

Scientific Overview

Discovering mixtures

Compactness

A solid can be extremely compact: for example, the elements that make up a pebble cannot be seen with the naked eye, whereas sand (which is known as a “granular material”) has some properties resembling those of liquids: it has no shape of its own in its dry state, and it flows between the fingers when we grab a handful. However, this property depends on the scale of observation. If we see a rockslide on a mountain in the distance, we will get the impression that the rocks and pebbles are flowing like sand.

How to separate the ingredients of a heterogeneous mixture

- Thanks to the difference in size of their particles: useful during sieving or filtration. Granulometry is the discipline that measures the size of granular materials and deduces properties from them.
- Thanks to the difference in their density: useful during centrifugation (a component is pushed outwards when its container is rotated), decanting or skimming.
- Due to the difference in their change of state temperature: useful when separating by evaporation or distillation (boiling + condensation): one of the components of the mixture vaporizes at a lower temperature and can be collected selectively.
- Due to the difference in their solubility: useful for separating, for example, salt and sand by dissolution: one dissolves in a benchmark solvent, e.g. water; the other does not.
- Because of their different magnetic properties: to separate certain metals in a mixture: iron or nickel are attracted by a magnet; aluminium or copper are not.

Homogeneous/heterogeneous mixture

These terms are introduced to qualify what is distinguishable with the naked eye. A mixture that is homogeneous to the naked eye may appear heterogeneous with a magnifying glass. At the molecular level, any mixture is heterogeneous. A homogeneous mixture can become heterogeneous over time. A solution is a homogeneous mixture – even under a microscope – that remains stable over time. Solutions have the same properties everywhere (density, colour, melting or boiling points, etc.). These properties depend on the substances mixed and their relative quantities.

A system is said to be homogeneous when the physical quantities that describe it are constant at all points.

Solutions

If a solid and a liquid form a solution, the solid is said to be soluble in the liquid. The solid – in smaller quantities – is the solute and the liquid is the solvent. This is called dissolution. In a solution, the solute is dissolved in the solvent. A mixture of two liquids is also called a solution. Water is the best solvent, i.e. the one that dissolves the most substances. Other solvents are alcohol and acetone.

Two liquids can be miscible (water and alcohol) or immiscible (water and oil); they can be miscible in any proportion or up to a saturation point.

Solubility is the maximum quantity of one substance that, at a given temperature, can be incorporated into a given volume (or mass) of the other substance, preserving a homogeneous status. The solution thus formed is said to be saturated.

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