

Experiment I

Home Made Paper

What you will need

Large bowl, sheets of used paper, egg beater or liquidiser, wire gauze of fine mesh (about 6 inches square), water, two sheets of blotting paper (or a newspaper), rolling pin, instant starch (two teaspoons in a cup) will provide what commercial papermakers call 'size'.

What you do

- 1 Tear the paper into very small pieces (not more than 1 inch square) and place in the bowl. (If a liquidiser is used, put the torn paper into the liquidiser, fill with water and beat until the fibres are separated. Add to large bowl of water then proceed as 4 below).
- 2 Fill the bowl with water (warm water is best). If you want to use starch, add two teaspoons to the water now.
- 3 Let the paper soak for ten minutes, then beat it with the egg beater until it becomes mushy, with the fibres well separated.
- 4 Dip the mesh into the bowl, tilting it so that the edge goes in first. Then lift the mesh up flat.
- 5 Let the water drip back into the bowl.
- 6 Turn the mesh upside down onto the blotting paper. This must be done carefully so that the pulp does not come apart.
- 7 Carefully remove the mesh and place the second sheet of blotting paper on top, and roll firmly.
- 8 Iron carefully until it is dry.
- 9 Peel back the blotting paper slowly, leaving your first sheet of hand made paper. This must then be left for 24 hours to dry completely.

Experiment II

Making Paper from Recycled Fibre

What you will need

Pestle and mortar, a one litre glass beaker, bunsen burner, tripod, bowl, sieve, gauze, waste paper

What you do

- 1 Tear up the waste paper into small pieces and place them into the beaker
- 2 Add enough water to just cover the paper pieces. Place beaker onto tripod and with bunsen burner boil for ten minutes
- 3 Pour the mixture into the mortar and mash with a pestle
- 4 Pour the pulp into a bowl and add water. Now continue by repeating the methods detailed in Method I from Number 4.

Method:

Some waste paper was torn up and placed in a beaker of boiling water. When the paper was soft it was mashed up in a mortar with a pestle. The pulp was placed in a bowl with sheets of paper made from it using a gauze.

Results:

The results of this experiment are your finished sheets of paper.

Questions on the experiment:

1. Why was the waste paper torn up and boiled in water?
2. For how long did you boil your paper?
3. Were there still lumps in your mashed up paper?
4. What improvements could you make to mashing up your paper?
5. From what materials are the very best papers made from?

Experiment III

Improving your Paper

Sizes and fillers can be added to your paper to improve it. Size stops ink soaking into the paper. Size can be mixed into the pulp or coated onto the finished paper. Fillers are added to the pulp to make the paper smoother.

Things you need:

Beaker, glass rod, bunsen burner, tripod, gelatine, aluminium sulphate

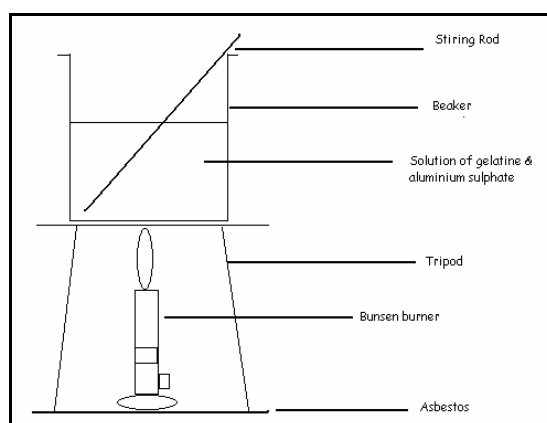
What to do:

- 1 Add one teaspoon of size (gelatine) to half a beaker of water.
- 2 When the gelatine has dissolved add one teaspoon of aluminium sulphate.
- 3 Stir to dissolve. Pour the solution into a large bowl.
- 4 Place your piece of paper in the solution and remove immediately.
- 5 Sandwich the paper between two pieces of cloth to remove excess solution.
- 6 Allow the paper to dry. When dry try writing on it.

COPY THE FOLLOWING INTO YOUR EXERCISE BOOK

Title: Sizing your Paper

Diagram:



Method: Some water was heated in a beaker. One teaspoon of gelatine was dissolved in the water followed by a teaspoon of aluminium sulphate. A piece of paper was wetted with this solution. The paper was dried.

Results: Your piece of improved paper

Experiment IV

Making Paper with Filler Added to Pulp

- 1 Take pulp, casein glue, china clay, beaker
- 2 Add one teaspoon of glue to half a beaker of water
- 3 Boil and stir until the glue has dissolved
- 4 Put water, pulp and china clay in bowl
- 5 Add the solution of glue to the mixture
- 6 Make some paper in the normal way

COPY THE FOLLOWING INTO YOUR EXERCISE BOOK

Title: Making Paper with Filler Added to the Pulp

Diagram: This is the same as for the previous experiment

Method: Some glue was dissolved in a beaker of water by heating and stirring. This was added to a mixture of water, pulp and china clay. Paper was made from it.

Results: The piece of dried paper

Why is filler added to pulp?

Paper made from fibrous pulp alone has certain shortcomings. Its surface lacks smoothness, and it tends to be translucent so that writing or printing shows through from the reverse side. For high quality printing the paper must be smooth and opaque so that the print is taken evenly and the fine detail shows up.

Fillers are added to improve the printing qualities of the paper, or give it certain properties. Fillers are fine white powders which are suspended in water with the pulp fibres. When sheets of paper are formed, the particles of filler are filtered out with the pulp fibres. As the water drains away these fine particles are washed into the spaces between the fibres. As a result the finished sheet of paper has a fairly smooth surface.

Unfortunately, fillers have the disadvantage of making the paper softer and more absorbent. To counter this, size is used to seal the surface of the paper and prevent the ink soaking in. China clay (which is decomposed granite) is the most widely used filler in Great Britain. It is mixed with pulp before it is poured onto the wire mesh band.

Although gelatine and aluminium sulphate have been used for external size, they are not recommended for internal size. This is because it is almost impossible to get a gelatine solution completely free from lumps. These small lumps can be brushed off when applied externally, but they form part of the sheet in the internal sizing process, and produce weaknesses and holes in the paper. For this reason glue size is added.

Experiment V

Treated Papers

Some papers require special finishes. The paper may be treated while still on the papermaking machine, or it may be subjected to various processes after leaving the machine. Passing dampened paper through a super-calender stack, which consists of extremely heavy rollers, gives the paper a very smooth surface which is ideal for printing.

Sometimes the paper is passed through a bath of size which makes it better to write on and easier to fold. Dipping paper into molten wax makes it water-repellent. Certain packaging papers are coated with plastic to make them resistant to chemical action. Glossy papers for high quality printing are made by coating the paper with minerals like china clay.

Making Tracing Paper

What you need

Oil and writing paper

What you do

- 1 Pour two drops of oil onto a sheet of paper
- 2 Rub the oil into the paper
- 3 When the paper looks 'dry' rub another piece of paper on it. If this paper does not mark then your paper is ready for use.
- 4 How does your paper compare with the tracing paper bought from the shop?

In your book

This time, write your own title and method (don't copy the one printed in this book). For results stick your tracing paper in your book. Copy the conclusion and fill in the blanks.

Conclusion:

Tracing paper can be made by oil into

It be marked with and

Experiment VI

Ink Absorption Test

When a paper is made the fibres are broken up smaller and smaller by beating, the amount of water they can absorb decreases steadily and we get a variation from kitchen towelling to greaseproof paper. It is important to be able to determine the amount of water paper can soak up (absorb). The following experiment is designed to measure the amount of absorption that occurs.

What you need:

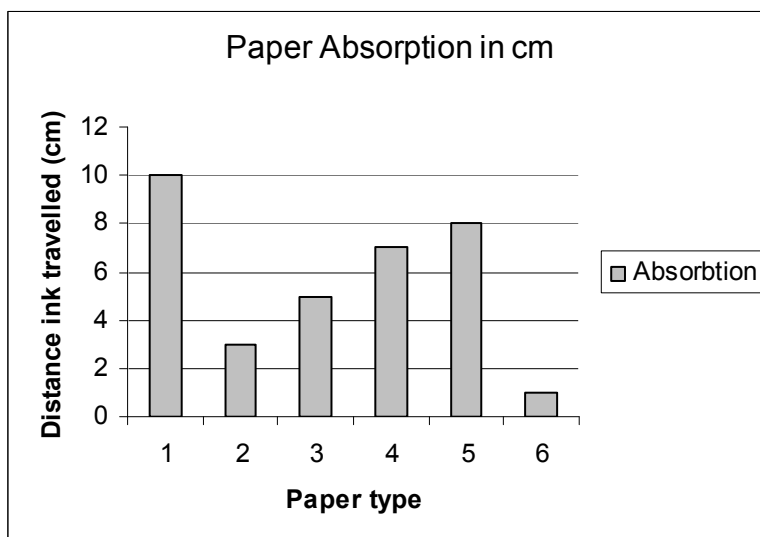
Beaker, ink, measuring cylinder, glass rod, paper clips, strips of different papers.

What to do:

- 1 Measure 10ml of ink into the beaker
- 2 Take a strip of test paper and fix a paperclip onto the end of it
- 3 Slide the paperclip onto the glass rod, so that the paper hangs down
- 4 Attach paperclips to the rest of the strips of paper and hang them on the glass rod
- 5 Place the glass rod on the beaker so that the ends of the paper are in the ink. Make sure that the strips of paper do not touch.
- 6 When the ink reaches the top of one of the pieces of paper, lift all of them out of the ink. Take them off the glass rod

Results

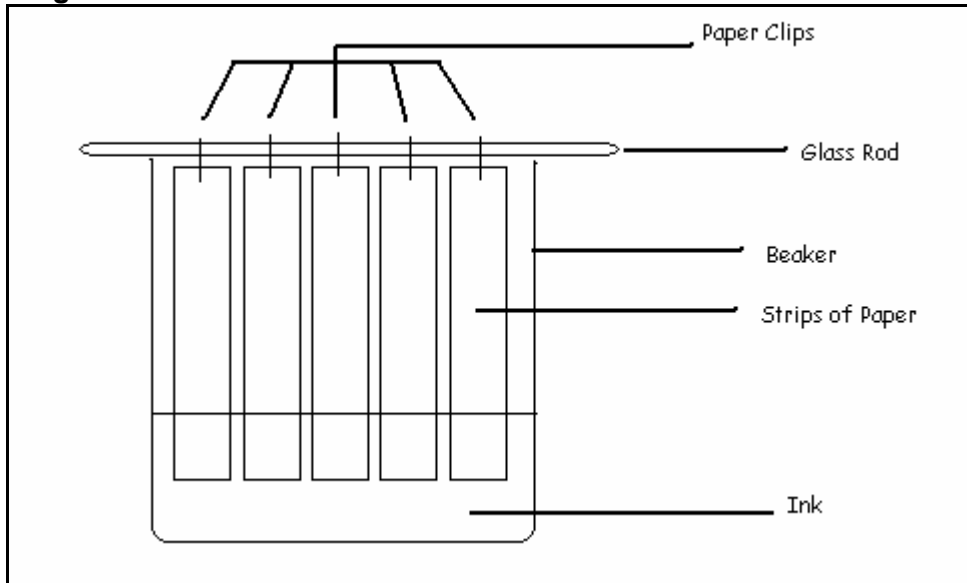
Draw a bar graph in your book, make it so that each section is the same size as your pieces of paper.



COPY THE FOLLOWING INTO YOUR EXERCISE BOOK

Title: Ink Absorption Test – Capillary Rise

Diagram:



Method:

Strips of different paper were hung from a glass rod using paperclips into a beaker containing some ink. When the ink reached the top of one of the pieces of paper, all of them were lifted out.

Results:

- 1 The bar graph on the previous sheet.
- 2 Make a list of the papers in order of their increasing absorbency (put the ones that soaked up the most ink first).

Conclusion:

The most absorbent paper that I have tested is

The least absorbent paper test was