
- What different types of changes have occurred during the making of a mince pie?

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 any of the ingredients used in the mince pie recipe, in particular those with nut allergies.
- Good food hygiene is fundamental in the safe preparation of food whether it be at home or in the classroom. It is essential that teachers are aware of the potential risks associated with the preparation and cooking of food in school.
- When working with sources of heat for cooking and baking activities, teachers should follow strict safety precautions. It is recommended that one adult should closely supervise a maximum of six children.

INDUSTRY LINKS AND AMBASSADORS

Mixing, heating and changing ingredients are core industrial processes. Links with the food industry will be most accessible to children, however, it should not be too difficult for them to appreciate that many non-food industries mix, heat and change ingredients to make non-food products. Some examples of this can be found at **www.industry-animated.org**, which demonstrates through animation:

- A reaction vessel which is an industrial cooking pan with a fixed lid into which ingredients are added through pipes
- An extruder which heats up and melts plastic pellets to shape them in to pipes, etc.

INDUSTRY LINKS AND AMBASSADORS

Children could visit **www.scienceofhealthyskin.org.uk** and have a go at the activity 'Lanolin Layers' which uses a series of photographs to demonstrate ovens being used to melt solid wool grease (washed from sheep fleeces) in order to pour it out of the large drums it is transported in.

If working with a STEM ambassador, links can be made with the company by providing a simple 'recipe' for their products, focusing on the mixing, heating and separating involved.

Note: The teacher should collaborate with the ambassador to ensure the recipe presented is at the correct level for understanding and that scientific vocabulary is used appropriately to reinforce the scientific concepts of melting, mixing, changing and heating etc.

CROSS CURRICULAR LINKS

English: opportunities to use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas. Also links to writing whereby pupils identify audience and purpose, as well as selecting the appropriate form.

Mathematics: links to sorting, classifying and grouping, mass and volume.

Design and Technology: the extension activity provides links to preparing and cooking a variety of dishes using a range of cooking techniques.

Mince Pie Recipe

INGREDIENTS

Mincemeat

- 75g cooking apple
- 40g shredded suet*
- 140g dried fruit (raisins, sultanas, currants)
- 40g candied mixed peel
- 60g soft dark brown sugar
- ½ orange and ½ lemon
- 10g chopped almonds
- 1 teaspoon mixed spice

Pastry

- 300g self raising flour
- 75g margarine
- 75g lard*
- pinch of salt
- cold water (to mix)

*vegetarian suets and solid fats are available

METHOD

Making the mincemeat

1. Peel, core and finely chop the apple.
2. Grate the rind of the orange and lemon and squeeze out the juice.
3. Finely chop the mixed peel.
4. Mix all the ingredients in a large bowl.
5. Loosely cover the mincemeat with foil and place in the oven (gas mark 4, 120°C) until the pastry cases are ready.

Making the pastry

1. Sieve the flour and salt into a large mixing bowl.
2. Cut the fat into small pieces and rub them into the flour until the mixture looks like breadcrumbs.
3. Add 3–4 tablespoons of cold water and stir into the flour and fat.
4. Add 1–2 tablespoons more of water and stir until the mixture forms a ball of pastry.

Making the pies

1. Roll out a sheet of pastry on a clean surface sprinkled with flour.
2. Cut out pastry cases with the large cutter, and lids with the small cutter.
3. Grease the baking tray hollows and put a pastry case in each one.
4. Take the mincemeat out of the oven and turn the oven up to gas mark 7, 200°C.
5. Spoon 2–3 teaspoons of mincemeat into each case, cover with a pastry lid and dust each pie with icing sugar.
6. Bake the mince pies in the oven for 15–20 minutes.
7. Cool for 10 minutes before taking off the baking tray.





[SUMMARY SHEET]

WHAT'S IN A BAR OF SOAP?

1 HOUR ACTIVITY

SUMMARY

Class discussion focuses on the Strictly Classified Recipe and why companies must make products in precisely the same way every time. Children experience irreversible changes through the manufacturing process as they mix solid and liquid ingredients, resulting in a bar of soap. They could communicate each step of their soap making by producing a cartoon strip to include scientific vocabulary and equipment used.

OBJECTIVES

- To create a mixture, by following a recipe, using solid and liquid ingredients
- To communicate what they have done in ways that are appropriate for different audiences

To be able to:

- Understand that mixtures other than foods are prepared using recipes

SCIENCE VOCABULARY

Recipe	Mixture	Measure
Crush	Mix	Compress
Solids	Liquids	

RESOURCES *(IN BRIEF)*

- Soap noodles (available online) or soap flakes
- Essential oil
- Food colouring
- Glycerine (available from local pharmacist)
- Pipettes
- Transparent Ziploc bag
- Rolling pin
- Mixing bowl
- Mixing spoon
- Soap mould
- Disposable gloves
- Safety glasses

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to follow step-by-step instructions in the correct chronological order. They should understand the difference between adding a full pipette of liquid and adding one single drop of liquid, and how misinterpretation would affect the final product.

[ACTIVITY DETAIL]

1 HOUR ACTIVITY

WHAT'S IN A BAR OF SOAP?

Class discussion focuses on the Strictly Classified recipe and why companies must make products in exactly the same way every time. Children experience irreversible changes through the manufacturing process as they mix solid and liquid ingredients, resulting in a bar of soap. They could communicate each step of their soap making by producing a cartoon strip to include scientific vocabulary and equipment used.

TYPE OF ENQUIRY

Observing changes over time

OBJECTIVES

- To create a mixture, by following a recipe, using solid and liquid ingredients
- To communicate what they have done in ways that are appropriate for different audiences

To be able to:

- Understand that mixtures other than foods are prepared using recipes

SCIENCE VOCABULARY

Recipe	Mixture	Measure
Crush	Mix	Compress
Solids	Liquids	

RESOURCES

Per group of 4 children:

- 60-75g soap noodles* or soap flakes
- Weighing scales
- 3 pipettes
- Glycerine (from local chemists)
- Essential oil
  (must be suitable for skin, eg aromatherapy oils)
- Food colouring (assorted colours)
- Silicone soap/cake/candle mould*
- Transparent, sealable plastic bag
- Rolling pin (or pestle and mortar, if available)
- Mixing bowl
- Mixing spoon
- Disposable or rubber gloves
- Safety glasses (if available)
- Activity sheets Strictly Classified Recipe and Soap Recipe
- Kitchen Chaos cartoon strip (optional)

* soap noodles and moulds can be sourced online from sites such as eBay or Amazon.

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to follow step-by-step instructions in the correct chronological order. They should know how to use a pipette, and understand the difference between adding a full pipette of liquid and adding one single drop and how misinterpretation would affect the final product.

ACTIVITY NOTES

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

Children are given copies of the Strictly Classified Recipe and asked: Why do companies need to need follow recipes for the products they make? What does 'strictly classified' mean? and Why do you think manufacturing recipes need to be classified? Refer to Questions for thinking to engage children in class discussion about the need for product consistency and how each manufacturer aims to be the market leader, never disclosing recipes to their competitors.

Explain to children that they are going to work in small 'company' groups to follow the manufacturing recipe very closely to produce a bar of soap. First, they must decide upon and allocate Job Roles and responsibilities within the group – this activity is just as much about the children developing personal capabilities such as team work and collaboration as it is about them furthering their knowledge and understanding of mixtures and the skills of working scientifically.

Refer to Safety guidance and check for individuals with allergies before the Resources Manager collects the equipment listed in the Soap Recipe. At every stage of the recipe, children are encouraged to make careful observations and discuss what is happening to their mixture and how it is changing. The solid soap noodles will change to a fine white powder when crushed sufficiently. If available, a more efficient method for crushing noodles is to use a pestle and mortar. This step is not required if using soap flakes.

By adding the liquid ingredients glycerine, essential oil and food colouring, they should observe changes in consistency, viscosity, smell and appearance. When spooning the mixture into the soap mould, it should not be too crumbly. Further drops of glycerine can be added, but too many will make the mixture so sticky that it sticks to the mould rather than release as a soap bar. After compression, the resulting soap bar should be solid.

Children are often extremely proud of the soap they have made and keen to take it home. However, another interesting way to observe changes over time would be to keep the bars of soap in school (maybe give one to each class to keep by the sink) and observe what happens as the soap gets used in the hand washing process over several weeks. It should be noted that the soap bars made in this activity will release colour when used, unlike those purchased from commercial manufacturers! The colour washes away when children rinse their hands.

Children might wish to record the soap making process in the form of a comic strip for others to follow and make their own bar of soap. They should think carefully about their audience, using scientific language and including the amounts of ingredients and equipment used. This activity also links very well to instructional writing and chronological reports.

EXTENSION OR HOME-BASED ACTIVITIES

It is important that children are given opportunities to explore their own ideas and raise different kinds of questions such as 'Which bar of soap produces the most foam?' 'Which bar of soap will last the longest?' or 'How does my bar of soap compare to soap bought from a shop?' They could select and plan the most appropriate type of scientific enquiry to use to answer their questions and this might involve them recognising when and how to set up comparative and fair tests and explaining which variables need to be controlled and why.

Children also enjoy the opportunity to design and make packaging for their soap, with excellent links to aspects of geometry in the mathematics curriculum. They can create posters or advertisements to accompany their products, affording further links with spoken language and writing in the English curriculum.

QUESTIONS FOR THINKING

- What recipes have you ever followed?
- Where are recipes usually used? Why?
- Why do companies need to follow recipes for the products they make?
- Why do you think manufacturing recipes need to be kept top secret?
- How might you improve the soap recipe to produce an even better bar of soap?
- What questions would you like to ask and investigate about your bar of soap?

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 any of the ingredients used in the soap recipe and also for any children with respiration problems, such as asthma, to take extra caution when crushing soap noodles into a fine powder.
- Disposable or rubber gloves should be worn to prevent any allergic reactions which children may have. As an additional precaution, children could wear safety glasses to prevent the rubbing of soap mixture into their eyes.

INDUSTRY LINKS AND AMBASSADORS

Soap comes in a variety of shapes, colours and textures and children can discuss and/or research how the soap they have made in the classroom is similar or different to large-scale industrial soap making processes. Examples they find might include:

- Soap usually starts with oil or fat being mixed and heated in a large vessel with ingredients including water.
- This hot bubbling liquid is sprayed onto a metal roll where it cools quickly and a large blade scrapes it off, creating ribbons of solid soap.
- The solid 'ribbons' fall onto big steel rollers called mills which mix and compress the soap before pushing it through an extruder that shapes it into soap noodles.
- The noodles are collected and dropped into an enormous mixer where colour and then fragrant oil is added and even more mixing takes place.
- Next, the soap is pushed through a forming plate to make long bars and then sharp blades slice these into shorter pieces called slugs.
- Mechanical presses now shape and stamp the individual pieces of soap before they finally travel through a wrapping station slide into boxes.

Watch an informative **5-minute video** which shows the soap making process in industry.

Children can watch the extrusion process on the **Industry-Animated website** to learn how pipes are made in a machine that melts plastic pellets and pushes liquid plastic through an extruder. This is similar to how the liquid soap is pushed through to make noodles or long bars.

The Children Challenging Industry website demonstrates how **toothbrushes** and **plastic bowls** are made using extrusion moulding. There are links here to plastic and toothpaste industries, and children can be encouraged to identify and research other industries where extrusion or injection moulding (material is injected into a mould) is a crucial part of the manufacturing process.

CROSS CURRICULAR LINKS

English: recording the soap making process in the form of a comic strip allows pupils to think carefully about their audience and appropriate language. This activity also links very well to instructional writing and chronological reports.

Mathematics: links to measuring (volume of liquids and mass of soap noodles) and also to learning more about shapes and nets (if carrying out extension activities).

Design and Technology: through soap making, and packaging design, children will select from and use a wide range of materials and ingredients as well as evaluate their functional properties and aesthetic qualities.

Soap Recipe

INGREDIENTS

- 60–75g soap noodles or flakes
- 3 pipettes glycerine
- 3–5 drops perfume
- 5–8 drops colouring

EQUIPMENT

- Pipette
- Rolling pin
- Soap mould
- Plastic bowl
- Plastic bag
- Pestle and mortar (optional)
- Mixing spoon

METHOD

1. Measure out the soap noodles or flakes and seal them in a plastic bag
2. Use a rolling pin (or pestle and mortar) to crush the noodles into a fine powder (soap flakes should already be powdery)
3. Add the fine powder and **all other ingredients** to a bowl
4. Mash the mixture until the colour is even
5. Spoon the mixture into the mould until no more can be added
6. Press the mixture down as hard as you can for at least 2 minutes
7. Gently remove the soap bar from the mould

Strictly Classified Recipe

CLASSIFIED

	PROCESS	MIX TIME	INGREDIENTS	MIX	QUANTITY
1	Add		Water	Liquid	142kg
2	Add		Ingredient a	Liquid	3.3kg
3	Mix /Add	1 min	Hot water and ingredient b	Liquid	1.5kg + 0.16kg
4	Add		Ingredients c and d	Yellow liquid	3.1kg
5	Add / Mix	1 min	Ingredient e	White powder	3.5kg
6	Add / Mix	1 min	Ingredient f	Thick liquid	0.4kg
7	Add / Mix	1 min	Ingredients g and h	Clear gel	116.6kg
8	Add / Mix until smooth	5 mins	Ingredients i and j	Fine white powder	831.5kg
9	Add / Mix	1 min	Ingredient k	White liquid	1.5kg

Role Badges

During primary science lessons, children should be encouraged to share their thoughts, questions and ideas. Working scientifically in small groups enables children to be actively engaged in discussion and collaboration. They take on the roles and responsibilities that support real life, industrial and academic contexts.

Give each child responsibility for a different job or role within the group and wear an appropriate badge to identify this. The images below may be photocopied onto card and made into role badges. 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 varied responsibilities associated with each role.

Health and Safety Manager

Responsible for overseeing the safety of the group and assessing any risk involved in practical activities.

Communications Officer

Responsible for eliciting the group's ideas and responses and reporting back to the rest of the class.

Administration Officer

Responsible for keeping written or pictorial records during the activity. This might include predictions, tables of results, lists of resources, conclusions and evaluations for the group.

Personnel Manager

Responsible for eliminating any disputes within the group and ensuring the team works cooperatively.

Resources Manager

Responsible for collecting, setting up, clearing away and returning all equipment used by the group.

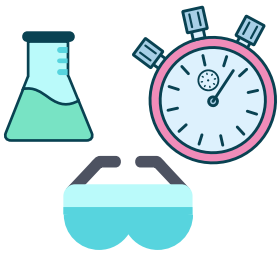
Role Badges

Health and Safety Manager

Communications Officer

Administration Officer

Personnel Manager



Resources Manager

[SUMMARY SHEET]

2 HOUR ACTIVITY

WHAT'S IN BUBBLE MIXTURE?

SUMMARY

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.

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:

- Know that a mixture can be made using different liquid ingredients

SCIENCE VOCABULARY

Liquids	Mix	Measure
Investigate	Compare	Ratio
Repeat	Adapt	Improve
Evaluate		

RESOURCES *(IN BRIEF)*

- Washing-up liquid
- Water
- Glycerine (available from local chemist)
- Wire / pipe cleaners or bought bubble wands
- Small yogurt or paint pots
- Pipettes
- Timers

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to describe and explore a range of mixtures including solids and liquids. An understanding of ratio and average is helpful but not essential.

[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.

We need a good bubbles recipe

Can *you* devise one?

OUR METHOD

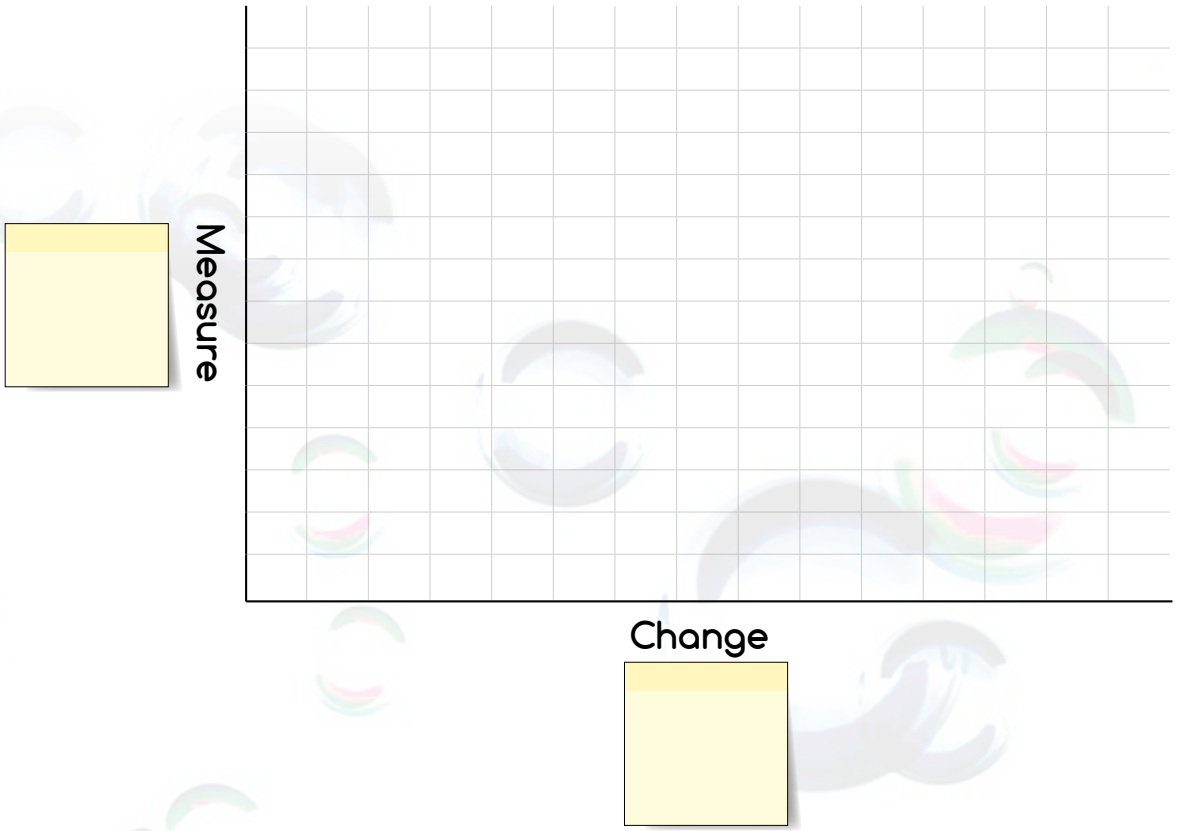
- We use washing-up liquid and water
- We will use glycerine if proved to be worthwhile
- We use as much water as good bubbles allow

When you have discovered the ideal mixture you must convince our directors that you have the best product

They will want to know...

- How you carried out your tests and made the test fair
- How you tested each bubble mixture you made
- What your results were

Considering evidence and evaluating evidence



When we changed...

What happened to?

Was your prediction correct?

How could we improve what we did?

Which recipe produces the longest lasting bubbles?

	Ratio of bubble mixture (in pipettes)			Life span of bubble (in seconds)			
	washing up liquid	water	glycerine	bubble 1	bubble 2	bubble 3	bubble 4
1							
2							
3							
4							
5							
6							

Which recipe would you recommend to make the most effective bubble mixture?

Why do you think this worked so well?

Obtaining evidence

Change	Measure/observe

Planning

We could change	We could measure/observe

We will change	We will measure/observe

We will keep these the same...

When I change... What will happen to?

I think that _____

because _____

Bubbles Planning Sheet

We will define the 'best bubbles' as:	Our first ratio of ingredients will be:
We will measure out the ingredients using:	We will keep these variables the same:
We will observe/measure our bubbles by:	We will keep a record of our results by:
We will test each recipe: _____ times	

Table of results

Which recipe would you recommend to make the most effective bubble mixture?

Why do you think this worked so well?

Role Badges

During primary science lessons, children should be encouraged to share their thoughts, questions and ideas. Working scientifically in small groups enables children to be actively engaged in discussion and collaboration. They take on the roles and responsibilities that support real life, industrial and academic contexts.

Give each child responsibility for a different job or role within the group and wear an appropriate badge to identify this. The images below may be photocopied onto card and made into role badges. 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 varied responsibilities associated with each role.

Health and Safety Manager

Responsible for overseeing the safety of the group and assessing any risk involved in practical activities.

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Responsible for eliciting the group's ideas and responses and reporting back to the rest of the class.

Administration Officer

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Resources Manager

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Role Badges

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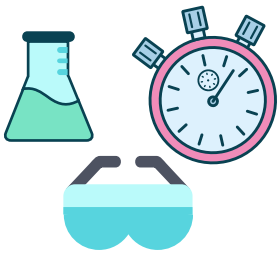
Communications Officer

Administration Officer

Personnel Manager



Resources Manager

[SUMMARY SHEET]

2 HOUR ACTIVITY

WHAT'S IN WASHING PRODUCTS?

SUMMARY

Children explore a range of real washing products and examine the packaging to see how they contain different mixtures, created to do the same job. Using the Post-it Planning Template or Interactive Planning Tool groups of children will work together to develop their understanding of fair testing and controlling variables. They will also use this method to choose an aspect of the effectiveness of washing products, devise their own enquiry question and investigate the outcome.

OBJECTIVES

- To investigate and compare different washing products (commercial mixtures)
- To recognise when and how to set up comparative and fair tests, and explain which variables need to be controlled and why

SCIENCE VOCABULARY

Mixture	Investigate	Compare
Variable	Change	Observe
Measure	Control	Fair Test

RESOURCES *(IN BRIEF)*

- 4-6 different washing products
- Hot and cold water
- Samples of stained fabric (eg margarine stain)
- Thermometers
- Timers
- Jugs and containers
- Post-it notes
- Planning sheet

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to set up simple practical enquiries, comparative and fair tests. They should be able to recognise when a fair test is necessary and help to make some of the planning required for this.

[ACTIVITY DETAIL]

2 HOUR ACTIVITY

WHAT'S IN WASHING PRODUCTS?

Children explore a range of real washing products and examine the packaging to see how they contain different mixtures, created to do the same job. Using the Post-it Planning Template or Interactive Planning Tool, groups of children will work together to develop their understanding of fair testing and controlling variables. They will also use this method to choose an aspect of the effectiveness of washing products, devise their own enquiry question and investigate the outcome.

TYPE OF ENQUIRY

Carrying out comparative and fair tests.

OBJECTIVES

- To investigate and compare different washing products (commercial mixtures)

To be able to:

- Recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why

SCIENCE VOCABULARY

Mixture	Investigate	Compare
Variable	Change	Observe
Measure	Control	Fair Test

RESOURCES

Per group or 4 children:

- Samples of 4-6 washing products, eg. automatic powder and liquid, hand-washing powder and liquid, product specifically for colours and product specifically for stain removal. Where at all possible try to include examples of powders, liquids, tablets and liquid capsules.
- Washing adverts (eg magazine cuttings or Youtube)
- Source of cold and hot water (up to 50°)
- Thermometers
- Stop watch / timer
- Measuring jug
- Teaspoons
- 4-6 x 500 ml containers with lids
- 4-6 samples of stained fabric (plain cotton or polyester) – foods for providing stains, eg margarine, flour, mincemeat (don't use foods which stain severely such as tomato sauce)
- Disposable or rubber gloves
- Safety glasses (if available)
- Two colours of post-it notes
- Post-it Planning Template or Interactive Planning Tool
- Kitchen Chaos cartoon strip (optional)

Note: (i) Pre-prepared fabric samples can be the same size for fair testing, (ii) many additional resource requirements are dependent on the investigations planned by the children.

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to set up simple practical enquiries, comparative and fair tests. They should be able to recognise when a fair test is necessary and help to make some of the planning required for this.

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.

Examine the packaging of a range of real washing products to learn more about how they are all examples of mixtures made up from extensive lists of ingredients. Discuss how there are so many different types of washing products to choose from!

Focus class discussion around accompanying adverts for washing products, each of them boasting how their product's recipe is 'new and improved' or 'the most advanced formula yet" due to continuous research and development by company scientists. Explain how companies need to market their products effectively using persuasive language and enticing images in order to ensure high volume of sales. Ask, "How do we know which of these mixtures is the 'best' washing product?"

Discuss how scientists perform all kinds of different controlled tests on their products and use the outcomes of these tests for marketing purposes. Explain to children that, in the same way, they will be planning and carrying out their own choice of washing product investigation. Allocate Job Roles and responsibilities within each group and please refer to safety guidance for this activity.

Children might like to use the generic Post-it Planning Template or Interactive Planning Tool for support in the planning phase, outlined in detail as follows:

To plan a fair test investigation, groups begin by thinking about all the things that they could change during the washing process when attempting to remove a stain from fabric. These could include: the cause of stain, the size of stain, the type of material, the size of material, the type of washing product, the amount of washing product, the amount of water, the temperature of water, the number of rubs, the time that the fabric remains in the washing solution, the number of rinses to fabric after washing, etc. The list of independent variables is long and varied and children should be encouraged to generate as many possibilities as they can, adding each on a separate post-it note. Ensure that there are no right or wrong suggestions at this stage and all responses are valued.

Children should now use a different coloured set of post-it notes, to write down all the things that they could either observe or measure as a result of the washing process. These could include: size of the stain after washing, visibility of the stain after washing, time taken to remove the stain completely, volume of lather produced, etc. This list of dependent variables is often more difficult to generate and must not be confused with things that can be measured during the investigation such as the amount of washing product used or the temperature of the water. These variables can be measured in their own right but will not offer an appropriate outcome to this investigation.

Each group then discusses and agrees upon one variable from their "We will change" post-it notes and one variable from their "We will observe or measure" post-it notes to generate their enquiry question. Using the question frame:

When I change ☐ what will happen to ☐ ?

is a great way to help children devise a question they can investigate practically and one that they would truly like to find the answer to.

ACTIVITY NOTES...continued

Possibilities might include:

- When I change the type of washing product, what will happen to the time taken to remove the stain? – This could be measured using a timer to record how long it takes for the stain to disappear.
- When I change the temperature of the water, what will happen to the visibility of the stain? – This might be an observation based on a 'visibility scale' determined by the children.
- When I change the number of rubs, what will happen to the size of the stain? – This could be measured by children measuring the length of the stain with a ruler or placing a transparent cm2 grid on top of the fabric and calculating the area of stain remaining under each test condition.

Once groups have decided upon their enquiry question, they focus their attention on the post-it notes for 'variables they could change' and dispose of the post-it notes for 'variables they could observe or measure'. It is important at this stage that they understand that the remaining variables are all the things they must keep the same during their washing investigations, to keep their test fair. They can move these post-it notes down the planning template to the section: We will keep these the same.

Groups should spend some time making decisions about the equipment they will require, exactly how they will carry out their tests and make careful observations or measurements as well as the best way to record the test outcomes. The post-it note variables in their enquiry question can very easily be transferred to make headings in a table or axes on a graph, should this be required.

During the investigation, groups should keep referring to their post-it notes to ensure that they are carrying out a fair test for each trial. They might also decide to include a control sample of stained fabric to compare the outcomes of different tests with the original stained material. They can also take photos or make annotated drawings and notes to assist them in the recording process.

Once the washing investigations are complete, give children time to discuss and make decisions about their results and, ultimately, formulate an answer to their original enquiry question. They could use the writing frame:

When we changed ☐ what happened to ☐ ?

To help them to offer a full explanation of the test outcomes. Please refer to Questions for thinking to aid and extend class discussion, including an evaluation of group investigations.

EXTENSION OR HOME-BASED ACTIVITIES

Children could design new packaging or adverts for the washing product that performed most favourably in their tests. This kind of creative thinking has excellent links with persuasive writing in the English curriculum as well as learning about how to make products appear innovative, functional and appealing in Design and Technology.

Children might also be interested in carrying out their own research by conducting a survey to find out what type of washing products families use at home such as tablets, powders, liquid capsules, liquids. There are plenty of interesting data handling opportunities to accompany the information gathered.

QUESTIONS FOR THINKING

- Why do you think there are so many different types of washing products available to buy?
- What do you think a really good washing product should be able to do?
- How well do you think your group controlled variables and carried out fair washing tests?
- If you were to do your washing tests again, what would you do differently and why?
- What other question would you like to investigate?

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 ingredients in any of the washing products or foods being used to stain fabrics. Disposable or rubber gloves should be worn to prevent any allergic reactions which children may have. As an additional precaution, children might wear safety glasses to prevent the rubbing of washing products into their eyes and also warned not to eat or taste any of the products provided.
- When performing washing tests, hot water from a kettle or water heater should be cooled before use to no more than 50°C and a thermometer used to test this. Care should be taken to avoid splashing water on the skin, even at this temperature, ensuring that any spills are cleaned up immediately and hot water dispensed carefully by an adult.

INDUSTRY LINKS AND AMBASSADORS

Links can be made with the washing powder and detergent industry via local companies and company websites. The STEM Directories is a great place to start looking at the **STEM Directories** and also manufacturer directories such as **www.europages.co.uk** or organisations such as the UK Cleaning Products Industry Association.

Industrial leaders such as Unilever, Procter and Gamble, and Croda provide speciality ingredients for household products including laundry and fabric care. The scientists at these companies are continuously investigating new ways to improve cleaning performance such as the rapid removal of fabric stains at lower temperatures and protection against colour fade.

Many manufacturing companies are also keen to improve how quickly their washing powders dissolve when added to water and there is great competition for them to produce powders, liquids, pods and capsules that outperform rival brands. Each company will have a team of marketing experts whose job is to tell customers about the benefits of choosing their products over others. Children could watch a video clip, **Marketing the Mixture**, on the Science of Healthy Skin website, and have a go at some marketing for themselves!

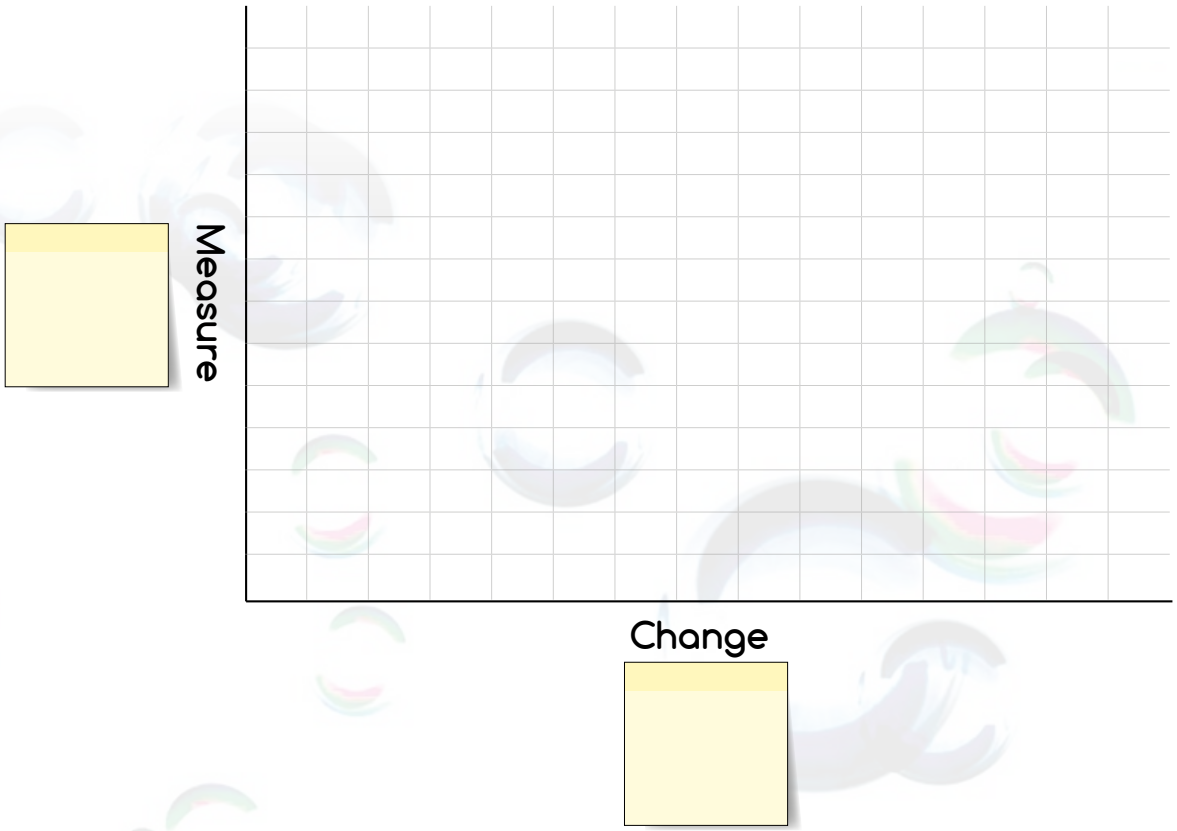
CROSS CURRICULAR LINKS

English: pupils could draft, edit and produce scripts and poster advertisements for the washing product that performed most favourably in their tests. This kind of creative thinking has excellent links with the genre of persuasive writing in the English curriculum.

Mathematics: pupils will use a range of equipment to measure and compare volumes of water and washing products, temperature of water and time taken to remove stains. There is also an opportunity to measure the area of the stains using grids.

Design and Technology: pupils could design new packaging for new and improved washing products. They will select from and use a wide range of materials as well as evaluate their functional properties and aesthetic qualities.

Considering evidence and evaluating evidence



When we changed...

What happened to?

Was your prediction correct?

How could we improve what we did?

Obtaining evidence

Change	Measure/observe

Planning

We could change	We could measure/observe

We will change	We will measure/observe

We will keep these the same...

When I change... What will happen to?

I think that _____

because _____

Role Badges

During primary science lessons, children should be encouraged to share their thoughts, questions and ideas. Working scientifically in small groups enables children to be actively engaged in discussion and collaboration. They take on the roles and responsibilities that support real life, industrial and academic contexts.

Give each child responsibility for a different job or role within the group and wear an appropriate badge to identify this. The images below may be photocopied onto card and made into role badges. 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 varied responsibilities associated with each role.

Health and Safety Manager

Responsible for overseeing the safety of the group and assessing any risk involved in practical activities.

Communications Officer

Responsible for eliciting the group's ideas and responses and reporting back to the rest of the class.

Administration Officer

Responsible for keeping written or pictorial records during the activity. This might include predictions, tables of results, lists of resources, conclusions and evaluations for the group.

Personnel Manager

Responsible for eliminating any disputes within the group and ensuring the team works cooperatively.

Resources Manager

Responsible for collecting, setting up, clearing away and returning all equipment used by the group.

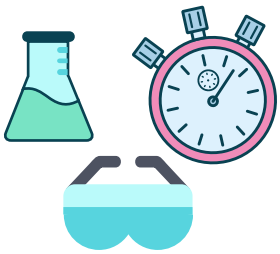
Role Badges

Health and Safety Manager

Communications Officer

Administration Officer

Personnel Manager



Resources Manager

[SUMMARY SHEET]

WHAT'S IN CREAM?

1 HOUR ACTIVITY

SUMMARY

The decision to buy real dairy whipping cream or imitation aerosol-cream to accompany a baked treat for the class is the starting point for this activity. Children have opportunities to compare the two types of cream by recording observations and measurements over an extended period of time. They can then make their own suggestions about the similarities and differences between these natural and processed mixtures and comment on different types of change.

OBJECTIVES

- To explore similarities and differences between natural and processed mixtures
- To investigate reversible and irreversible changes in mixtures
- To make systematic and careful observations over an extended period of time and, where appropriate, take accurate measurements using standard units

To be able to:

- Understand that air can be part of a mixture by creating a mixture using liquid and gas ingredients

SCIENCE VOCABULARY

Liquid	Gas	Air
Mixture	Natural	Processes
Observe	Measure	Volume
Change		

RESOURCES *(IN BRIEF)*

- Plate of mince pies
  (these could be from the mince pie baking activity or purchased)
- Whipping cream
- Aerosol cream
- Whisk
- Bowl
- Measuring beakers or yoghurt pots

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used. Children should also understand that air is a gas

[ACTIVITY DETAIL]

1 HOUR ACTIVITY

WHAT'S IN CREAM?

The decision to buy real dairy whipping cream or imitation aerosol-cream to accompany a baked treat for the class is the starting point for this activity. Children have opportunities to compare the two types of cream by recording observations and measurements over an extended period of time. They can then make their own suggestions about the similarities and differences between these natural and processed mixtures and compare types of change.

TYPE OF ENQUIRY

Observing changes over time.

OBJECTIVES

- To explore similarities and differences between natural and processed mixtures
- To investigate reversible and irreversible changes in mixtures
- To make systematic and careful observations over an extended period of time and, where appropriate, take accurate measurements using standard units

To be able to:

- To understand that air can be part of a mixture by creating a mixture using liquid and gas ingredients

SCIENCE VOCABULARY

Liquid	Gas	Air
Mixture	Natural	Processes
Observe	Measure	Volume
Change		

RESOURCES

Per class:

- Plate of mince pies (could be from Activity 3)
- Tub of dairy whipping or double cream
- Aerosol can of processed cream
- Whisk
- 2 large measuring beakers
- Disposable teaspoons
- Kitchen Chaos cartoon strip (optional)

Per group of 4 children:

- 2 small measuring beakers (or yoghurt pots, etc)
- Source of warmth (eg radiator or desk lamp) – optional

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used. Children should also understand that air is a gas.

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.

After unveiling a tray of tasty baked mince pies, children are given the opportunity to vote on whether they would prefer to eat these with whipping cream or aerosol-cream. To help them to make their decision, children will first take part in a taste test and then create a sample of each type of cream to observe over time.

Note: Healthy eating and the option of "no cream" can be discussed.

Open a container of dairy whipping or double cream and explain that this is known as a natural mixture because it is taken from cow's milk, which contains fats and water, and does not have other ingredients added to it. A clean measuring beaker of whipping cream is prepared, using a whisk, in front of the children so that they can see the volume of cream gradually double in size as it is turned into a foam filled with air.

Now open a container of aerosol cream and give the can a few gentle shakes before turning it so that the nozzle points down and then squirting the same amount of cream out into another clean measuring beaker. Discuss how this cream does not need whisking and looks as though it has already been whipped in the can, however, this is not the case. Air is mixed into the cream as it is sprayed and this causes it to foam out. Explain that aerosol cream is known as a processed mixture because it is an imitation of cream, not taken from cow's milk, rather it is made up from many ingredients such as skimmed milk, vegetable oil, sugar or sweeteners mixed together.

Children then try a sample of the two creams (see Safety Guidance) and make comparisons based on smell, appearance and taste, thinking carefully about which cream they prefer and why. Please refer to the Questions for Thinking to aid and extend whole class discussion.

Some children may report that the aerosol cream seems to 'disappear' quickly in their mouth and this can be investigated further by children working in small groups, once they have allocated Job Roles and responsibilities within the group. They should create a measured sample of each type of cream and position these in a warm place, such as on radiators or under desk lamps, to simulate the temperature inside our mouths. Alternatively the samples of cream can simply be left to stand at room temperature, though it may take longer to observe the volume change.

Children working together should decide for themselves how often they will observe their samples of cream and how they will record their observations and measurements. This activity provides superb opportunities to link with technology whereby children might decide to use a camera or video facility on an iPad for example, including time lapse, to document change over an extended period.

ACTIVITY NOTES...continued

Children will observe that the whipped cream remains the same whilst aerosol cream will 'shrink' substantially. They should offer conclusions in terms of thinking about what has 'escaped' from the aerosol cream and why this has not happened to the whipped cream. A simplified explanation is that the air forced into the canned cream as it is sprayed out has slowly escaped, whilst the whipped cream has been permanently changed during whipping in such a way that the air is trapped and cannot escape.

Children should use the findings from their investigations to make a final decision regarding which cream they would prefer to accompany the pies, explaining reasons for their choices. A wonderful ending to this activity is the children enjoying baked treats with their chosen cream (or no cream at all) and knowing that their informed decisions have been based upon scientific research.

EXTENSION OR HOME-BASED ACTIVITIES

Dairy or Not? provides information on the two types of cream and their production, and can be used during an extended discussion of natural and processed products. It is also an excellent starting point for children who wish to carry out their own research into the health benefits of aerosol cream compared to real dairy cream. They can be challenged to recognise which additional secondary sources will be most useful to them and begin to separate opinion from fact.

Cream is a stable emulsion although emulsifiers or stabilisers have often been added to cartons of cream to increase the shelf life of this product. Extended enquiry opportunities could include children investigating stable and unstable emulsions. To demonstrate what an emulsion is, white vinegar and oil can be shaken in a transparent container and children observe how the oil forms a separate layer on the vinegar. Immediately after vigorous shaking, the oil can be seen dispersed throughout the vinegar in an emulsion. This emulsion is unstable and, when left to stand, the oil droplets gradually form larger and larger droplets, until the oil layer has reformed on the surface of the vinegar.

An alternative extended practical investigation could be the children planning and then finding the optimum spray angle for aerosol cream.

QUESTIONS FOR THINKING

- What are the differences between the two types of cream?
- Where do the two types of cream come from?
- What happens when you whip cream?
- Why do you seem to get more cream than you started with once it has been whipped?
- Which cream do you prefer? Why?
- Why do you think there are so many different types of cream available in shops?

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 any of the ingredients used in the two different types of cream.
- Ensure clean conditions or eating and taste testing activities. Children should taste the samples of cream using clean, disposable teaspoons. When using aerosol cream, wipe the nozzle off after use and don't lick it, as bacteria from your mouth can cause the cream in the can to spoil faster when you put it back in the fridge. For more detailed advice please follow your authority's guidelines or contact a membership advisory service such as **CLEAPSS**.

INDUSTRY LINKS AND AMBASSADORS

The production of different types of cream mostly involves separating butterfat (the natural fatty portion of milk) from whole milk. This is done by whizzing milk around at high speeds using an electric motor in a centrifugal separation tank. The force of this process causes the milk fat globules to separate from the denser liquid and this is continued until the correct type of cream is produced. Children can compare this to the way in which a washing machine spins wet laundry at high speed to remove the water or they might wish to try spinning wet lettuce leaves in a salad spinner to see what happens (**www.colour-ed.org**).

More information on the production of cream can be found at The Dairy Council: **www.milk.co.uk** and a list of approved milk and dairy product establishments can be downloaded from the Food Standards Agency at **www.food.gov.uk**

Children may also be interested to learn about how air is added to other food products, such as bread and cakes. Air can be added mechanically to food during whisking, sieving, creaming, beating, rubbing and rolling. Some foods can be cooked at high temperatures and the water in the recipe will turn to steam, adding air into the product (such as Yorkshire puddings) or, alternatively, raising agents such as yeast is added to bread dough or bicarbonate of soda could be added to a cake mixture to produce a gas. In addition to this, children could learn more about how carbon dioxide is pumped into bottles or cans of drink at high pressure. The gas dissolves into the liquid drink and is sealed to ensure that it remains fizzy

CROSS CURRICULAR LINKS

English: opportunities to use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas. Also links to reading whereby pupils use secondary sources of information and begin to separate opinion from fact.

Mathematics: links to measuring volumes over time and perhaps plotting results in a line graph.

Design and Technology: exploring cream production and taking part in taste tests links well with pupils learning to apply principles of nutrition and healthy eating.

Computing: this activity provides superb opportunities to link with technology whereby children might decide to use camera or video recording equipment, including time lapse, to document change over an extended period.

From the dairy or not?

Cream bought from a dairy is originally found mixed in fresh cow's milk.

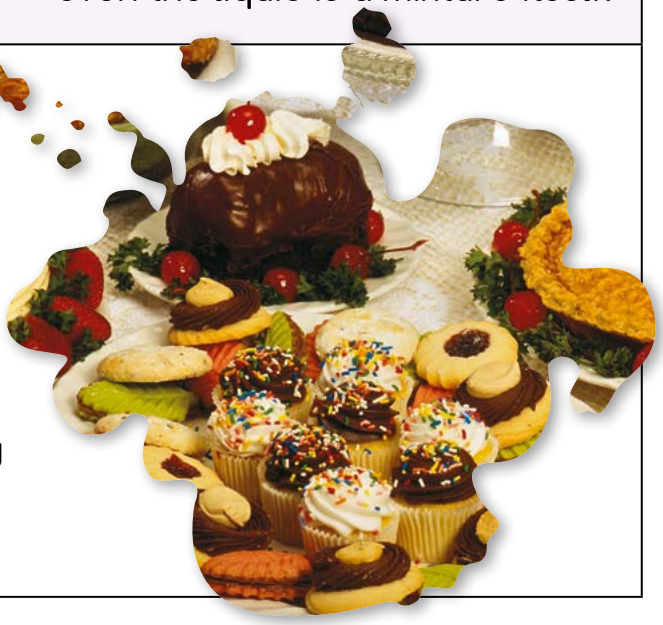
The cream is lighter than milk so it will eventually rise and settle at the top. It is taken out of the milk by spinning the mixture round very quickly in a special machine.

A pot of cream is made up of lots of tiny drops of fat that are mixed evenly in water.

Whipping cream has 8 times more fat drops than milk and it is these fat clusters that keep the air in place once the cream has been whipped. This makes cream an extremely interesting mixture as it is made up of gas and liquid... and even the liquid is a mixture itself!

Processed cream such as aerosol cream has less fat and food energy than real dairy cream.

Fatty foods are less healthy for us and not good for people with heart disease so eating aerosol cream is better for you although you do have to consider the sugar that it contains. Even healthy people should not eat too much fatty food like dairy cream.



From the dairy or not?

Dairy cream sold in shops does not have any ingredients added to it.

Aerosol cream is not dairy cream, so is often called imitation or processed cream. It is not taken directly from cow's milk. It is made from a mixture of many ingredients such as skimmed milk, vegetable oil, sugar or sweeteners, salt and colourings.

Any foods that have a lot of fats also have a lot of energy. Energy s measured in kilojoules (or kilocalories). When you have eaten, the food energy your body does not use during exercise or throughout the day stays in your body as fat.

Cream that can be bought in a can comes out by a gas in the can pushing the cream through the pressed nozzle. The cream mixes with air as it sprays out. The cream and the air take up four times more space than the cream did in the can! This cream looks like whipped cream but it will shrink if left to stand as the air will escape.

[SUMMARY SHEET]

1 HOUR ACTIVITY

WHAT'S IN MY KITCHEN CUPBOARD?

SUMMARY

A range of mixtures found in the kitchen cupboard provide an interesting starting point for thinking about which products may be dangerous if care is not taken when using. Children are introduced to new vocabulary and definitions associated with hazards before designing their own warning labels to compare with those used conventionally. The activity concludes with children sorting and grouping common products before and after revealing internationally recognised warning symbols.

OBJECTIVES

- To show an understanding of new vocabulary by designing symbols to represent warnings
- To talk about criteria for grouping, sorting and classifying mixtures found in a kitchen cupboard

To be able to:

- Recognise the symbols used on household products which alert the user to the potential hazards of misusing products

SCIENCE VOCABULARY

Mixture	Product	Safety
Hazard	Warning	Toxic
Harmful	Corrosive	Irritant
Highly Flammable	Explosive	

RESOURCES *(IN BRIEF)*

- Collection of empty containers from household products with hazard warning labels covered (using squares of paper or card)
- Hoops or string (for sorting)

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to compare and group materials together, looking closely at their similarities and difference.

[ACTIVITY DETAIL]

1 HOUR ACTIVITY

WHAT'S IN MY KITCHEN CUPBOARD?

A range of mixtures found in the kitchen cupboard provide an interesting starting point for thinking about which products may be dangerous if care is not taken when using. Children are introduced to new vocabulary and definitions associated with hazards before designing their own warning labels to compare with those used conventionally. The activity concludes with children sorting and grouping common products before and after revealing internationally recognised warning symbols.

TYPE OF ENQUIRY

Identifying, classifying and grouping.

OBJECTIVES

- To show an understanding of new vocabulary by designing symbols to represent warnings
- To talk about criteria for grouping, sorting and classifying mixtures found in a kitchen cupboard

To be able to:

- Recognise the symbols used on household products which alert the user to the potential hazards of misusing products

SCIENCE VOCABULARY

Mixture	Product	Safety
Hazard	Warning	Toxic
Harmful	Corrosive	Irritant
Highly Flammable	Explosive	

RESOURCES

Per class:

- Collection of empty, clean, sealed containers from household products – hide each container's hazard label by blu-tacking paper/card over them
- 2 PE hoops (for sorting/grouping)
- Hazard warning designs
- Hazard labels
- Safe clothes and signs
- Kitchen Chaos cartoon strip (optional)

Note: Containers could include:

Mr Muscle	oven cleaner	corrosive
Clean-off	oven cleaner	corrosive
Domestos	bleach	irritant
Stain-devil	stain-remover	irritant
Johnson's	wax polish for antiques	flammable
Jiff Mousse	surface cleaner	flammable
Halfords	screen wash	harmful

PRIOR KNOWLEDGE/EXPERIENCE

Children should have opportunities to compare and group materials together, looking closely at their similarities and difference

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.

Please refer to Safety guidance for this activity before providing an interactive display of empty, clean and sealed containers for the children to eventually use and explore. At this starting point in the activity, explain to children that many mixtures found in the kitchen cupboard at home should not be experimented with or handled and therefore, carry a warning symbol called a hazard warning to help keep us safe.

Some or most of these 'warning words' could be new vocabulary to children so it is important that the teacher spends some time introducing and discussing common hazard phrases, determining what the children understand by them and giving definitions and guidance where they are uncertain. Formal hazard warning definitions have been summarised in the table below:

Toxic	A substance that, if inhaled, swallowed or if it penetrates the skin, may involve a very serious health risk or even death
Harmful	A lower grade of toxicity
Corrosive	A substance which may destroy the skin, clothes or other surfaces when in contact with them
Irritant	Non-corrosive, but may cause inflammation when in contact with skin
Highly Flammable	Substances that will burn readily below average room temperature
Explosive	A substance which may explode if near a flame, or as a result of friction or vibrations

Children might discuss only the definitions with a partner and attempt to match these up with the warning word or phrase. More able children could write their own definitions to show their understanding of this potentially new vocabulary.

Explain to children that a simple black and white picture symbolises a warning on the label of any hazardous product. This is to ensure that the warning can be understood by people all over the world. Invite children to choose two of the hazards discussed and design a picture or symbol to represent that warning. Remind them that the picture must be simple, easy to interpret with no text, as it has to fit into a square on the label which is about 2cm x 2cm (see Hazard warning designs). Individuals should share their suggestions with each other before the 'big reveal' whereby the teacher shows examples of what the real hazard labels look like. Children can compare how similar or different their own suggestions were.

Throughout the week, each group of children should have the opportunity to work with the interactive display of sealed containers with their hazard labels hidden, discussing which products might pose which hazards and justifying reasoning based on the use of each product. The containers can be sorted into suggested hazard categories, using hoops and hazard labels if required. Photographs should be taken as evidence, before revealing the official warning symbols once all groups have had a turn. Children can then evaluate their decisions and discuss any incorrect classification. Please refer to Questions for Thinking to extend whole class discussion at this point in the activity.

ACTIVITY NOTES...continued

Children may be interested to learn that not all mixtures found in a kitchen cupboard carry hazard warning labels, as many do not contain ingredients that pose risks or dangers to us if handled incorrectly. These products might include washing-up liquid, hand soap, cleaning wipes and shoe polish. They may also notice that products carrying a warning label might also have written warnings and advice about treatment, as well as safety lids to prevent young children from opening them.

EXTENSION OR HOME-BASED ACTIVITIES

Children could extend their awareness of hazard warning symbols by keeping a journal of those found around school, at home, during car journeys, or researching warning signs and symbols using secondary sources such as the internet. They can be challenged to find unusual warnings and safety signs around the town, country or other parts of the world, as well as learn more about hazard warnings found in science labs or in industry. They should notice the universality of these signs.

QUESTIONS FOR THINKING

- Which products found in the kitchen cupboard have hazard warnings on them? Why?
- Which products found in the kitchen cupboard have you used in any of the other activities in this resource?
- Which products have no warnings on them at all? Why?
- What do you notice about the caps of the bottles which have a hazard warning? Why is this?
- Can you think of any other dangers that people need to be warned about? What kind of warning symbol should accompany this hazard?
- What warning symbols can you recognise in your school and at home? Where else can you find hazard warnings?

SAFETY GUIDANCE

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

- All containers must be thoroughly cleaned and sealed before being handled by the children. Children must be warned not to touch any of the household products at home.

INDUSTRY LINKS AND AMBASSADORS

Health and safety is of paramount importance in every kind of industry, with strict safety rules in place for all employees to follow. The job of the Health and Safety Manager is to plan, put in place, monitor and review safety practices, which includes making suggestions for how risks could be reduced and hazards can be managed. Teachers could link with a local company to arrange a visit to school from their Health and Safety Manager and children could plan a range of questions to help them find out more about the role. For help with finding and requesting a STEM Ambassador in your local area, please go to **www.stemnet.org.uk/ambassadors**.

If a visit to a real manufacturing company can be arranged, children could focus their attention on the safety signs and safety clothes they see around site and record this on the safe clothes and signs activity sheet. Alternatively, they might look at some of the introductory challenges found at **www.risk-ed.org** (a resource for children aged 11+).

Children might like to research and examine a greater range of standardised warning signs created by the International Standards Organistion (ISO) and discuss how these might help us to understand potential dangers and use machines and equipment safely. They could create a safety sign quiz and have great fun trying to identify the hazards represented by different symbols.

CROSS CURRICULAR LINKS

English: opportunities to use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas. Also links to writing whereby pupils identify audience and purpose, as well as selecting the appropriate form.

Mathematics: links to sorting, classifying and grouping.

Design and Technology: pupils will develop design criteria to create their own hazard warning symbols that are fit for purpose. They will also have opportunities to work in a range of relevant contexts [for example, the home, school, leisure, culture, enterprise, industry and the wider environment].

Hazard warning labels

Harmful

Explosive

Toxic

Corrosive

Flammable

Irritant

Hazard warning designs

Do you know what these hazard warning signs mean?

toxic	highly flammable
harmful	irritant
explosive	corrosive

CHOOSE 2 OF THESE WARNINGS AND DESIGN A LABEL FOR EACH ONE:

_____

_____

[SUMMARY SHEET]

30 MINUTE ACTIVITY

WHAT'S IN A FIRE EXTINGUISHER?

SUMMARY

Class discussion focuses on extinguishers, buckets and blankets, and their use in extinguishing fires. Children model how a fire extinguisher works by creating carbon dioxide gas from a solid – liquid mixture, to extinguish a candle flame. This activity can be recorded in a variety of ways and lead to opportunities for children to carry out and present their own research using secondary sources of information.

OBJECTIVES

- To observe the effect of mixing bicarbonate of soda and vinegar on a nearby candle flame

To be able to:

- Explain that some mixtures result in the formation of new materials and that this kind of change is not usually reversible
- Recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigation

SCIENCE VOCABULARY

Solid	Liquid	Gas
Carbon Dioxide	Air	Oxygen
Mixture	Irreversible	Change
Burn	Extinguish	

RESOURCES *(IN BRIEF)*

- Bicarbonate of soda (or baking powder)
- Vinegar
- Matches
- Tea lights
- Saucer or coffee lid
- Sand
- 2 litre ice-cream tub (or similar container)

PRIOR KNOWLEDGE/EXPERIENCE

Children should be able to identify materials, according to whether they are solids, liquids or gases and also have a simple understanding of changes that are reversible such as dissolving, mixing and changes of state.

[ACTIVITY DETAIL]

30 MINUTE ACTIVITY

WHAT'S IN A FIRE EXTINGUISHER?

Class discussion focuses on extinguishers, buckets and blankets, and their use in extinguishing fires. Children model how a fire extinguisher works by creating carbon dioxide gas from a solid – liquid mixture, to extinguish a candle flame. This activity can be recorded in a variety of ways and lead to opportunities for children to carry out and present their own research using secondary sources of information

TYPE OF ENQUIRY

Researching using secondary sources.

OBJECTIVES

- To observe the effect of mixing bicarbonate of soda and vinegar on a nearby candle flame

To be able to:

- Explain that some mixtures result in the formation of new materials and that this kind of change is not usually reversible
- To recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigation

SCIENCE VOCABULARY

Solid	Liquid	Gas
Carbon Dioxide	Air	Oxygen
Mixture	Irreversible	Change
Burn	Extinguish	

RESOURCES

Per group of 4 children:

- 3 teaspoons of bicarbonate of soda (or baking powder)
- Small foil dish
- 50ml vinegar
- Safety lighter (or safety matches)
- Tea-light candle
- Transparent mixing bowl (or similar – with a flat bottom is best for this)
- Sand (for bottom of bowl)
- Children's hazard warning designs from activity 8 (Hazard Warning Design sheet)
- Extinguish the Flame
- Kitchen Chaos cartoon strip (optional)

PRIOR KNOWLEDGE/EXPERIENCE

Children should be able to identify materials, according to whether they are solids, liquids or gases and also have a simple understanding of changes that are reversible such as dissolving, mixing and changes of state.

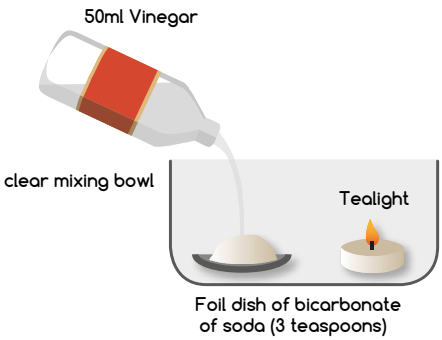
Prior knowledge of the fire triangle is beyond the primary national curriculum in England; however, teachers may wish to address this in response to children's questions and to extend their understanding of why the flame has been extinguished.

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 activity begins by revisiting the official 'flammable' hazard warning symbol as well as children's individual designs from Activity 8 and then discussing the kinds of equipment we might have at home, school, in public buildings and industry to help us to extinguish fires. Refer to Questions for thinking to aid and extend open questioning. Children should talk about safe and sensible behaviour as well as how fire buckets, blankets and extinguishers work by smothering a fire and blocking out the air that would otherwise keep it burning.

Explain to children that they are going to model how a carbon dioxide fire extinguisher works in order to further their understanding of the interesting mixture found inside. In small groups, they should discuss Job Roles and responsibilities before observing the teacher model how to set up the equipment, as shown in the accompanying diagram. Each Resource Manager should gather the equipment required for their group to arrange in the same way.



Note: The candle should be as far away from the foil dish as possible and a thin layer of sand added to the bottom of the bowl as an extra safety precaution before lighting the candle with a safety lighter. All children must recognise that working sensibly and safely is paramount for this activity.
(Please refer to Safety Guidance).

As children pour the vinegar (liquid ingredient) onto the bicarbonate of soda (solid ingredient), they should observe the mixture fizzing as a gas, called carbon dioxide, is produced. The changes observed with the fizzing and foaming are irreversible due to a new material being formed. It would now be impossible or extremely difficult to recover the original materials.

It is not long before the candle flame is extinguished and those children who are observing closely may notice that this happens from the bottom of the flame upwards. Ask children for suggestions as to why the flame has been extinguished in this way (see Questions for thinking). Discuss how the candle needs air to keep burning but the carbon dioxide gas fills the tub from the bottom upwards and therefore pushes the air away from the flame and prevents the candle from burning any longer.

ACTIVITY NOTES...continued

Explain how red fire extinguishers, found in school, work in the same way as their model fire extinguisher, by using carbon dioxide to displace the air that the fire needs to burn.

For a video demonstration of an alternative version of this activity, please refer to the **Learn Chemistry website**.

Children will need to recognise which secondary sources will be most useful in order to carry out their own research into different types of fire extinguisher and how they work, such as by excluding air with foam or carbon dioxide gas or by removing heat with water. They could utilise their research, perhaps in the form of a fire safety information poster to be placed around school or in a more formal way using Extinguish the Flame.

EXTENSION OR HOME-BASED ACTIVITIES

Children can learn about the 'fire triangle' which shows the three things needed for a fire to start and keep going: oxygen present in air, heat and fuel. They can explore how if one of the sides of the fire triangle is removed, a fire will not start, and how a fire that is already burning will go out. Children should understand that fire-fighting relies on this principle and also that different types of fires need to be tackled in different ways. Learning about fires and fire safety also has excellent links to outdoor learning and Forest Schools materials.

QUESTIONS FOR THINKING

- Does anyone have a fire extinguisher at home? If so, where is it kept and why?
- Does anyone have anything else at home for putting out fires? If so, what are they?
- What do we have at school to put out fires? Where can we find these?
- How do you know that a gas is being produced when bicarbonate of soda and vinegar are mixed together?
- Why do you think the candle flame is extinguished from the bottom upwards?
- What other reactions can you think of that produce a gas?
- Why is this kind of change not usually reversible?

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 bicarbonate of soda and/or vinegar. Tealights should be placed securely in a container with a layer of sand and then lit using a safety lighter. All children should be warned about the hazards associated with heating and burning and carry out this activity under close adult supervision.

INDUSTRY LINKS AND AMBASSADORS

Children may be fascinated to learn that not all fires are the same and that they are identified using a classification system depending on the types of fuel involved. Different types of fire require different types of fire extinguisher. Carbon dioxide fire extinguishers, similar to the model made by children in this activity, extinguish flames by removing oxygen and are best used on Class B fires caused by flammable liquids or gases, and Class C fires involving electrical equipment. Class A fires, caused by burning wood, paper, cloth or plastics are best extinguished using water and foam extinguishers which remove the heat quickly from a fire.

All types of companies, whatever their size, must appoint a responsible person to minimise the risk of fire in and around the site. Fire extinguishers must be accessed at different points and it is the safety manager's responsibility to ensure that these are appropriate for different types of fire. Children could investigate who has been appointed as fire safety manager at their school. They could make a note of the different types of fire extinguishers and their location around the school building as well as help to review current fire drill procedures.

Teachers could also contact their local fire brigade for further information regarding fire safety and risk management.

CROSS CURRICULAR LINKS

English: opportunities to use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas. Also links to reading and writing whereby pupils note and develop initial ideas and then draw upon reading and research where necessary.

Learning about fires and fire safety also has excellent links to outdoor learning and Forest Schools materials.

Hazard warning designs

Do you know what these hazard warning signs mean?

toxic	highly flammable
harmful	irritant
explosive	corrosive

CHOOSE 2 OF THESE WARNINGS AND DESIGN A LABEL FOR EACH ONE:

_____

_____

Extinguish the Flame

Draw and label diagrams and explain what is happening at each stage of the activity:

1. The equipment is set up and the candle is lit

2. The vinegar is added to the bicarbonate of soda

3. The flame is extinguished