



# THE NATURE OF MATTER

**SNC1W**



# WHAT IS CHEMISTRY?

# WHAT IS CHEMISTRY?

- **Chemistry** is the study of matter and changes in matter.
- A chemist studies how and why different substances combine to form other substances.
  - They also study how substances interact with each other.



# WHAT IS CHEMISTRY?



## **Chemistry in daily life:**

- Cooks use chemistry to bake food.
- Medicine is made with the help of chemistry.
- Chemistry is used in photography and solving crimes.

# WHAT IS CHEMISTRY?

- Chemistry is sometimes called the **central science**.
- It is required to fully understand the other two science strands:

Physics



Chemistry



Biology





Choose a career that relies on chemistry for daily work. Describe the career and how chemistry is used in this profession.

Profession:

Career description and chemistry involved:





# WHAT IS MATTER?

# WHAT IS MATTER?

- All things on Earth are made up of matter.
- Matter can be solid, liquid, or gas.
- **Matter** is anything that has mass and volume (takes up space).



# WHAT IS MATTER?

- All matter is made of tiny particles called **atoms**.
- Atoms are so small that you need to use a microscope to see them.

What do you know about atoms?





Think about the positioning of the particles in solids, liquids, and gases. How are they similar? How are they different?

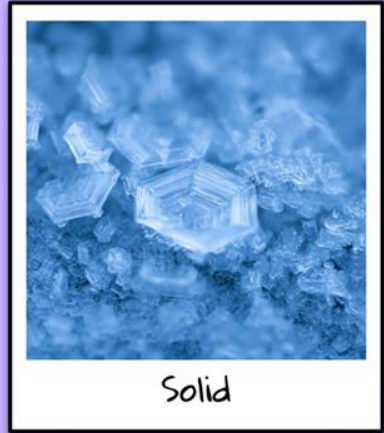
A large, empty rounded rectangular box with a black border, intended for a student's response to the question.



Gas



Liquid



Solid



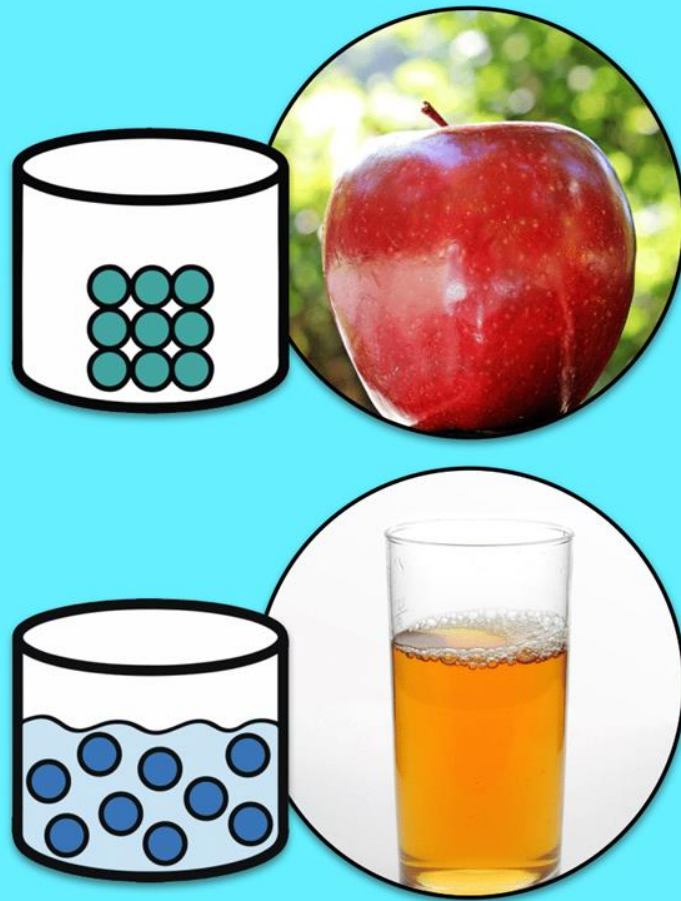
Different states of matter fill volumes (an amount of space) in different ways.

What does this mean?



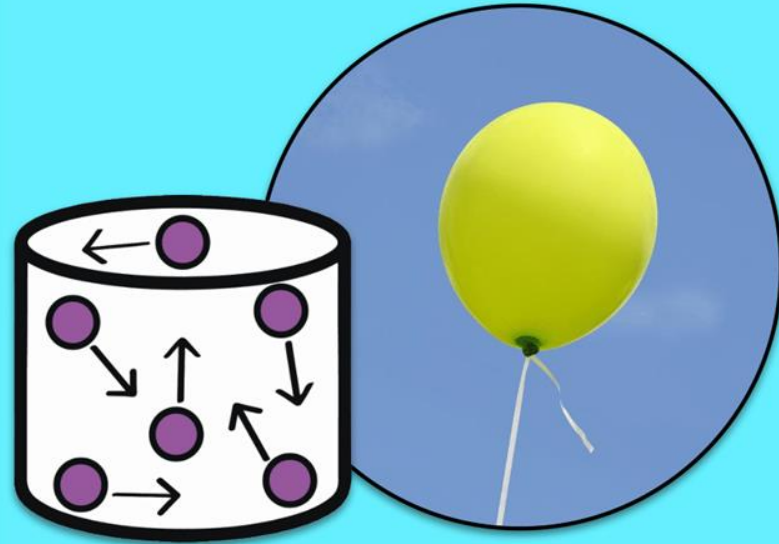
# SOLIDS AND LIQUIDS

- When matter is **solid**, the atoms are packed together in the same shape.
- When matter is **liquid**, the atoms are close together, but they can flow.



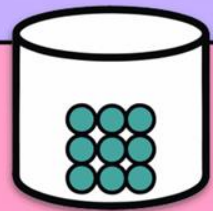
# GASES

- **Gases** have particles that are more spread apart than both solids and liquids.
  - These particles move freely at high speeds.



Air is a gas. What other examples of gases do you know of?

# WHAT IS A SOLID?

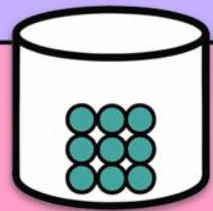


- A **solid** holds its shape unless a force is applied to it.
- Solids do not flow or take the shape of their container.

Is sand a solid?  
Explain.



# WHAT IS A SOLID?



- Solids can range in shape, size, and texture (how they feel).

## Examples:

- Fur on a dog's coat
- A tree stump
- An icicle





What different properties can be used to describe and compare solids? Create a list.

A large, empty, light blue rounded rectangle intended for students to write their list of properties.



# WHAT IS A LIQUID?



- A **liquid** is a form of matter that has no defined shape.
- Liquids can take the shape of the container that they are stored in.

What happens to the particles in water as the temperature rises or declines?



# WHAT IS A LIQUID?



## Examples:

- Liquids are found in nature in rain, lakes, oceans, and rivers.
- Drinks, like orange juice and hot chocolate, are also liquids.

What properties do liquids have that solids and gases do not?

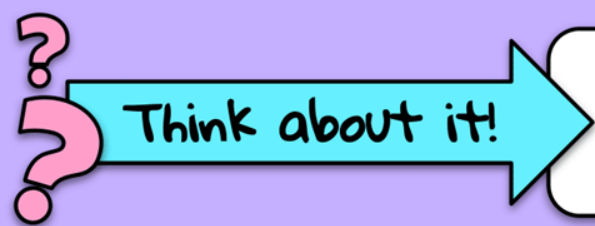


# WHAT IS A GAS?



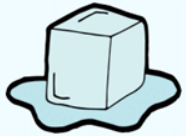
- A **gas** expands to fit the volume of the container it is placed in.
  - This occurs whether it is a small container or a large room.
- Gases are often invisible.
  - Air is an example of an invisible gas.





Describe the characteristics of each state of matter that make them unique.

## Solids



## Liquids



## Gas



# UNDERSTANDING MATTER

- All matter must have mass.
- **Mass** is a measure of the amount of matter in an object.
  - The size (volume) of an object does not necessarily mean it has a lot of mass.



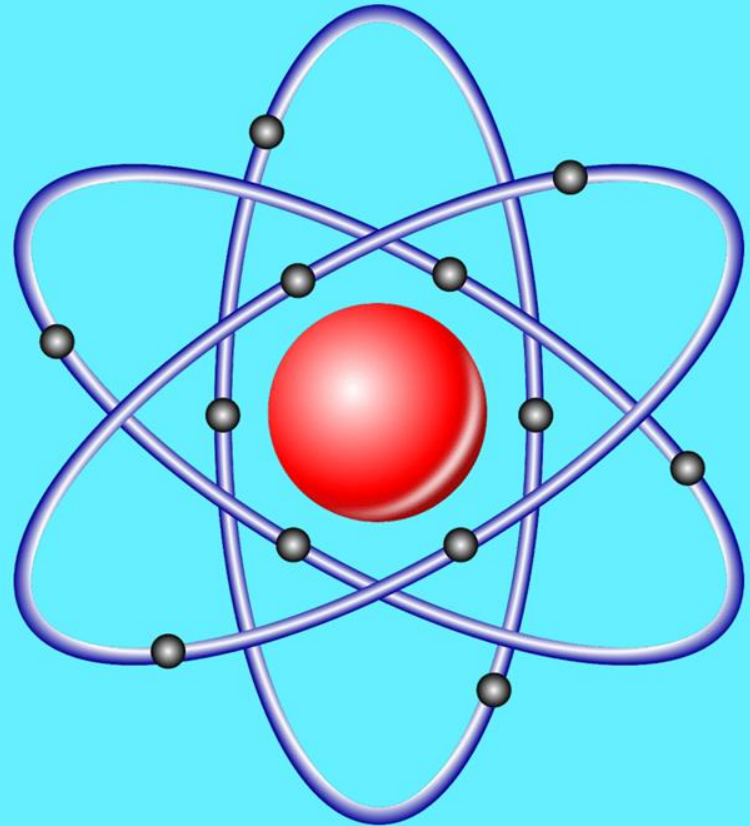
# UNDERSTANDING MATTER



- **Volume** is the amount of space something occupies.
- Solids, liquids, and gases fill volumes in different ways.
- **Examples:**
  - The CN Tower occupies a lot of volume.
  - Coins occupy a small amount of volume.

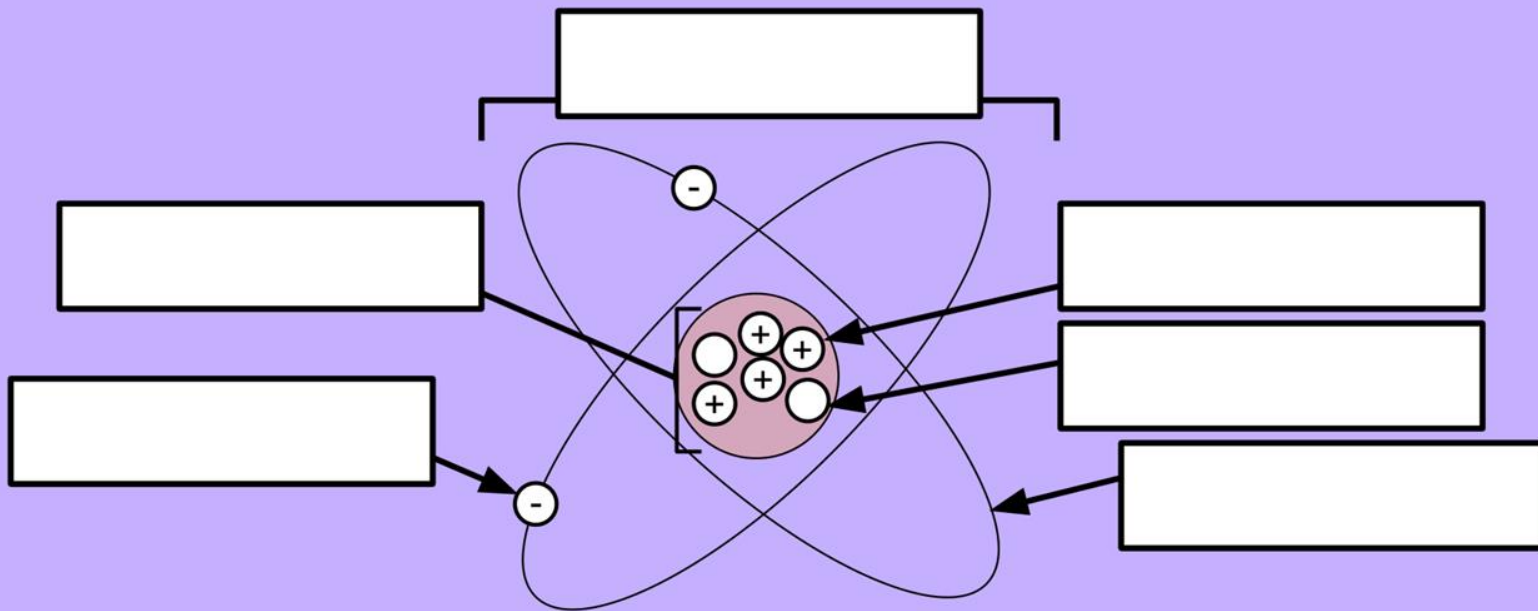
# UNDERSTANDING MATTER

- All matter is made up of tiny particles called atoms.
- **Atoms** are the basic unit of a chemical element.
  - They consist of protons, neutrons, and electrons.





Use the Word Bank to label the atom below.



Word Bank		
Proton	Orbit	Electron
Nucleus	Neutron	Atom



Is it true or false? Click and drag the T/F boxes.

Solid particles have more energy than liquid particles.	
The particles move freely in both solids and liquids.	
A gas expands to fit the volume of the container it is in.	
Temperature affects the movement of particles.	
Solid particles are still in motion despite being close together.	
Gases have mass.	
All matter is made of tiny particles called neutrons.	
The particles in liquids have an ordered arrangement.	
Precipitation can be in solid, liquid, or gas form.	
It is possible to change between different states of matter.	

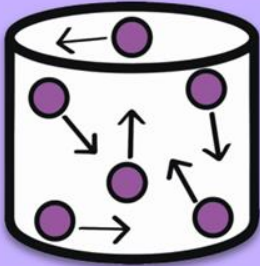
T

F

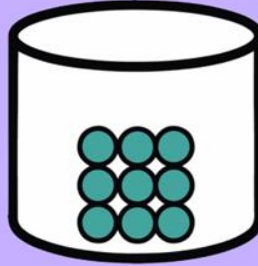


For each image, write whether the particles would look like A, B, or C. Explain.

**A**



**B**



**C**



**Ice cubes**

Blank area for writing the answer for Ice cubes.



**Flowing water**

Blank area for writing the answer for Flowing water.



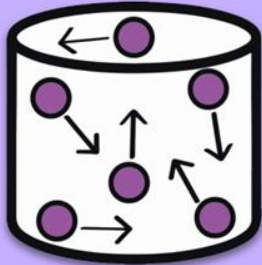
**Water vapour**

Blank area for writing the answer for Water vapour.

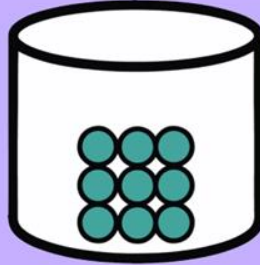


For each image, write whether the particles would look like A, B, or C. Explain.

**A**



**B**



**C**



**Helium balloon**

Blank light blue box for writing the answer for Helium balloon.



**Jello**

Blank light blue box for writing the answer for Jello.



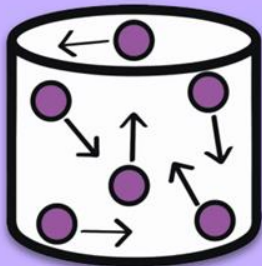
**Sand**

Blank light blue box for writing the answer for Sand.

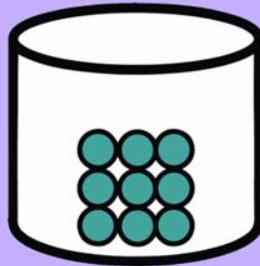


For each image, write whether the particles would look like A, B, or C. Explain.

**A**



**B**



**C**



**Clouds**

Blank light blue rectangular area for writing an answer for Clouds.



**Carbon emissions**

Blank light blue rectangular area for writing an answer for Carbon emissions.



**Honey**

Blank light blue rectangular area for writing an answer for Honey.



Drag and drop **solid**, **liquid**, or **gas** next to the correct description.

A \_\_\_\_\_ has particles that are widely spaced.

A \_\_\_\_\_ has particles that are closely packed.

Ice is water in \_\_\_\_\_ form.

Water vapour is water in \_\_\_\_\_ form.

A \_\_\_\_\_ can flow slowly or quickly.

Water will turn \_\_\_\_\_ when it is below 0 °C.

A \_\_\_\_\_ takes the shape of its container.

When ice melts, it becomes \_\_\_\_\_.

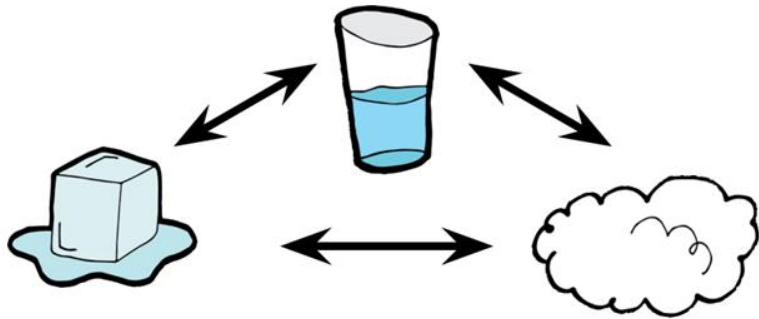
**solid**  
**liquid**  
**gas**

A photograph of several large, jagged icebergs floating in a blue ocean under a clear blue sky. The icebergs are white and blue, with some showing signs of melting. A large, semi-transparent white circle is overlaid on the center of the image, containing the text.

# CHANGING STATES

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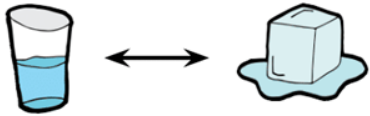
- All matter can change from one state to another.



- Sometimes, extreme temperature changes are required to make a substance change its state.

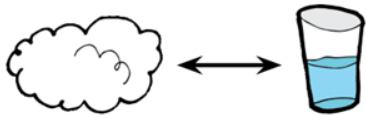


# CHANGING STATES



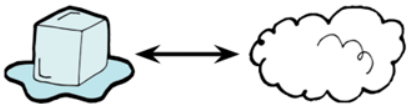
**Melting** - When a solid becomes a liquid

**Freezing** - When a liquid becomes a solid



**Evaporation** - When a liquid becomes a gas

**Condensation** - When a gas becomes a liquid



**Sublimation** - When a solid becomes a gas

**Deposition** - When a gas becomes a solid

# PURE SUBSTANCES & MIXTURES

- Matter can be either a **pure substance** or a **mixture**.
- Pure substances can be **elements** (like in the Periodic Table of Elements) or compounds.



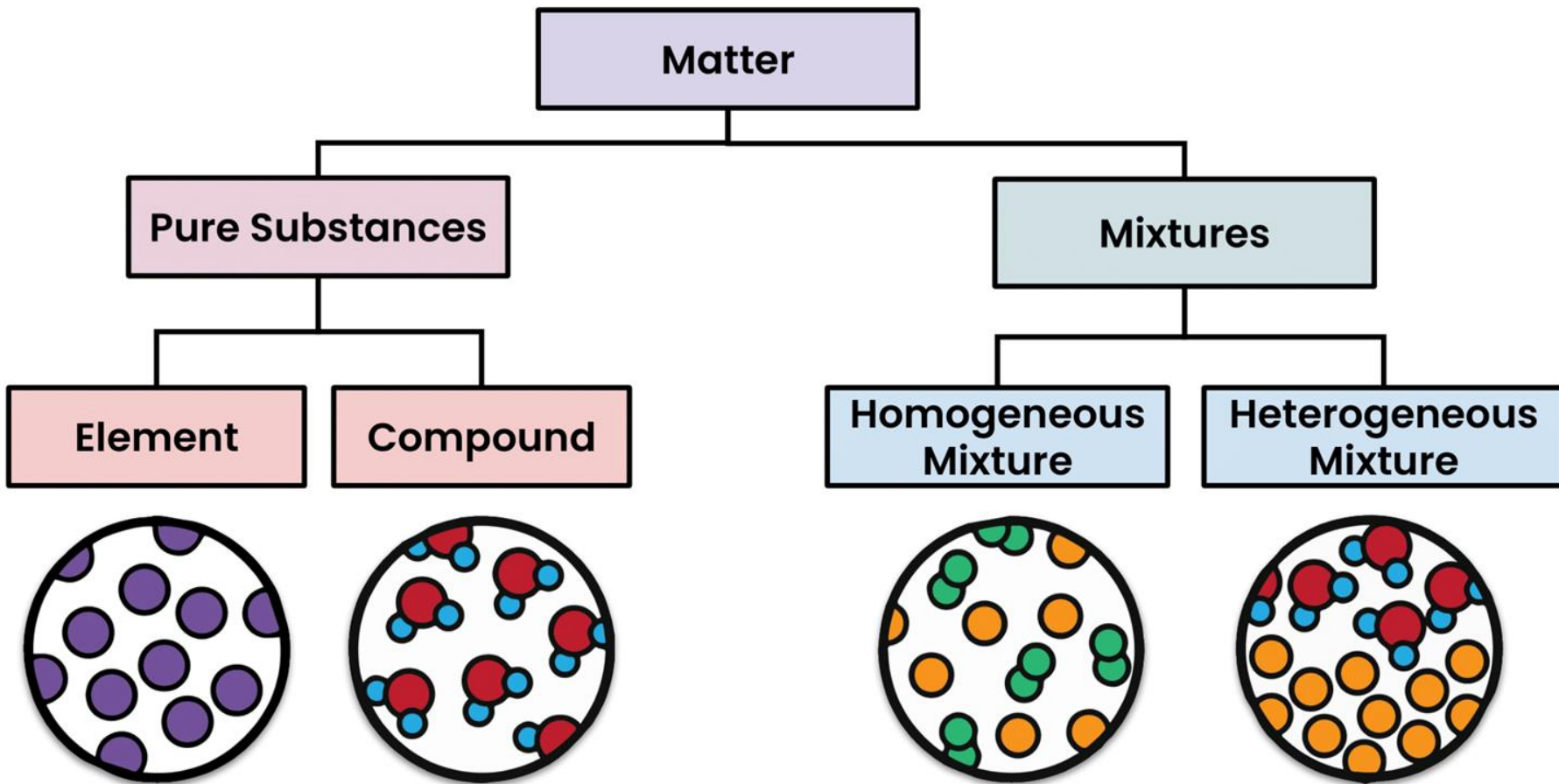
# PURE SUBSTANCES & MIXTURES

- **Mixtures** are substances that are physically combined but can be separated into their original components.

Can you think of an example of a substance that is a mixture?



# PURE SUBSTANCES & MIXTURES



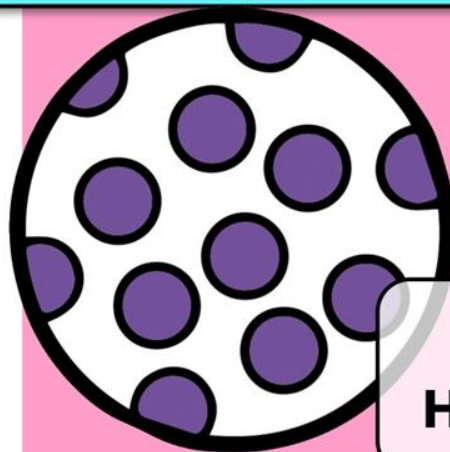


# PURE SUBSTANCES

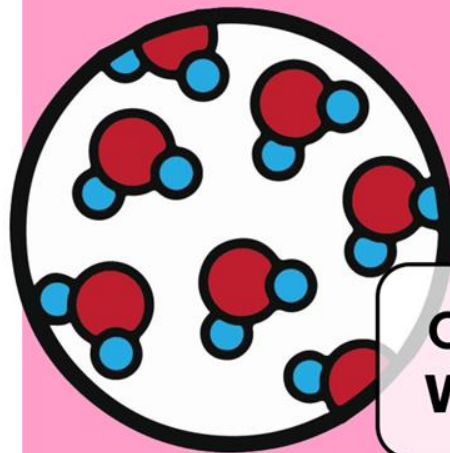
Helium in a balloon is  
99.99% pure.

# PURE SUBSTANCES

- A **pure substance** contains one type of particle throughout.
- A pure substance can be either an element (as found on the Periodic Table) or a compound.



Element:  
**Helium (He)**

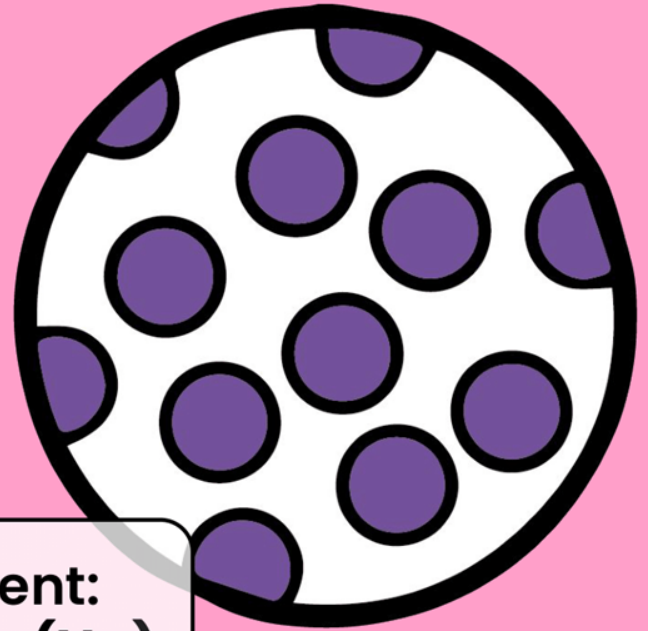


Compound:  
**Water (H<sub>2</sub>O)**



# PURE SUBSTANCES

- An **element** has a single kind of atom.
- **Examples:**
  - Gold (Au)
  - Sodium (Na)
  - Carbon (C)
  - Helium (He)

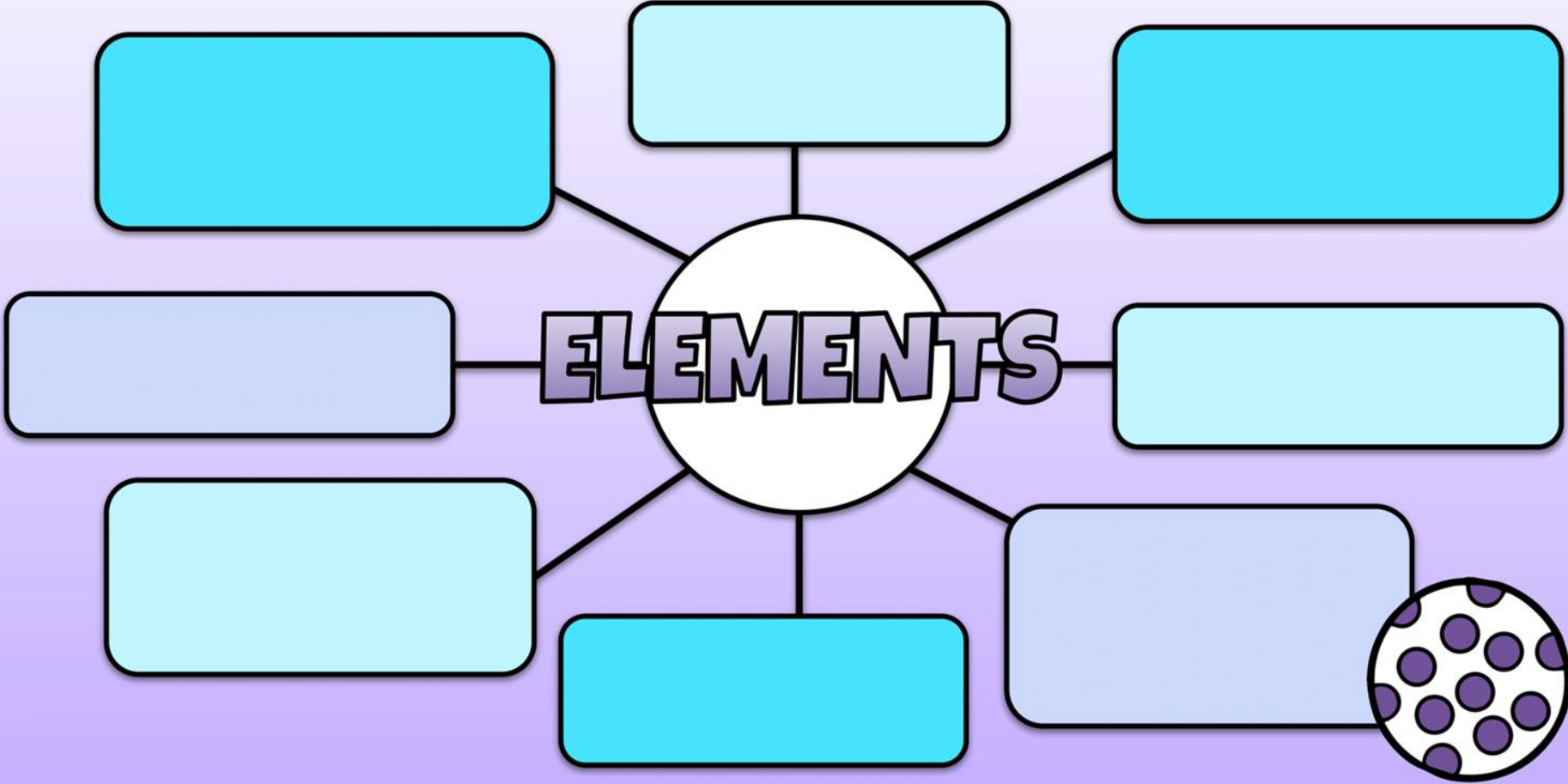


Element:  
**Sodium (Na)**



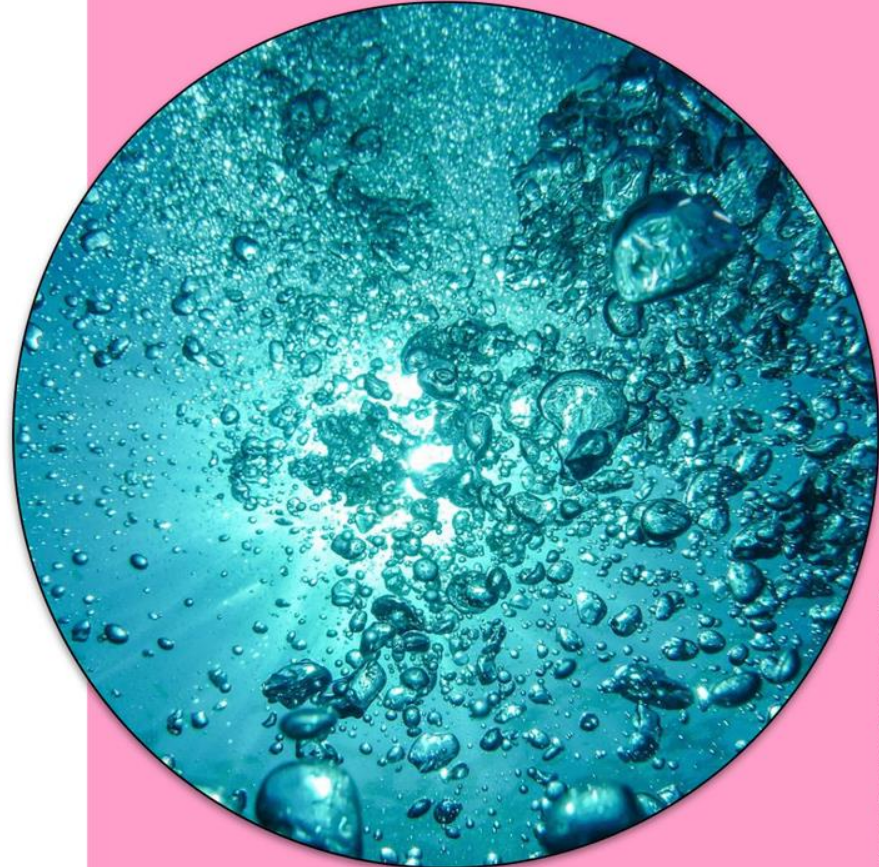


Brainstorm other elements that are included on the periodic table. Try your best to fill out the diagram.



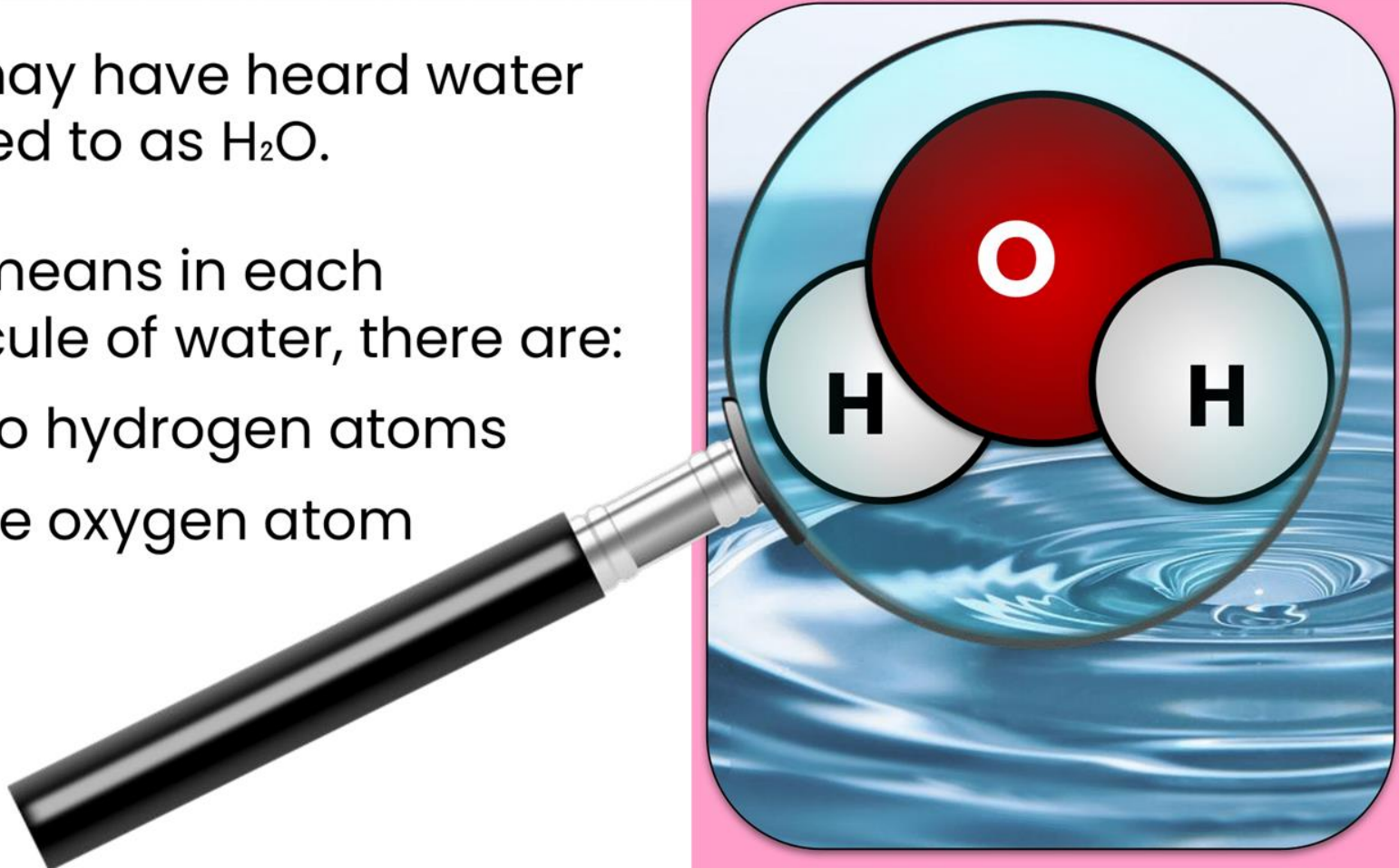
# PURE SUBSTANCES

- A **compound** is made up of two or more elements.
- **Example:** Water
  - Water is made up of the elements hydrogen (H) and oxygen (O).



# PURE SUBSTANCES

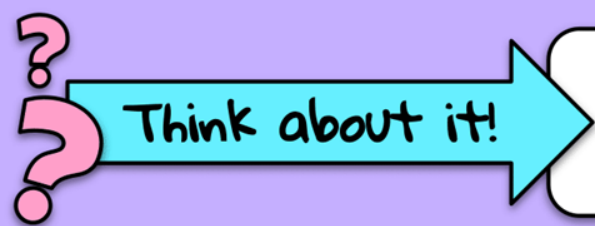
- You may have heard water referred to as  $H_2O$ .
- That means in each molecule of water, there are:
  - Two hydrogen atoms
  - One oxygen atom





Look at the compounds and their chemical symbols.  
Write what elements they are made from and how many of each atom they have.

Compound	Elements	How many of each atom?
Acetone C <sub>3</sub> H <sub>6</sub> O		
Ethanol C <sub>2</sub> H <sub>5</sub> OH		
Hydrogen chloride HCl		
Sulphur dioxide SO <sub>2</sub>		



Look at the compounds and their chemical symbols.  
Write what elements they are made from and how many of each atom they have.

Compound	Elements	How many of each atom?
Methane CH <sub>4</sub>		
Ammonia NH <sub>3</sub>		
Sulphuric Acid H <sub>2</sub> SO <sub>4</sub>		
Glucose C <sub>6</sub> H <sub>12</sub> O <sub>6</sub>		

A close-up photograph of a bowl of soup. The soup is a rich, orange-red color, likely tomato-based, and contains visible chunks of vegetables and herbs. The bowl is made of a light-colored material, possibly ceramic or metal. To the left of the bowl, there are several slices of rustic, whole-grain bread. A silver spoon is placed to the right of the bowl. The entire scene is set on a green and white checkered tablecloth. A semi-transparent circular overlay is centered over the bowl, containing the word "MIXTURES" in a bold, white, sans-serif font with a black outline.

# MIXTURES

# MIXTURES

- A **mixture** is a type of substance that contains more than one kind of particle.
- Mixtures contain two or more pure substances mixed together.



**Mixture: Coffee**  
(Water, Coffee beans)

# MIXTURES

- When a small amount of salt is stirred into water, the water is no longer a pure substance.
  - This is because there are two pure substances mixed together.

What are other examples of mixtures?



# MIXTURES



- Mixtures can be solids, liquids, or gas.
  - **Example solid:** Steel is a solid metal that is made from different elements.
  - **Example liquid:** Tea is a mixture.
  - **Example gas:** The air that we breathe is made of different elements.



# HETEROGENEOUS MIXTURES

- A heterogeneous mixture is a mixture where the composition is not uniform.
  - The prefix “hetero” means different.
  - Also called a mechanical mixture



**Heterogeneous mixture:  
Mixed veggies**

# HETEROGENEOUS MIXTURES

- Chocolate chip cookies have chocolate chips that are separate from the cookie dough.
  - Although cookie dough is all one mixture, the components are separated.



# HETEROGENEOUS MIXTURES

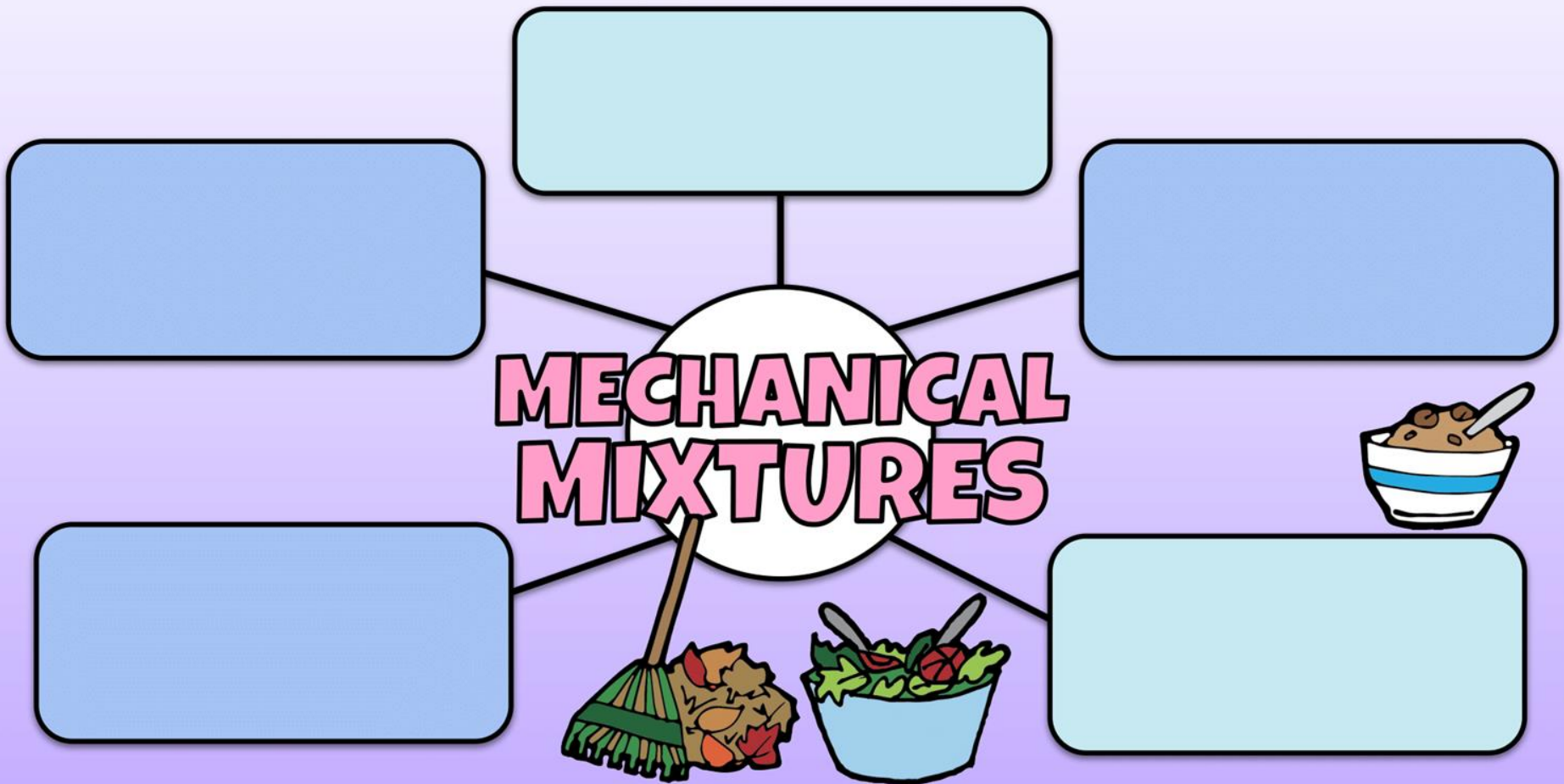
- Soil is another example of a mechanical mixture.
  - You can see all the different components like sand, twigs, and dead leaves.

Is a rock a mechanical mixture? Explain.





Brainstorm examples of mechanical mixtures.



# HOMOGENEOUS MIXTURES

- A **homogeneous mixture** is a uniform mixture of two or more pure substances.
- Unlike heterogeneous mixtures, homogeneous mixtures combine uniformly.

**Homogeneous mixture:  
Orange juice**



# HOMOGENEOUS MIXTURES

- Homogeneous mixtures are also referred to as **solutions**.
  - The prefix "homo" means "same."

Can you think of a homogeneous mixture that is not a drink?



# HOMOGENEOUS MIXTURES



- **Example:** Combining a small amount of salt into a glass of water.
  - The salt is combined with the water.
  - The salt has completely dissolved in the water.




Drag and drop to label the mixtures as homogeneous or heterogeneous.



Hot chocolate

Blank space for labeling




Cereal with milk

Blank space for labeling



Smoothie

Blank space for labeling



Salad

Blank space for labeling




Soap

Blank space for labeling



Chocolate chip cookies

Blank space for labeling



Sunscreen

Blank space for labeling



Trail mix

Blank space for labeling

**homogeneous**

**heterogeneous**