

What Is Matter?

You have probably seen, touched, and tasted hundreds of different things in your life. You have touched wood, steel, and ice. You use shampoo, and you drink milk. You breathe air. Have you ever wondered what all these things are made of?

The examples listed above are all made of matter. In fact, all of the objects around you are made of matter (Figure 1). **Matter** is anything that has mass and takes up space. Remember the chocolate chip cookies at the beginning of the unit? All of the ingredients are examples of matter. A mixing spoon is an example of matter. Your entire body is made of matter!

matter: anything that takes up space and has mass

LINKING TO LITERACY

Before Reading: Skimming and Scanning

To improve your understanding of informational text, think of it as a puzzle in which you need to put all of the pieces together. Start by looking at the title. Then, skim and scan the page for more information. Are there captions you can read? Are there subtitles or headings? What about pictures? Are there words that are highlighted or bolded, and that jump out at you from the page? Take a moment to connect all of your thoughts. What have you learned about this text even before beginning to read it?



Figure 1 What examples of matter can you see?

chemistry: the study of matter and its changes

The Science of Matter

The study of matter and its changes is called **chemistry**. Scientists who work in chemistry are called chemists. The photograph at the beginning of this chapter shows chemists working in a lab. Knowledge of chemistry is useful in many different careers. People who work in medicine, cooking, art, photography, and solving crimes all use chemistry in some way.

Some chemists use their knowledge about matter to develop new kinds of matter. Often, scientists study matter that is found in nature, and then imitate it. These “imitation” chemicals are sometimes better than natural chemicals. For example, natural almond extract comes from wild almonds. It contains tiny amounts of a dangerous poison called cyanide. Artificial almond extract is a mixture of substances made in a chemistry lab (Figure 2). It is similar to the natural flavour, but it does not contain poisonous cyanide. Artificial chemicals are also sometimes cheaper to obtain than natural chemicals.

Artificial chemicals, however, are not always better than natural ones. Lemonade made with real lemons includes lots of Vitamin C. Lemonade made with artificial flavour may taste almost the same, but will probably not have the same vitamin content. 🌐

The Makeup of Matter

What makes up matter? To help us think about matter, we will look at something made of just one type of matter: aluminum foil (Figure 3). Imagine using stronger and stronger microscopes to examine the foil. What would you see?

With the first microscope, you would see the smooth, shiny surface of the foil, perhaps with some little scratches or marks (Figure 4).

With a stronger microscope, the marks would be more visible, but you could still recognize the material as aluminum foil.

What if you used the most powerful kind of microscope available—a scanning probe microscope? You might be surprised at what you would see. Figure 5 shows what a piece of aluminum foil looks like through a scanning probe microscope. The surface is not smooth or silver-coloured. Instead, it is made of many tiny bumps. These bumps show the presence of aluminum particles.



Figure 3 Aluminum foil is made of just one kind of matter: aluminum.



Figure 4 If you look at aluminum foil through a microscope, it still looks like a smooth, silver-coloured metal.



Figure 5 A scanning probe microscope allows you to see the aluminum particles in the foil.



Figure 2 Artificial almond extract is a kind of matter that chemists copied from nature.

To learn more about artificial flavours,

[Go to Nelson Science](#)



Gaining Meaning from Context

Read the text on this page. Without looking in a dictionary, can you gather enough information to understand what the word “particle” means?

particle theory of matter:

an explanation of what matter is made of and how it behaves; the particle theory states that all matter is made up of tiny particles that are always moving, that attract each other, and that have space between them

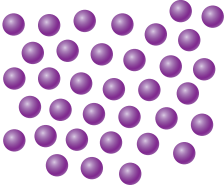
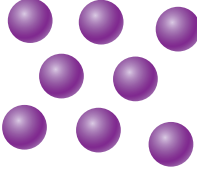

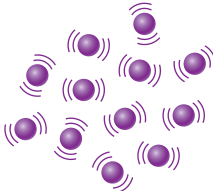

A small piece of aluminum foil contains billions of tiny aluminum particles. All matter is made of particles that are too small to be seen, except through powerful microscopes. These particles of matter are tinier than the smallest thing you can imagine. Imagine a piece of aluminum foil that is 1 cm by 1 cm. If each particle in that piece of foil were expanded to the size of an egg, the eggs would cover the entire surface of Earth to a depth of several metres.

The Particle Theory of Matter

All matter is made of tiny particles. Different kinds of matter are made of different kinds of particles. The particles themselves do not look like the kind of matter they make up. For example, a single particle of aluminum does not look the same as a piece of aluminum. A single particle of water does not look or behave like the water in a lake. Only when large numbers of particles are together do aluminum particles behave like aluminum, or water particles behave like water.

The **particle theory of matter** (also known as “particle theory”) helps to explain what scientists have learned about these tiny particles of matter. The main ideas of the particle theory are listed in Table 1.

Table 1 The Particle Theory

Main idea	Illustration
1. All matter is made up of tiny, invisible particles.	
2. Particles have empty spaces between them.	
3. Even though you cannot see them, particles are moving randomly all the time.	
4. Particles move faster and spread farther apart when they are heated.	
5. Particles attract each other, so they tend to stay together rather than fly apart.	

Using the Particle Theory

You can use the particle theory to explain many of the things you observe in everyday life. The following sample problem shows how to use the particle theory to explain an observation.

SAMPLE PROBLEM: Explain an Observation Using the Particle Theory

If you placed a few drops of food colouring in a container of water without stirring, what do you think you would see (Figure 6)?

Solution: Particles of food colouring and particles of water are moving and bumping into each other all the time. This causes the food colouring particles and the water particles to mix together, even without stirring.



Figure 6

Look at the paper in this textbook. Is it hard to believe that the paper is made of billions of invisible particles? If you answered yes, you are not alone. For thousands of years, people did not know that matter is made of particles. Today, we accept the particle theory because it helps scientists to explain many puzzling observations.



TRY THIS: Explain Observations Using the Particle Theory

SKILLS MENU: performing, observing, analyzing, communicating

In this activity, you will make observations and use the particle theory to explain your observations. You may want to review the main ideas of the particle theory in Table 1.

Equipment and Materials: tablespoon; ceramic coffee mug; timing device; sugar; room-temperature water; cold water; ice; hot water



Never taste anything in the science lab. Use care when working with hot water.

1. Stir a flattened spoonful of sugar into a mug of water at room temperature. At the same time, start timing. Keep stirring until you can no longer see the crystals of sugar. Measure the time it takes for the sugar to completely disappear. Record your observations.
2. Empty the sugar water into the sink and rinse the mug.
3. Repeat steps 1 and 2 using cold water with a couple of ice cubes in it.
4. Repeat steps 1 and 2 using hot water.
 - A. What did you observe in all three mugs of water?
 - B. Use the particle theory to explain your observations.
 - C. In which mug of water did the sugar crystals disappear most quickly?
 - D. Use the particle theory to explain your observations in part C.



CHECK YOUR LEARNING

1. (a) In this section, you learned that matter is made of very tiny particles. Do you find this idea easy or difficult to understand? Explain why.
(b) What can you do to help you understand this idea better?
2. (a) What is matter?
(b) Give three examples of things that are made of matter.
3. In point form, list the five main ideas of the particle theory. You may use diagrams.

Credits

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Unit A

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