

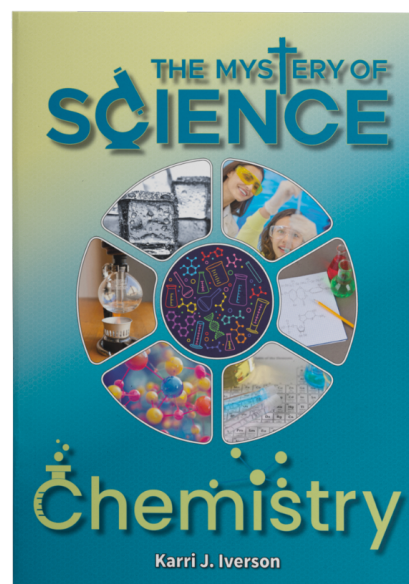
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CHEMISTRY / LESSON 6

Elementary Elements

Explore the building blocks of matter and the order behind the periodic table.

Inside: selected pages from the Student Reader, so you can see Karri's writing and the lesson format for yourself.



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LESSON 6

ELEMENTARY ELEMENTS

Goal: To identify elements as the purest form of matter and understand their organization on the periodic table.

Gold! Pure gold! Imagine the excitement in a prospector's voice as he finds gold—especially pure gold. When scientists think of a substance that is pure, they are usually thinking of an element.

Remember, everything you see and touch is matter. Matter can be made entirely of one kind of material or of different materials combined. An **element** is the purest form of matter that exists. Gold, sodium, and carbon are all elements. Each of these examples is made of only one kind of atom; gold has only gold atoms, sodium has only sodium atoms, and so on. All the known elements in the universe are organized by their physical properties in the **periodic table of the elements**. This table contains very important information that we will study throughout the next several lessons.



Most jewelry worn every day is not pure gold; instead, it has other metals added to it.

PERIODIC TABLE

Alkali Metal Alkaline Earth Transition Metal Basic Metal Semimetal Nonmetal Halogen Noble Gas Lanthanide Actinide																		Atomic Number ↓ 58 Ce 140.116 Cerium <table><tr><td>1</td><td colspan="16">H 1.008 Hydrogen</td><td>2</td><td colspan="16">He 4.002602 Helium</td></tr><tr><td>3</td><td colspan="16">Li 6.94 Lithium</td><td>4</td><td colspan="16">Be 9.0121831 Beryllium</td><td>5</td><td colspan="16">B 10.81 Boron</td><td>6</td><td colspan="16">C 12.011 Carbon</td><td>7</td><td colspan="16">N 14.007 Nitrogen</td><td>8</td><td colspan="16">O 15.999 Oxygen</td><td>9</td><td colspan="16">F 18.998403163 Fluorine</td><td>10</td><td colspan="16">Ne 20.1797 Neon</td></tr><tr><td>11</td><td colspan="16">Na 22.98976928 Sodium</td><td>12</td><td colspan="16">Mg 24.305 Magnesium</td><td>13</td><td colspan="16">Al 26.9815385 Aluminum</td><td>14</td><td colspan="16">Si 28.085 Silicon</td><td>15</td><td colspan="16">P 30.973761998 Phosphorus</td><td>16</td><td colspan="16">S 32.06 Sulfur</td><td>17</td><td colspan="16">Cl 35.45 Chlorine</td><td>18</td><td colspan="16">Ar 39.948 Argon</td></tr><tr><td>19</td><td colspan="16">K 39.0983 Potassium</td><td>20</td><td colspan="16">Ca 40.078 Calcium</td><td>21</td><td colspan="16">Sc 44.955908 Scandium</td><td>22</td><td colspan="16">Ti 47.867 Titanium</td><td>23</td><td colspan="16">V 50.9415 Vanadium</td><td>24</td><td colspan="16">Cr 51.9961 Chromium</td><td>25</td><td colspan="16">Mn 54.938044 Manganese</td><td>26</td><td colspan="16">Fe 55.845 Iron</td><td>27</td><td colspan="16">Co 58.933194 Cobalt</td><td>28</td><td colspan="16">Ni 58.6934 Nickel</td><td>29</td><td colspan="16">Cu 63.546 Copper</td><td>30</td><td colspan="16">Zn 65.38 Zinc</td></tr><tr><td>37</td><td colspan="16">Rb 85.4678 Rubidium</td><td>38</td><td colspan="16">Sr 87.62 Strontium</td><td>39</td><td colspan="16">Y 88.90584 Yttrium</td><td>40</td><td colspan="16">Zr 91.224 Zirconium</td><td>41</td><td colspan="16">Nb 92.90637 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Alkali Metal

Alkaline Earth

Transition Metal

Basic Metal

Semimetal

Nonmetal

Halogen

Noble Gas

Lanthanide

Actinide

Atomic Number

Symbol

Atomic Mass

Name

58

Ce

140.116

Cerium

57 La Lanthanum 138.90547	58 Ce Cerium 140.116	59 Pr Praseodymium 140.90766	60 Nd Neodymium 144.242	61 Pm Promethium 145	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92535	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93033	68 Er Erbium 167.259	69 Tm Thulium 168.93422	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.9668
89 Ac Actinium 227	90 Th Thorium 232.0377	91 Pa Protactinium 231.03688	92 U Uranium 238.02891	93 Np Neptunium 237	94 Pu Plutonium 244	95 Am Americium 243	96 Cm Curium 247	97 Bk Berkelium 247	98 Cf Californium 251	99 Es Einsteinium 252	100 Fm Fermium 257	101 Md Mendelevium 258	102 No Nobelium 259	103 Lr Lawrencium 260

LESSON 6

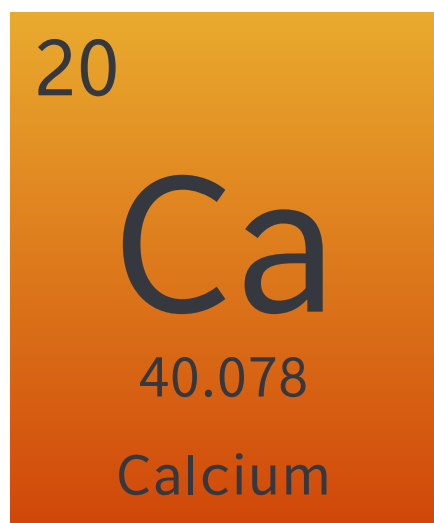
There are 3 ways to categorize how elements exist. First, scientists have discovered about 92 elements that exist naturally in creation. Second, there are several more that occur in very small amounts, so scientists disagree about whether those can be labeled as naturally occurring. That brings the number to 98. Third, about 20 elements have been manufactured in a laboratory. Even the ones made in the lab are made from elements that already existed—just changed somewhat.

As elements were discovered, scientists named them based on who discovered them, their properties, and or the place where they were originally found. Chemists usually write element names in an abbreviated form called a **symbol** that uses 1 or 2 letters of the alphabet. Some are easy to remember, such as O for oxygen, N for nitrogen, H for hydrogen, Ca for calcium, I for iodine, S for sulfur, and Al for aluminum. Some symbols come from the Latin name for the element, such as Au (*aurum*) for gold and Ag (*argentum*)

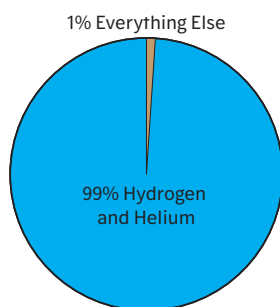
for silver. Does *argentum* sound like any other word you may have heard? The name *Argentina*, which is the country known as the land of silver, is derived from this word.

There is one element that makes up most of the matter in the universe. Can you guess which one it is? (It is not gold!) About 75% of all matter in the universe has hydrogen in it, including our bodies, plants, water, and even Earth's crust. The second most common element is helium (He), which is found in more places than just balloons. Helium makes up about 24% of matter and is found under Earth's crust. This means that the rest of the elements are much less common and make up only about 1% of matter.

It is not just on Earth that these elements are found but throughout the universe. Elements are in our atmosphere and on other planets.



Ca is the symbol for calcium. C is used for carbon.



Hydrogen and helium make up the majority of elements on Earth and in the universe.

The Mystery of Science: Chemistry

Matter on Mars or in stars comes from the same elements as matter on Earth. Jupiter is made up mainly of hydrogen and helium. Uranus, which is also known as an ice giant, has massive amounts of frozen water, which is made of hydrogen and oxygen. God created these unique building blocks that make up all matter in our universe.



Jupiter is a planet made mostly of hydrogen and helium. If you managed to visit, you would find no ground to walk on.

Just like an element is pure, the way elements combine can be pure. A **pure substance** is made of only one element; its composition is the same throughout. Nitrogen gas is a good example; it's made of only one element—nitrogen. Just like our example earlier, pure gold has nothing else mixed with it.

All matter in the universe is made up of these elements. Our God is a god of order and design, so it's no surprise that He created the smallest parts of everything with order and design as well!



VOCABULARY

element
periodic table of the elements
symbol
pure substance



SCRIPTURE MEMORY

Colossians 1:16: "For by Him all things were created, both in the heavens and on earth, visible and invisible, whether thrones, or dominions, or rulers, or authorities—all things have been created through Him and for Him."

LESSON 6

Nitrogen
14.007

P
Phosphorus
30.974

As
Arsenic
74.922

Sb
Antimony
121.76

Bi
Bismuth
208.98

Mc
Moscovium
288.10

16

34

52

T
Tellurium
127.60

84

Po
Polonium
209

116

32

CREATION CORNER

SILVER

Did you know that nothing rhymes with the word *silver*? There are also scientific things that make silver a unique metal on the periodic table. It is very lustrous and malleable, which means that it can easily be bent into beautiful jewelry and tableware. Silver was one of the first metals to be discovered and the first metal to be used in currency; the United States minted the silver dollar in 1794. It is a better conductor of electricity than gold and copper. But perhaps the most interesting fact about silver is its germ-fighting qualities. A cup or spoon made of silver can kill microbes, fungi, or viruses. The phrase “born with a silver spoon in his mouth” usually refers to a baby born into a wealthy family; however, many people also think it can refer to the health of a baby because of the silver in the spoon. The ancient Greeks used it for stomach pain or to heal wounds. Now silver can be used to purify water or be made into an antiseptic. Even more fascinating is that bacteria don’t become resistant to silver like they do with antibiotics.



The Mystery of Science: Chemistry

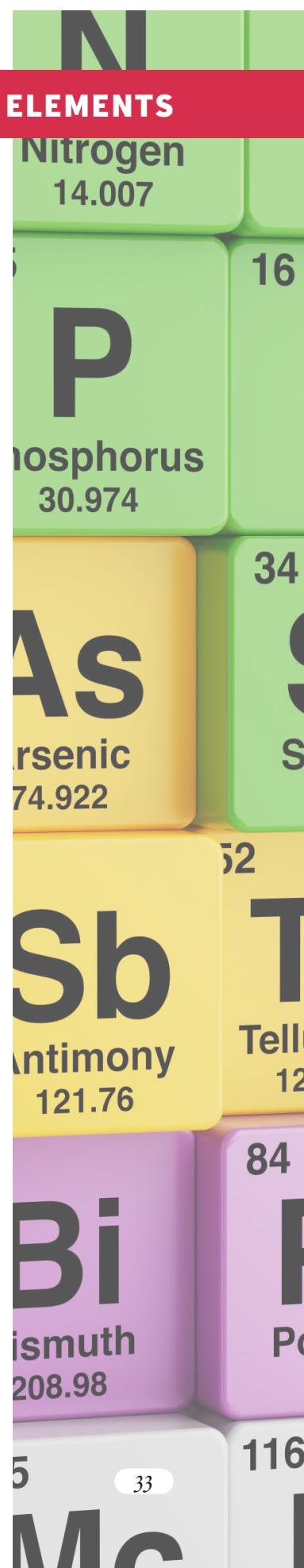
MEET THE CHEMIST

STEPHANIE KWOLEK (1923–2014)

When you see a police officer on duty, you will usually notice that he is wearing a bulletproof vest to protect his torso from life-threatening weapons. That body armor is made from Kevlar, a material developed by American chemist Stephanie Kwolek. Kwolek grew up studying nature with her father and learning sewing with her mother. She was an avid reader and found it very easy to memorize information. As a chemist, she worked at a DuPont research laboratory, developing a compound called poly-paraphenylene terephthalamide. Although Kwolek was originally trying to find a material to make tires stronger, her studies demonstrated that the stiff material had incredible strength—enough to stop a bullet. It is stronger than steel and doesn't rust. In addition to the Kevlar that makes bulletproof vests, the compound is used in helmets, tires, ropes, cables, and space equipment. Kwolek won numerous awards for her research, including induction into the National Inventors Hall of Fame. More importantly, her invention has saved thousands of lives.



Unit 2: Elements, Atoms, and the Periodic Table



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Created by Karri Iverson, homeschool mom of five and science educator.