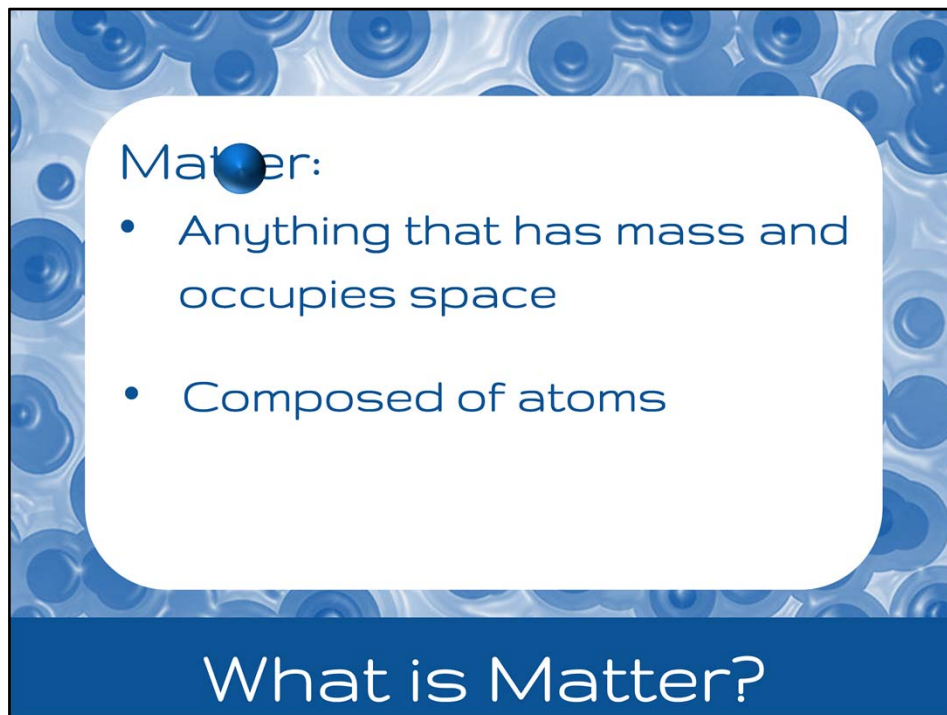


Module 1: What is Chemistry?
Topic 1 Content: Classification of Matter Presentation Notes



Classification of Matter

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Matter:

- Anything that has mass and occupies space
- Composed of atoms

What is Matter?

Matter is a very broad term for anything that has mass and occupies space. Matter is composed of tiny particles called atoms. Because the term “matter” encompasses so many things, it is important for scientists to have ways to classify it.

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☐ Not everything is matter!

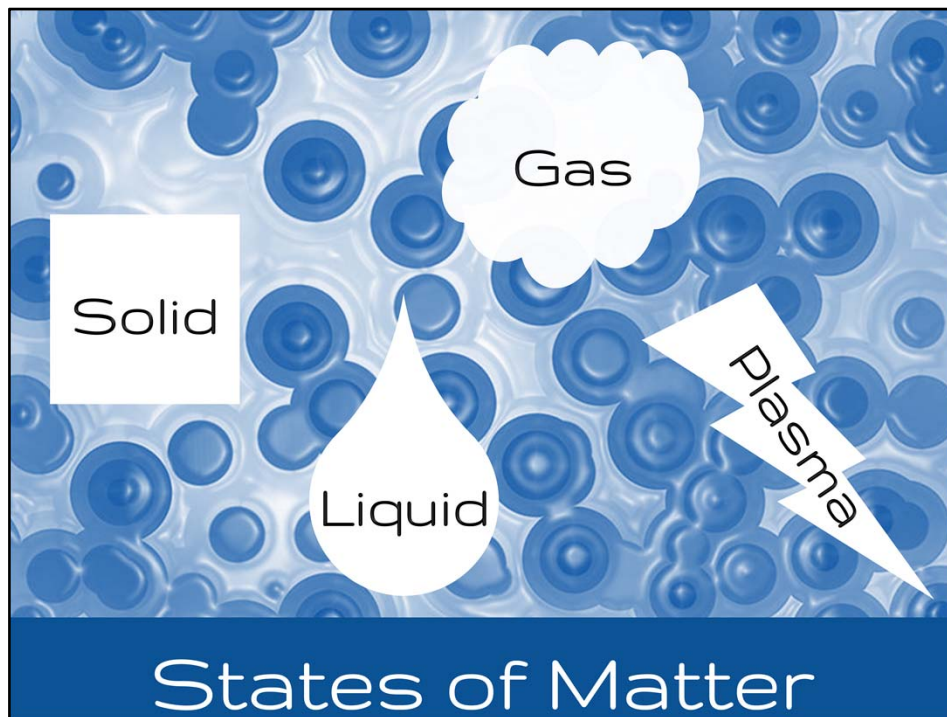


Is It Matter or Not?

The image is a presentation slide with a blue background featuring a pattern of water ripples. At the top, it says '☐ Not everything is matter!'. Below this, there are two square images side-by-side. The left image shows a bright, glowing energy source with the word 'Energy' written across it. The right image shows a woman with glasses looking thoughtful, with many question marks floating around her head and the word 'Ideas' written at the bottom. At the bottom of the slide, a dark blue banner contains the text 'Is It Matter or Not?' in white.

Not everything in the universe qualifies as matter. What sorts of things do not have a mass or occupy space? Energy, for one. There are various types of energy, none of which occupy space or have mass. Ideas, like the thought you are having right now. Does it have a mass? No. Does it have a volume? No. Therefore, it is NOT matter.

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Matter can be classified in a variety of different ways. One of the most common classifications uses the state, or phase, of the matter. A substance may be described as solid, liquid, gas, or plasma.

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- Fixed shape and volume
- Molecules have vibrational movement
- Water is the exception - ice expands

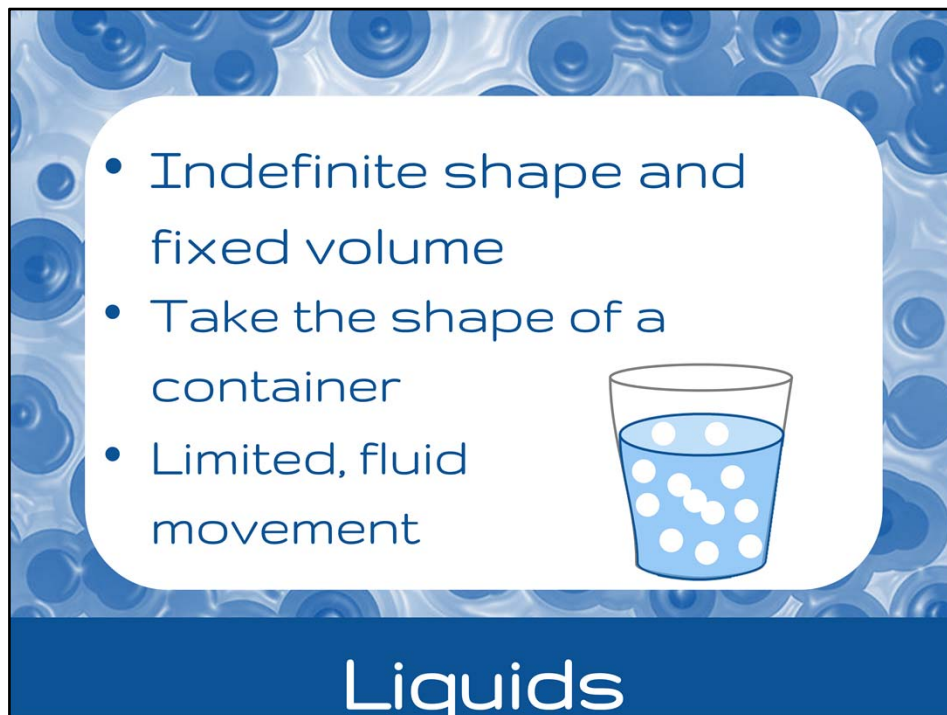
Solids

Solids have a fixed, or definite, shape and volume. This means that solids do NOT take the shape or size of the container in which they are stored. This block will not take the shape of the glass into which it is placed because it is a solid and already has a definite shape and volume.


The molecules within a solid have vibrational movement. The solid state is typically denser than the other phases. Water is an exception since ice expands upon freezing, causing the density to decrease. This is why ice floats in water. Solid aluminum would not float in liquid aluminum; instead, it would sink.

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- Indefinite shape and fixed volume
- Take the shape of a container
- Limited, fluid movement

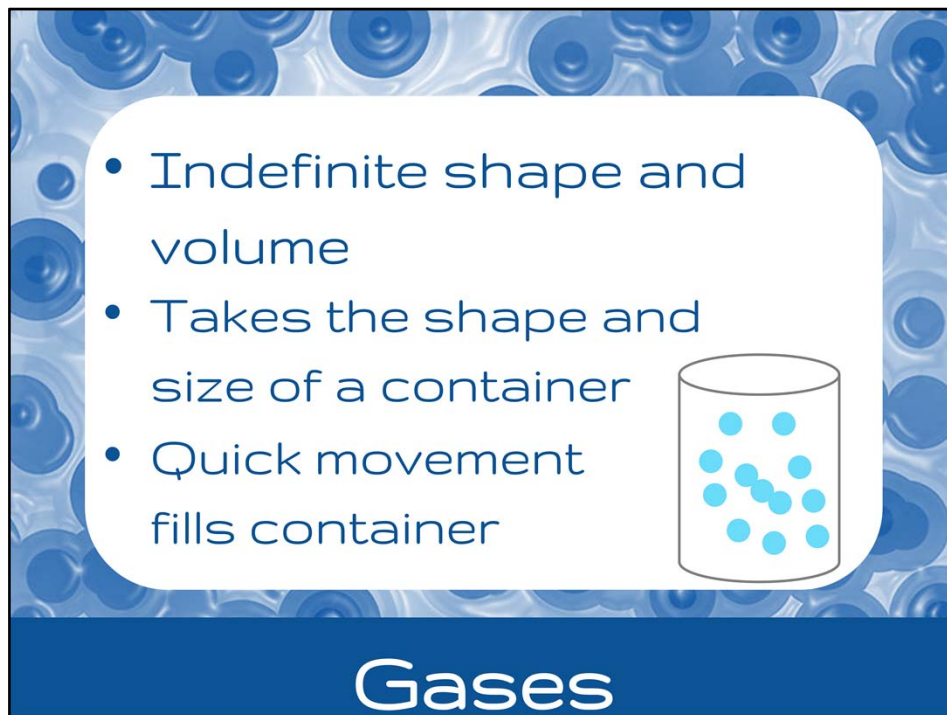


Liquids

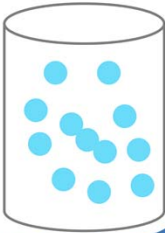
Liquids have an indefinite shape, but a fixed volume. This means that liquids take the shape of the container in which they are stored, but do not take the volume of the container. The molecules of a liquid have limited movement and are often described as fluid.

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- Indefinite shape and volume
- Takes the shape and size of a container
- Quick movement fills container

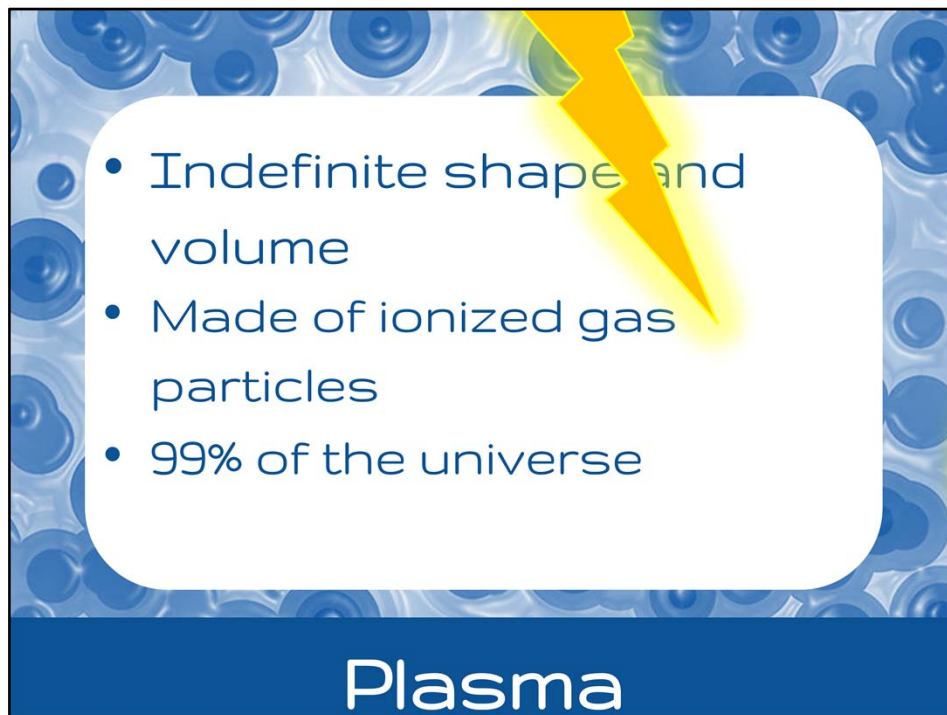


Gases

Gases have an indefinite shape and volume. This means that gases both take the shape and size of the container in which they are stored. Gas molecules move quickly and diffuse to fill their container.

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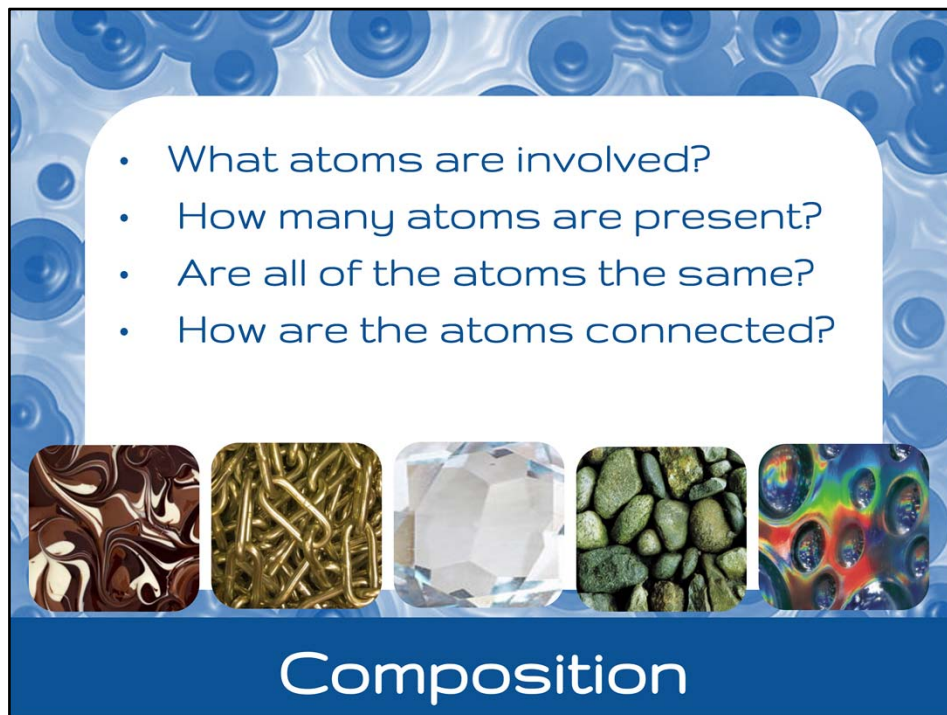
- Indefinite shape and volume
- Made of ionized gas particles
- 99% of the universe

Plasma

Plasmas, like gases, have an indefinite shape and volume. Plasmas are made of ionized gas particles. This means that they carry a charge. Although it is the least familiar state of matter to most people, plasma makes up 99% of the universe. The Sun and other stars are made of plasma and, while naturally occurring plasmas are very rare on Earth, lightning strikes are examples of plasma.

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- What atoms are involved?
- How many atoms are present?
- Are all of the atoms the same?
- How are the atoms connected?

Composition

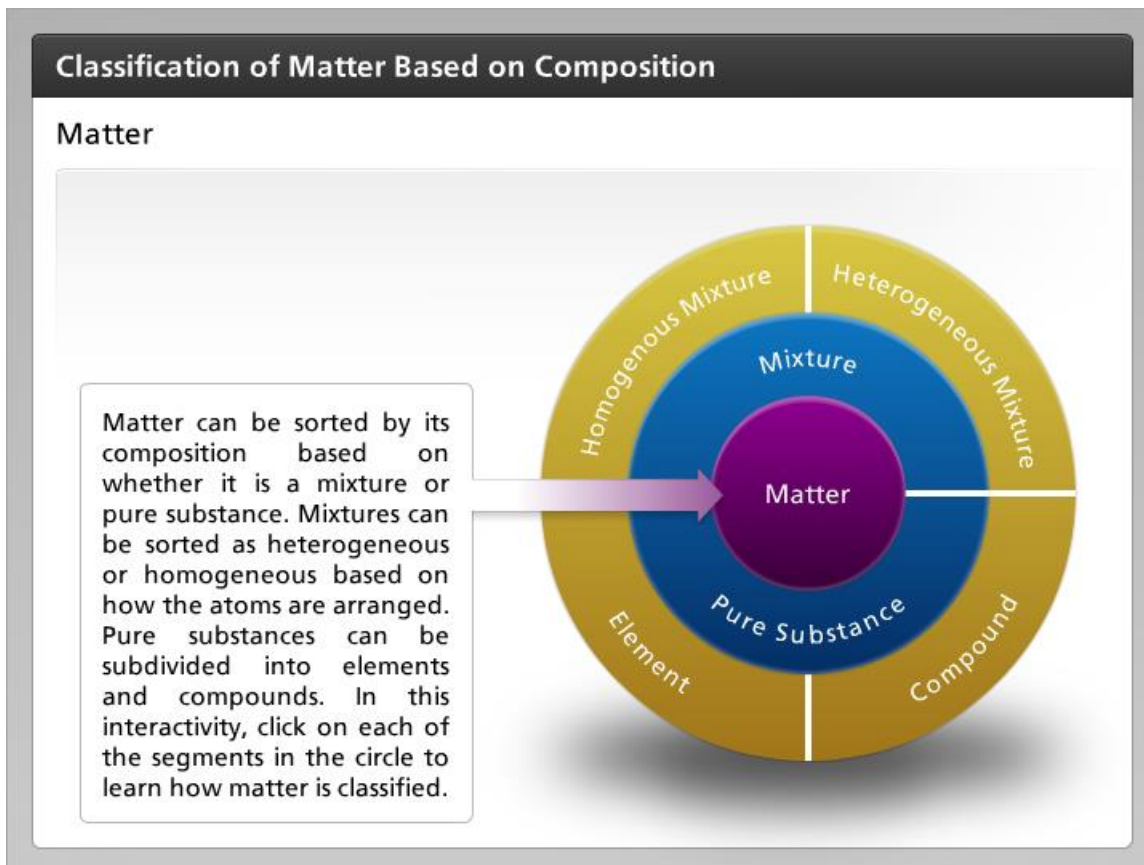
In chemistry, another way to classify matter is based on the composition of the sample. For example, chemists may ask:

- What atoms are involved?
- How many atoms are present?
- Are all of the atoms the same?
- How are the atoms connected?

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Matter

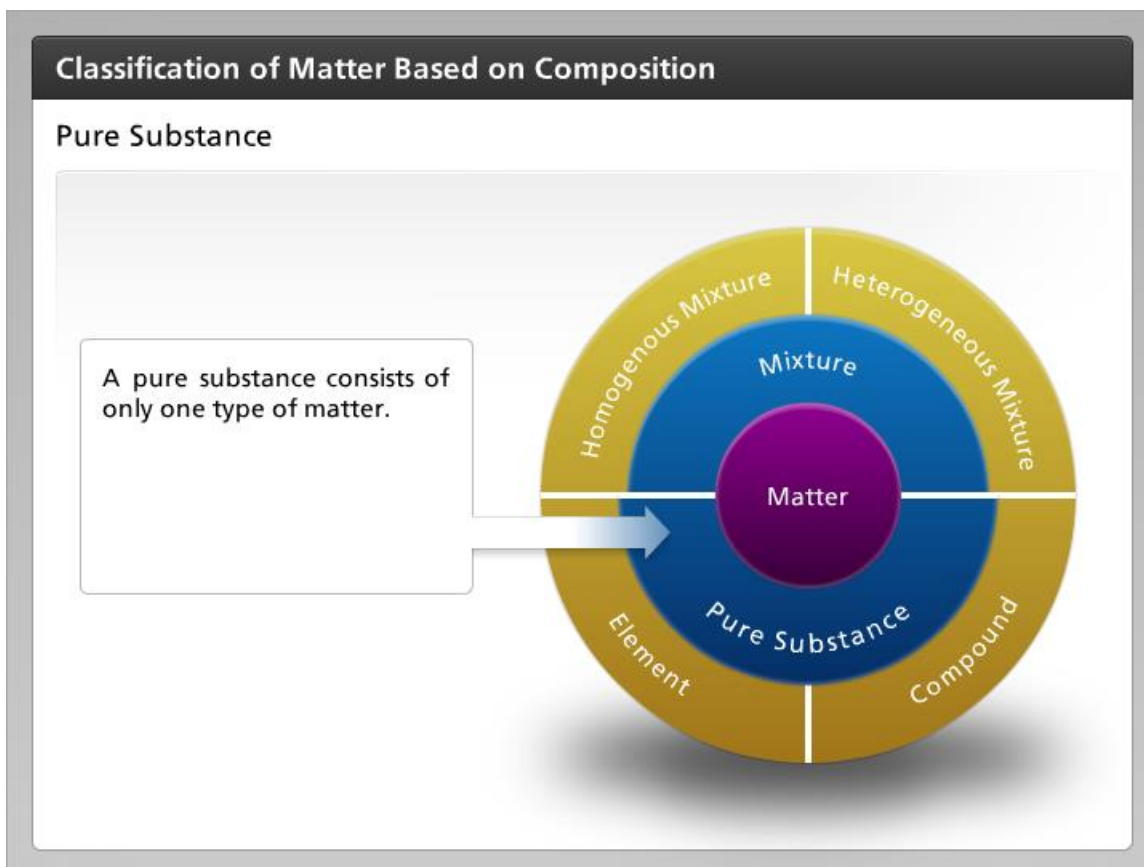


Matter can be sorted by its composition based on whether it is a mixture or pure substance. Mixtures can be sorted as heterogeneous or homogeneous based on how the atoms are arranged. Pure substances can be subdivided into elements and compounds. In this interactivity, click on each of the segments in the circle to learn how matter is classified.

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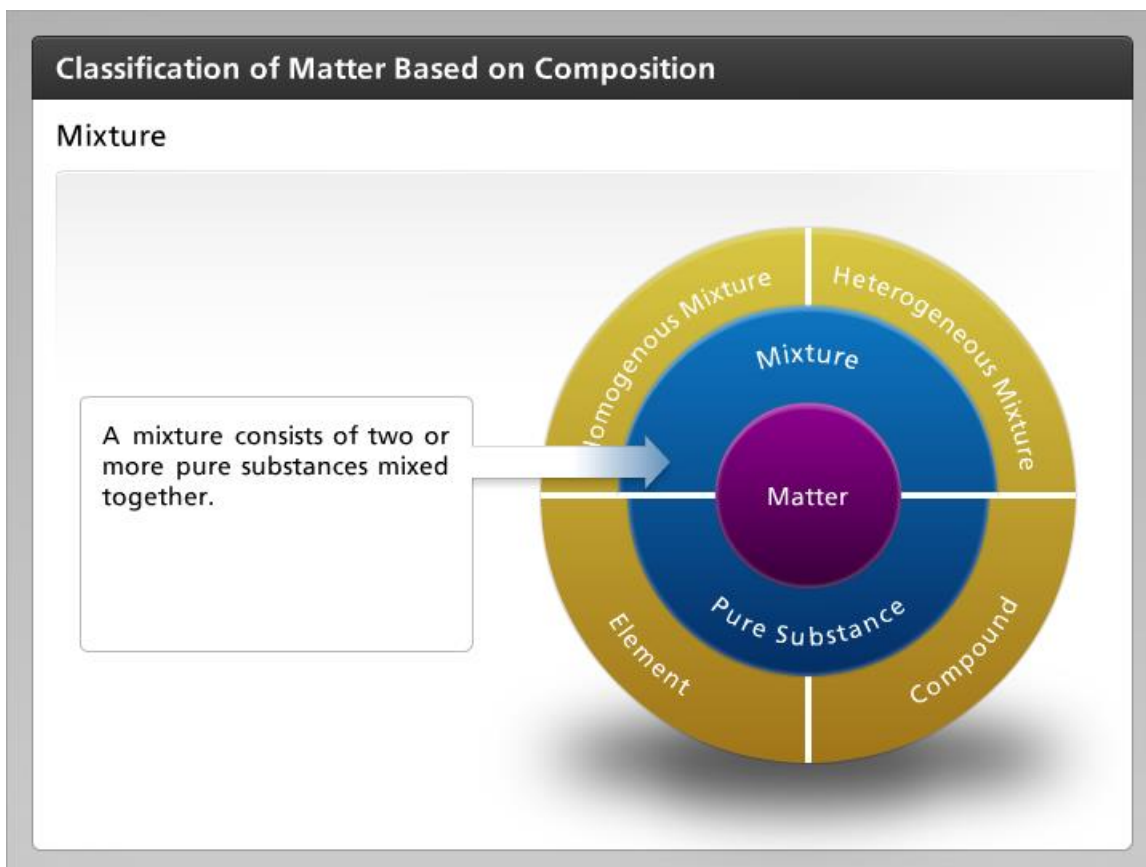
Pure Substance



A pure substance consists of only one type of matter.

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Mixture

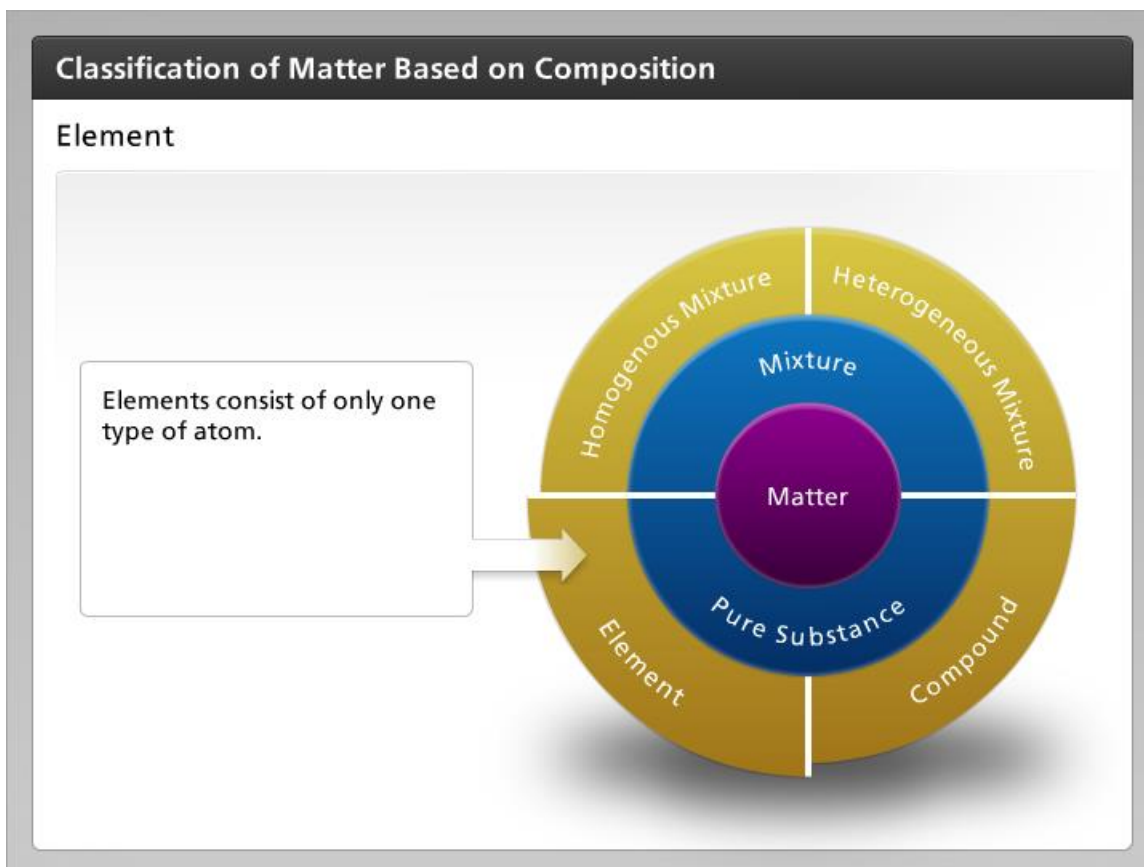


A mixture consists of two or more pure substances mixed together.

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Element

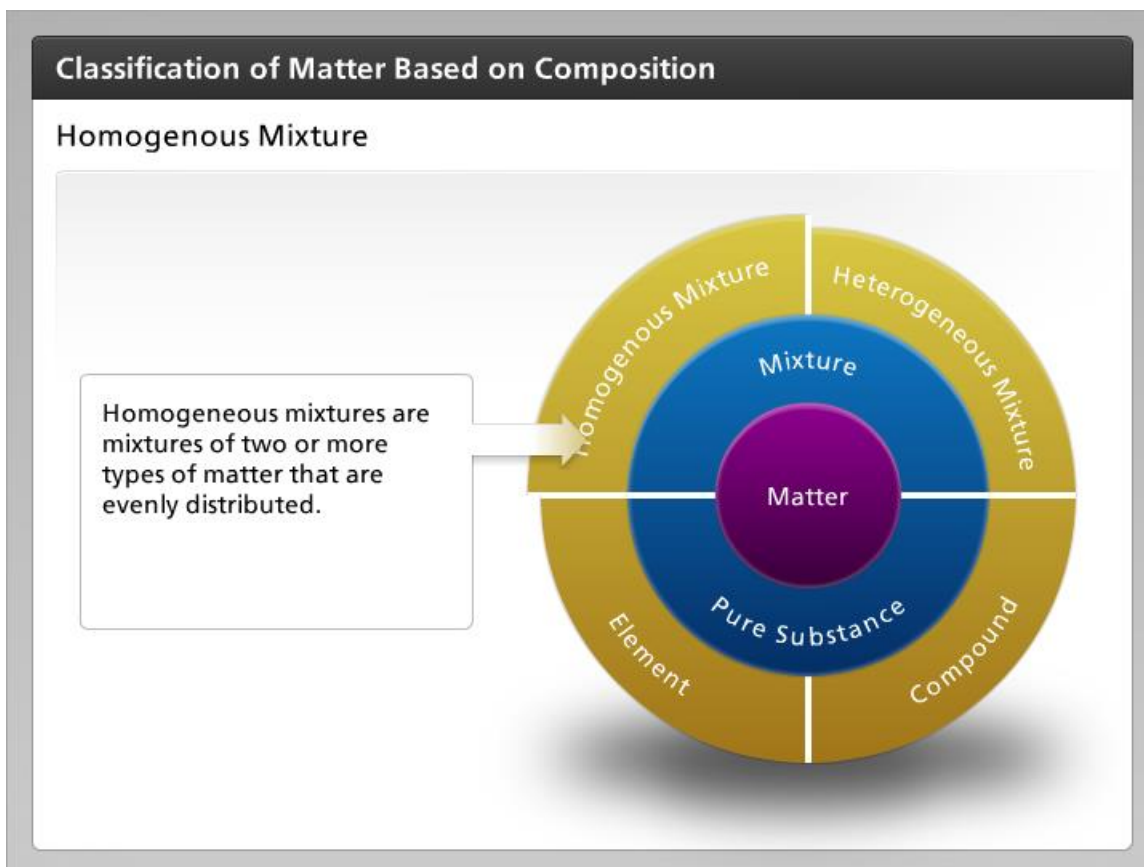


Elements consist of only one type of atom.

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Homogenous Mixture

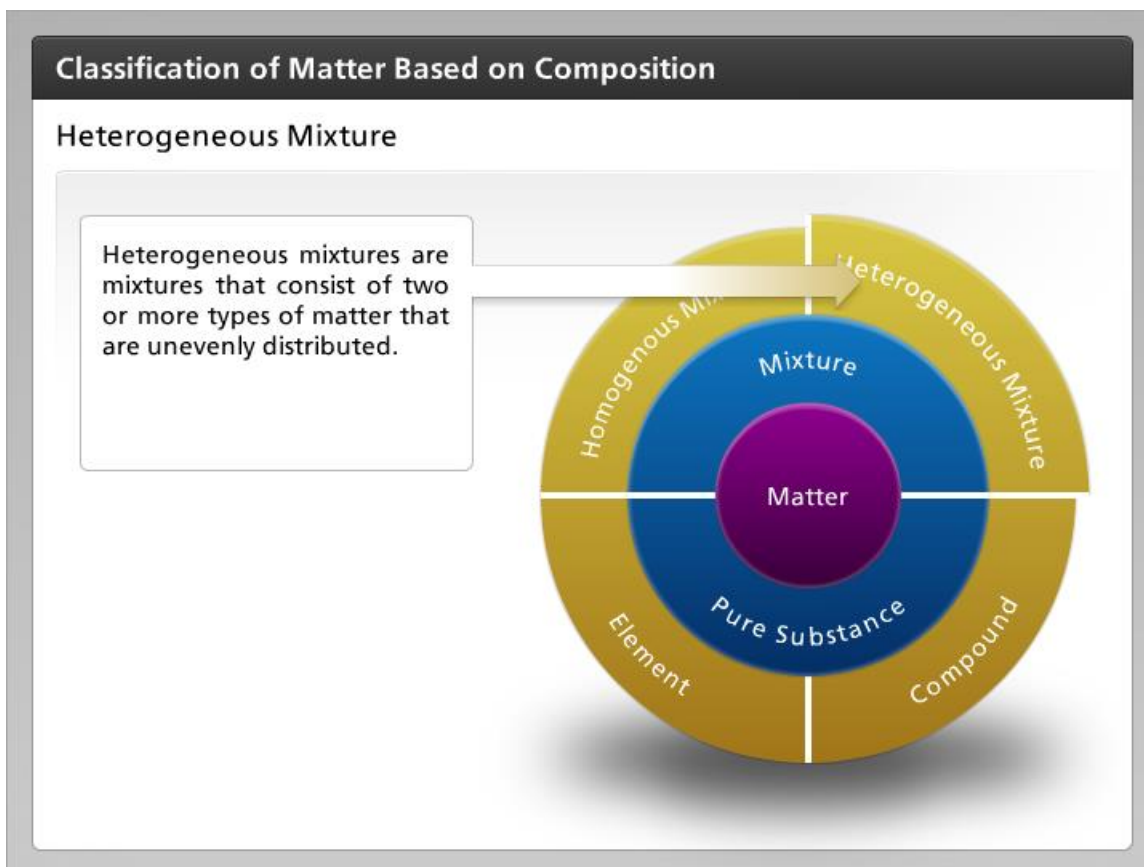


Homogeneous mixtures are mixtures of two or more types of matter that are evenly distributed.

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Heterogeneous Mixture

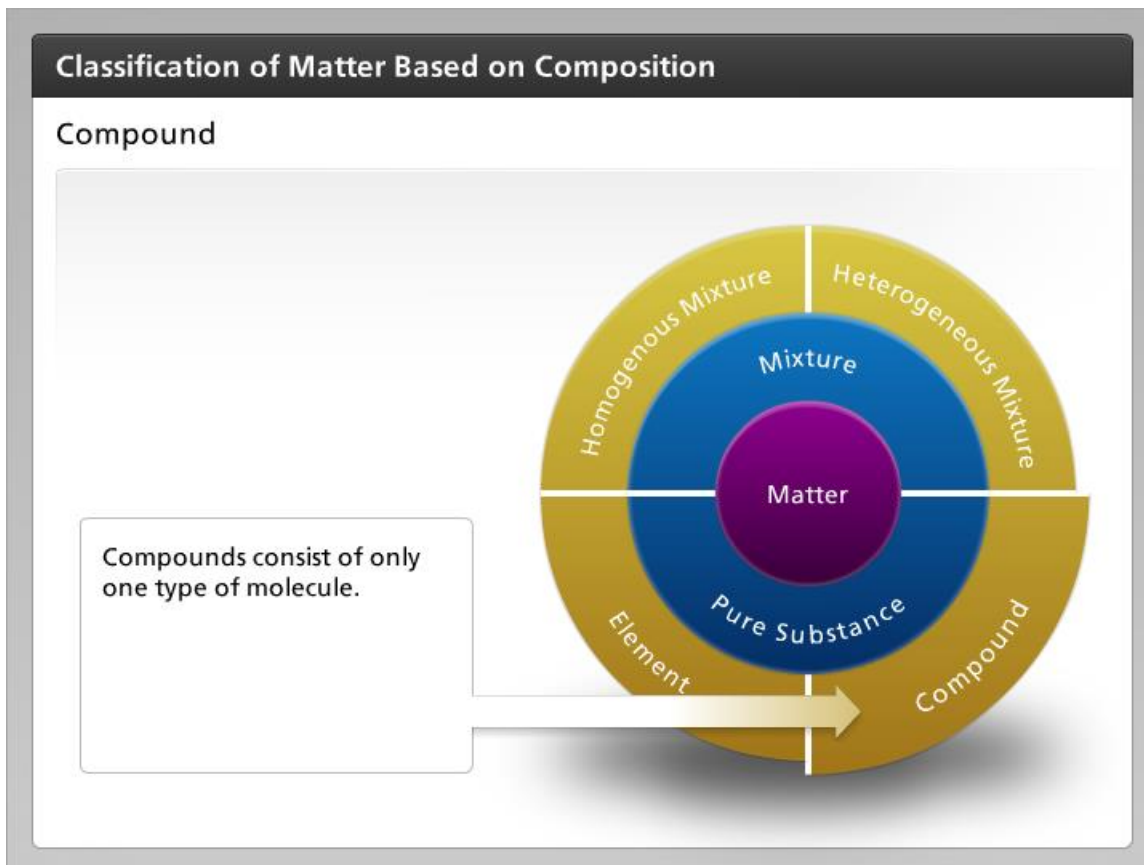


Heterogeneous mixtures are mixtures that consist of two or more types of matter that are unevenly distributed.

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Compound



Compounds consist of only one type of molecule.

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Pretend that someone placed the following four items in front of you and asked you to classify them based on their composition: a bar of gold, a glass of water, a bottle of Italian salad dressing, and a cup of apple juice. How would you classify each of these items?

The bar of gold would be a pure substance, and classified even further, would simply be an element. A glass of water would also be a pure substance, but it would be a compound because it contains all of the same types of molecules of H_2O . The Italian salad dressing would be classified as a heterogeneous mixture because the oil, vinegar, herbs, spices, and vegetables are unevenly distributed. In fact, you have to shake the bottle to mix the items before you can pour it on your salad. Finally, the apple juice would be a homogeneous mixture. While other items, like water and sugar, are added to the juice, they are mixed evenly and are not separated out.

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Other ways to classify matter include examining their radioactivity, behavior, or whether or not they are hazardous.

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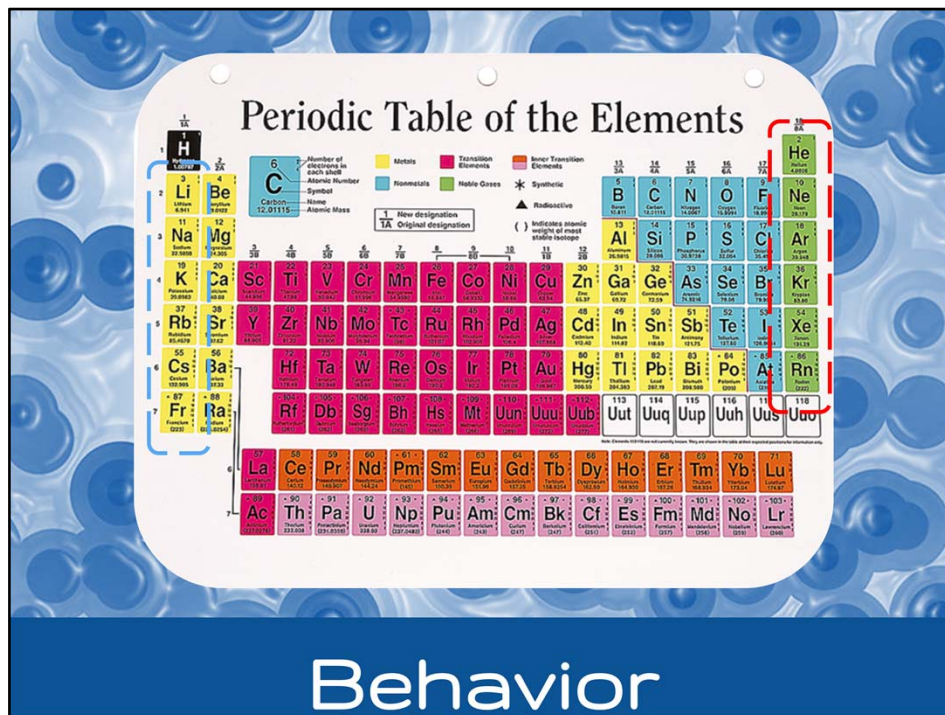
Topic 1 Content: Classification of Matter Presentation Notes



Some elements are considered radioactive. This means that they are unstable and have the tendency to undergo nuclear reactions as a result of this instability. Examples of radioactive elements include: radium-226, cobalt-60, cesium-137, iodine-131, uranium-235, uranium-238, and strontium-90. These isotopes will undergo nuclear reactions until a more stable isotope is achieved.

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Elements are organized into families on a periodic table of elements. The families are comprised of elements that have similar chemical behaviors. For example, alkali metals are the metals in group 1. All of these metals are highly reactive with water and oxygen. Noble gases are in group 18 or 8A on the periodic table. These elements are inert, or non-reactive.

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- Explosives
- Gases
- Flammable and combustible liquids
- Flammable solids, spontaneously combustible materials, and dangerous when wet materials
- Oxidizers and organic peroxides
- Toxic (poison or poisonous) material and infectious substances
- Radioactive materials
- Corrosive materials
- Miscellaneous dangerous goods

Hazardous Materials

Hazardous materials are labeled to indicate the nature and level of danger that they pose. They are broken into the nine hazard classes shown here.

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Now that you have learned about some of the ways in which matter can be classified, look around you. Try to classify some of the items that you see. Some of them may fall into more than one category of classification. How does each type of matter compare to other types of matter?