1. Oil and water

1 hour

Based upon the extraction of lanolin from wool grease, the activities include testing immiscible liquids using oil and water and investigating the effects of adding detergent to produce emulsions which in turn reduce the efficiency of the separation of oil from water. Products containing lanolin can be manufactured in pastille form. The final activity in this section involves investigating techniques for producing pastilles and testing the effect of viscosity upon the pastilles produced.

OBJECTIVES

- To demonstrate that mixing is a reversible change
- To explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible
- To observe that detergent can cause immiscible liquids to mix, producing an emulsion
- To take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate

RESOURCES

(Per group of 4 children unless otherwise stated)

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

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ADVANCE PREPARATION

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

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

INTRODUCING THE ACTIVITY

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

ACTIVITY

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

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

Did the liquids mix?

Did shaking make the liquids mix?

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

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

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

Are the liquids still separate?

If not, do they separate after a time?

How long does this take?

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

PLENARY

The children share their observations and conclusions with the class[1].

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?

EXTENSION ACTIVITY

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

INFORMATION FOR TEACHERS

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

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

AMBASSADOR ROLE

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

Appendix 1

Role Badges

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

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

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

Administrator keeps a written and pictorial record for the group

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

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

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

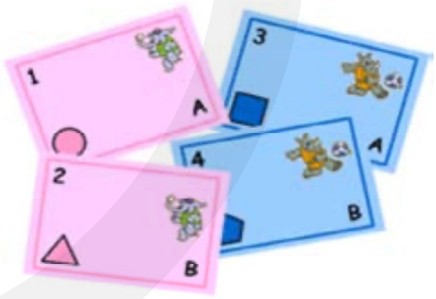
Where groups of 5 are necessary, the following role can be used:

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

Appendix 2

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.

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.

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

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.