Pure Substances and Mixtures

The apple juice in Figure 1 is labelled as 100 % pure. Does this mean that the juice is made of only one kind of matter? Does it have only one kind of particle in it?

Apple juice is actually a mixture of water particles, sugar particles, flavour particles, and vitamin particles. Apple juice may look like one kind of matter, but it contains many kinds of particles all mixed together.

Pure Substances

Most examples of matter in everyday life contain more than one kind of particle. Some types of matter, however, do contain only one kind of particle (Figure 2). A piece of aluminum foil contains only one kind of particle. Each aluminum particle is the same as every other aluminum particle. White table sugar is made of only sugar particles.

Aluminum and table sugar are both examples of pure substances. A pure substance is a type of matter that contains only one kind of particle (Figure 3(a)). Other examples of pure substances include distilled water and salt. Uranium, used in nuclear power stations to produce electricity, is another pure substance.

Water from your tap is not a pure substance. It contains water particles and a number of other kinds of particles, too. Distilled water, however, has had all of the “non-water” particles removed: it is pure water.

Mixtures

When you stir a spoonful of sugar into a glass of distilled water, the sugar disappears and the water tastes sweet. Now there are two kinds of particle in the glass. The sweetened water is not a pure substance anymore. It is a mixture containing sugar particles and water particles.

A mixture is a type of matter that contains more than one kind of particle. A mixture is made of two or more pure substances mixed together (Figure 3(b)).
1.4 Pure Substances and Mixtures

Mixtures can be solids, liquids, or gases, or even combinations of these. Steel, batteries, and cookies are all mixtures in the solid state. Antifreeze and milk are mixtures in the liquid state. The air you breathe is a mixture of gases.

Many mixtures that we use, such as the mixtures inside compact fluorescent light bulbs (CFLs) and batteries, include some pure substances that can be harmful if they escape into the environment. CFLs contain mercury. Some batteries contain cadmium while others contain lead. Mercury, cadmium, and lead are all pure substances that are toxic to both animals and people. We should not dispose of CFLs and batteries in the regular garbage. We should carefully collect them and deposit them at special recycling stations, where their components can be separated out and recycled.

**TRY THIS:** Test a Sample of Matter

**SKILLS MENU:** performing, observing, analyzing

You can test the ink in a black marker to determine if it is a pure substance.

**Equipment and Materials:** water-soluble black marker; colourless drinking glass or beaker; 10 cm strip of filter paper; tap water

1. Use the marker to draw a horizontal black line about 3 cm from the bottom of the strip of filter paper.
2. Pour water into the glass to a depth of about 1 cm.
3. Carefully stand the strip of filter paper in the glass of water. The black line should be close to the water, but not touching it (Figure 4).

A. What happens to the black line on the paper after 1 min?
   After 5 min?

B. Is the ink in a black marker a pure substance or a mixture?
   What evidence supports this?

![Figure 4](image)

**CHECK YOUR LEARNING**

1. (a) What is a pure substance? Give three examples.
   (b) What is a mixture? Give three examples.

2. In your notebook, draw a sample of matter that is a pure substance. Make sure you show the types of particles present in the pure substance. Explain why your drawing shows a pure substance and not a mixture.

3. Is milk a pure substance or a mixture? Explain how you know.

4. (a) Why should you not place used batteries in the regular garbage?
   (b) How should you dispose of batteries?