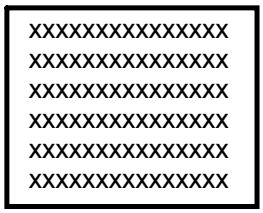
Pure Substances and Mixture

Pure Substances



- Contains only 1 type of particle

ex. sugar, salt, distilled water, diamond, pure alcohol, etc.

Mixtures

2 types,

1) Homogeneous (Solutions)

- At least 2 types of particles
- Uniformly distributed
- It appears as though there is only one substance

ex. air, tap water, sugar water, salt water, steel, gold jewellery etc.

2) Heterogeneous

- At least 2 types of particles
- NOT uniformly distributed
- The different substances are visible to the naked eye
or can be seen through a microscope

ex. smog, muddy water, concrete, a $2 coin etc.

Solutions

- Homogeneous mixture containing 2 or more substances

If you mix sugar and water you get a solution

- The 2 particles (sugar & water) are evenly distributed, giving the impression of only 1 (water)
- The sugar does not disappear, it dissolves in the water

How do you make a solution?

1) You need a ***soluble substance*** (a substance whose particles have the ability to separate until uniformly distributed in another substance)

The soluble substance is the ***Solute*** (the part of the mixture that gets dissolve)

2) You need a ***Solvent*** (the part of the mixture that dissolves the other substances)

Example: Sugar & Water

Sugar is ***soluble*** therefore it is the ***solute***

Water is the ***solvent***

A solution can have ***more than 1 solute***, but ***only 1 solvent***

Example: Air

87% Nitrogen - SOLVENT
21% Oxygen - **SOLUTE**
< 0.1% Carbon Dioxide - **SOLUTE**
1% Other Gases - **SOLUTE**

Dissolution

- When 2 or more substance mix to form a solution
- The solute (salt) dissolves in the solvent (water)

Aqueous solution

- Is a solution where water is the solvent

Separation Techniques for Mixtures

Why separate mixtures?

To get gasoline, it must be distilled from Petroleum (heterogeneous)

To get precious metals to make jewellery, it must be extracted from rock (heterogeneous)

To get aluminum for cans, it must be extracted from a rock called bauxite (heterogeneous)

Dirty water (heterogeneous) must be filtered to get fresh water (homogeneous)

4 Types of Separation Techniques

1) Sedimentation
2) Decantation
3) Filtration
4) Distillation

1) Sedimentation: Slow but Sure

- The mixture is allowed to sit

- Used for heterogeneous mixtures, like muddy water

- The heavier particles (sediment) deposit on the bottom of a beaker

ex.

- The pulp (sediment) in orange juice deposits at the bottom of the container

The vinegar (sediment) in salad dressing settles to the bottom of the container

- Sedimentation is the 1st step in water-treatment plants

2) Decantation: From one container to another

- Often used after sedimentation

- Used for a heterogeneous mixture, that has layers that can be separated into distinct substances.

- One of the layers is poured into another container

ex.

Muddy water that has already gone through sedimentation, can have the water poured into another container leaving behind the mud.

3) Filtration: Fast and effective

- Used for heterogeneous mixtures, in place of sedimentation and decantation (to long)

-Used when substances are suspended in the form of droplets, within a liquid

- The liquid is poured through a filter paper containing many holes

- The paper holds the bigger particles (residue)

- The smaller particles (filtrate) pass through

4) Distillation: Separating the Invisible

- Used to separate homogeneous mixtures (Solutions)

- It relies on boiling point (characteristic property)

Example: Separating a salt-water solution

1) The solution is heated to 100 ^{o}C (the boiling point of water)
2) The water vapour passes into a tube called the **condenser**
3) The vapour cools and returns to its liquid state in the **condenser**
4) The water (**distillate**) accumulates in the beaker
5) The salt stays behind in the original flask (**residue**)

Distillation can be done with a solution of 2 liquids

- The liquid with the lower boiling point will transform into vapour 1st

Example: A ethanol-water solution

1) Ethanol boils 1st, at 78.3 ^{o}C
2) Ethanol returns to liquid state in the condenser and becomes the **distillate**
3) The water stays in the original container and becomes the **residue**

Making Drinkable Water from Dirty Water

Step 1 - ***Sedimentation***

- Larger debris settles to the bottom of the container

Step 2 - ***Decantation***

- The water at the top is poured into another container

Step 3 - ***Filtration***

- Smaller debris is caught in the filter (Residue) and the still slightly dirty water passes through the filter (filtrate)

Step 4 - ***Distillation***

- The water from the slightly dirty water is boiled and collected in the condenser where it becomes liquid water (distillate) again. This is drinkable.

- The dirty residue is let behind