

CONCEPT 1

Matter and its interactions make up our world.

Activity

Describe It, Separate It

Your teacher will provide your group with a mixture. You will have access to equipment such as magnets, filters, and sieves. Before starting, examine **Figure 2.1** below.

1. Is your mixture heterogeneous or homogeneous (a solution)? How do you know?
2. Can you separate your mixture into parts? Try to do so.
3. Are the parts of your sample mixtures or pure substances? Explain.
4. What further tests would you like to conduct to gather more information about the components of your sample?

matter anything that has mass and takes up space

pure substance matter that has a definite composition and cannot be separated by physical means

mixture a blend of two or more pure substances in which each substance retains its individual properties; can be separated by physical means

You are surrounded by **matter**, and chemistry is the science of matter and its interactions. By studying chemistry, we can better understand the properties and behaviour of matter on Earth and beyond. Matter can be classified as either a **pure substance** or a **mixture**. Pure substances are made up of one type of particle. Mixtures are made up of two or more pure substances, and therefore two or more types of particles. **Figure 2.1** summarizes the classification of matter.

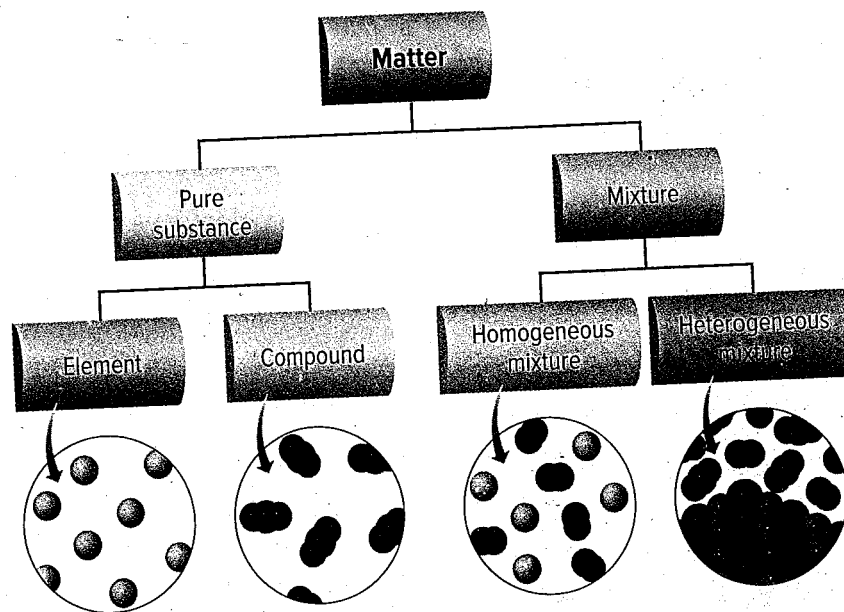


Figure 2.1 Matter is either a mixture or a pure substance. A mixture can be homogeneous or heterogeneous. A pure substance can be an element or a compound. Give one example of each of these: a mixture, an element, and a compound.

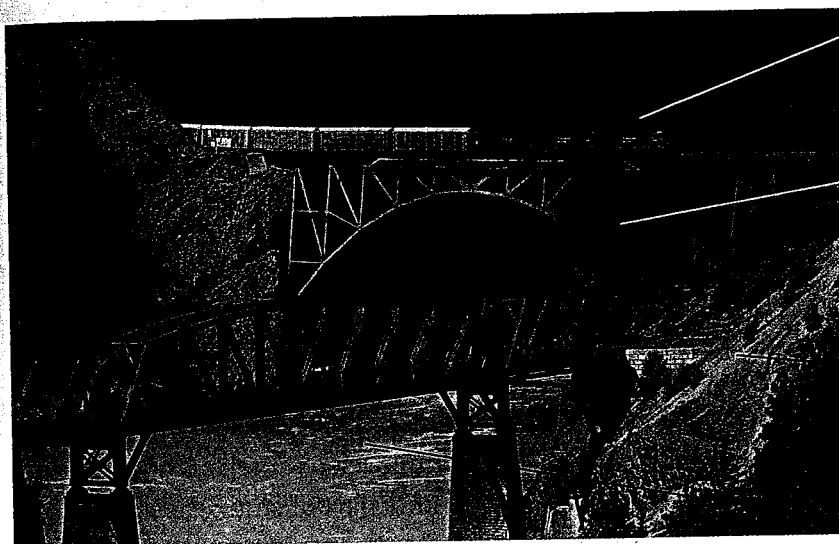


Figure 2.2 This pair of railway bridges, called the Cisco bridges, is found at Siska, B.C. Make a table to list the mixtures, compounds, and elements mentioned. Add one example not mentioned.

This train runs on diesel fuel. Diesel is a mixture of chemical compounds made of the elements hydrogen and carbon.

The metal used to make the bridge is steel. Steel is a very strong solid mixture—an alloy—composed of iron and small amounts of other elements, such as carbon.

The rock of the hillside is a mixture that includes quartz, which is a compound made of the elements silicon and oxygen.

This river water is a mixture made up of the compound water, a variety of compounds and elements dissolved in the water, and suspended bits of rock.

Mixtures, Compounds, and Elements

Most of the materials we interact with each day are mixtures.

Figure 2.2 shows and describes some examples of solid, liquid, and gas mixtures. Some—such as air and steel—are homogeneous mixtures, or *solutions*. They are mixed uniformly throughout, and you cannot see their components, even with a microscope. Others, such as rock, have different parts that you can see. These are *heterogeneous mixtures*. But all are made up of two or more different pure substances.

Pure substances can be elements or compounds. **Elements** are made up of just one type of atom and cannot be broken down into simpler substances by chemical means. **Compounds** are made up of atoms of two or more elements.

Properties of Matter

The steel of the railway tracks in **Figure 2.2** is a strong, hard, shiny solid. Rock is also a hard solid, but it is brittle. Air is a clear, colourless gas. These descriptions all use *physical properties*. These are characteristics of matter that can be observed or measured without changing its chemical identity. In contrast, *chemical properties* describe the ability of matter to react with another substance to form one or more different substances. **Table 2.1** gives further examples.

element a pure substance that cannot be broken down into simpler substances by physical or chemical means

compound a pure substance made up of two or more elements; can be broken down into elements by chemical means

Table 2.1 Physical and Chemical Properties

Physical Properties		Chemical Properties
<ul style="list-style-type: none"> • colour • malleability • texture • viscosity • ability to conduct heat and electricity 	<ul style="list-style-type: none"> • state of matter • melting point • boiling point • hardness • solubility 	<ul style="list-style-type: none"> • combustibility • reactivity with acids • reactivity with oxygen • lack of reactivity

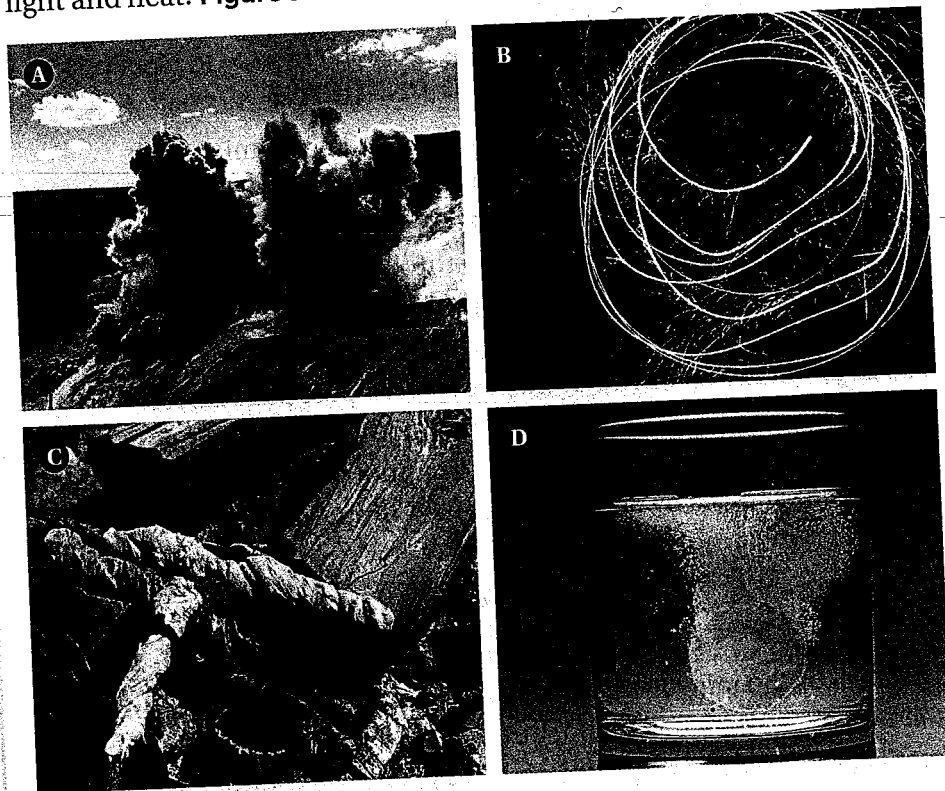
Chemical Reactions

chemical reaction a process in which the atoms of one or more pure substances are rearranged to form a different substance or substances.

An important part of studying matter is carrying out and observing chemical reactions. In a **chemical reaction**, one or more pure substances interact to form a different substance or substances. For example, elements can react to form compounds, compounds and elements can react to form different compounds, and compounds can break apart to form elements and simpler compounds.

A fire is a common example of a chemical reaction. In a forest fire, compounds in plants react with oxygen in the air to form many compounds, including carbon dioxide, carbon monoxide, and water, as well as the element carbon. You cannot see or smell carbon dioxide or carbon monoxide, but water is a visible part of smoke as it cools and forms droplets in the air. You can see the carbon as the black charcoal left behind by the fire. Energy is also released in the form of light and heat. **Figure 2.3** shows other examples of chemical reactions.

Figure 2.3 **A** Explosive chemical reactions are used in mining to break apart rock and soil. **B** In a sparkler, metals react with air and release energy in the form of light and sound. **C** Exposing food to heat results in chemical reactions that change its taste and appearance. **D** The chemical reaction between substances in this tablet and water produces gas, which you can see as bubbles in the water.



Before you leave this page . . .

1. What is the difference between a pure substance and a mixture? Use diagrams in your answer.
2. List three physical properties of water at room temperature.
3. Give one example of an element and one example of a compound. Explain how they are different.
4. What happens in a chemical reaction?