



Fleece To Grease

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

Introduction

Context

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

Based upon the extraction of lanolin from wool grease, the activities include testing immiscible liquids using oil and water and producing emulsions by adding detergent.

Activities and accompanying website

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Products containing lanolin can be manufactured in pastille form. The final activity involves investigating techniques for producing pastilles and testing the effect of viscosity upon the pastilles produced.

It is intended that the website <http://www.ciec.org/healthyskin> is used to introduce the storyline and that the children interact with the web pages throughout their investigations. In particular, questions, animations, multiple choice and other activities used in the plenary sessions will greatly enhance and embed the learning and also provide the stimulus for further investigation.

National Curriculum links

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

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

Ambassador role

Ambassadors could enhance the activities in this theme by showing the children samples of products or ingredients and by giving real examples of their use in industrial processes. They could also bring photographs showing the laboratory and large-scale equipment, along with photographs and information or stories about people who work in this area of the business. They might also act as 'experts' and answer any questions the children may have.

Activity 1: Oil and water



Objectives

- To describe changes that occur when materials are mixed.

To understand that:

- oil and water do not mix
- immiscible liquids can be separated
- detergent can cause immiscible liquids to mix producing an emulsion.

Resources

Per group of four children unless otherwise stated

Activity sheet 1

Role badges (Appendix 1)

300 ml water - sample A

300 ml sunflower oil - sample B

100 ml clear detergent - sample C

100 ml water –sample D

100 ml water-sample E

6 clear plastic mini pop bottles or lidded containers

Food colouring – 2 colours

Pipette

Teaspoon or similar for stirring

100 ml Measuring cylinder

Advance preparation

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

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

Introducing the activity

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

Activity

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

The children measure 30 ml sample A and pour into a container such as a mini pop bottle. 30 ml of sample B are then added and the lid replaced. The children explore, observe and discuss the liquids, tipping the bottle on its side, on its lid, shaking it gently, quickly, vigorously, etc. The teacher can ask some of the following questions:

Did the liquids mix?

Did shaking make the liquids mix?

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

The teacher then reads an e-mail from a technical manager (Activity sheet 1) explaining that they need to separate the lanolin but they are experiencing some problems. They think another liquid is affecting the efficiency of the process, and believe it might be one of three samples C-E. The children are to investigate whether adding any of the samples affects the separation of the two liquids.

The children initially should try adding a small volume, e.g. 5 ml of sample C to the water and oil in the container and observe what happens to the liquids. They should then stir or gently shake the liquids and allow to rest, and consider:

Are the liquids still separate?

If not, do they separate again?

How long does this take?

They then prepare further mixtures of A and B before repeating the test with samples D and E.

Plenary

The children share their observations and conclusions with the class¹.

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

Did all groups have the same result?

What will they report to the company?

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

Extension activity

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

Ambassador role

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

Activity 2: The pastillator



Objectives

- To understand that it is important to test ideas using evidence from observation and measurement.
- To understand that different liquids have different viscosities.

To discover whether:

- viscosity affects the size or shape of drops (pastilles) produced
- different dropping techniques produce pastilles of different sizes or shapes
- the height of the drop or the surface affects the size or shape of the pastille produced

Resources

Per group of four children unless otherwise stated

Activity sheet 2

Laminated card

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

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

Advance preparation

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

Introducing the activity

The children watch the final stages of the production of lanolin on the website <http://www.cciproject.org/healthyskin/> and discover that lanolin can be mixed with other ingredients to make many products such as cosmetics, coatings and health care items. They will see one of the processed lanolin products emerging in the form of pastilles from the pastillator. The lanolin product is runny when it enters the pastillator and falls through a mesh onto the conveyor in the form of drops called pastilles. The pastilles travel along the conveyor, cool, solidify and are bagged.

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

Activity

In their groups, the children discuss their ideas for techniques and equipment needed for making droplets of liquids. They test out their ideas using water and the resources they have suggested. Laminated card can be provided as a surface for dropping liquid. The children are then shown the test liquids, samples 1-3, and asked to create and test their own methods for producing drops and recording their findings. They should be allowed time to observe the liquids before carrying out the activity. A selection of the following questions can be used, depending on the ability of the children:

How many ways can you find to make water drops?

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

Which method is easiest?

Which method would you recommend?

Does your method work as well with the sample liquids?

How can you make your test fair?

Are the drops always the same size/shape?

What happens when you drop the liquid from different heights?

Is it better to make the drops quickly or slowly?

Do the drops always stay the same shape?

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

Does a runny liquid or thick liquid make better drops?

What is the largest drop you can make?

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

Plenary

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

Which technique for drop-making proved most effective?

Which method produced drops that could be replicated most easily?

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

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

Was there an ideal runniness for producing drops?

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

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

Extension activity

The teacher returns to the webpage 'Lanolin Uses' in the Fleece to Grease section of the website where the children discover the wide variety of products containing lanolin.

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

Ambassador role

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

e-mail from **Sumptuous Skincare Ltd**

From: Melanie Williams

Sent:

To: Science consultants

Subject: Separating liquids

Dear Consultants

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

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

We have therefore sent you samples of the liquids we believe may be causing the problem. We would like you to observe the effect each of these ingredients has on the separation process. Could you find out whether we should remove any of these liquids from the tank?

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

Kind regards

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

e-mail from **Sumptuous Skincare Ltd**

From: Melanie Williams

Sent:

To: Science consultants

Subject: Making drops The Pastillator

Dear Pupil scientists

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

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

They would like you to help them in their experiments.

1. Would you investigate some different ways of making drops, using sample liquids instead of the real ingredients as the ingredients we use are expensive? Our customers like the pastilles to all be the same size, so you should try to make your drops the same size too if you can.
2. Would you also investigate whether the runniness of the liquids affects the quality or size of drops or how quickly the drops can be made?
3. Finally, they would like to know whether the surface the liquids are dropped onto affects the size or shape of the drops?

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

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

Role Badges

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

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

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

Administrator keeps a written and pictorial record for the group

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

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

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

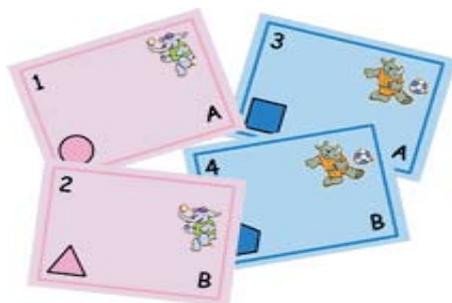
Where groups of 5 are necessary, the following role can be used:

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



Discussion strategies

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



Talk cards

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

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

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

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

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



ITT (Individual Think Time)

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



Talk Partners

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

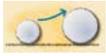
¹ For more information go to www.azteachscience.co.uk

A > B Talk



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

Snowballing



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

Envoying



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

Jigsawing



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

Appendix 3

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

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