

Topic Review: Separation of mixtures

Using scientific language

- a** You are given a mixture of three solids: iron filings, copper sulfate and yellow chalk dust. The mixture is dry. Design (and carry out if time permits) an experiment to separate these three substances. Outline the procedures used, and draw a fully labelled diagram of the apparatus you would use. Include as many words from the following list as possible: solution; filtrate; dissolve; magnet; funnel; dilute; solute; distillation; suspension; solubility; evaporate; solvent; sieve; insoluble; residue; decant; concentrated; mixture; sediment; colloid; condense.

b For each word that you did not use from the list, define it and explain why it is not related to your experiment.

Check your knowledge

- In a solution of salt dissolved in water;

a Which substance is the solute?

b Which substance is the solvent?
- What happens to the particles of sugar when a sugar cube is dissolved in water?
- The solvent in a solution does not always have to be water. Name three other liquids which could be used as solvents.
- What gas is dissolved in water to make soda water?
- Name two mixtures which are formed by mixing a liquid with a liquid.

6. What is the name of the insoluble substance which settles to the bottom of its container?

7. Complete the following table.

SOLUTION	SOLUTE	SOLVENT
oil-based paint		
permanent ink		
sea water		
soft drink		
coffee		

8. A solution of sugar in water is known to be saturated when:

9. The particles in an emulsion, a colloid and a suspension are different sizes. List them in order of size from smallest to largest.

10. You have made two cups of instant coffee. One has one teaspoon of coffee, the other two teaspoons. Which is the more concentrated?

11. List two factors which will affect the solubility of potassium chloride when you dissolve it in water.

12. Choose the correct answer. Which of the following would you filter to separate the mixture?

A salt water

B muddy water

C copper sulfate solution

D a suspension of copper carbonate in water

Apply your skills

1. In a recipe you are asked to dissolve a quantity of gelatine in half a cup of water, but when you stir it in not all the gelatine disappears. What could you do to dissolve all the gelatine?

2. Jean was doing the gardening and found that the soil contained large pieces of clay and small nails left over after the building renovations. Describe how she would separate the soil from the debris.

3. The lid was left off a bottle of lemonade on a warm day and the lemonade was later found to be flat. Suggest why this would be so.

4. Suggest two different ways of separating each of the following mixtures:
 - a oil and water

 - b salt and pepper

 - c iron filings and sugar

 - d polystyrene beads and metal bearings.

5. How could you decide if a sample of a substance is a pure substance or a mixture?

Answers

Using scientific language

- a.** Use a **magnet** in a plastic bag to separate out the iron filings from the **mixture**. Place the remaining **mixture** in a beaker, add water and stir. The soluble copper sulfate will **dissolve** forming a **solution**, while the **insoluble** chalk will form a **suspension**. Filter the **mixture** using a **funnel** and filter paper. The chalk dust will not pass through the filter paper and will leave a **residue** that can be dried later. The copper sulfate will pass through the filter paper. This is called the **filtrate**. Place the copper sulfate solution in an evaporating basin and heat gently. The water will **evaporate**, leaving the copper sulfate.

b. Dilute: a dilute solution is one with little solute added.

Solute: the substance which dissolves in a liquid to form a solution.

Distillation: method used to separate and recover the solvent in a solution.

Solubility: how readily a substance dissolves in a solvent.

Solvent: the part of a solution which dissolves another.

Sieve: device used to separate parts of a mixture based on their size.

Decant: method used to separate an insoluble sediment from a liquid by carefully pouring off the liquid.

Concentrated: a concentrated solution contains a large amount of solute.

Sediment: an insoluble substance which settles to the bottom of a liquid.

Colloid: a liquid containing fine particles which do not settle out.

Condense: change state from a gas to a liquid on cooling.

Check your knowledge

- a** salt **b** water
- They break up in water and become so small they cannot be seen.
- petrol, dry-cleaning fluid, methylated spirits
- carbon dioxide
- Two-stroke motor fuel (petrol and oil), vodka (alcohol and water).
- sediment
-

Solution	Solute	Solvent
oil-based paint	pigments	mineral turpentine
permanent ink	pigments	alcohol
sea water	salt	water
soft drink	sugar, carbon dioxide	water
coffee	coffee granules	water

- No more sugar will dissolve in it.
- emulsion, colloid, suspension

10. two teaspoons
11. temperature, amount of water
12. D

Apply your skills

1. Warm the water. In general, increasing temperature will increase the solubility of a solute.
2. She could use a sieve and check the soil with a magnet.
3. Carbon dioxide diffuses from the drink and it goes flat.
4. **a** Centrifuging; fractional distillation
b Sieve and mix with water, filter and recover the salt via evaporation
c Magnetic separation and mix with water; decant and recover the sugar via evaporation
d sieving; gravity separation
5. Dissolve in a suitable solvent and place a drop on chromatography paper and see if there is separation into different parts. Other methods raised in this topic could be tried depending on what the mixture is suspected of containing, e.g. mixing it with water might show one part is insoluble.