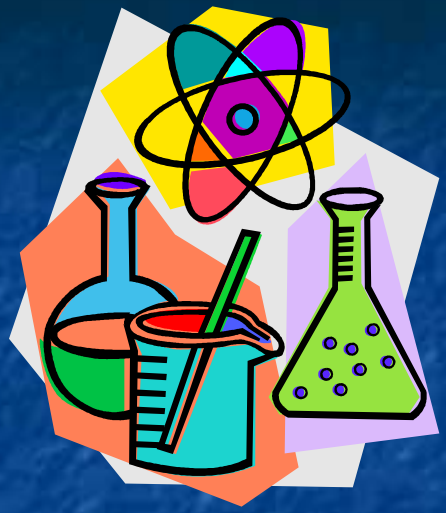


A Matter of Fact

Mixtures, Elements and Compounds

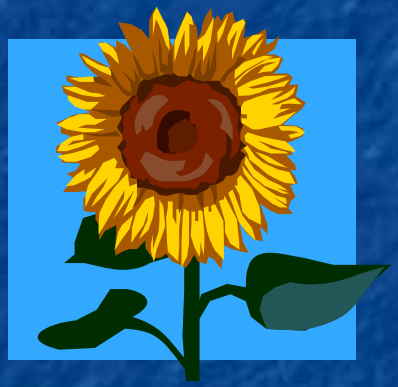
Mixtures, elements, compounds

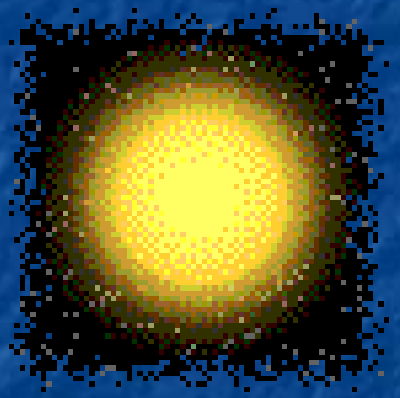
- Scientists like to classify things.
- One way that scientists classify matter is by its composition.
- Ultimately, all matter can be classified as mixtures, elements and compounds.

Why isn't it a good idea to classify matter by its phases?

- Because one kind of substance can exist in more than one phase – such as H_20. And matter changes phases rather easily.

Why isn't matter classified according to its physical characteristics, such as color?



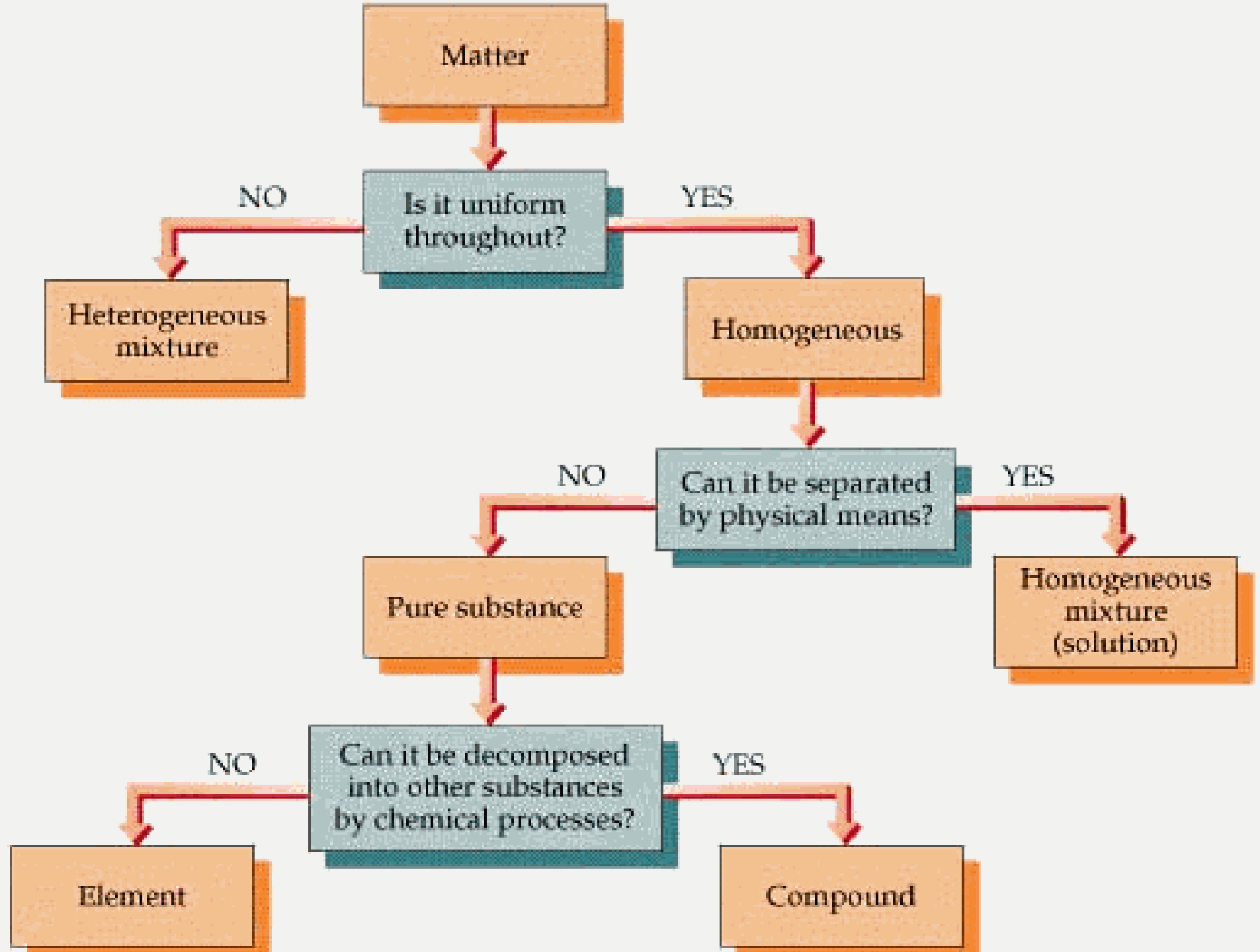


- Scientists wouldn't find it very useful to group gold, sunflowers, and the sun together.

- Scientists ask themselves these questions?
  - Is the matter uniform throughout?
  - Can it be separated by physical means?
  - Can it be separated by chemical means?

By asking these questions scientists can classify matter into:

- Mixtures – two or more substances that are not chemically combined with each other and can be separated by physical means. The substances in a mixture retain their individual properties.
  - Solutions – a special kind of mixture where one substance dissolves in another.
- Elements – simplest form of pure substance. They cannot be broken into anything else by physical or chemical means.
- Compounds – pure substances that are the unions of two or more elements. They can be broken into simpler substances by chemical means.


Matter
Is it uniform throughout?
NO
YES
Heterogeneous mixture
Homogeneous
Can it be separated by physical means?
NO
YES
Pure substance
Homogeneous mixture (solution)
Can it be decomposed into other substances by chemical processes?
NO
YES
Element
Compound

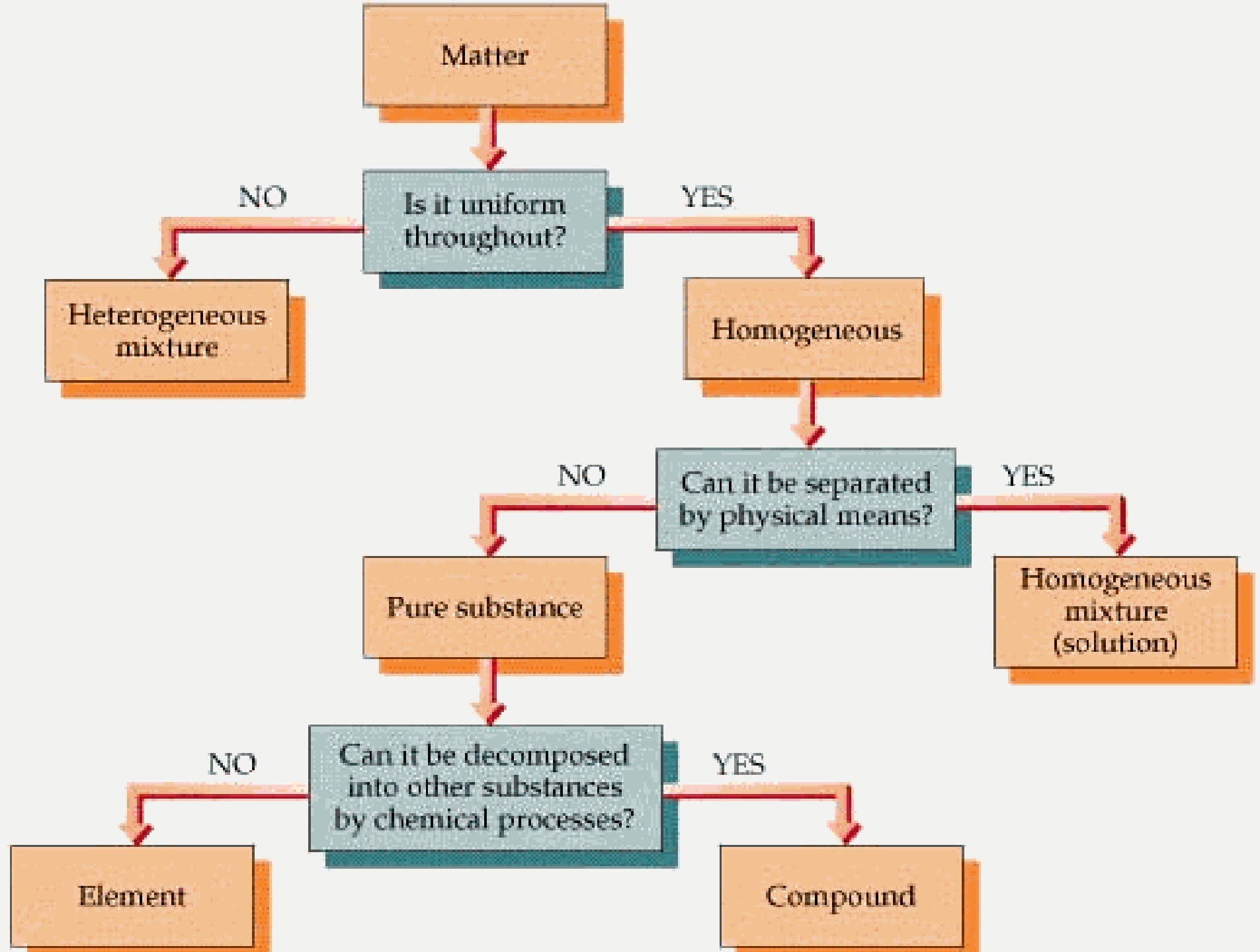
Is it uniform throughout?

- If the answer is no, the matter is a heterogeneous mixture.
  - Considered the "least mixed."
  - Does not appear to be the same throughout.
  - Particles are large enough to be seen and to be separated from the mixture.

Examples of heterogeneous mixtures

- Sand and pebbles
- Oil and water
- Powdered iron and powdered sulfur

Granite is a heterogeneous mixture.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Can it be decomposed into other substances by chemical processes?
NO
YES
Element
Compound

Is it uniform throughout?

- If the answer is yes, the matter is homogeneous (looks the same throughout).
- That leads us to another question.

Can it be separated by physical means?

- If the answer is yes, the matter is a homogeneous mixture or solution.

Homogeneous Mixtures

- A mixture that appears to be the same throughout.
- It is “well mixed.”
- The particles that make up the mixture are very small and not easily recognizable.

Examples of homogeneous mixtures

Milk, toothpaste, and mayonnaise are homogeneous mixtures. They are also colloids.

Colloids

- In a colloid the particles are mixed together but not dissolved.
- The particles are relatively large and are kept permanently suspended.

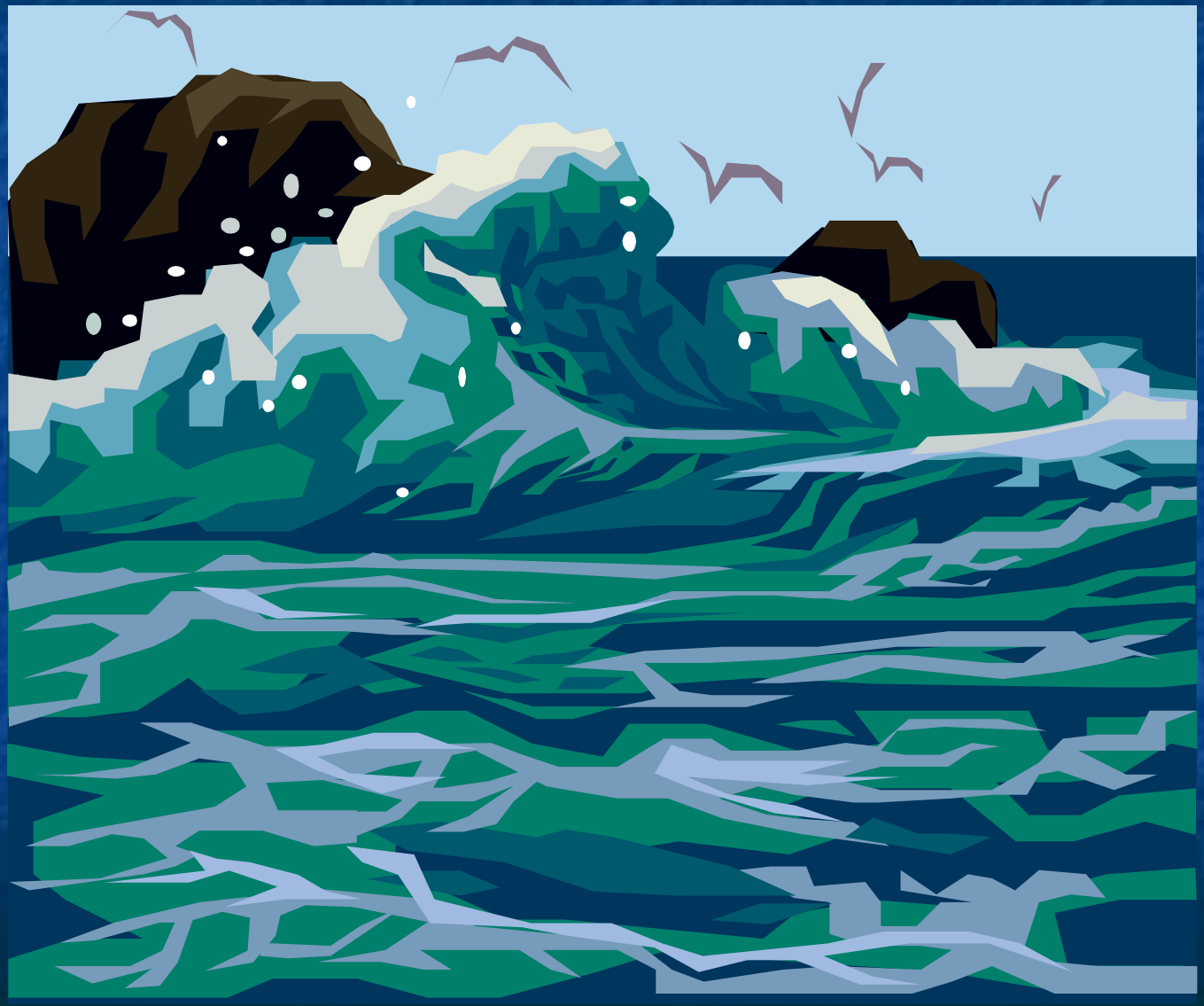
Colloids

- A colloid will not separate upon standing.
- The particles are constantly colliding, and this allows a colloid to scatter light – thus colloids often seem cloudy.

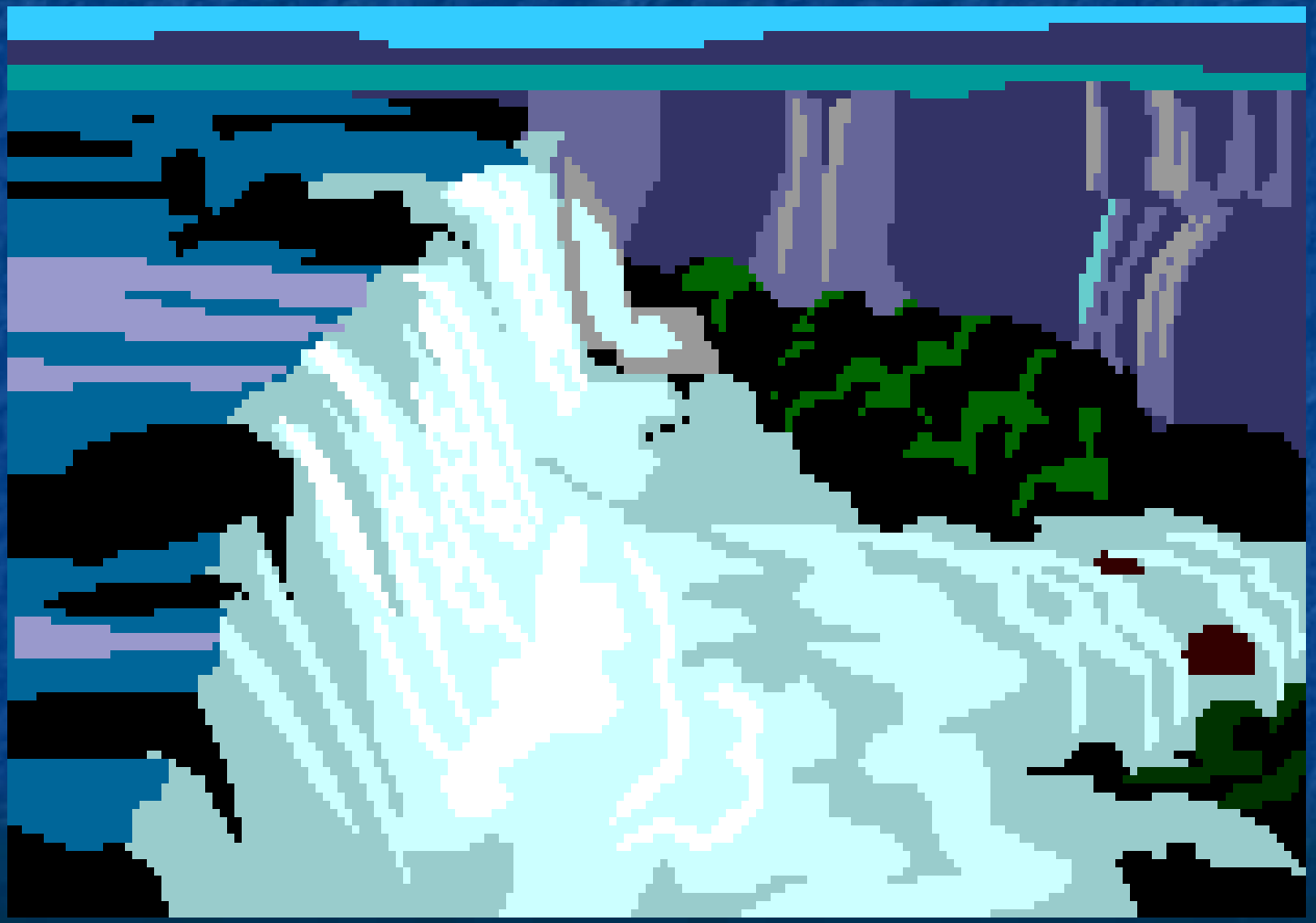
Solutions

- A solution is a type of homogeneous mixture formed when one substance dissolves in another.
- It is the best mixed of all mixtures.
- A solution always has a substance that is dissolved and a substance that does the dissolving.
- The substance that is dissolved is the solute and the substance that does the dissolving is the solvent.

Ocean water is a solution



The universal solvent: Water



Water as a solvent

- Many liquid solutions contain water as the solvent.
- Ocean water is basically a water solution that contains many salts.
- Body fluids are also water solutions.

Types of solutions

Solute	Solvent	Example
Gas	Gas	Air (oxygen in nitrogen)
Gas	Liquid	Soda water (carbon dioxide in water)
Solid	Liquid	Ocean water (salt in water)
Solid	Solid	Gold jewelry (copper in gold)

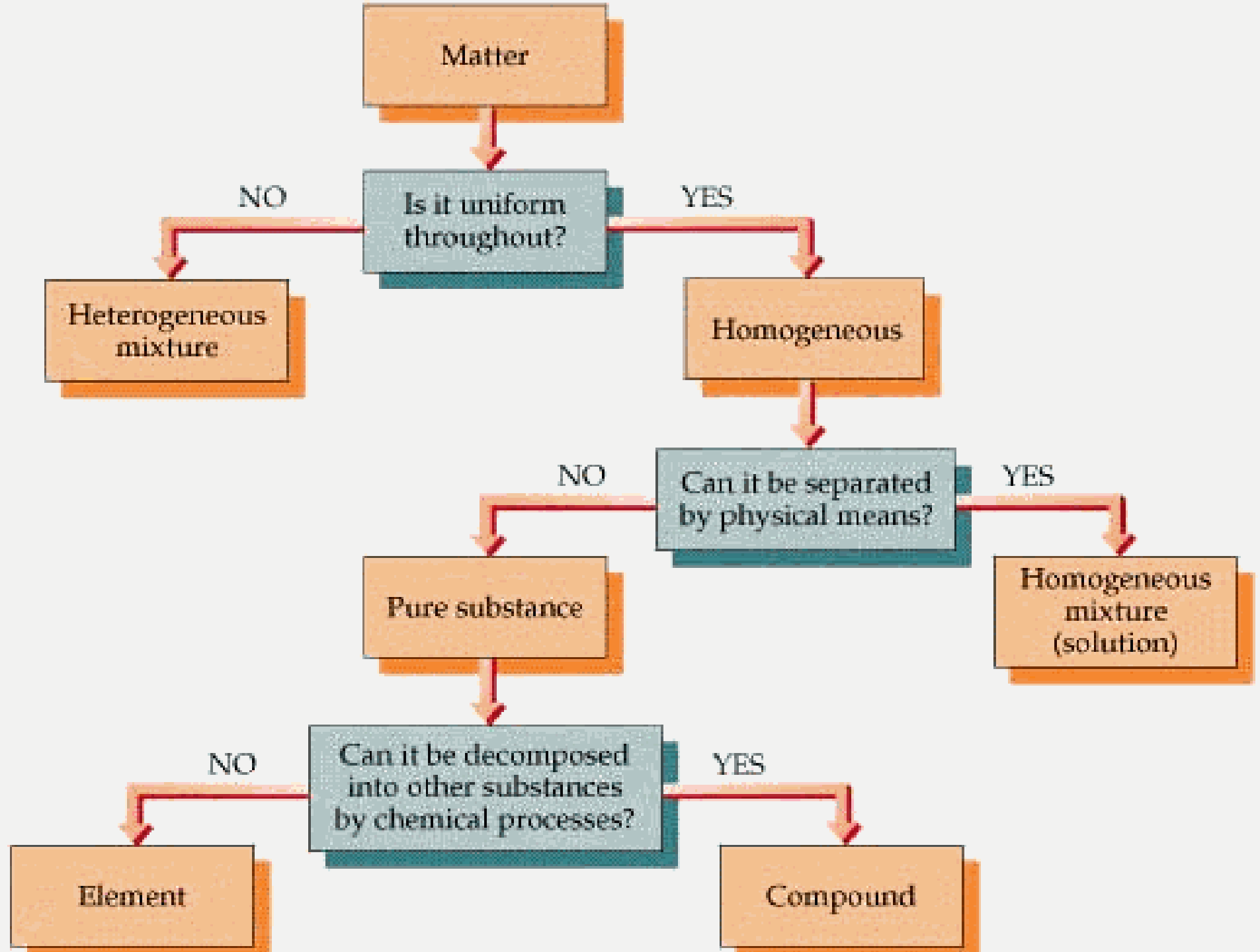
Metals dissolved in metals are called alloys.

Air is a solution of oxygen and other gases dissolved in nitrogen

Alloys

Stainless steel is a mixture of iron and chromium.

Brass is an alloy of copper and zinc.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Homogeneous mixture (solution)
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NO
YES
Element
Compound

Can it be separated by physical means?

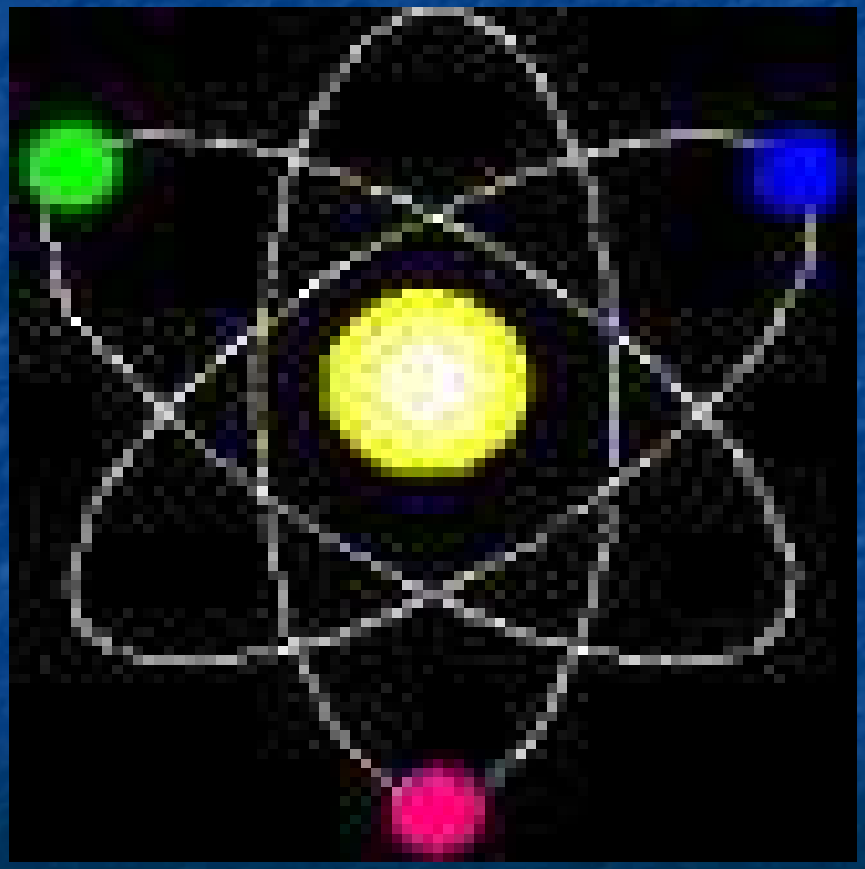
- If the answer is no, the matter is a pure substance.
  - An element
  - Or a compound

Elements

- Elements are the simplest pure substance.
  - An element can not be changed into a simpler substance by heating or any chemical process.
- The smallest particle of an element that has the properties of that element is called an atom.
  - An atom is the basic building block of matter.
- There are more than one hundred known elements in the universe listed on the periodic table of elements.
  - These elements combine in such a way to create millions of compounds.

Elements

- All elements are made of atoms.
- Atoms of the same element are alike.
- Atoms of different elements are different.



Elements

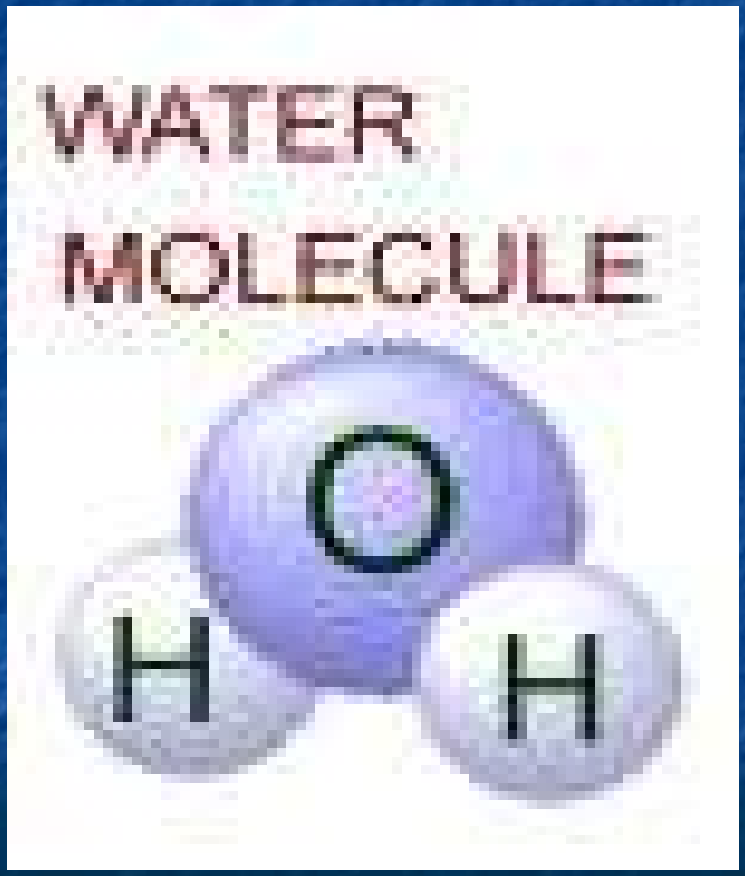
- In 1813, a system of representing elements with symbols was introduced.
  - Each symbol consists of one or two letters.
  - Two letters are needed for a chemical symbol when the first letter of that element's name has already been used.

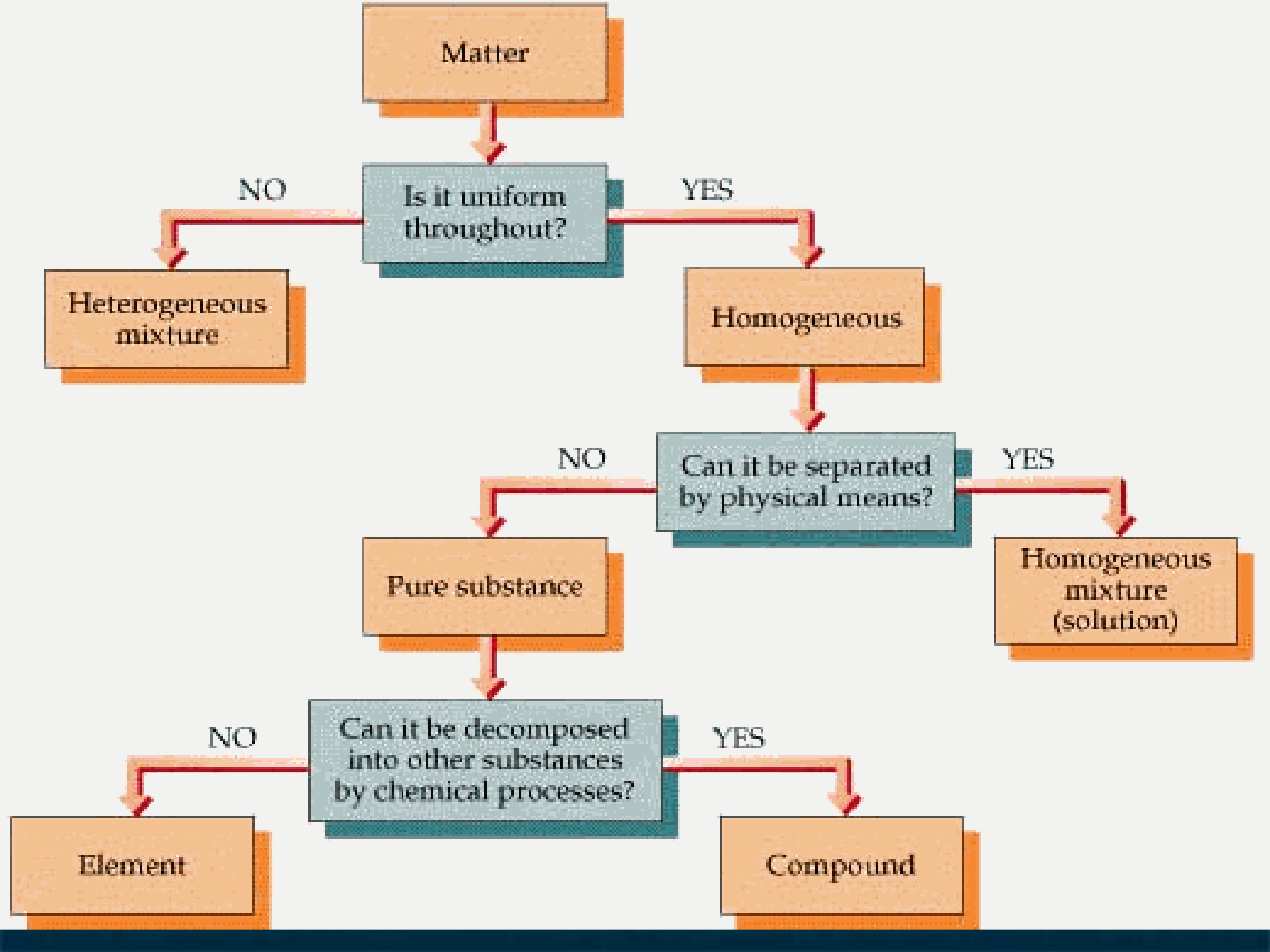
Common Elements

Aluminum	Al
Bromine	Br
Calcium	Ca
Carbon	C
Gold	Au
Helium	He
Hydrogen	H
Nitrogen	N

Compounds

- Compounds are also pure substances.
- But compounds are made from more than one element.
- Water is a compound.
- Water can be broken down into simpler substances – hydrogen and oxygen.

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