1.8

Models of Matter

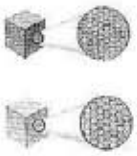
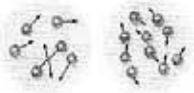
Up to this point, you have observed matter and its behaviour. You have observed both physical and chemical properties, and how these have changed during a physical and chemical change. You have seen a number of ways in which matter is used, based on these properties.

Now comes the hard part: how do you explain the physical evidence that you have observed in earlier sections of this unit? Science has always used models to explain behaviour. A model for matter that you may remember is the particle model.

The Particle Model

When you first learned about the particle model you may have been asked to imagine taking a small sample of a chemical substance and breaking it up into smaller and smaller pieces. You would eventually come to the smallest possible particle. This smallest particle was called a "building block." The basic principles of the particle model are illustrated and explained in **Table 1**.

Table 1 **A Particle Model for Matter**

Principle	Illustration
1. All matter is made up of tiny particles.	
2. All particles of one substance are the same. Different substances are made of different particles.	
3. The particles are always moving. The more energy the particles have, the faster they move.	 hot cold
4. There are attractive forces between particles. These forces are stronger when the particles are closer together.	particles far apart—force weak  particles close together—force strong

Pure Substances, Mixtures, and the Particle Model

You have learned that matter can be classified into three categories: elements, compounds, and mixtures.

A particle model for a pure substance shows that it contains only one kind of particle. A mixture, on the other hand, contains at least two kinds of particles (**Figure 1**).

Each kind of particle that is observed in a mixture, then, must represent a pure substance. A mixture consists of two or more pure substances.

When you make pizza, for example, you first spread tomato sauce over the dough. The dough can be considered a pure substance, and the tomato sauce can be considered a pure substance. So can the mushrooms, pepperoni, and other ingredients you scatter over the cheese and

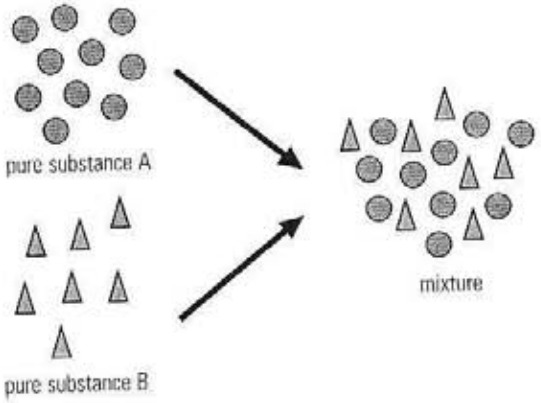


Figure 1

Most substances you will come into contact with are mixtures. Mixtures contain at least two pure substances.

tomato sauce. Each part can be clearly seen before and after baking the pizza. Pizza is an example of a mixture (**Figure 2**).

Elements, Compounds, and the Particle Model

Many properties of matter can be explained by using the particle model. But what are these particles?

Observations of pure substances as they were discovered led scientists to believe that these particles, or building blocks, were elements and compounds. On the classification of matter chart in section 1.9, pure substances were subdivided into elements and compounds. Today there is evidence that elements and compounds can be broken down into smaller particles. These particles are called **atoms** and **molecules**.

Figure 2
A mixture contains several kinds of particles.

Understanding Concepts

1. Use a diagram to illustrate and explain the difference between a pure substance and a mixture.
2. Give two examples of molecules that are made from the same kind of atom. Which compounds do they represent?

Making Connections

3. Copy and complete **Table 1** by filling in the middle column. Choose from
   (i) pure substance—element
   (ii) pure substance—compound
   (iii) mixture

Table 1

Name of substance	Type of substance	Description
table salt		white crystalline solid
orange juice		mixture of juice and pulp
copper		reddish-brown wire
iron		coarse black powder
salad dressing		oil and vinegar

4. Now that you know that atoms and molecules are the "particles" in the particle model, do you think atoms can be broken down into smaller particles? Explain.

Challenge

1, 2 The particle model is used to help explain matter. How could you use this model in the Challenge you have chosen?

3 The scientists credited with exploring the atom include Dalton, Thomson, Rutherford, and Bohr. How was their world different from the world we live in today?