# Separating mixtures

Student activity • class activity

YEAR 10 / LESSON 5 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

## The question

**How can we recover salt from a mixture containing insoluble sand?**

Use differences in solubility to separate a prepared sand–salt mixture. Dissolve the salt, filter out the sand, then concentrate the solution and allow crystals to form. Record what actually happens; crystal growth and air drying may continue after the lesson. This is a physical separation, not a reaction making a new salt.

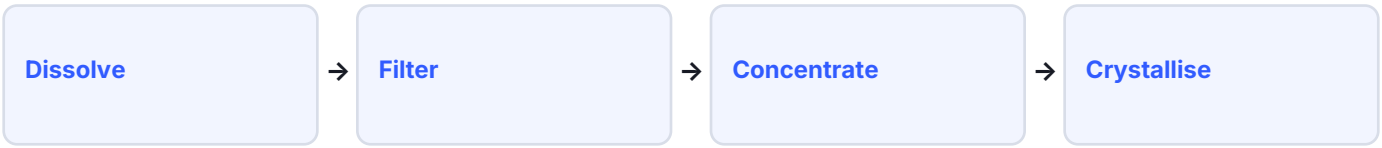
## Equipment

- Eye protection; labelled student booklet and pencil
- 5 g teacher-prepared sand–salt mixture; 20 $cm^3$ water plus up to 5 $cm^3$ for rinsing
- 100 $cm^3$ beaker, 25 $cm^3$ measuring cylinder and glass stirring rod
- Filter funnel, filter paper, funnel support and 100 $cm^3$ conical flask
- Small evaporating basin and heatproof mat; labels for retained samples
- Teacher-managed electric heating station; suitable basin tongs for the teacher

Wear eye protection. Do not taste any sample. Avoid raising sand dust. Keep glassware stable. Heating is teacher-managed: stay clear of the hot basin and hotplate, which can remain hot after switching off. Never heat to dryness or wait for spitting; tell the teacher if vigorous bubbling occurs. Leave hot apparatus in place to cool. Report spills and broken glass; do not pick up fragments.

Course coverage: 1.8 and 1.10: mixtures, filtration and crystallisation.

## Process map • conceptual, not an apparatus drawing




Use your observed apparatus to explain each stage. This map does not show supports, the heating controls or the condenser cooling-water circuit.

# Method and reasoning

Read the whole sequence before starting

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**1.** Label your beaker and add the issued 5 g mixture. Measure 20 $cm^3$ water into it and stir gently for two minutes. Let coarse grains settle briefly. Record what seems to dissolve and what remains.

**2.** Fold and seat the filter paper in a supported funnel. Moisten it with a little water and place the flask below; the funnel tip should touch the inside wall of the flask.

**3.** Pour the mixture slowly down the glass rod into the paper. Keep the liquid below the paper rim. Transfer the remaining solid using no more than 5 $cm^3$ additional water in small rinses. Do not tear or poke the paper.

**4.** Record the appearance of the residue and filtrate. If the filtrate is visibly cloudy, ask the teacher to check the paper and repeat filtration with fresh paper if needed.

**5.** Pour the clear filtrate into a labelled evaporating basin. Take it to the designated heating station when directed. The teacher gently concentrates it using electric heating; students observe from the assigned position.

**6.** The teacher stops heating while liquid still remains, when crystals first appear at the edge or a small drop transferred with a glass rod onto a cool tile crystallises. Do not touch the test drop or heat the basin dry.

**7.** Leave the basin to cool in place. Record crystals if visible; if no crystals are visible yet, record that honestly and leave the labelled basin for slow evaporation. Examine it again next lesson.

**8.** Retain the labelled sand and salt samples as directed. Explain what each separation step achieved. Do not calculate salt yield from a damp sample.

## Cleanup

• Let the teacher confirm that apparatus is cool. Put sand and used filter paper into the designated solid-waste container, not the sink. Keep labelled salt samples for the next observation. Wash apparatus and hands as directed.

# Record your evidence

Blank spaces are for your own work

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## Reference and task data

| Term | Meaning |
|---|---|
| Residue | Material retained on the filter paper |
| Filtrate | Liquid that passes through the paper |
| Evaporation | Solvent leaves the liquid as vapour |
| Crystallisation | Solute forms solid crystals from solution |

Record only your own observations. Salt can remain dissolved after concentration; you may need to revisit the labelled basin next lesson. A damp solid is not ready for a dry-mass measurement.

| Stage | What I observed | What this suggests |
|---|---|---|
| Before adding water | | |
| After stirring | | |
| Filter residue | | |
| Filtrate | | |
| After concentration/cooling | | |
| Next-lesson observation | | |

**Sketch your filtration setup and label residue and filtrate.**

# Explain and evaluate

Use evidence and show calculation steps where relevant

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**1.** Why does adding water help separate this mixture?

**2.** Name the residue and the filtrate. Explain why dissolved salt passes through the filter.

**3.** Why does filtering alone not recover solid salt?

**4.** Why should we stop heating before all liquid disappears?

**5.** Explain why a damp sample cannot give a reliable dry mass of salt.

**6.** Would this method separate two soluble salts? Explain the limitation.