

Student Sheet

In this practical I will be:

- Carrying out, and carefully observing the results, of the practical.
- Applying my understanding of mixtures and hydrophobic solutions to explain my observations.
- Evaluate the results of the two experiments, determining which is better- and explaining why this method is better.

Introduction:

You are an ancient Egyptian science-artist and you have been tasked with creating a 'marble effect' on some papyrus. This will make your art look as if it has been painted onto marble, at a fraction of the cost.

You have seen how when oil is dropped onto water it creates an interesting rainbow effect- maybe this effect can be used to create your marbled look. You decide to investigate further...

Equipment:

- At least 1 piece of different sorts of paper; printer, cartridge, tissue, etc. different effects can be achieved depending upon your selection
- Cheap shaving cream or hair mousse, perhaps a scented one. Peppermint or a floral scented shaving cream will make your marbled paper fragrant
- Red, green, blue and yellow food colouring, ink or poster paints
- Plastic tray approx. 30 cm by 20 cm or large enough to take your paper
- Disposable plastic pipettes or eye droppers for each colour
- 1 spoon
- 1 fork, spill or toothpick
- Squeegee cloth or ruler and paper towels
- String and pegs to hand the paper to dry (or somewhere flat to lay them)
- Newspaper to cover the work area and place the sheets onto

Wear disposable plastic gloves



Method:

1. Use a spoon or spatula to spread a thin, very shallow layer of shaving cream in the bottom of the plastic tray.
2. Put one plastic pipette or eyedropper in each colour. Using the pipette eyedropper dot the surface of the shaving cream with colours of your choice.
3. Use a fork to gently drag the fork prongs through the shaving cream and the colours in a wavy style. Don't swirl the colours or they will run together.
4. Gently lay the paper of your choice on top of the coloured layer in the plastic tray.
5. Gently smooth the paper out over the shaving cream with a paper towel.
6. Carefully remove the paper by holding the corners nearest to you.
7. Lay the paper down with the coloured side facing upwards.
8. Lay a paper towel on the top of the coloured side being careful not to slide the towel across the surface.
9. Lift off and repeat laying a paper towel on the surface until all the excess shaving cream has been removed.
10. Allow marbled paper to dry. Don't worry if it curls, it can be ironed flat using a low heat.
 - Describe the appearance of the paper.
 - Using the ideas you gained from P006, P007 and P008 try to explain why the paper has formed this pattern.

Going further:

It is possible to make a more substantial marbled paper by using the following method:

Wear disposable plastic gloves and safety glasses

Equipment:

- 15 g of alum
- Balance
- 2 weighing boats
- 2 spatulas
- Stirring rod
- Measuring cylinder
- 475 cm³ of warm water
- 2 beakers (600 cm³)



- 1 fork
- 3 sheets of non-glossy plain paper
- 1 medium paint brush
- 57 g of corn starch
- 60 cm³ cold water
- 475 cm³ hot water
- Shallow tray approx. 30 cm by 20 cm or large enough to take your paper
- Blue and red food colouring or acrylic paint thinned out with water to the consistency of milk
- 2 eye droppers
- 1 comb
- 3 sheets of newspaper
- String and pegs to hang the paper to dry (or somewhere flat to lay them)
- Newspaper to cover the work area and place the sheets onto

Method:

1. Add 15 g of alum to a 600 cm³ beaker.
2. Add 475 cm³ of warm water to the alum and mix with a fork or stirring rod until it's completely dissolved.
3. Make a small mark on one side of a sheet of plain paper with a pencil.
4. Use the brush (or a sponge) to lightly coat the marked side of the paper with the alum solution (mordant) until damp (not wet).
5. Allow the paper to fully dry. This could take about an hour (a hairdryer can be used to dry the paper). If the paper is wrinkled you can iron it between two plain sheets of paper on a low setting.
6. Add 57 g of corn starch to a 600 cm³ beaker.
7. Add 60 cm³ cold water to the corn starch powder; mix with a clean fork or stirring rod to form a white creamy like mixture.
8. Once it's well mixed, add 475 cm³ hot water to the corn starch mixture.
9. Mix until the solution is syrupy and then pour into the shallow tray.
10. Use eye droppers or pipettes to dot the food colouring or paint onto the surface of the corn starch solution. Use 1 or 2 colours. You want the paint to float on the surface of the cornstarch solution.
11. Use the comb to swirl, rake, and spread the paint across the solution's surface to create swirls of different colours. Avoid disrupting it so much that the individual colours are no longer visible.



12. Take a photograph to remind you of the original pattern.
13. Carefully lay the paper, marked side down (the side coated with the alum solution), into the tray, smoothing it out so that no bubbles remain.
14. Leave it for 30 to 45 seconds.
15. Carefully lift the paper by the corners nearest to you out from the solution.
16. Under a slow gentle running tap rinse off any excess solution with a gentle stream of water. (Do not hold the paper by the corners as it may tear easily. Instead, place your hands flat underneath the paper and move it under the gently running water.)
 - Describe the final marbled pattern and compare with the original pattern.
 - Which method is the best?
 - Explain why you say that.

Theory:

Over history several methods for making marbled papers have been developed. In most methods a shallow tray is filled with water, and various kinds of coloured ink or paint are carefully applied to the surface with an ink brush. Various additives or chemicals are used to help the colours float on the water. For one effect dropping water into a colour drop floating on the water helps turn a drop of colour into a ring. The process is repeated until the surface of the water is covered with concentric rings of different colours.

In another method the floating colours are manipulated by blowing on them through a straw, fanning them, or carefully using a hair to stir them. In the 19th century, the Japanese Kyoto master *Tokutaro Yagi* developed a method using a split piece of bamboo to gently stir the colours and create concentric spiral designs. Finally, a sheet of *washi* paper is carefully laid onto the water surface to capture the floating design.

In some commercial methods they first prepare the paper with a **mordant** (a substance used to fix dyes). Mordants are used to fix a dye onto a fabric or in this case paper. Mordants can be used before, during or after the process of colouring.

