

Classroom Resource

Investigating the Separation of Materials



Investigation

Investigating the Separation of Materials

Class Level - All levels

Curriculum Links

Strand:	Materials
Strand Unit:	Materials and Change; Properties and Characteristics of Materials
Curriculum Objectives:	Identify and investigate a range of common materials used in the immediate environment; Explore some simple ways in which materials in a mixture may be separated
Skills Development:	Questioning, Observing, Predicting, Investigating and Experimenting, Estimating and Measuring, Analysing, Recording and Communicating
New words/vocabulary:	Filtration, Evaporation, Condensation, Physical Change
Focail nua:	Scagachán (Filtration)
Cross curricular links:	Maths, Language, Geography - natural environments
Equipment/materials	 Selection of garden sieves, kitchen sieves, or different sized wire mesh Selection of materials: sand, salt, gravel, soil Funnels and jars or plastic bottles Empty glass jars with lids Kitchen paper, coffee filter or filter paper Saucepan and hot plate Iron filings (optional, depending on availability) and large magnet Black marker









Engage

Prompt questions

- Are different materials often mixed together?
- Can you give examples of mixtures in nature? Sand and gravel on a beach, soil, salt water in the sea?
- Can you give examples of times that we might mix materials? Mixing ingredients when cooking, mixing soil and compost for planting.
- When might we need to separate materials? Removing stones from soil in the garden, filtering water for drinking, and accidental spills.
- In what ways could we separate materials that have been mixed?

Background information

When different materials are mixed together, but no new substance has been formed, we call this a physical change. Sometimes physical changes can be easily reversed by separating the materials.

Real-world application

We often need to separate materials for different reasons. Sand and gravel are often found together as they were transported together by glaciers in the past or by rivers or the sea. For road building, construction, or even gardens, we might need to have sand on its own or gravel that is sorted into similar sizes.

Lots of things can be carried in water: large items like rubbish, naturally occurring particles like soil, leaves, or twigs, and also dissolved substances like salt or chemical pollutants. Cleaning water for drinking involves the separation of these materials.

When we place our clean and dry paper, plastic, and metal in the recycling bin, these have to be separated out from each other using different methods so that they can be recycled.

Explore

Present the learners with a number of different mixtures in containers. Either have a set of mixtures for each group or give one to each group and pass them around the classroom so all learners can examine and explore them. Groups should discuss ways of separating the various mixtures. Mixtures can include but are not limited to the following:

- Sand and gravel
- Sand and water
- Salt and water
- Salt and sand
- Salt and iron filings (optional, depending on availability)
- Soil (contains different components)
- A black marker explain that the black ink is a mixture of different coloured inks









Investigate

Discuss some simple investigations the class could carry out to separate the mixtures of materials. A number of investigations can be carried out here. Before they are carried out, learners should be encouraged to discuss and design how they would go about separating the components of different mixtures. You could then choose to carry out one or more investigations with the class. All groups could work on the same investigation, or different groups could carry out different investigations and then demonstrate to the class.

Starter questions

- Investigation 1: Can we separate sand and gravel?
- Investigation 2: Can we separate sand and water?
- Investigation 3: Can we separate salt and water? (This may work best as a teacher demo).
- Investigation 4: Can we separate salt and sand?
- Investigation 5: Can we separate salt and iron filings? (optional, depending on availability)
- Investigation 6: Can we separate soil into its various parts?
- Investigation 7: Can we separate black ink into its different colour component?

Prediction

Learners should make a prediction based on their chosen investigation and give reasons for their predictions.

Conducting the investigation

These are suggested methods for separating each mixture. Learners should discuss their own ideas for separating their mixture and design an investigation.

Investigation 1: Separate a mixture of sand and gravel?

- Examine a number of sieves, nets, or mesh.
- Choose one that will hold the gravel but allow the sand grains to pass through.
- Sieve the mixture.



Investigation 2: Separate a mixture of sand and water

- Use filtration to separate the mixture.
- Place a coffee filter or sheet of strong kitchen paper into a funnel and place it into the neck of an empty jar. (A simple funnel can be made by cutting a plastic bottle in half. The bottom half of the bottle can be used to collect the liquid).
- Pour the sand and water mixture slowly through the funnel.







Investigation 3: Separate a mixture of salt and water (Teacher demonstration)

- Use evaporation to separate the mixture.
- Put the mixture into a small pot.
- Place the pot on a hot ring and bring the mixture to boiling point.
- Allow to boil until all the water is boiled off.
- The salt will remain in the pot.
- Make sure to turn off the heat once the water has evaporated, and remove the pot from the heat source, to avoid burning the salt.

Investigation 4: Separate a mixture of salt and sand

- Pour the mixture into a container of warm water.
- The salt dissolves in the water.
- Filter the mixture. The sand is caught in the filter paper. The salt water runs through.
- Separate the salt out by evaporation.

Investigation 5: Separate a mixture of salt and iron filings (optional, depending on availability)

- Use a magnet to separate the mixture.
- Hold the magnet and dip it into the container.
- The magnet will pick up the iron filings, leaving the salt behind.
- Repeat until all the iron filings have been separated.



Investigation 6: Separating the different components of soil

- Soil is a mixture of sand, silt, clay, and humus.
- Place a sample of soil in a jar of water.
- Screw on the lid and shake vigorously.
- Leave the jar aside for one hour or overnight if possible.
- The sand, silt, and clay particles sink to the bottom of the jar. The humus floats.
- The largest particles will settle first, so the sand, silt, and clay will form separate layers within the jar.
- A ruler can be used to measure the height of each layer and calculate the percentage of each component.

Adapt for home: Learners could bring in soil samples from their own gardens and compare the composition of different soils from different gardens or areas.

Investigation 7: Separating black ink into different colours

- The process used here is called **Chromatography**.
- Cut a strip of kitchen roll 20cm long and 4cm wide.
- Draw a pencil line 5cm from the bottom of the strip.
- Using a black marker, put a spot in the middle of the pencil line.
- Put 2cm of water in a jam jar.
- Hang the paper strip in the jar, making sure that the black spot does not touch the water.
- Watch what happens as the water rises up along the paper different colours start to appear.
- This can be repeated with different colour markers to see if they are pure colours or made up of a mixture of colours.
- The colours used in Smarties and Skittles could also be tested. Wet the sweet and rub it on the paper strip to create a spot.







Take the Next Step

Learners should decide how to present their results to the class. If different groups have carried out different investigations, they might repeat the investigations for the rest of the class to observe. They might consider the answers to the following questions:

- Did you manage to separate your materials fully, partly, or not at all?
- Were your materials easy or difficult to separate? Why do you think some materials are easier than others to separate?
- Did it work the first time, or did you need to adapt your method?
- Would you do anything differently next time?

Adapt for home:

Some of these investigations could easily be done at home using easily available equipment and materials. Separating salt and water could possibly be done at home with parental supervision more easily than in a classroom. Learners could try some of the investigations at home and share their findings with the class.

Adapt for junior/senior level:

Junior classes could separate sand and gravel, sand and water, or salt and iron filings with instruction from the teacher. They could also separate the components of soil and try the chromatography investigation. For senior classes, different groups could work on separate investigations or do some at home.

Follow-up challenge/project/citizen science link:

- Research how materials are sorted for construction: sorting of sand and gravel, screening of clay for building with cob.
- Research the process of de-salination (separating salt from water). How is it done on a commercial scale? Why do you think it is not done more often?
- Find out where your waste goes after you place it in the bin. Research the recycling process and the separation of waste for recycling, composting, or disposal. Why is it important to separate your waste properly and place it in the right bins? Why is it important that everything in the recycling bin is clean?





