# **Chapter 2: Exploring Matter and Its Properties**

## <H1> Essential Questions

1. How do physical and chemical properties help us identify substances?
2. Why are elements, compounds, and mixtures classified differently, and how do their properties vary?

## <H1>Chapter Big Idea

## Fig. C2.1 Matter around us

Chemistry is the fundamental language for understanding the universe, and by mastering its key concepts (such as density, states of matter, chemical reactivity), we gain the tools to explore the diverse nature of matter.

## <H1>Chapter Exploration: The Mysterious Compound

An extravagant bracelet, insured for a large sum, has been reported stolen. The owner described the bracelet as made of pure gold and adorned with diamonds and other precious materials. Weeks later, the police located a bracelet matching the description. However, when the police returned the bracelet to the owner, the owner claimed it was a fake, that the stones were not diamonds but cubic zirconia, and the metal was not gold but rather gilded copper. The insurance company refuses to pay until a scientific analysis is performed to determine if the found bracelet is indeed the stolen one.

The insurance company hired a forensic chemist to analyze the bracelet and determine its authenticity. Made of metal and stones, the bracelet did not appear uniform, and the forensic chemist had to test each component separately. First, the chemist started with the metal. They set out to test some properties of the metal, such as repeated measurements to calculate the density of the metal and compare it to the density of pure gold, which is 19.32 g/cm³ (the density of gilded copper is much lower). Some decisions had to be made before testing, however. What conclusion would the chemist reach if the density found for the metal were 18 g/cm³? What if it were 19 g/cm³? Would 19.3 g/cm³ be close enough? Would it have to be 19.3200 g/cm³?.

## <H1>Chapter STEM Task

Develop models and perform experiments to study the properties of matter—such as density, solubility, reactivity, and conductivity—and how elements, compounds, and mixtures behave in different environments. Investigate real-world applications of these properties, such as creating stronger, lightweight alloys for aircraft or testing food products for contamination and authenticity to ensure safety and quality.

Develop models and conduct experiments to explore the nature of matter, its physical and chemical properties, and how different types of matter—elements, compounds, and mixtures—behave under various conditions. to research and identify real-world problems where the knowledge of matter and its properties is applied.

## <H1>Chapter Overview

**Lesson 1:** The Nature of Matter

**Lesson 2:** Properties of Matter and Changes

**Lesson 3:** Elements, Compounds, and Mixtures

# Chapter Wrap-Up

## <H1> Summary

* Matter is defined as anything that occupies space and has mass.
* Matter can be classified in two main ways: physical properties and chemical properties.
* Physical properties do not alter the chemical identity of matter, but chemical properties (reactions) do.
* Phase changes (such as melting or freezing) are physical changes, whereas rusting or burning are examples of chemical changes.
* Elements are pure substances consisting of only one type of atom, while compounds consist of two or more elements chemically combined in fixed proportions.
* Mixtures are physical combinations of substances that retain their individual properties.
* Mixtures can be homogeneous (uniform composition) or heterogeneous (distinct components).
* **Solution**, **colloids**, and **suspensions** are mixtures that differ based on the size of the particles and how they are distributed within the mixture.

## <H1> Continuing the Exploration

What is that mysterious compound?

The mysterious compound is made up of particles and has a fixed shape and volume. It exhibits both physical and chemical properties but it undergoes a physical change that is new substance is formed by it. It has been concluded that the mysterious compound is a mixture as it is not chemically combined. Hence, the chemist has determined that the mystery compound is gilded copper.

## <H1>Bring It Together!

In this chapter, you set out to learn about matter and its properties to create a model to represent them and how matter can be explained in terms of particle nature. To do that, you had to use your prior knowledge of the matter and its nature in Lesson 1 of this chapter. Then, in Lesson 2, You classified matter physically and chemically and experimented with the physical and chemical changes. In Lesson 3, you distinguished between elements, compounds, and mixtures.

## <H1>Chapter Reflective Journal

# Record the key learning from this chapter on exploring matter and its properties. You may exchange ideas with a classmate.