Separating Solutions

Mandatory experiment 23.1

To separate a mixture of water and soil using filtration

Apparatus required: filter paper; filter funnel; glass rod; retort stand and clamp; wash bottle; beaker or conical flask

Chemicals required: mixture of water and soil

Method

1. Take a filter paper and fold it into the shape of a cone as directed by your teacher.
2. Rinse a filter funnel with water and place the cone of filter paper in it as shown in *Fig. 23.3*. Rinsing the filter funnel not only cleans it but also helps the filter paper to stick to it.

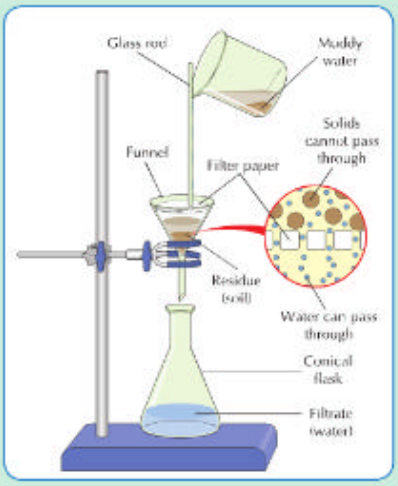


Fig. 23.3 Apparatus to separate water and soil. The soil remains behind on the filter paper. The water passes through the filter paper.

3. Set up the apparatus shown in *Fig. 23.3*. Carefully pour some of the mixture down a glass rod and into the filter funnel, *Fig. 23.3*.
4. Keep adding the mixture until it has all been filtered.
5. Open the filter paper and allow the soil to dry.

Note: There are millions of tiny holes in the filter paper. These holes allow liquids to pass through the filter paper. However, solid particles are too large to pass through. In other words, the filter paper traps any solid particles like those of soil or sand.

Result

The solid remaining on the filter paper is called the **residue**. (The word residue means 'what is left behind'). In this case, soil is the residue. The clear liquid that passes through the filter paper is called the **filtrate**. In this case, water is the filtrate.

Separating Solutions

Mandatory experiment 23.2

To separate sodium chloride from a solution of sodium chloride in water

Apparatus required: evaporating basin; tripod and wire gauze; beaker; bunsen burner

Chemicals required: salt solution

Method

1. Pour the salt solution into an evaporating basin. Place the evaporating basin on a tripod as shown in *Fig. 23.5(a)*.

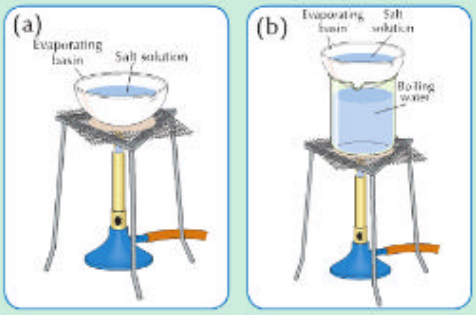


Fig. 23.5(a) Evaporation is a very useful method of separating salt from water provided that only the salt is required. (b) Heating the salt solution using steam.

2. Heat the evaporating basin gently until most of the water is driven off.

Note: It is very important that you wear your safety glasses when evaporating the solution. (The reason for this is that the solution can 'spit'. If this occurs, turn down the gas to make the flame smaller.)

3. Then place the evaporating basin over the beaker of boiling water as shown in *Fig. 23.5(b)*. ***Note:*** Use tongs to transfer the evaporating basin as it may be quite hot. (Heating with the boiling water prevents the salt from crackling and spurting out of the basin during the final stages of evaporation.)
4. Carefully remove the salt from the evaporating basin and show it to your teacher.

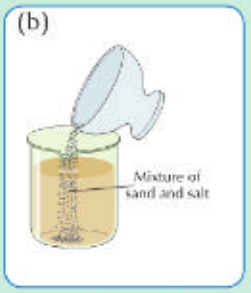
Mandatory experiment 23.3

To purify rock salt (sand and salt) using filtration and evaporation

Apparatus required: pestle and mortar; beaker; stirring rod; Bunsen burner; tripod; wire gauze; conical flask; evaporating basin; wash bottle; retort stand and clamp

Chemicals required: rock salt

(a) In this experiment we will separate sand and salt from rock salt.



(b) We make use of the fact that salt dissolves in water but sand does not.

(c) Therefore, when we add water to the mixture, the salt dissolves but the sand does not.

(d) If this mixture is filtered, the salt solution passes through the filter paper but the sand remains behind on the filter paper.

Method

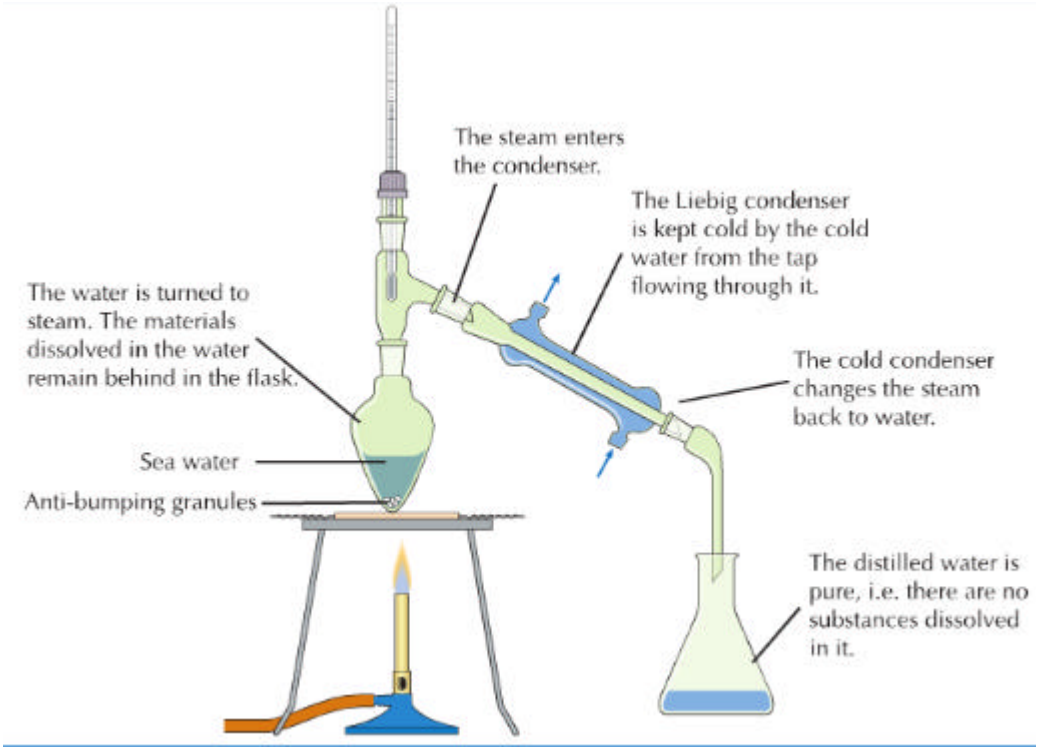
1. Crush some small lumps of rock salt using a pestle and mortar, *Fig. 23.6*. Do not forget to wear your safety glasses.
2. Place the rock salt in a beaker of warm water and stir to dissolve the salt. Add more water, if necessary, to dissolve all the salt and continue heating over the Bunsen burner for about fifteen minutes.
3. Turn off the Bunsen burner and leave the beaker stand until it has cooled down. Filter the warm mixture into a conical flask or an evaporating basin.
4. Evaporate the water from the sodium chloride solution using the method detailed in *Experiment 23.2*. Examine what is left in the evaporating basin. You have produced crystals of pure salt!

Mandatory experiment 23.4

To obtain a sample of pure water from sea water

Method

1. Pour some sea water into the distillation flask. Add a few anti-bumping chips to help the liquid to boil more smoothly. Set up the apparatus shown in *Fig. 23.7*.
2. Turn on the water to the Liebig condenser. The purpose of the water is to keep the inner tube cool.
3. Heat the distillation flask gently. Note that the temperature remains at 100°C while the water distils over. Note also that as the steam passes through the Liebig condenser it is being cooled and converted to a liquid again. The pure liquid that is being collected in the receiver is called 'distilled water'.
4. Remove the Bunsen burner when most of the liquid has been boiled off.



Separating Solutions

Mandatory experiment 23.5

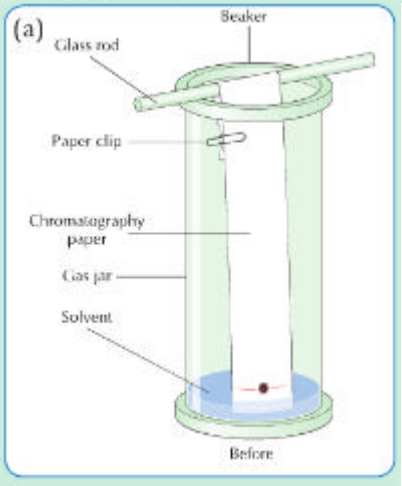
To separate the dyes in a sample of ink using chromatography

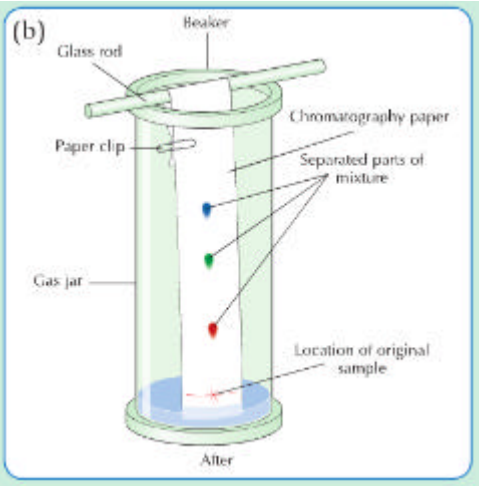
Apparatus required: gas jar; glass rod; dropper or capillary tube; strip of filter paper or chromatography paper; scissors; paper clip

Chemicals required: markers of various colours (black, brown, etc), water (if the dye is water soluble), propanone, alcohol, hexane, etc. (if the dye is not water soluble).

Method

1. Cut a strip of absorbent paper (filter paper or chromatography paper or paper from the side of a newspaper) long enough for a beaker or a gas jar as shown in *Fig. 23.8*.





2. Using a pencil, draw a line about 3 cm from the end of the paper to indicate where the spot will be placed. Using a marker, place a spot of the ink on the line. If the dye is in liquid form, use a dropper or a capillary tube to put a spot of ink on the paper. Using the pencil, write the colour of the ink and solvent on the top of the paper. (Your teacher will tell you what solvent to use.)
3. Pour some solvent into the container to a depth of 2 cm maximum and hang the paper so that the solvent level is below the ink mark as shown in *Fig. 23.8*.
4. When the solvent reaches the top of the paper, take out the paper and allow it to dry. Examine the chromatogram and note the colours of the dyes that were in the ink.
5. Repeat the experiment using a different colour of ink.

How it Works

1. The solvent carries the various dyes in the ink up the paper.
2. Some dyes are more soluble in the solvent than others.

- Dyes that are **not very soluble** in the water come out of solution **early on** and appear as a colour near the bottom of the filter paper.
- Dyes that are **very soluble** in the water stay in solution and get carried **further up** the paper.