Separating mixtures

Teacher / technician

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

Staff preparation and answer guidance. Keep separate from student sheets. Expected residue and crystals are guidance, not supplied results. Do not promise all crystals within 50 minutes. No sodium thiosulfate demonstration or heating to dryness is included.

Coverage and delivery

1.8 and 1.10: mixtures, filtration and crystallisation.

Allow about 50 minutes. Follow the student sequence and use the answers to check reasoning.

Requisition • class of 30, working in 15 pairs

Item	Per pair / setup	Class total
Prepared mixture	5 g	75 g
Water, including rinses	up to 25 cm^3	up to 375 cm^3
Filtration set and basin	1 set	15 sets
Student booklet	1 per student	30 copies
Electric heating station	shared, teacher-operated	1 or more supervised stations

Immediate safety

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.

Preparation and delivery

Read alongside the student method

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1. For 15 pairs, prepare 75 g of a clean model mixture containing 15 g sodium chloride and 60 g clean sand; mix thoroughly before dispensing 5 g portions. This represents rock salt without unidentified natural contaminants.

2. Use the listed 20 cm^3 dissolution water and small rinses. Trial your basin and heating station beforehand; crystallisation may need a later lesson. Supply a separately labelled earlier sample if needed, without presenting it as the pupils' result.

3. Set up a stable, suitable electric heating station and a safe cooling area. Add a cool spotting tile and glass rod for the teacher endpoint check. Assess the actual heater, basin and classroom layout before use.

4. The class mixture contains approximately 1 g salt per portion, but portions can vary. No quantitative recovery is claimed. An extension would require drying to constant mass and a balance; it is not part of this lesson.

Close of lesson

• 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.

Verification before use

Check quantities and available apparatus against this requisition. For heated work, complete the school risk assessment and trial the actual setup. This editorial review is not a record of a physical laboratory trial. All supplied calculation datasets are labelled teaching examples.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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• Water dissolves sodium chloride while sand remains insoluble. Stirring helps contact; it does not change the substances.

• The residue is mainly sand; the filtrate is aqueous sodium chloride. Dissolved ions pass through the filter with the water. A clear filtrate need not be pure water.

• Evaporation removes solvent, increasing concentration. Crystallisation recovers solid solute. Sodium chloride has only a small temperature dependence of solubility, so solvent removal matters more than cooling alone.

• Heating dry can cause hot solid or concentrated liquid to spit and wastes heat. Stop with liquid remaining and allow the basin to cool.

• Water retained in a damp sample increases measured mass. Transfer losses and incomplete crystallisation also affect recovery.

• Two soluble salts generally pass into the filtrate together. Differences in solubility may allow other methods, but this activity does not demonstrate their separation.

References and provenance

RSC / Nuffield: separating sand and salt

Pearson Chemistry specification

Prepared 22 November 2026. Original wording, tables and questions. Sources inform the concepts and technique; the lesson scope and classroom quantities are explicitly described here. No laboratory trial or final school risk approval is claimed.