

The Classification of Matter

- ❑ **Matter** is anything that occupies space and has mass.
 - Your textbook, your desk, your chair, and even your body are all composed of matter.
- ❑ A specific instance of matter is called a **substance**.
- ❑ We can classify matter according to its **state** (its physical form) and its **composition** (the basic components that make it up).





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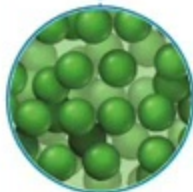
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The States of Matter

- Matter can be classified as **solid**, **liquid**, or **gas** based on what properties it exhibits.
- The state of matter changes from solid to liquid to gas with increasing temperature.



Solid matter



Liquid matter



Gaseous matter

- ❑ Solids may be **crystalline**—the atoms or molecules are in patterns with long-range, repeating order.
 - ❑ Examples: table salt, diamond
 - ❑ Analogy: students seated in rows
- ❑ Other solids are **amorphous**—the atoms or molecules have no long-range order.
 - ❑ Examples: glass, plastic
 - ❑ Analogy: kindergartners seated on the floor for story time

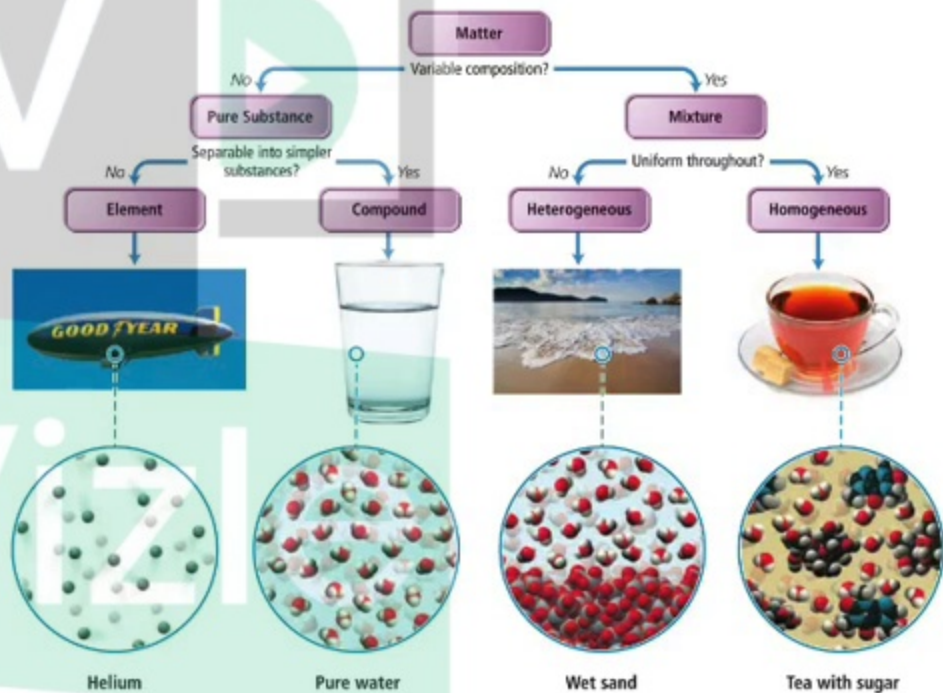
Crystalline Solid:
Atoms are arranged in a regular three-dimensional pattern



Diamond
C (s, diamond)

Classifying Matter according to its Composition (1 of 2)

Matter can also be classified according to its composition: elements, compounds, and mixtures.



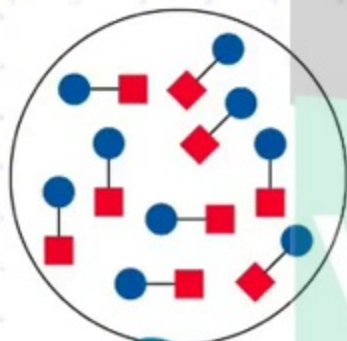
Classification of Pure Substances (2 of 2)

- An **element** is a substance that cannot be chemically broken down into simpler substances.
 - Basic building blocks of matter
 - Composed of a single type of atom, like helium
- A **compound** is a substance composed of two or more elements in fixed definite proportions.
- Most elements are chemically reactive and combine with other elements to form compounds like water, sugar, etc.

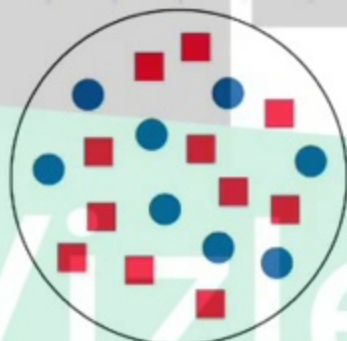
Conceptual Connection 1.2

Pure Substances & Mixtures

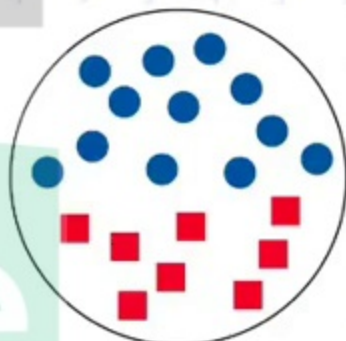
In these images, a blue circle represents an atom of one type of element, and a red square represents an atom of a second type of element. Which image is a pure substance?



(a)



(b)



(c)

Separating Mixtures (1 of 3)

- Mixtures are separable because the different components have different physical or chemical properties.
- Various techniques that exploit these differences are used to achieve separation.
- A mixture of sand and water can be separated by **decanting**—carefully pouring off the water into another container.



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