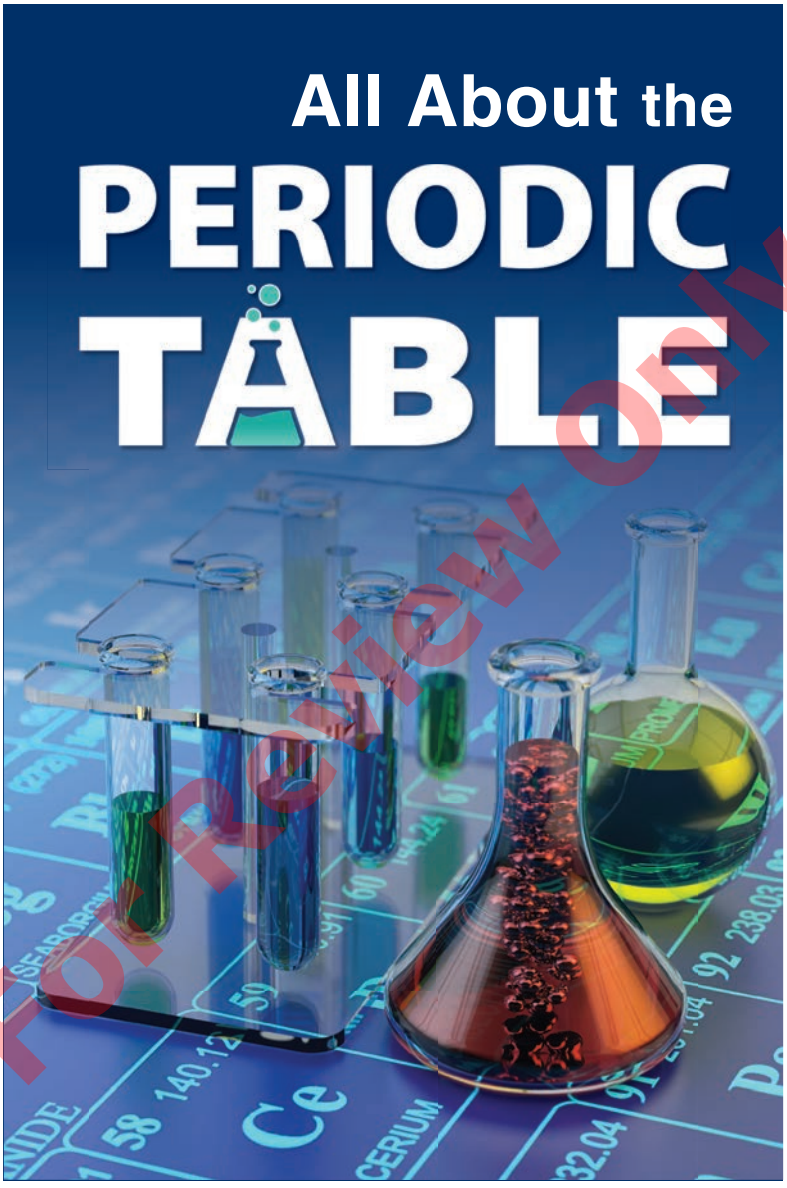
All About the PERIODIC TABLE



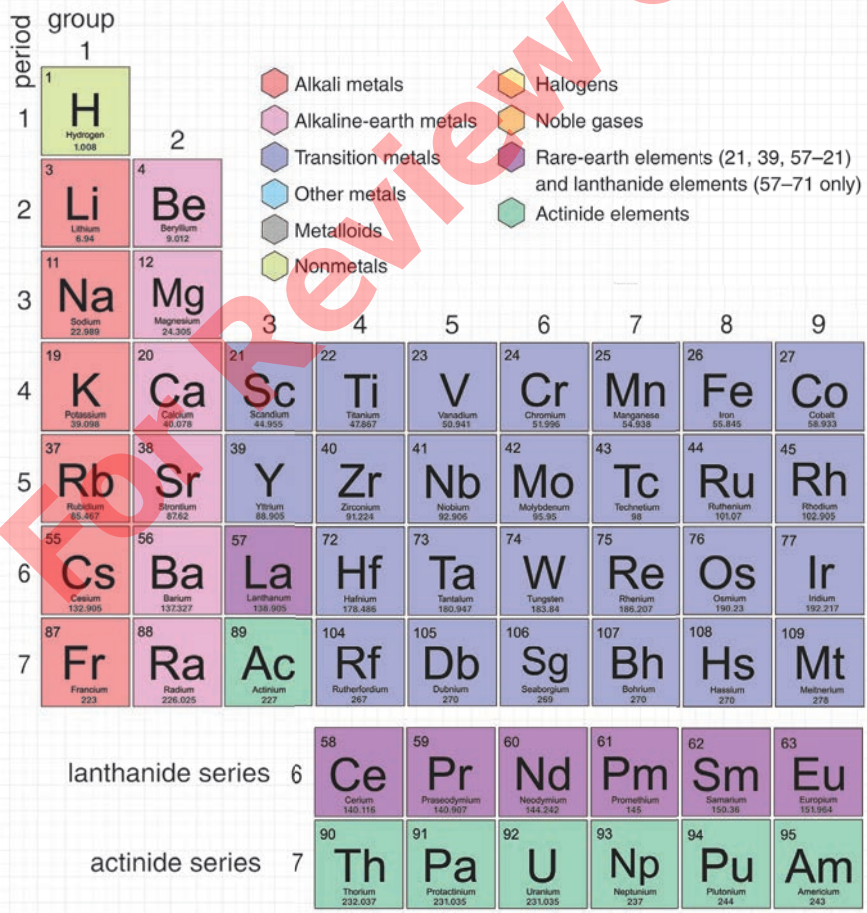
Georgia Beth

Table of Contents

The Basic Ingredients

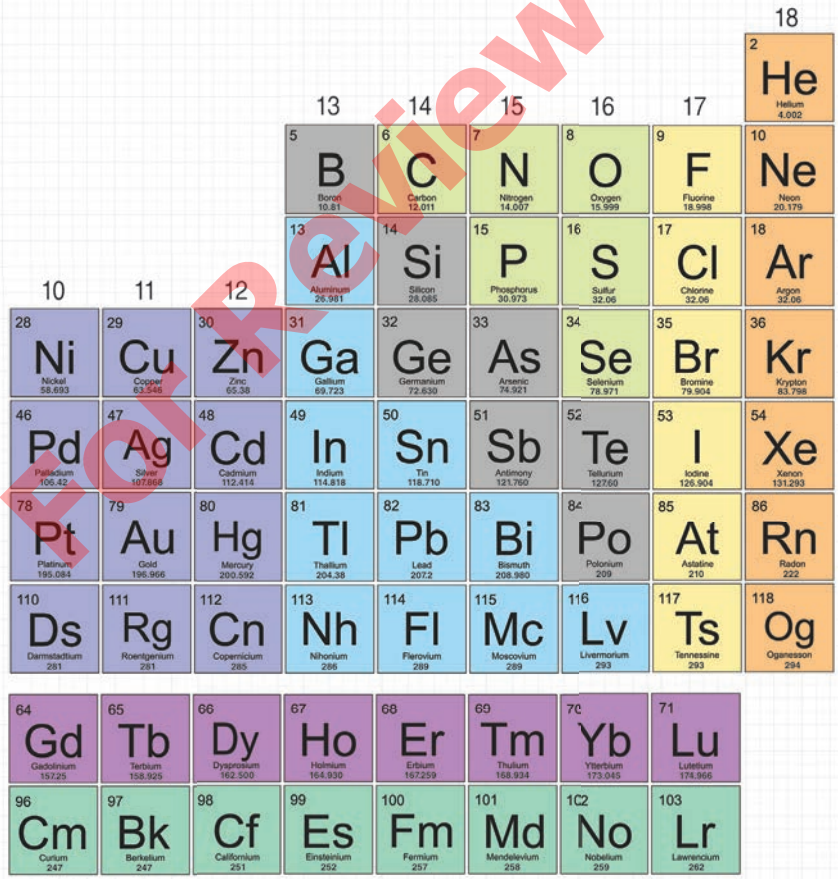
It's lunchtime, and you're hungry. You want something spicy and comforting. By combining a little of this and a little of that, you've made a delicious curry. If you had different ingredients, you might have made a sandwich or a burrito. It all depends on the foods you have and what you're hungry for!

Just like your lunch, everything in the world is made up of ingredients. **Elements** are the building blocks of everything in the universe. Hydrogen and oxygen combine to make water. Sodium and chlorine combine to make salt.



Hydrogen and helium are a bit like bread and butter—they are commonly found. Elements such as chromium and titanium are rarer. Everything from rocks to tomatoes exists because different elements combined in different ways.

The periodic table of elements is a list of all the discovered elements in the universe. Every element is described in basic terms. And similar elements are grouped by the **properties** they share. The periodic table organizes all this information in one easy-to-read chart. It is a useful tool in the **chemistry** field. Today, the periodic table is used daily by scientists and students around the world.



A Brief History of Atoms

Before diving into the information presented in the periodic table, we have to go back in time—and start small. Throughout history, people have wondered what objects on Earth are made of. They have questioned how objects break down, too. For example, what would happen if you sliced an object into tinier and tinier parts? We know that smashing a rock can break it into smaller pieces. But how can a tomato be divided into pieces when, at some point in cutting it smaller and smaller, it turns into red mush? And are tomatoes and rocks made of the same things deep down, even though they look and behave differently?

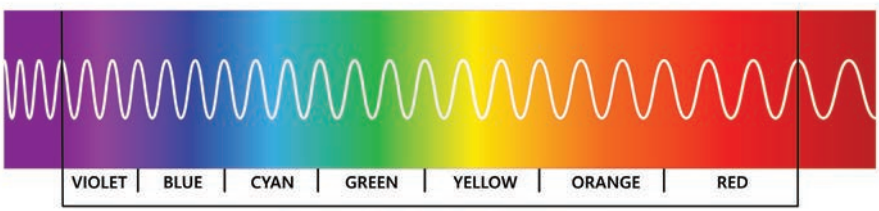
In ancient Greece, philosophers had many theories about the world. They argued that the world is composed of tiny things that can't be cut into more pieces. They called those units ***atoms***. The word *atom* means "indivisible" in Greek. Democritus, a philosopher, had a hypothesis. He argued that everything on Earth is composed of particles.

Democritus

Eventually, scientists were able to test his idea. In fact, scientists advanced the theories of many early thinkers. Scientists discovered that atoms make up everything in the universe. They learned that atoms are smaller than cells, and they can only be seen by the most powerful electron microscopes. Scientists have been studying atoms in-depth for more than 200 years!

FUN FACT

Democritus proposed many theories during his life. He was the first person in recorded history to attempt to explain how colors work. He thought colors were caused by the position of atoms. In his theory, black was caused by bumpy and uneven atoms. White was caused by even and smooth atoms. Today, scientists know that colors are different wavelengths of light.

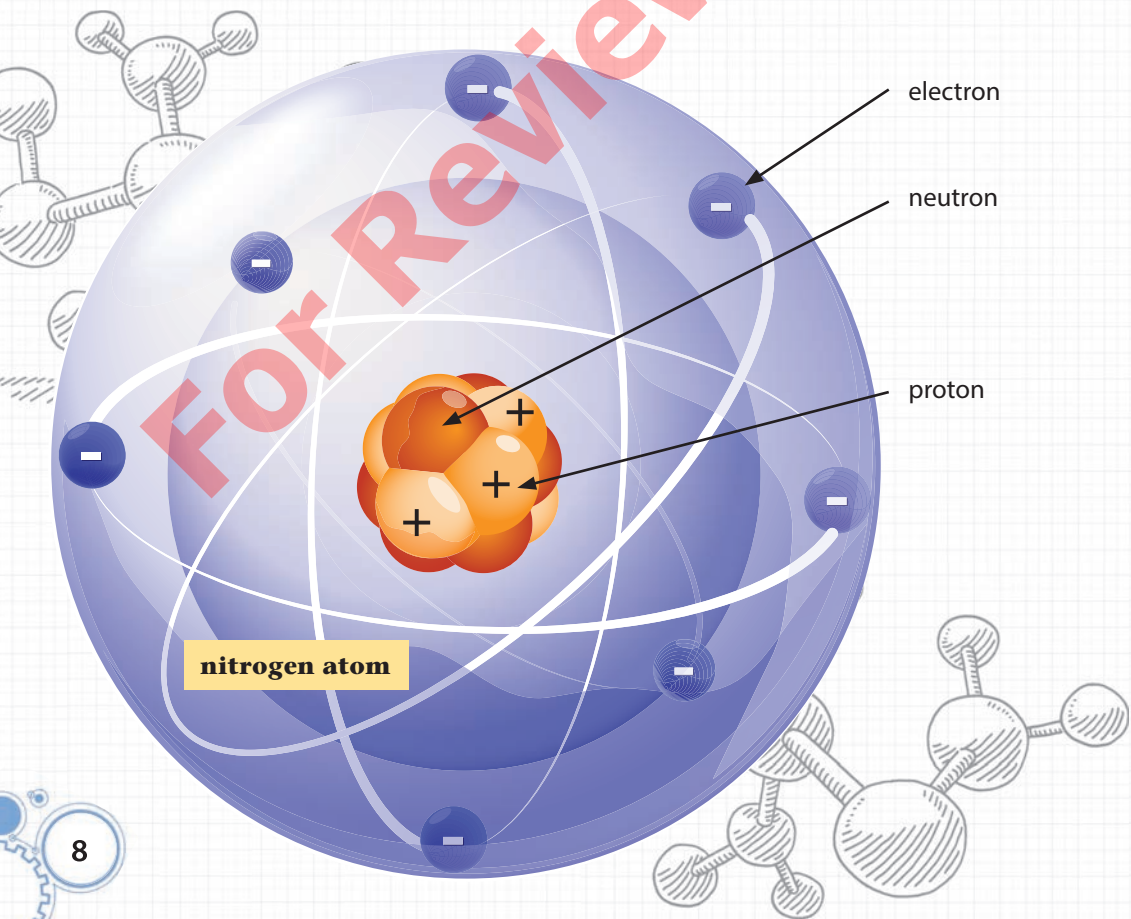


VISIBLE SPECTRUM

Subatomic Particles

Modern scientists learned that atoms can be divided into smaller particles. These are **subatomic** particles. There are three types. The first and second types are **protons** and **neutrons**. They are found in the nucleus of an atom. **Electrons** are the third type. These move around protons and neutrons.

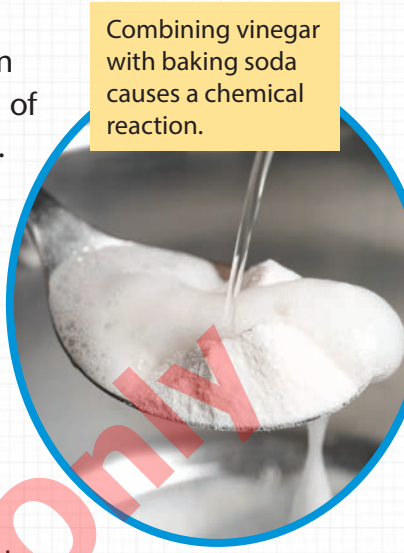
Each type of particle is different. First, protons are heavy and have positive charges. The number of protons is an atom's defining trait. Adding or subtracting protons changes the way atoms behave. Neutrons are similar in size and mass to protons but don't have any charge. Electrons are tiny and lightweight. Each one has a negative charge equal in strength to the proton's positive charge.



Making Molecules

Atoms combine in different ways to form new molecules. Some molecules are made of two atoms. Others are made of thousands.

Through chemical reactions, atoms combine into new molecules. When this happens, no atoms are created or destroyed. Molecules that combine are called *reactants*. The bonds between atoms break, and new bonds form. The new molecules are called *products*.



Combining vinegar with baking soda causes a chemical reaction.

Each different type of atom is a unique element. Some atoms can form molecules by themselves. Atoms of different elements can combine to form more complex molecules.

TECHNOLOGY

New Compounds

Some chemists use elements to develop new **compounds**. In the last 200 years, they have discovered nearly 15 million compounds! Some of these compounds can also be found organically. In June 2023, astronomers using the James Webb Space Telescope detected a compound for the first time. It is called *methyl cation* (MEH-thul CAT-eye-on). It was found in a nebula about 1,350 light years away from Earth!

Orion Nebula

STEAM CHALLENGE

Define the Problem

The periodic table has been a source of inspiration for art, accessories, and decor. A children's furniture and decor company is working on a line of science-themed items for budding scientists. They have asked you to create a mobile inspired by the periodic table. It needs to be hangable in a nursery or in a young child's room.

Constraints: You may only use the materials provided to you.

Criteria: Your mobile must include representations of at least three different elements from the periodic table. It must be able to hang and remain intact. It must be visually appealing so customers will want to buy it and babies or young children will enjoy looking at it.

CAREER ADVICE
from Smithsonian

Do you dream of studying chemistry?

Here are some tips to keep in mind for the future.

"Understanding chemistry helps us understand the world around us. Everything from salt on our food, to clouds in the sky, to volcanic eruptions, involves chemistry."

*– **Benjamin Andrews**, Geologist and Associate Curator of Rocks and Ores, National Museum of Natural History*

"The periodic table helps make sense of the building blocks that make up everything around us."

*– **Gabriela Farfan**, Research Geologist, National Museum of Natural History*