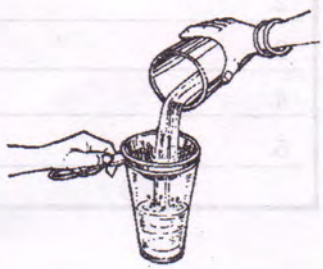
SEPARATION 14

We mix rice, *dal* (pulse), salt, chilli powder and other ingredients to make *khichri*. That means *khichri* is a mixture of various things. We use many such mixtures every day. A cup of tea, cooked vegetables, mud bricks and mortar are all mixtures.

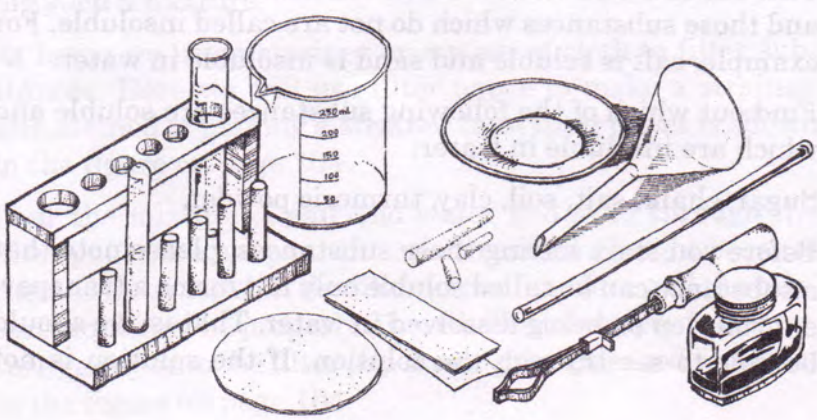


Sometimes we need to separate some things from a mixture. For example, we have to pick out and separate small stones from rice, wheat or pulses that we buy from the market. How do we identify a stone from a grain of food?

If the stones are visibly very different from the grain, they can be easily picked and separated. Sometimes there are stones mixed with rice that are shaped like rice and have the same colour as rice. In such cases it is more difficult to separate them from rice.

We separate many things from various mixtures every day. What are the different methods we use to separate things?

Each group (*toli*) must suggest at least one method for separating mixtures and also explain the basis used for separating things. For example, to separate stones from wheat grain,



we used differences in the shape, size and appearance between the two.

Copy the following table in your exercise book. When each *toli* suggests a method, the whole class should discuss and analyse the method to see if it is feasible.

If everyone agrees that the method will work, note it in your table. (1)

TABLE 1

No.	Method of separation	Example	Basis of separation
1.	Hand picking	Removing stones from wheat grain	Difference in shape size and colour
2.			
3.			
4.			
5.			

In the table above list all the methods that were agreed upon in the classroom. Choose one of these methods and actually put it into practice.

SEPARATING SALT FROM SAND

If sand and salt are mixed with each other, can you separate them?

For this we will have to use the difference between the two substances with respect to a particular property. Let us try to understand this property.

If we put sand and salt into water, would both these substances dissolve? Which would dissolve in water and which would not dissolve? (2)

Those substances which dissolve in water are called soluble and those substances which do not are called insoluble. For example, salt is soluble and sand is insoluble in water.

Find out which of the following substances are soluble and which are insoluble in water:

Sugar, chalk, salt, soil, clay, turmeric powder.

Before you start sorting these substances, please note that a substance can be called soluble only if it forms a transparent solution on being dissolved in water. That is, we should be able to see through the solution. If the solution is not

transparent and if the particles of the substance can be seen floating in the water then the substance cannot be considered soluble.

Can we separate salt and sand using the property of solubility? If yes, describe how it can be done. (3)

EXPERIMENT 1

You will require two test tubes, a test tube stand, a funnel, a glass rod, filter paper and water for this experiment.

Pour the mixture of salt and sand into a test tube. For this experiment, half a spoon of this mixture would be the proper quantity to take. Fill the test tube up to one-third with water. Shake the test tube vigorously and keep it on the test tube stand. Learn the correct way of shaking the test tube from your teacher.

Let the test tube stand for some time, observe it and then try to explain where the salt is and where the sand is.

One method of separating the salt solution from the sand is decantation. Gently pour out the salt solution and the sand

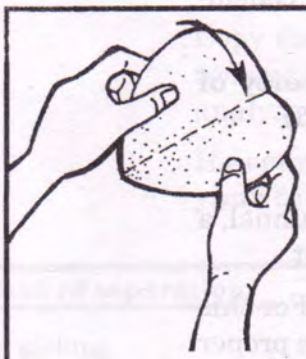
will be left at the bottom of the test tube.

Filtration, however, is better than decantation for separating such a mixture.

At home we use a strainer or a piece of cloth to filter substances. Here we will use filter paper to make a strainer. The method of making a strainer from filter paper is shown in the figure on page 104.

Pour the mixture of salt and water and sand through the filter paper. Do not pour the mixture from a height because there is a chance that the filter paper may tear and the mixture would not be properly filtered. Therefore, pour the mixture gently onto the filter paper along the glass rod as shown in the figure on page 104.

Filter paper

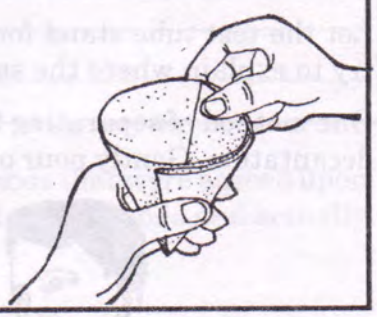


1. Fold the round filter paper along its diameter.

2. Fold it once more as shown here.

3. Now open it in such a way that three folds remain on one side and one remains on the other side.

4. Put this cone in the funnel. The filter paper should stick properly to the sides of the funnel. If it does not stick properly, ask your teacher for help. Hold the funnel over an empty test tube. Moisten the filter paper by sprinkling a little water on it. This is our strainer (filter). Now get ready to filter the mixture.



Do not pour the entire solution at one go or the cone may overflow. There should be a little space left at the top of the filter paper. Now wait till the water seeps through the filter paper. When the entire mixture has been filtered see if there is any sand left in the first test tube. If there is some sand, wash the test tube with some water and pour this water also into the filter paper.

What do you see in the test tube below the filter paper after filtration?

Where is the sand left behind?

How would you recover the salt from the salt and water solution? Suggest a method. (4)

Understanding solubility a little better

If we understand the property of solubility a little better, we can use the above method more effectively. For example, in the following experiment, we will try to observe the effect of heat on solubility.

Experiment 2

You will require a boiling tube, a test tube holder, a test tube stand and a candle for this experiment. Keep a plastic spoon with you as well.

Your teacher will give you the following four substances:

Common salt

Benzoic acid

Ammonium chloride

Calcium carbonate

Copy Table 2 in your exercise book.

Try this experiment in turn with each substance

Table 2

No.	Substance	Dissolves in cold water?	Dissolves in hot water?	What happens when hot water is cooled
1.	Common salt			
2.	Benzoic acid			
3.	Ammonium chloride			
4.	Calcium carbonate			

and record your observations in the table. (5)

Put about a quarter of a spoon of the first substance in the boiling tube and fill it one-third with water. Shake it well.

How will you take out these substances from the bottles in which they are stored? You could do so by using a piece of paper, but a better way is to use the spoon in the kit. Be sure to clean and dry the spoon every time before using it.

If the substance dissolves in cold water, write 'Yes' in the first blank column of the table and if it does not dissolve, write 'No'.

If the substance does not dissolve in cold water then heat the boiling tube over a candle or a spirit lamp. Use your test tube holder to hold the boiling tube over the flame but remember to keep it slightly tilted with its mouth pointing away from you. Shake the boiling tube gently as you heat it.

Does the substance dissolve in hot water. If it dissolves, write 'Yes' in the appropriate column of the table. If it does not, write 'No'.

If the substance dissolves in hot water, place the boiling tube on the test tube stand until it cools. Observe the solution in the boiling tube after it has cooled.

Can some substance be seen in the boiling tube after it has cooled?

Write down your observations in the table.

After these tests are completed with one substance, wash the boiling tube properly before repeating the tests with the next substance. Repeat the tests with all four substances one by one.

Don't forget to write down your observations in the table.

Suggest how we can separate the following three substances from a mixture on the basis of solubility in hot and cold water:

Salt, benzoic acid and sodium carbonate. (6)
If you are given a mixture of salt, ammonium chloride and calcium carbonate, can you separate these substances from the mixture? (7)

We have observed in the above experiments that different substances have different solubility in water. We have also studied the effect of heat on solubility.

These properties of substances are not only used by scientists for various purposes but also by us in our daily lives. For example, if there is some impurity in water we filter it through a piece of cloth.

Give at least two more examples of the use of filtration from your daily life. (8)

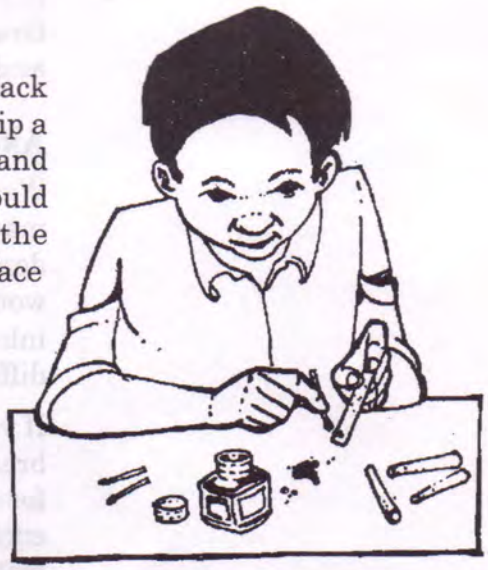
AN IMPORTANT RULE
Don't taste any of the materials you use in the experiments. Some of them might harm you.

CHROMATOGRAPHY: A NOVEL METHOD OF SEPARATION

You may not have heard of this method of separating things. But chromatography is very interesting. However, instead of reading about it, why don't you just see it for yourself by doing it. You will enjoy the experiment.

Chromatography with chalk

Experiment 3



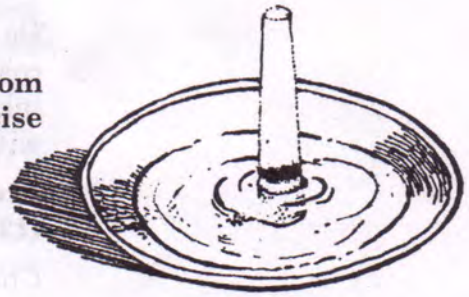
Take a whole stick of white chalk and make a ring of black ink about 1 cm from its broad end. To do this you could dip a matchstick or the tip of a ballpoint pen refill into ink and touch it to the chalk as shown in the picture. You should complete the ring slowly and carefully, touching the ink-wetted matchstick in a circle along the curved surface of the chalk.

Now pour some water in a plate or the lid of a tin and stand the chalk in the water. Ensure that the water in the plate is not more than 0.5 cm deep. The ink on the chalk should not be immersed in the water. Now watch and see the patterns that form on the piece of chalk.

Does the water rise in the chalk?

Can you see anything else happening?

Remove the chalk before the water reaches its top.



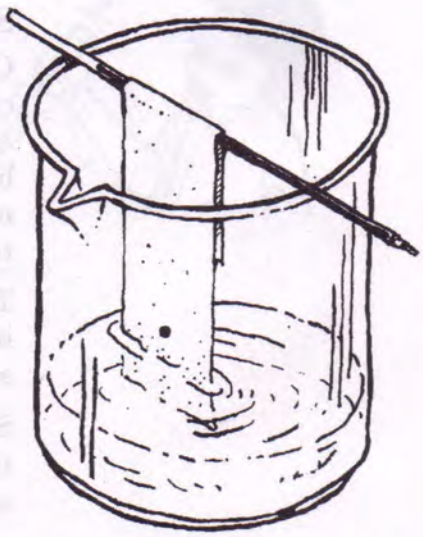
Which colours do you see on the chalk from the bottom to the top? Draw a picture of the chalk in your exercise book and show the colours you see in it. (9)
From where did these colours appear? (10)

Chromatography with filter paper

Experiment 4

We use filter paper for filtration. The same filter paper can also be used for chromatography. Let us see how.

Take a beaker and a refill of a ballpoint pen. Fill water up to a height of 1cm in the beaker. Cut a strip of filter paper about 12 cm long and 4 cm wide. Dip the head of a pin in black ink and put a small drop from it on the strip of filter paper roughly 2 cm from one end of the strip.



Now fold the other end of the filter paper strip, hook it over the refill and hang it in the beaker as shown in the figure alongside. The end of the strip that has the ink mark should dip into the water. Ensure, however, that the ink drop itself is above the level of the water. The filter paper strip should not touch the sides of the beaker either.

Wait for a little while. You will observe the water climbing up the filter paper strip. When the wetness nears the refill, remove the filter paper strip and dry it. How many colours do you see on the strip? Name these colours. What

is their order from bottom to top?

Draw a picture of the filter paper in your exercise book and show the colours in the same order. (11)

Another interesting experiment

Wasn't this experiment interesting? The ink appears to be made of a single colour but it actually has many colours hidden in it. Now that you know the truth about black ink, would you not like to see the colours hidden in other coloured inks? Why wait? Just go ahead and try chromatography with different inks and find out which colours they contain.

If you want to separate these colours from each other, then break the different coloured portions of the chalk you used for chromatography. Grind each piece separately and put each coloured powder into a different test tube. Pour some water into each test tube and shake the test tube well. The different colours will appear in the different test tubes.

Do the black inks of different companies have the same colours or are they mixtures of different colours? Take black ink produced by different manufacturers and compare them with each other using chromatography.

Are the black inks of all makes made of the same colours? (12)

Chromatography is a very useful technique for separation. It is difficult to match this method for separating materials. In fact, it can be used even when the amount of mixture to be separated is very small. For example, you needed only a drop of ink for separating its colours.

Separating medicines from plants

Chromatography can be used to separate medicinal chemicals from plant extracts. Many plants like *tulsi*, neem, *chiraita* etc have medicines in them. The plants are first boiled in water and filtered to obtain an extract. Then chromatography is used to separate the medicines from the extract.

There are many other uses for chromatography. For example, it can be used to detect contamination in different substances and to examine the colours of flowers.

Separation of substances is a very important scientific activity and is also important in our daily lives. You have learnt some methods of separating materials in this chapter. The

properties of the substances in a mixture always suggest ways in which they can be separated.

Questions for Revision

1. Can you separate the components of the following mixtures on the basis of their solubility :

   A. Milk and water

   B. Sugar and salt

   C. Sand and sugar

   D. Powdered chalk and sand

* Give the reason for your answers

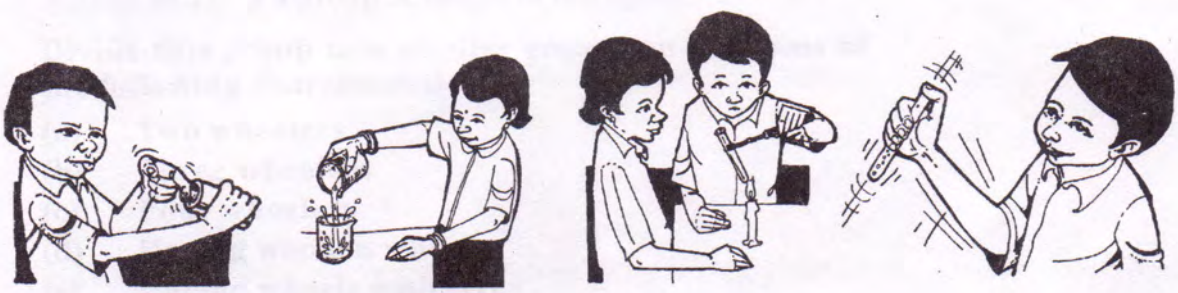
2. Think, explain and do:

   Jetram observed that kerosene rises up the wick of a lantern. He also saw that oil rises up the wick of a lamp. He thought, 'Why not try chromatography with these two substances instead of water?' He took a fresh wick and put a spot of ink just above one of its ends. Then he dipped the wick into kerosene just as you had dipped the filter paper into water in your chromatography experiment.

   Do you think Jetram's experiment was successful? Try it and see for yourself.

3. Can you separate sawdust and sand using the difference in their solubility? If you cannot, then how would you separate them?

4. Pictures of some experiments being performed are given below. Spot the mistakes in them and write them down.



New Words

soluble insoluble solubility chromatography