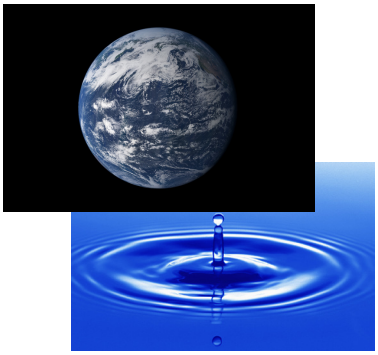
STUDENT GUIDE

Part I: Elements are the Building Blocks

Fundamental Question: What is an element?



Earth is known as the Water Planet. Water can be found on Earth in three states of matter: solid, liquid, and gas.

What other facts do you know about water? Perhaps you sometimes refer to water using its chemical name: H_2O or H_2O. List some facts that you know about water in your Journal.

H_2O is really a formula, identifying the building blocks of water.
Water is a compound made of two distinct pure substances:

Hydrogen (H) and **Oxygen (O)**

Hydrogen and oxygen each have their own distinctive properties such as: freezing and boiling temperatures, color, reactivity, and mass.

These two unique substances are classified as ELEMENTS. An element is a PURE SUBSTANCE that cannot be broken down into simpler substances and still maintain its chemical identity.

Elements are sometimes described as the building blocks of the universe because all matter in the universe is made of elements. For example, hydrogen and oxygen are the building blocks of water.

Carbon dioxide might be another chemical that is familiar to you because it is the gas that you exhale with each breath. Carbon dioxide is a compound. Its formula is **CO_2.**

The **O** in **CO_2** is the same oxygen element that you find in water. You may already know the name of the element that **C** stands for, but if you didn't know the name, you could look it up in the Periodic Table of Elements.

Record answers for these questions in your Journal.

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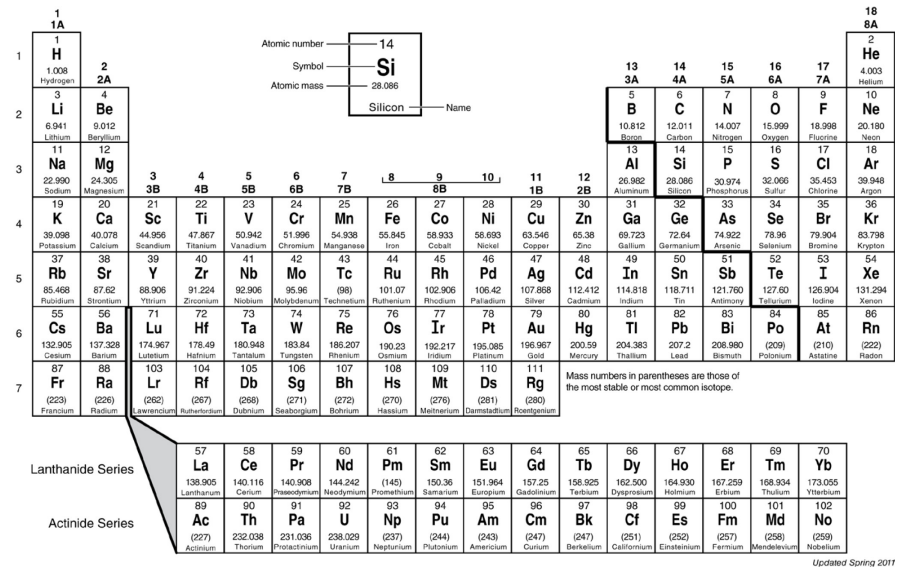
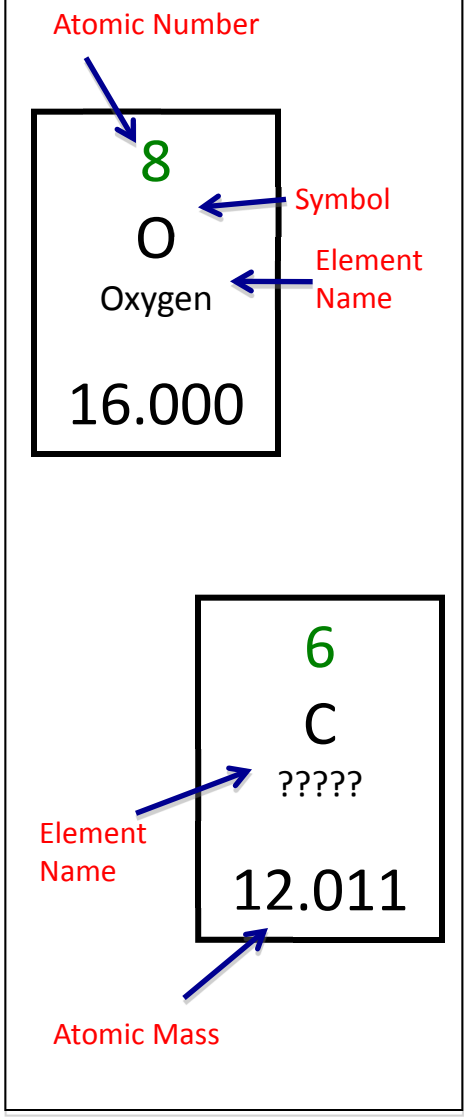
Part I: Elements are the Building Blocks (continued)

Fundamental Question: What is an element?

1. What is the name of the element that **C** stands for?
2. What is the atomic number for C?

PERIODIC TABLE OF THE ELEMENTS





Back in 1869, Russian chemist Dimitri Mendeleev organized all the known elements into a chart according to their physical and chemical properties. Today that chart is known as the Periodic Table of Elements. The Periodic Table organizes information about the elements and their properties.

The Periodic Table is made up of horizontal rows and vertical columns of boxes. Each box contains specific information about a single element. This information includes the element's name, the chemical symbol for the element, the element's atomic number, and the element's atomic mass.

Your teacher will provide you with a Periodic Table to color code using the key in the Student Journal. Keep this color-coded Periodic Table for reference during later activities.

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Part II: The Periodic Table of Elements

Fundamental Question: What is an element?

1. Compare your color-coded Periodic Table with your group members.
2. Locate the boxes for hydrogen (atomic number 1), oxygen (atomic number 8), and carbon (atomic number 6).
3. Consider how the atomic number of each element helped you locate the elements' positions in the Periodic Table.
4. Complete the questions about elements and the Periodic Table in your Student Journal.

Part III: Show and Tell Elements

Fundamental Question: What is an element?

1. Your teacher will supply you with a card providing information on one element.
2. Record the information from your card by placing a check in the appropriate columns of the Show and Tell Elements table in your Student Journal.
3. Once you record your information, complete the rest of your table by switching cards with other students.
4. Repeat step #3 until you complete the table in your Student Journal.

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Part IV: Earth and Living Elements

Fundamental Question: What elements make up the solid portion of Earth? What elements are common to living matter?

1. Study the Venn diagram circles labeled Solid Earth and Living Matter Elements in your Student Journal. When you finish this Venn diagram, you will have sorted out the elements that the solid Earth and living systems have in common and those elements that are not shared between these two systems.

2. Based on the Element Table you completed in the previous activity, identify the key elements most often found in the solid parts of Earth.

3. Lightly pencil in the names of these key elements in the Solid Earth circle of the Venn diagram. NOTE: Do not place any of the names in the section overlapping the Living Matter circle.

4. Repeat steps #2 and #3 using the key elements most often found in Living Matter.

5. Now compare the two lists. Transfer any element found in both lists to the central area of your Venn diagram, thus indicating that the element is found in both Living Matter and the Solid Earth. Once transferred to the center area, erase the element from the original location in the circles.

Part V: Oceans and Atmosphere Elements

Fundamental Question: What elements make up the ocean? What elements make up the atmosphere?

1. Based on the Element Table you completed in the previous activity, identify the key elements most often found in Earth's oceans.

2. Lightly pencil in the names of these key elements in the Oceans circle of the Venn diagram. NOTE: Do not place any of the names in the section overlapping the Atmosphere circle.

3. Repeat steps #1 and #2 using the key elements most often found in the Atmosphere.

4. Now compare the two lists. Transfer any element found in both lists to the central area of your Venn diagram, thus indicating that the element is found in both Earth's Oceans and Earth's Atmosphere. Once transferred to the center area, erase the element from the original location in the circles.

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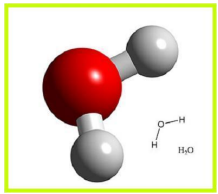
Part VI: Elements are Pure Substances

Fundamental Question: Why are elements described as pure substances?

You have already learned that H_20 is a compound made of the elements hydrogen and oxygen. You probably also understand that a single sample of the water molecule is very small. It is impossible to see a single water molecule with the naked eye or even with the most powerful microscope.

In a single drop of water there are 3×10^{21} water molecules. This number is a scientific way of writing a very large number. It is read as, "three times ten to the twenty first power." Another way to write 3×10^{21} is 3,000,000,000,000,000,000,000!

In your Journal, record how many hydrogen elements and oxygen elements are in a single water molecule.



In your Journal, record how many hydrogen elements and oxygen elements are in a single water drop.

The process used to break water down into its two building blocks, hydrogen and oxygen is called electrolysis. Your teacher may provide you with a website address so you can watch this process.

Part VII: Elements Combine to Make Compounds

What is the difference between an element and a compound?

There are close to 110 elements on the Periodic Table. Everything in the universe – you, the table, Earth, and all the stars are made up of combinations of these elements. As you know, elements are pure substances, the basic building blocks. Earlier you thought about the many water molecules in a drop of water and realized that when you took a smaller and smaller portion of the drop you still had a water molecule made of hydrogen and oxygen. To break the water molecule down any more would result in the pure elemental substances.

Elements cannot be broken down into smaller substances without totally changing their identity therefore elements are considered pure substances.

When we combine these pure substances with each other they become compounds. Compounds, like water, are also considered pure substances, composed of many H_2O molecules, which in turn can be broken down further into the individual elements of hydrogen and oxygen.

Complete Part VII: Elements Combine to Make Compounds in your Student Journal.