

## Classifying Matter by Composition

- Another way to classify matter is to examine its **composition**.
- composition includes:
  - > types of particles
  - > arrangement of the particles
  - > attractions and attachments between the particles

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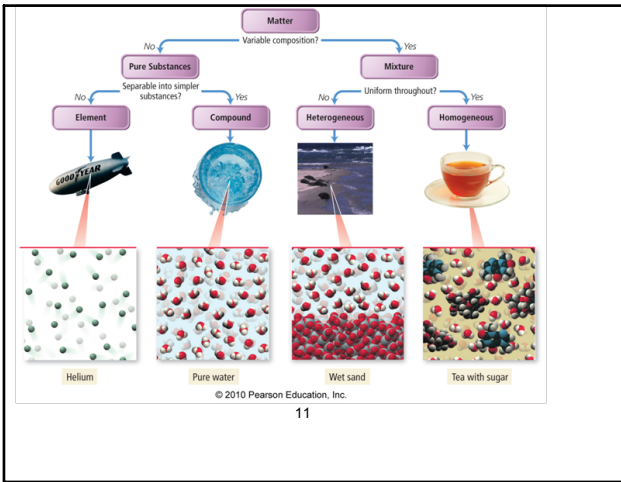
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## Classification of Matter by Composition

- Matter whose composition does not change from one sample to another is called a **pure substance**.
  - > made of a single type of atom or molecule
  - > Because the composition of a pure substance is always the same, **all samples have the same characteristics**.
- Matter whose composition may vary from one sample to another is called a **mixture**.
  - > two or more types of atoms or molecules combined in variable proportions
  - > Because composition **varies**, different samples have different characteristics.

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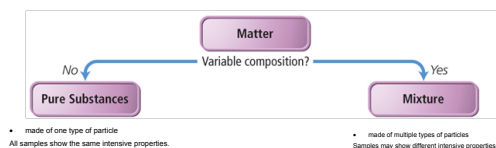
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## Classification of Matter by Composition



• made of one type of particle  
All samples show the same intensive properties.

• made of multiple types of particles  
Samples may show different intensive properties.

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## Classification of Pure Substances? Elements

- Pure substances that cannot be decomposed into simpler substances by chemical reactions are called **elements**.
  - > decomposed = broken down
  - > basic building blocks of matter
  - > composed of single type of atom
    - though those atoms may or may not be combined into molecules

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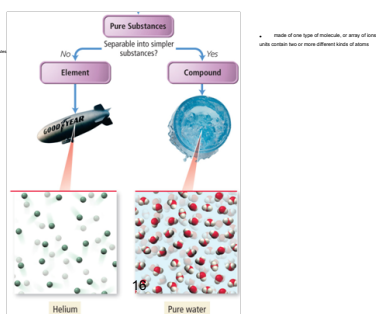
## Classification of Pure Substances? Compounds

- Substances that can be decomposed are called **compounds**.
  - > chemical combinations of elements
  - > composed of molecules that contain two or more different kinds of atoms
  - > All molecules of a compound are identical, so all samples of a compound behave the same way.
- Most natural pure substances are compounds.

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# Classification of Pure Substances



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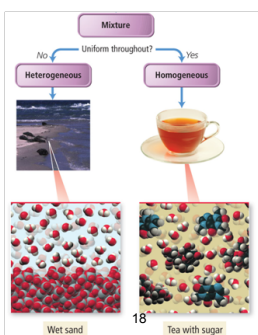
# Classification of Mixtures

- **homogeneous** = mixture that has uniform composition throughout
  - > Every piece of a sample has identical characteristics, though another sample with the same components may have different characteristics.
  - > atoms or molecules mixed uniformly
- **heterogeneous** = mixture that does not have uniform composition throughout
  - > contains regions within the sample with different characteristics
  - > atoms or molecules not mixed uniformly

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# Classification of Mixtures



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## Changes in Matter

- Changes that alter the state or appearance of the matter without altering the composition are called **physical changes**.
- Changes that alter the composition of the matter are called **chemical changes**.
  - > During the chemical change, the atoms that are present rearrange into new molecules, but all of the original atoms are still present.

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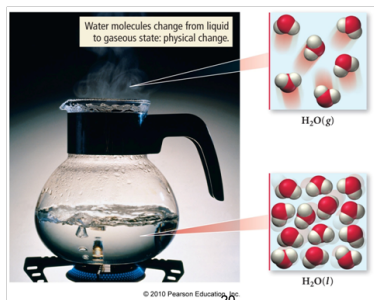
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## Physical Changes in Matter



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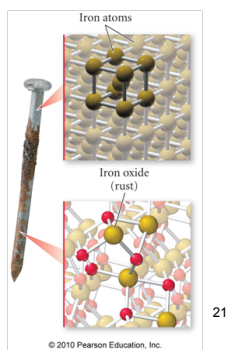
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## Chemical Changes in Matter



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# Properties of Matter

- **Physical properties** are the characteristics of matter that can be changed without changing its composition.
  - > characteristics that are directly observable
- **Chemical properties** are the characteristics that determine how the composition of matter changes as a result of contact with other matter or the influence of energy.
  - > characteristics that describe the behavior of matter

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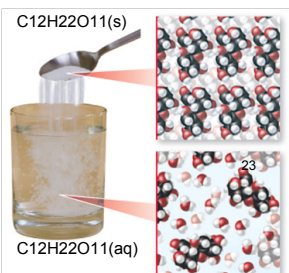
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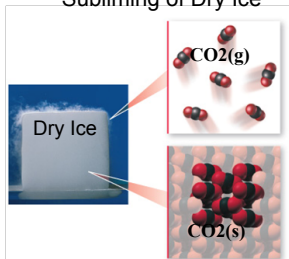
# Common Physical Changes

- processes that cause changes in the matter that do not change its composition
- state changes
  - > boiling/condensing
  - > melting/freezing
  - > subliming

### Dissolving of Sugar



### Subliming of Dry Ice



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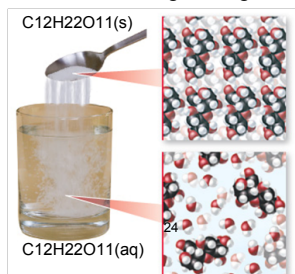
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# Common Physical Changes

### Dissolving of Sugar



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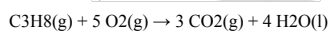
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## Common Chemical Changes

- processes that cause changes in the matter that change its composition
- rusting
- processes that release lots of energy
- burning



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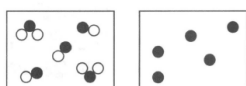
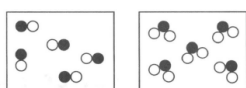
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## Particle Diagrams

Key	
○	= atom of one element
●	= atom of a different element



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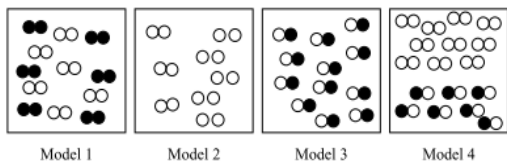
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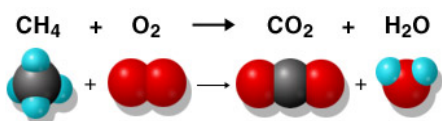
## Separation of Matter

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## Substances

-Elements cannot be separated. They ARE THE SIMPLEST FORM OF MATTER.

-Compounds must be separated by chemical reactions.



Reactants		Products
1 C atom	=	1 C atom
4 H atoms	≠	2 H atoms
2 O atoms	≠	3 O atoms

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## Separating Mixtures

-Mixtures are separated by PHYSICAL MEANS. This means each component of the mixture retains their chemical composition once removed from the mixture.



This is a mixture of iron filings and solid sulfur. The iron can be separated by a magnet.

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There are multiple techniques for physical separation

1. Filtration
2. Distillation
3. Decanting
4. Centrifuge
5. Chromatography
6. Sorting

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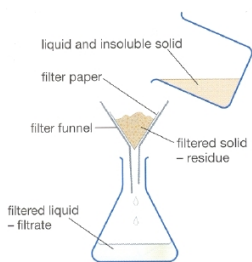
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### Filtration



-Liquid/solid mixture

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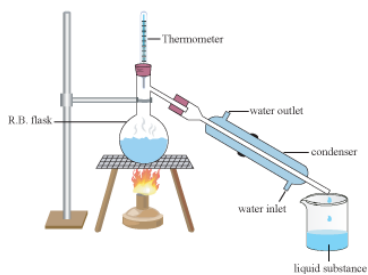
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### Distillation



Liquid/  
Liquid  
Mixture  
  
-Lower boiling point vaporizes first.

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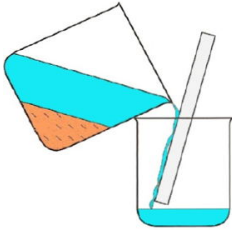
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### Decanting



-Solid/Liquid Mixture. Usually larger solid particle size.

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### Centrifuge



- Rapid spinning that separates mixture.  
-Used to separate red blood cells and plasma.

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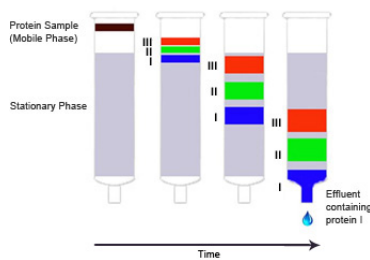
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### Chromatography

- Separates mixture based on particle size.



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Sorting



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