

Reading 1.1 What is Chemistry?

Section 1.1 What is Chemistry?

Lesson Objectives

The student will:

1. give a brief history of how chemistry began.
2. list some new materials produced by chemists.

Vocabulary

- chemistry

Introduction

During medieval times, a group of people known as alchemists began looking for ways to transform common metals, such as lead, copper, and iron, into gold. Can you imagine how much money you would make if you could go to the store, buy some iron nails, and turn them into gold? You'd be rich in no time! he

The Origin and Evolution of Chemistry

Alchemists experimented with many different kinds of chemicals, searching for what they termed the “philosopher’s stone”—a legendary substance necessary for transforming common metals into gold (see Figure below). We now know that there is no such thing as a philosopher’s stone, nor is there any chemical reaction that creates gold from another metal. We know this because we now have a much better understanding of how the matter in our universe behaves. Nevertheless, those early alchemists kindled interest in chemical transformations and inspired the development of modern chemistry.

Chemistry is the scientific study of matter and the changes that it undergoes. It’s no coincidence that the word “chemistry” looks a lot like the word “alchemy.” Early alchemists were commonly known as “chemists,” and over time, people started referring to their work, particularly the more legitimate forms of it, as chemistry. While it may seem strange, in many ways it is appropriate that our word for the present-day study of matter comes from the early practice of alchemy. A lot of the techniques and equipment fundamental to modern chemistry were actually developed by early alchemists.





This painting shows an alchemist in search of the philosopher's stone.

Alchemy was practiced in China and India and later in the Arab world and Europe. The origin of the word “alchemy,” however, is something of a mystery. Certainly, early Europeans derived the term “alchemy” from the Arabic word “al-kimia,” meaning “the art of transformation” (of course, the transformation that alchemists were primarily concerned with involved the creation of gold). Most of what we know today about early alchemy is based on translations of Arabic documents, as the Muslim alchemists were among the first to keep careful notes about their experiments.

Even though our earliest records of alchemy come from the Arab Empire, some scholars believe that Arabs adopted alchemy and the word “al-kimia” from the Greeks around 650 A.D. The Greeks, in turn, may have learned of alchemy from the Egyptians. Khem was an ancient name for Egypt, and the Egyptians of early history were known as masters at the art of working with gold. It’s very likely that al-kimia is actually a distorted version of the word “al-kimiya,” meaning “the art of the land of Khem,” or the art of Egypt. In those days, “chemistry” was primarily involved in purifying and combining metals, making alloys such as bronze and steel, to make useful materials.

Medieval Europeans were similarly fascinated by alchemy. Unfortunately, many alchemists in Europe borrowed ideas from the more mystical of the Arabian alchemists, and, as a result, European alchemy quickly became associated with wizardry, magic, and the search for the philosopher’s stone. It wasn’t until the late 17th century that European chemists began applying the scientific method (see the lesson “The Process of Science” for a more detailed discussion about the scientific method). Robert Boyle (1627–1691) was the first European chemist to do so, using quantitative experiments to measure the relationship between the pressure and the volume of a gas. His use of scientific methods paved the way for other European chemists and helped to establish the modern science of chemistry.

The man who would greatly advance the development of modern chemistry was Antoine Lavoisier (1743–1794). Considered the father of modern chemistry, Lavoisier (seen in Figure below) discovered that although matter may change its shape or form, its mass always remains the same. As a result, he would state the first version of the law of conservation of mass. Lavoisier also wrote the first extensive list of elements, including oxygen and hydrogen, and helped to reform chemical nomenclature.





Antoine Lavoisier is considered to be the father of modern chemistry due to his many contributions to chemistry.

What Chemists Do

You might wonder why the study of chemistry is so important if you can't use it to turn iron into gold or to develop a potion that will make you immortal. Why didn't chemistry die when scientists like Boyle and Lavoisier proved alchemy was nothing but a hoax? Although we can't use chemistry to make gold or to live forever, modern chemistry is still very powerful. There may be no such thing as a potion that cures all diseases, but many chemists today are working to develop cures for specific diseases, including HIV/AIDS and various forms of cancer.

Chemists apply information about matter and the changes it undergoes to improve our lives in many different ways. Modern chemists study not only chemicals that can help us, but also chemicals that can hurt us. For example, environmental chemists test the air, soil, and water in our neighborhoods to make sure that we aren't exposed to heavy metals (such as mercury or lead) or chemical pesticides. Moreover, when environmental chemists do find dangerous substances, they use their knowledge of chemistry to clean up the contamination. Similarly, every time you buy packaged food from the grocery store, you can be sure that many tests have been done by chemists to ensure those foods don't contain any toxins or carcinogens (cancer-causing chemicals).

Chemists are also responsible for creating many important materials that we use today. In addition, many technologies rely on chemistry as well. In fact, flat-screen LCD televisions, cubic zirconium rings, and energy-efficient LED lights are all thanks to our improved understanding of chemistry.

One of the huge breakthroughs in recent history has been the discovery of plastics (see Figure below). Initially, plastic was made by chemically modifying cellulose, a naturally occurring chemical found in plants. As chemical knowledge developed, however, scientists began to realize that plastics had special properties. On a microscopic scale, plastics are composed of thousands of tiny chains of molecules all tangled up together. Scientists reasoned that if they altered the chemicals in these chains but still managed to keep the chains intact, they could make new plastics with new properties. Thus began the plastic revolution!



Some common objects made of plastic.

Semiconductors are another class of “new” materials whose development is largely based on our improved understanding of chemistry. Because scientists know how matter is put together, they can predict how to fine-tune the chemical composition of a semiconductor in order to make it absorb light and act as a solar cell, or to emit light and act as a light source.

We’ve come a long way from our early days of producing bronze and steel. Nevertheless, as our understanding of chemistry improves, we will be able to create even more useful materials than the ones we have today.

Lesson Summary

- Chemistry began as the study of alchemy. Most alchemists were searching for the philosopher’s stone, a fabled substance that could turn common metals into gold.
- Chemistry is the scientific study of matter and the changes that it undergoes.
- The word “chemistry” comes from the Arabic word “al-kimia,” meaning “the art of transformation.”
- Chemists apply information about matter and the changes it undergoes in many different ways to improve our lives.

Vocabulary

- **chemistry**: the scientific study of matter and the changes that it undergoes

Further Reading / Supplemental Links

[Section Homework --> \(https://uvu.instructure.com/courses/362094/quizzes/583325\)](https://uvu.instructure.com/courses/362094/quizzes/583325)