Mixtures and Solutions



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Itty-Bitty Bits

What's the smallest thing you can think of? Now, take a hammer and smash it in your mind. What makes up the smaller pieces?

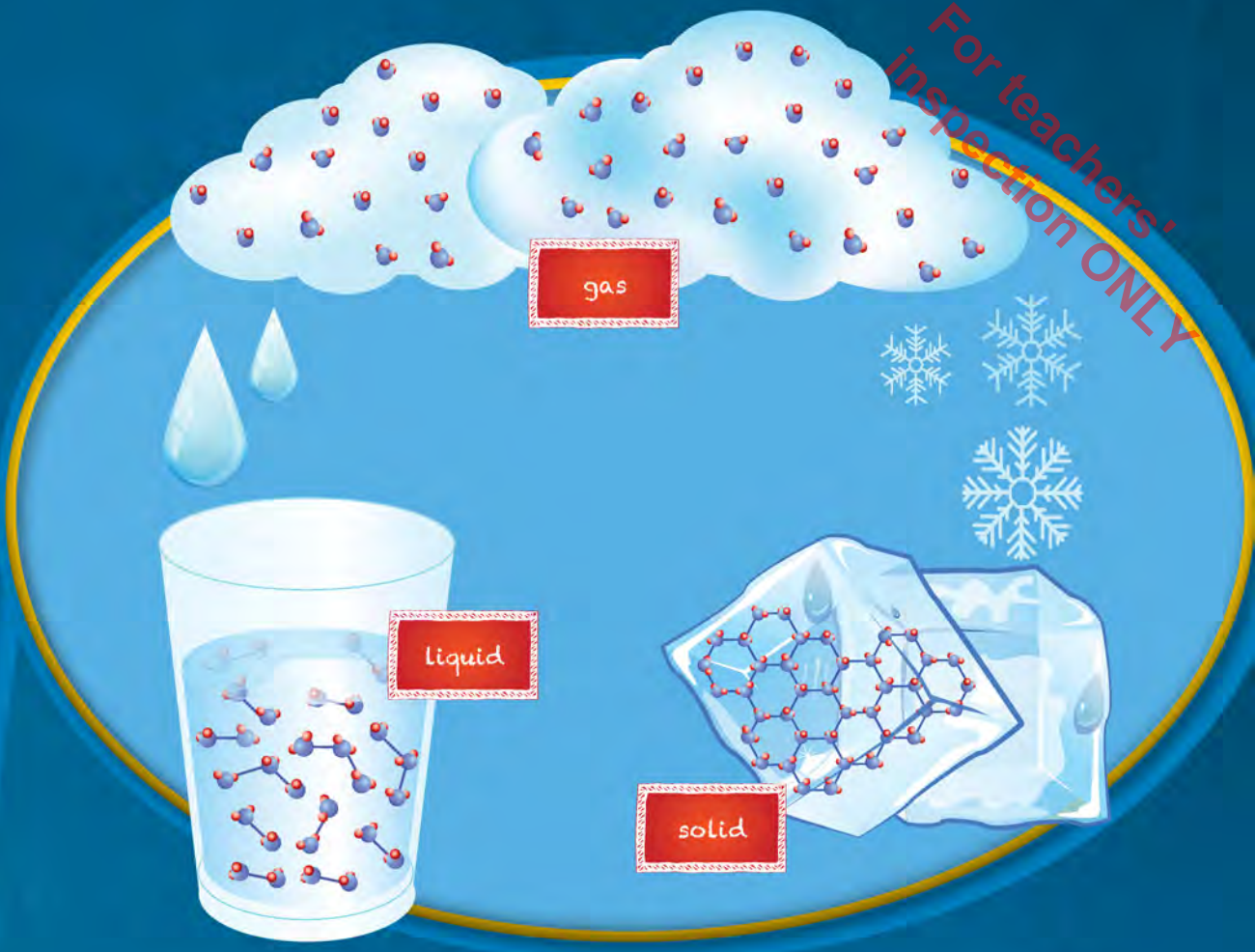
All matter, whether it's smaller than a grain of sand or as big as a whale, is made up of itty-bitty bits called **atoms**. Atoms are too small to see with the human eye or even most microscopes. Atoms combine to create **molecules**. Molecules combine to create everything we see in the universe.

Water without any minerals is called *distilled water*. Most people don't like the way it tastes because we're used to the taste of minerals.



This machine crushes rocks to itty-bitty bits.

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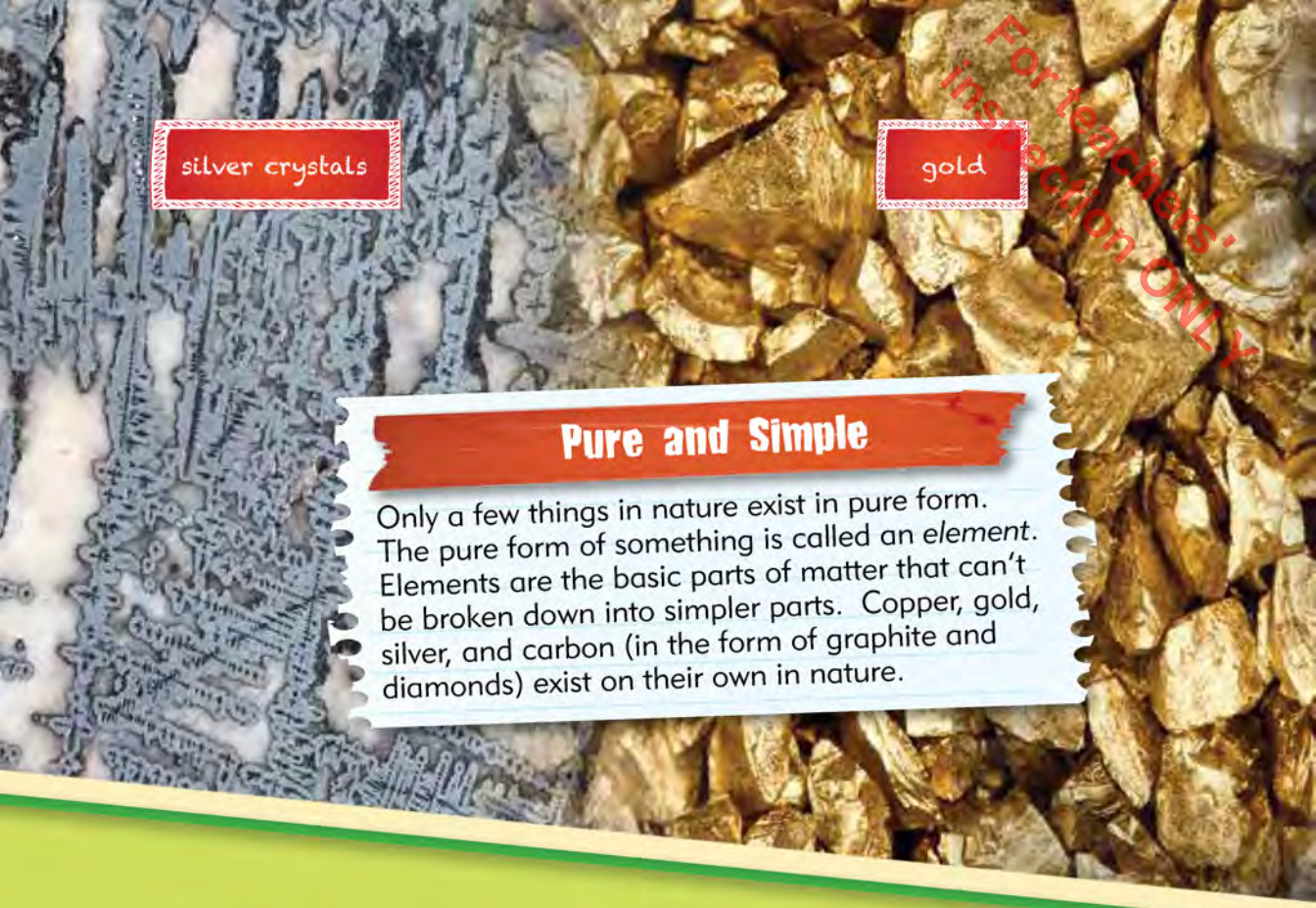


Molecules and atoms can take the form of a solid, a liquid, or a gas. Each state of matter has its own properties. Solids can be hard or soft. Plastic, metal, stone, bone, straw, sand, and feathers are all solids. Objects in a solid state don't change size or shape unless they are cut or broken.

Unlike solids, liquids change shape. They can flow, pour, and even spill. They change their shape to fill the space around them. Milk, oil, and ink are all liquids.

Gases don't have any shape or size of their own. They spread freely to fill the space around them. Similar to liquids, gases flow easily. But they can also be **compressed**, or squeezed. Gases are often invisible. So most of the time, we can't see them. But gases are all around us.

Together, these three states of matter make up most everything in the universe.



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Pure and Simple

Only a few things in nature exist in pure form. The pure form of something is called an *element*. Elements are the basic parts of matter that can't be broken down into simpler parts. Copper, gold, silver, and carbon (in the form of graphite and diamonds) exist on their own in nature.

All Mixed Up

The world would get pretty boring if each **substance** could only be found on its own. But substances combine to form **mixtures**. There are mixtures everywhere in the world—millions of them. Air is a mixture of gases. Rocks are mixtures of minerals. Oceans and lakes are mixtures of gases, minerals, and water.

Most of the things we eat are mixtures. Think about a salad. It's a mixture. The tomatoes are still tomatoes. The lettuce is still lettuce. The carrots are still carrots. But together they make a nutritious—and tasty—mixture. The wide variety of mixtures in our food is what creates so many different flavors. And if a meal wasn't a mixture when it entered your mouth, it is by the time it leaves your stomach!

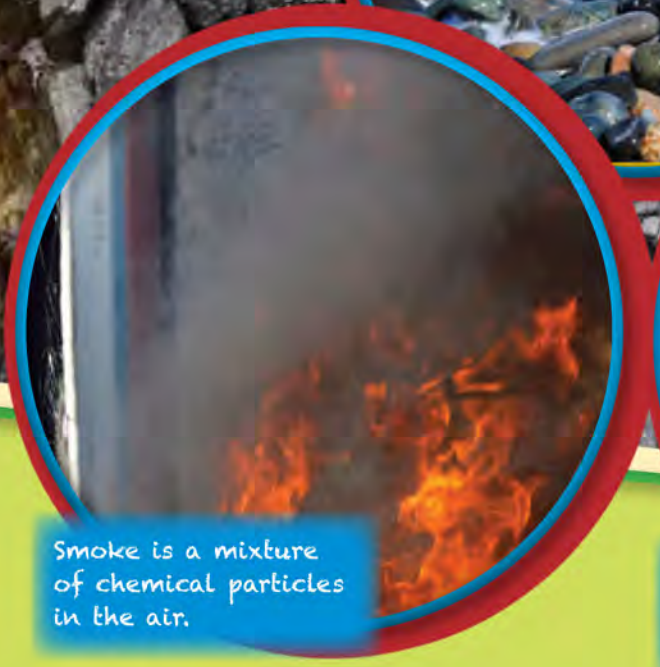
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carbon

Smoke, blood, and water are all mixtures.



Water is a mixture of pure water and minerals.



Smoke is a mixture of chemical particles in the air.



Blood is a mixture of plasma, red blood cells, white blood cells, and platelets.

The different parts of a mixture mingle loosely. That makes it possible to separate them from one another. You can pick out the various ingredients in a salad with a fork. Other mixtures might require a more precise tool to pick them apart. You might need a magnet or filter paper to do the job. But when you separate a mixture, you can find the original substances you started with.

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Mixtures can be sorted into two categories, with few exceptions. **Heterogeneous mixtures** are made of substances you can see. Vegetable soup is a heterogeneous mixture. So is trail mix.

The substances in **homogeneous mixtures** have been mixed together thoroughly and are spread evenly throughout. If you examine a piece of the mixture, it will look just like any other piece of the mixture, no matter how small the sample. Milk is a homogeneous mixture. It contains protein, sugar, water, and fat, but these substances cannot easily be separated or tasted individually. Regardless of how you pour it, each glass of milk looks the same.

Can't remember the difference between heterogeneous and homogeneous? Look to the root words. Hetero means "different" and homo means "the same."



Smoothies

A smoothie is a heterogeneous mixture. The fruit or vegetables, ice, and juice can separate over time.

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Heterogeneous Mixtures

Suspensions are one of the most common types of heterogeneous mixtures. One part of a suspension is always liquid. The other part is a solid or a liquid. One substance always settles to the bottom of the container. Suspensions change and separate over time.

Most salad dressings are suspensions. They usually contain oil and vinegar, which don't mix. That's why salad dressing labels say, "Shake well before using." Liquid medicines often have the same directions.

Paints are also suspensions. They contain a solid pigment, or color, and a liquid. If a can of paint has been sitting on the shelf for a while, the pigment sinks to the bottom. Before the can of paint is sold, it's placed in a machine that shakes it. That motion stirs the paint so the pigment and the liquid are thoroughly combined again. If you don't mix suspensions well, you'll quickly notice the results!

A Clear Sign

Suspensions are never completely clear. They're usually murky. After sitting for a while, suspensions will have a distinct line where the substances start to separate.



Think Like a Scientist

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Which substances are soluble? Experiment and find out!

What to Get

- clear glasses
- hot and cold water
- stopwatch
- substances to dissolve such as sugar, pepper, sand, and hot chocolate powder
- teaspoon

