



Pure Substances, Mixtures, and
Solutions

- Pure substance: matter that has a fixed (constant) composition and unique properties. Contains only 1 type element or compound; homogeneous
- Mixture: Contains at least 2 ***PHYSICALLY*** combined compounds; can be homogeneous or heterogeneous

Homogeneous Substances

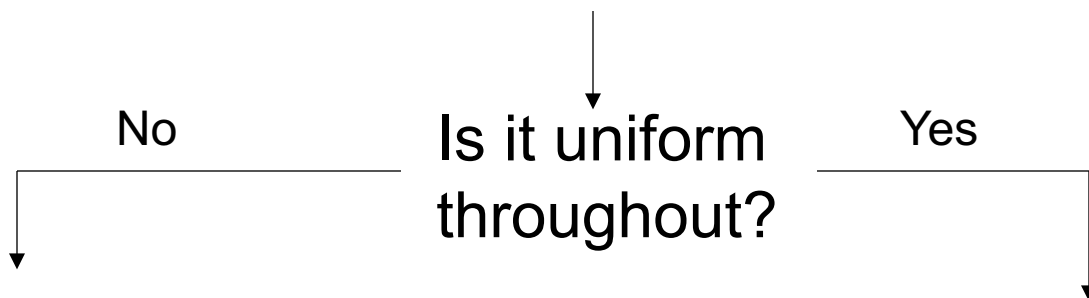
- Means same throughout
 - 1) element: only 1 type of atom
 - 2) compound: 2 or more **CHEMICALLY** combined elements (not easily separated from each other)
ex: water, CO₂
 - 3) Solution: a special kind of mixture 2 phases/parts (SOLUTE dissolves & SOLVENT does the dissolving)
ex: moist air (H₂O in Air); sterling silver (Cu in Ag...called an alloy)

Heterogeneous matter

- Means different throughout
- Always a MIXTURE (solutions are mixtures that are NOT heterogeneous)
 - 2 or more PHYSICALLY combined substances (elements/compounds)
 - ex: blood, air, muddy water

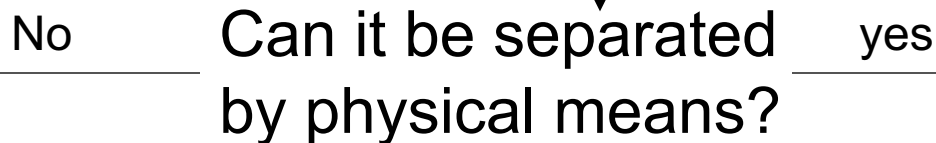
- Matter can also be classified according to its composition. Mixtures can be homogeneous or heterogeneous.
- Mixtures can be separated into pure substances, and pure substances can be either compounds or elements.

MATTER



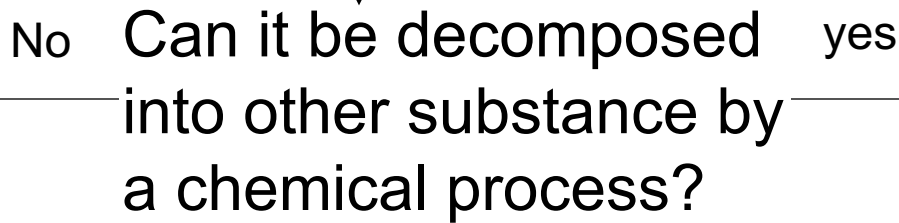
Heterogeneous mixture

Homogeneous



Pure Substance

Homogeneous Mixture (solution)



Element

Compound

3 classes of MIXTURES

	Solution	Colloid	Suspension
Examples	salt water, air	Soot, fog, mayonnaise	Muddy water, Italian dressing
Particle Type	ions, atoms	Small Clusters	Large Clusters
Particle Size	small	medium	large
Scatter Light? (TYNDALL EFFECT)	No	yes	yes
Settle while standing?	No	No	yes
Separate by filtration?	No	No	yes

[A colloid can be separated by filtration?]

 A. True

 B. False

Homogeneous mixtures

Homogeneous mixtures : is a mixture in which the components are evenly distributed among each other. You can't see the component parts.

Homo means the same throughout.

It has a constant composition throughout.

Homogeneous mixtures are also called **SOLUTIONS**

Examples: Salt dissolved in water, sugar dissolved in water, apple juice, tea, copper (II) sulfate solution in water, alloys....



C Copper(II) sulfate (CuSO_4) in water, a homogeneous mixture (solution)

Solutions

- Well-mixed (uniform) – single phase
- homogeneous
- transparent
- cannot be separated by filter
- do not separate on standing



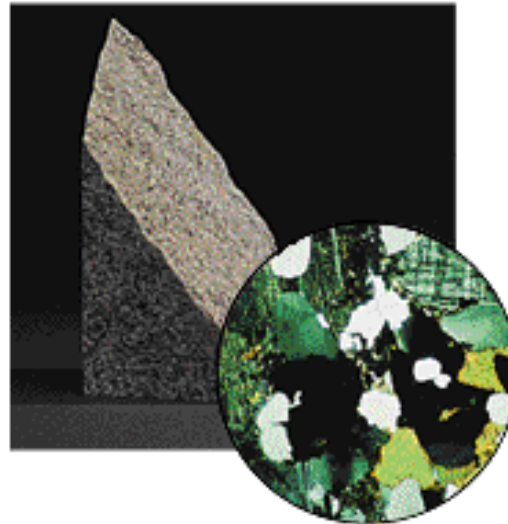
States of matter in solution	Example of solutions
gas in gas	air (N ₂ , O ₂ , Ar, CO ₂ , other gases)
gas in liquid	soda pop (CO ₂ in water)
liquid in liquid	gasoline (a mixture of hydrocarbon compounds)
solid in liquid	Filtrated sea water (NaCl and other salts in water)
gas in solid	H ₂ in platinum or palladium
liquid in solid	dental amalgams (mercury in silver)
solid in solid	alloys (brass, (Cu/Zn), solder (Sn/Pb), Steel (Fe/C))

heterogeneous mixtures

Heterogeneous mixture : the components are not evenly distributed among each other. An heterogeneous mixture has **two or more distinct phases** that are usually detectable. This type of mixture does NOT have uniform properties.

Heterogeneous mixtures that look like solutions can be distinguished because they scatter light (**Tyndall effect**).

Examples: Sand water, oil and water, milk, sulfur and iron, granite, blood...







A Granite, a heterogeneous mixture

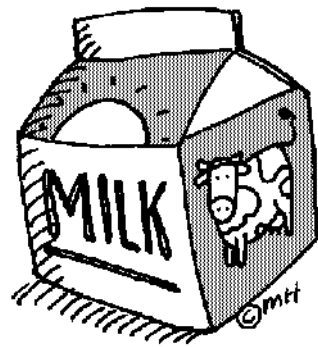


B Human blood, a heterogeneous mixture

[After passing through a muddy pond, the water in a stream contains dirt particles. Which of the following describes the stream?]

-  A. [solution]
-  B. [suspension]
-  C. [pure substance]
-  D. [colloid]

Colloids



non transparent, non uniform, large particles, cloudy (milky)

but stable system

Suspensions

- A suspension of liquid droplets or fine solid particles in a gas is called an aerosol. In the atmosphere these consist of fine dust and soot particles, and cloud droplets.
- suspension: system does not stay stable and settle
- Examples of Suspensions
 - Mud or muddy water, is where soil, clay, or silt particles are suspended in water.
 - Flour suspended in water, as pictured to the right.
 - Paint
 - Chalk powder suspended in water.
 - Dust particles suspended in air.
 - Algae in water
 - Milk of Magnesia







Tyndall effect:

You can see the light passes through a colloid or suspension.
(particles scatter light.)

emulsion: a mixture of immiscible substances
(liquid-liquid).

like milk and mayonnaise

[Which of the following will show the Tyndall Effect]





-  A. [water]
-  B. [sugar water]
-  C. [oxygen gas]
-  D. [fog]



Suspensions like coffee are easily filtered to take out the tiny solid clumps floating in the liquid.

In colloids and many homogeneous mixtures have clumps that are so small they pass through most filters.

[Which of the following is a colloid]

-  A. [milk]
-  B. [NaCl in water]
-  C. [sand and water]
-  D. [raisin bread]