



SCIENCE

STUDENT BOOK

▶ **11th Grade** | Unit 2

SCIENCE 1102

ELEMENTS, COMPOUNDS, AND MIXTURES

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Elements, Compounds, and Mixtures

Introduction

Chemistry is an ancient science. Early in Genesis (Genesis 4:22) record is made of man's use of chemistry. In man's quest for ways to "subdue the earth and have dominion over it," chemistry has played a major role. Our synthetic world of today with its many different forms of plastic is a result of the knowledge man has gained about chemistry.

On the other hand, our polluted streams, dirty atmosphere, and trash-laden landfills are also a result of our knowledge of chemistry. Knowledge is neither good nor bad, but man's use of it can be either good or bad. Because of man's innate sinful nature, self is first, encouraging the misuse and poor stewardship of God's creation.

In this LIFEPAK[®] you will study the history of chemistry, the classification of matter, and man's knowledge of the world about him.

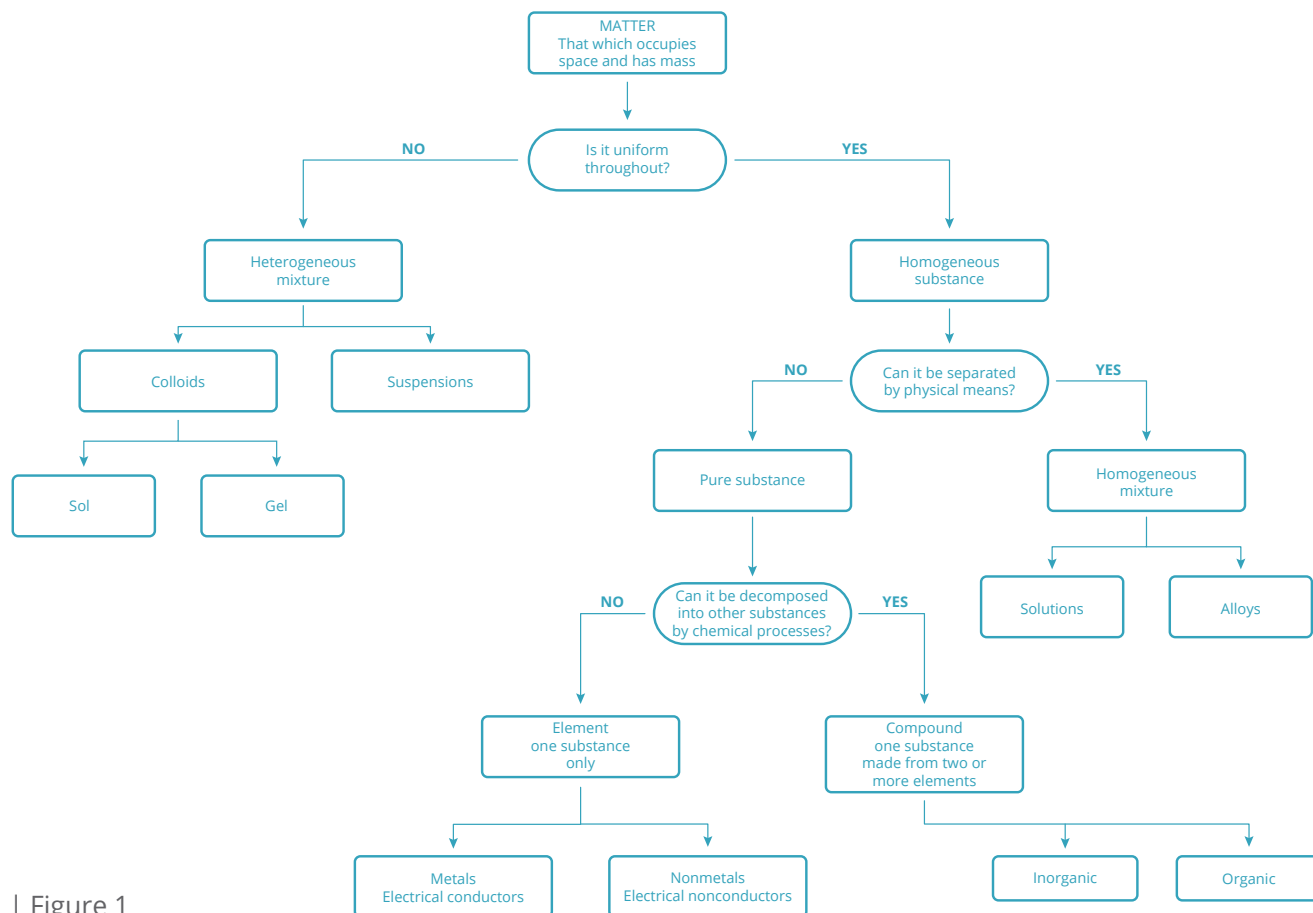
Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAK. When you have finished this LIFEPAK, you should be able to:

1. Trace the history of chemistry to about 1750.
2. Describe alchemy and what it has contributed to us.
3. Describe elements.
4. Distinguish between and describe chemical, physical, and phase changes.
5. Describe compounds and distinguish them from elements.
6. Classify compounds as organic or inorganic.
7. Describe and give examples of various types of mixtures.

1. ELEMENTS

All matter can be classified in the following classification scheme:



| Figure 1

We will use this classification scheme for our study of chemistry.

In man's effort to find order in the universe, he has learned to classify. Man has always been curious about the world around him. The word *science* comes to us from the Latin verb *scio* which means *to know*. The Latin noun *scientia* means knowledge. In both cases the meaning is broader than mere recognition. In this section you will study the history of alchemy, the contributions of alchemy, and the properties of the simplest parts of matter, elements.

Section Objectives

Review these objectives. When you have completed this section, you should be able to:

1. Trace the history of chemistry to about 1750.
2. Describe alchemy and what it has contributed to us.
3. Describe elements.
 - 3.1 Give the symbols of several common elements.
 - 3.2 Classify elements by properties.
 - 3.3 Define atoms.

Vocabulary

Study these words to enhance your learning success in this section.

alchemy

alloy

atom

compound

element

metal

nonmetal

Note: All vocabulary words in this LIFEPAK appear in **boldface** print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.

ALCHEMY

Who was the first chemist? No one really knows, but Genesis 4:22 clearly describes Tubalcain as an art teacher who worked with brass and iron. This information indicates that chemistry had been established as a science by then. However, that chemistry was probably limited to simple metallurgy and the use of metals.

History. As civilization grew, the center of all scientific knowledge became Alexandria, Egypt. About 300 B.C. the science of **alchemy** became important. The Egyptians were interested in making life easier. As a result, a deliberate effort was made to combine the Egyptian arts of metallurgy, dyeing, and glassmaking with a search for a “better” life. As a result, the alchemist tried to:

1. Discover a universal cure for disease,
2. Discover a means to prolong life, and
3. Transmute the base elements like lead into gold.



| Alchemy tools

Prepare a report.

- 1.1** The history of the spread of alchemy to Europe from 300 B.C. through the Dark Ages and up to about 1750 is interesting because it was greatly influenced by the religious beliefs of the nations in control. Aristotle, Descartes, and Roger Bacon are examples of people who influenced the growth of chemistry throughout this period. Find out what “puffers” and “adepts” were. Prepare a report on the growth and spread of alchemy from 300 B.C. to about A.D. 1750. Include names, dates, and specific influences the church had on this spread. Submit the report for evaluation.



CHECK

Teacher

Date

Legacy. Early alchemists contributed much to modern knowledge of matter. They were able to isolate and study the properties of common **elements** such as copper, sulfur, iron, lead, gold, silver, arsenic, and mercury. They also studied compounds such as mercury oxide and **alloys** of **metals** and developed laboratory techniques that were used by later scientists.

The transition from alchemy to the science of chemistry occurred when the basis of the study became truly experimental in practice. Scientists in the sixteenth century began to put each theory to the test and found the laboratory the heart of the learning process.

Complete these statements.

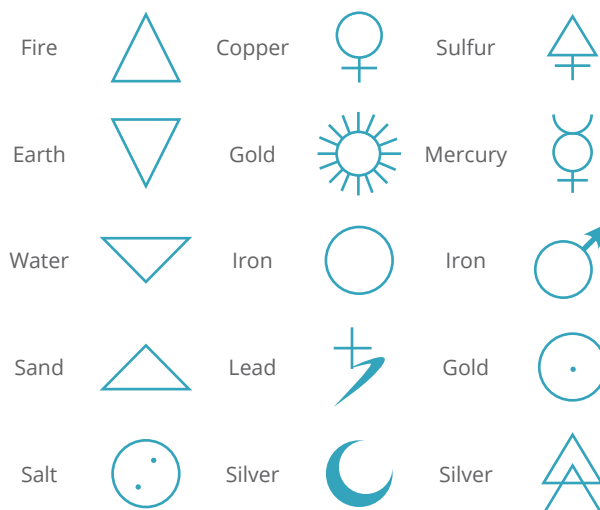
- 1.2** The two main classes of homogeneous matter are a. _____ and
b. _____.
- 1.3** Pure substances can be classed as a. _____ or b. _____.
- 1.4** The three purposes of alchemy were:
a. _____,
b. _____, and
c. _____.
- 1.5** The city that was first known for alchemy was _____.

SYMBOLS

Very early, even in the days of alchemy, chemists discovered the need for symbols to express what they were doing. Using symbols provided a simple way to communicate without always writing out the full words or names.

Derivation. Early symbols were derived from the surroundings, things that were simple and easily understood.

Representation. Today's symbol representation is derived primarily from an abbreviation of the name of the element, either the English or Latin spelling. A list of common elements and symbols is found in Figure 3. These should be memorized.



| Figure 2: Early symbols were derived from surroundings.

Name	Symbol	Name	Symbol	Name	Symbol
Hydrogen	H	Silver	Ag	Aluminum	Al
Carbon	C	Lead	Pb	Zinc	Zn
Nitrogen	N	Nickel	Ni	Gold	Au
Calcium	Ca	Oxygen	O	Magnesium	Mg
Copper	Cu	Neon	Ne	Uranium	U
Iron	Fe	Helium	He	Tin	Sn
Mercury	Hg	Iodine	I	Arsenic	As

| Figure 3: Names and symbols of common elements

Answer these questions.

- 1.6 What is common to all first letters of the element symbol? _____

- 1.7 When two names begin with the same letter (i.e., hydrogen and helium), how are the two represented so that they can be distinguished from each other?

- 1.8 Notice that several elements have symbols quite different from their names. Do these symbols come from the English or Latin name? _____

Complete this activity.

- 1.9 Fill in the following table.

Symbol	Name of Element
Cu	
Pb	
Hg	
Ag	
Au	

PROPERTIES

Each element has its own unique properties. Those properties identify it as that element, and no other element has exactly those same characteristics.

Physical. Some of the easiest ways to identify a particular element is by its physical properties.

These properties include such things as color, hardness, boiling point, melting point, density, magnetic properties, crystalline shape, and ability to conduct electricity.



| What are some characteristics of this sulfur?

Try this investigation.**These supplies are needed:**

- flashlight battery with light bulb, socket, and wires
- sample of aluminum, zinc, carbon, iron, copper, and sulfur

Follow these directions and complete the activities. Put a check in the box when each step is completed.

1. Put together the conductivity tester as shown. The ends of the wire can be taped to the contacts of the battery with electrical tape.
2. Touch the two loose ends, A and B, together to see if the bulb lights. If it doesn't light, recheck your circuit. If it still doesn't light, change bulbs and/or batteries. Be sure the bulb does light before you go on.
3. Using each sample separately, touch A to one end and B to the other end of the sample. For sulfur, if it is in powder form, place the points A and B in the powder about 1 cm apart. Record your results in the second and third columns of the chart in 1.10.



Conductivity Experiment

**Complete these items.**

1.10 Give the results of your investigation. Complete columns two and three.

Element	Symbol	Conducts (yes / no)	Classification
Aluminum			
Zinc			
Carbon			
Iron			
Copper			
Sulfur			

1.11 Look back at the classification scheme for matter in Figure 1. On the basis of the classification of elements, classify the test elements as metals or **nonmetals**. Complete the last column of the chart in 1.10.



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