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Mixtures and separation





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Mixtures and separation

Uniform does not mean pure



THE IDEA

A mixture contains more than one substance. Salt water looks uniform but its composition can vary. A pure substance has a fixed composition.

Homogeneous mixtures are uniform at the scale examined. Heterogeneous mixtures have distinguishable parts or phases.

CHECK YOUR THINKING

Can a transparent liquid be a mixture?

A No; every mixture must look cloudy.

B Yes; dissolved substances may be invisible.

B. A solution can be transparent and uniform while containing multiple substances.

A RELATED EXAMPLE

Name both parts of a solution

Solute and solvent have different roles. The solute dissolves in the solvent. In salt water, salt is the solute and water is the solvent. Solutions can involve gases, liquids or solids. Air is a gas mixture; some alloys are solid solutions.

Mixtures and separation

Make the denominator

Mass before and after dilution

Salt	15 g
Water at first	85 g
Water added	100 g

THE IDEA

A solution contains 15 g salt and 85 g water. Add the masses before calculating the percentage. Then predict what happens if another 100 g water is added.

The solute amount stays fixed while total solution mass grows.

CHECK YOUR THINKING

What is the mass percentage after dilution?

A 7.5%.

B 15%.

A. The final mass is 200 g. 15/200 × 100 = 7.5%.

A RELATED EXAMPLE

Mass percentage

Use solution mass in the denominator. Dissolve 12 g sugar in 48 g water. Solution mass = 12 + 48 = 60 g. Mass percentage = 12/60 × 100 = 20%. Using 48 g would compare solute with solvent, a different ratio.

Mixtures and separation

A dissolving limit has conditions



THE IDEA

Solubility depends on substance and temperature. A saturated solution cannot dissolve more of that solute at the stated temperature. Undissolved solid may remain.

Heating increases the solubility of many solids, but not all substances behave alike. Gas solubility often decreases on warming.

CHECK YOUR THINKING

Does stirring alone guarantee a higher final solubility?

A No; it mainly changes how fast dissolving occurs.

B Yes; enough stirring dissolves any amount.

A. Rate and final dissolving capacity are different properties.

A RELATED EXAMPLE

State which percentage you mean

Different ratios need different units. Mass-by-volume percentage gives grams of solute per 100 mL of solution. Volume percentage gives mL of solute per 100 mL of solution. A 5% m/v solution contains 5 g in a final volume of 100 mL, not necessarily 100 mL of solvent.

Mixtures and separation

One ink can contain several dyes



THE IDEA

Chromatography separates different movements. Solvent travels through paper. Dyes move different distances because they differ in attraction to paper and solubility in the solvent.

The starting spot must begin above the solvent level. Otherwise it may dissolve directly into the liquid pool.

CHECK YOUR THINKING

Why keep the starting spot above the solvent surface?

A So the solvent never reaches it.

B So it travels with the rising solvent through the paper.

B. The solvent front must pass through the spot, rather than wash it into the pool.

A RELATED EXAMPLE

Recover the solvent too

Distillation combines two state changes. The solvent evaporates from the heated mixture and condenses in a cooler part of the apparatus. Simple distillation can recover water from salt water. Close-boiling miscible liquids need a more effective separation, such as fractional distillation.

Mixtures and separation

A solid can bypass the liquid state



THE IDEA

Sublimation can separate some mixtures. A sublimable solid changes directly to vapour and can deposit again on a cool surface.

A suitable non-subliming component stays behind. Choose the method from substance properties; heating unknown mixtures is not a classroom task.

CHECK YOUR THINKING

What is deposition?

A Gas changing directly to solid.

B Liquid changing to gas.

A. Deposition reverses sublimation without a liquid stage.

A RELATED EXAMPLE

Drain one liquid layer

Immiscible liquids form separate phases. Oil and water separate into layers because they do not mix completely. Density determines which layer is lower. A separating funnel lets the lower layer drain first. Dissolved salt cannot be removed from water this way.

ONE LAST CHALLENGE

Why do you need two separation steps?

A container holds a layer of oil above salt water. You want to recover the oil and the salt.



THE REVEAL

Separate the liquid layers first, then evaporate water from the salt solution.

Oil and salt water form separate phases. Dissolved salt passes through a simple filter with the water.

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