



ESSENTIAL QUESTION

What Is the Atomic Theory?



Engage Your Brain

As you read the lesson, look for the answer to the following question and record it here.

This building in Brussels, Belgium, is called the Atomium. Why do you think it was given that name?



ACTIVE READING

Lesson Vocabulary

List the terms. As you learn about each one, make notes in the Interactive Glossary.

Visual Aids

A diagram adds information to the text that appears on the page with it. Active readers pause their reading to review the diagram and decide how the information in it adds to what is provided in the text on the pages.

More than 2,000 years ago, I stated that all matter is made of tiny, solid balls called atoms. The word atom means "indivisible."

A Teeny Tiny Theory

From the time of Democritus, scientists have studied matter and proposed theories about it. What do we now think about what makes up matter?

ACTIVE READING As you read the next page, draw a line from each part of the atom diagram to the sentences that describe it.

Suppose you could break a silver chain into smaller and smaller pieces. The pieces would become so small that you couldn't see them without a microscope. How small could the pieces get before they were no longer silver? The answer—one silver atom. An **atom** is the smallest unit of an element that maintains the properties of that element.

The **atomic theory** is a scientific explanation of the structure of atoms and how they interact with other atoms. Democritus first suggested that the smallest part of matter is an atom. Over the years, theories that scientists made about atoms have changed as scientists learn more about atoms.

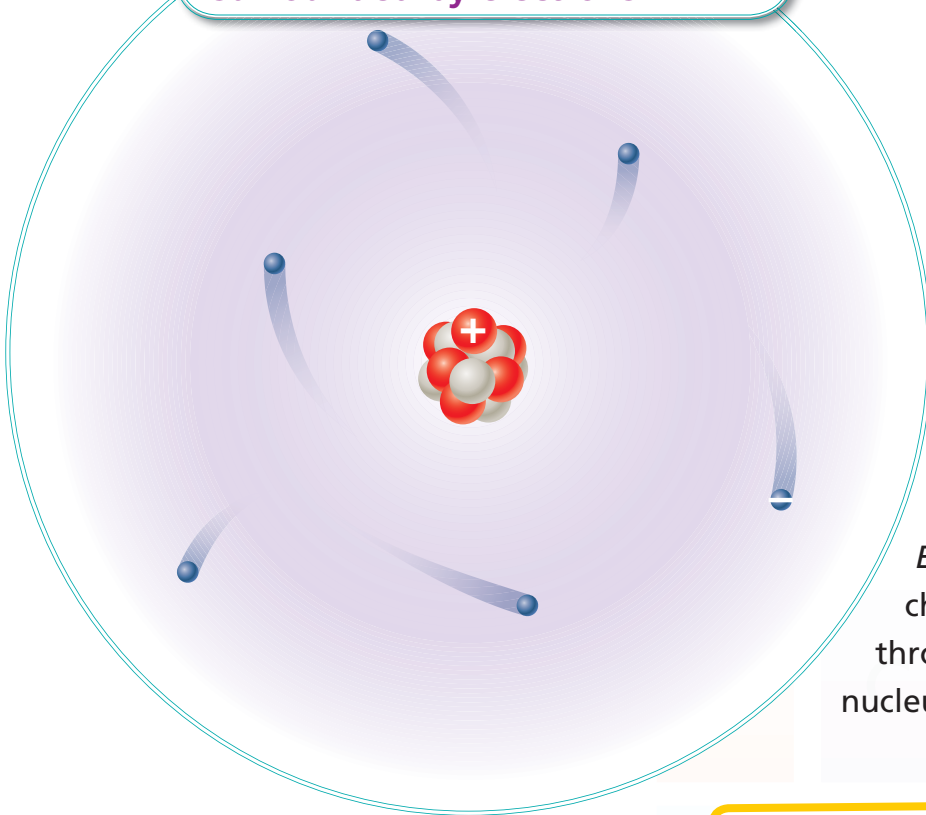
Gold is one type of matter.

Gold brick

Flakes of gold

Atoms are the building blocks of all matter.

Current atomic theory states that an atom is mostly empty space. At its center, there is a small, dense core called the nucleus. The nucleus is surrounded by electrons.



Proton

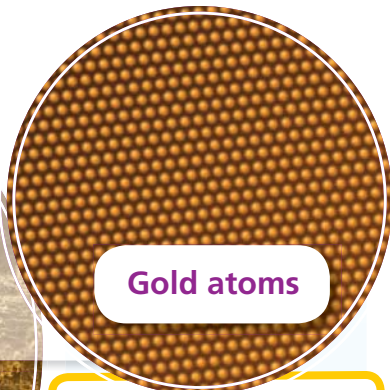
A *proton* is a positively charged particle found in the nucleus of an atom.

Neutron

Neutrons are also particles found in the nucleus, but a neutron has no charge.

Electron

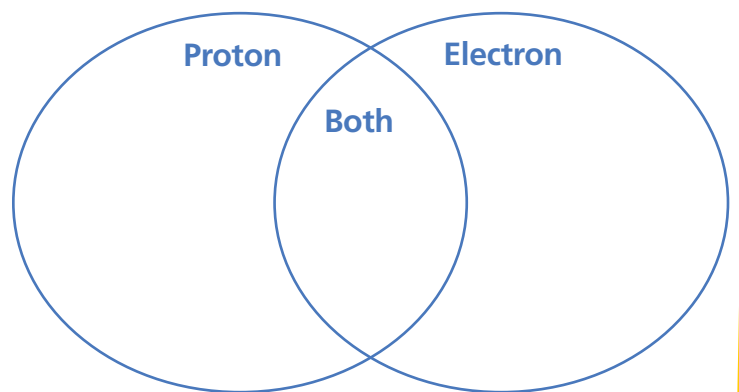
Electrons are negatively charged particles that speed through an area around the nucleus called the electron cloud.



Gold atoms

► Draw an arrow pointing to a single gold atom.

► Use the Venn diagram to compare and contrast electrons and protons.



In the mid-1800s, I organized all known elements by their properties and increasing mass. Scientists still organize elements based on my work.

It's Elementary!

Copper, oxygen, and mercury have one thing in common. They are all elements. Exactly what is an element?

ACTIVE READING As you read these two pages, draw a large *E* next to the names of five elements that are described.

There are many kinds of matter. An **element** is the type of matter made of just one kind of atom. All atoms of an element have the same number of protons. For example, boron is an element. Every atom of boron contains exactly five protons. No other element has atoms with exactly five protons.

What's so special about protons? Electrons are far from the nucleus, so they can be gained or lost. Also, different atoms of the same element can contain different numbers of neutrons. Protons stay the same.

Atoms

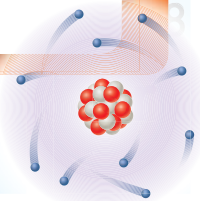
→ Elements

Compounds

Neon

Protons: 10

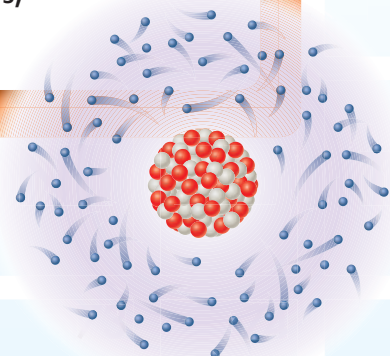
Uses: neon signs, helium-neon lasers, television tubes, refrigerant



Mercury

Protons: 80

Uses: laboratory instruments, thermostats, dental fillings, pesticides

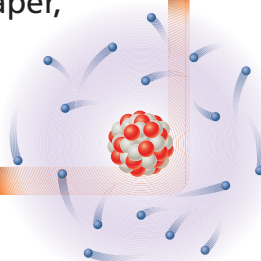


Elements are substances that can't be broken into simpler substances.

Chlorine

Protons: 17

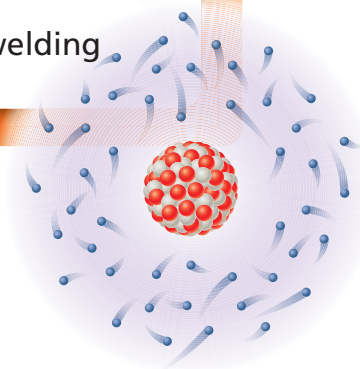
Uses: disinfecting water; making paper, paints, plastics, and dyes



Silver

Protons: 47

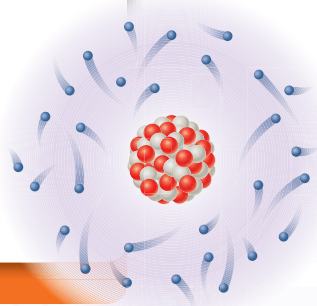
Uses: jewelry, silverware, photography, welding solder, mirrors



Copper

Protons: 29

Uses: plumbing, coins, electrical wires, making brass and bronze



Draw and Label a Carbon Atom

Use the information provided to draw and label a carbon atom.

Protons: 6

Neutrons: 6

Electrons: 6

Part of my atomic theory stated that different types of atoms combine to form chemical compounds.

Putting It All Together

There are more than 100 elements, but you can see that there are many more types of matter than that. What are these other types?

ACTIVE READING As you read this page, draw boxes around the names of the two things that are being compared.

Many atoms go through chemical change with a different type of atom and form molecules. A **molecule** is made up of two or more atoms joined together chemically. A **compound** is a substance formed by atoms from two or more elements.

The properties of a compound are often different from the properties of the elements that form it. For example, atoms of carbon and oxygen will react, forming the compound carbon dioxide. This compound has its own properties that are different than those of carbon and oxygen.

Atoms

Elements

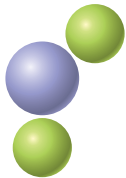
→ Compounds



Compounds are made of atoms of at least two different elements.

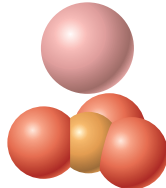
Firework Colors

Orange
calcium
chloride



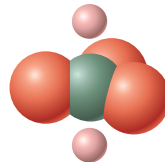
1 calcium
2 chlorine

Yellow
sodium
nitrate



1 sodium
1 nitrogen
3 oxygen

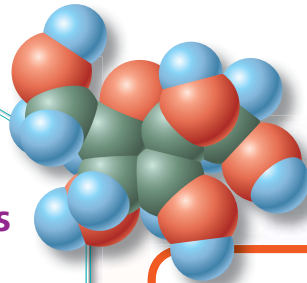
Red
lithium
carbonate



2 lithium
1 carbon
3 oxygen

Some of the colors in fireworks come from compounds. For example, calcium chloride, which contains one calcium atom for every two chlorine atoms, results in an orange color.

Fructose is often called fruit sugar. For every 6 atoms of carbon in the compound, there are 12 hydrogen atoms and 6 oxygen atoms.



DO THE MATH

Use Fractions

Add the total number of atoms in fructose. In lowest terms, what fraction of fructose consists of:

1. carbon atoms? _____

2. hydrogen atoms? _____

3. oxygen atoms? _____