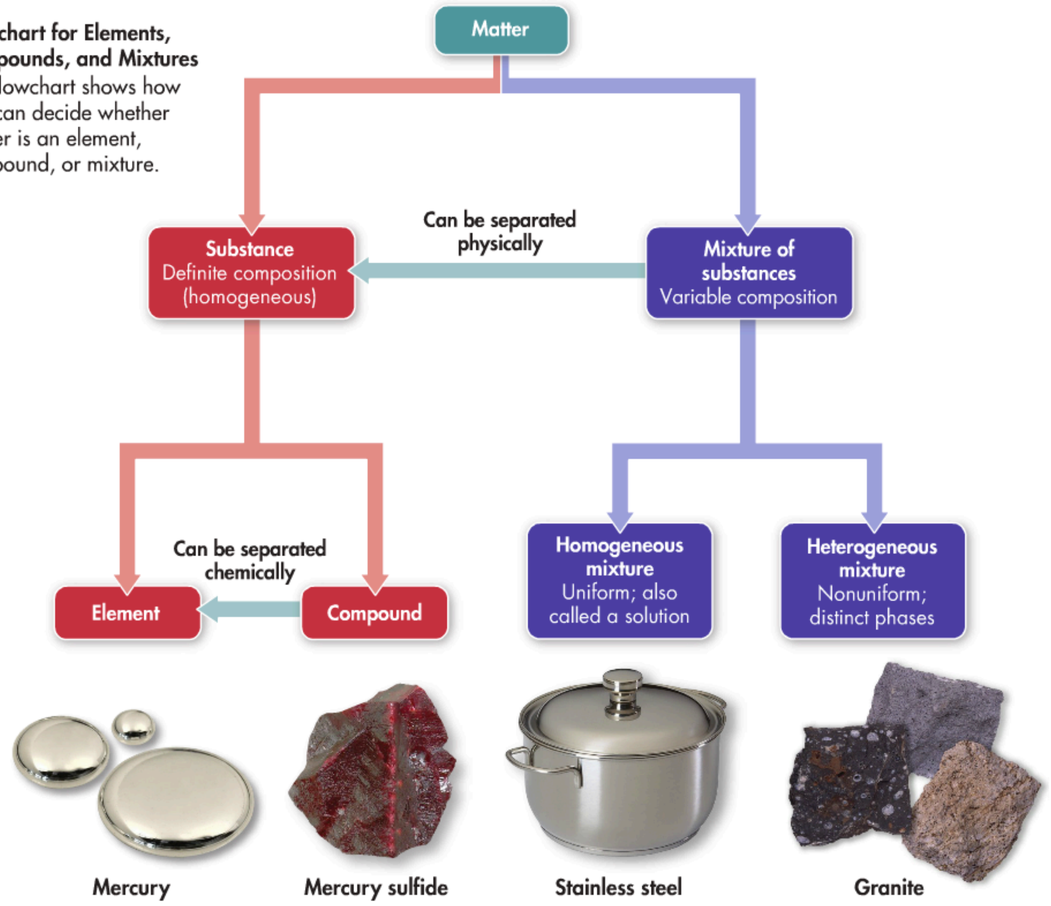
Distinguishing Substances and Mixtures

Can you tell if a sample of matter is a substance or a mixture based only on how it looks? That could be difficult. After all, homogeneous mixtures and substances both appear to be made of only one kind of matter. Sometimes you can decide by thinking about whether there is more than one kind of the material in question. For example, you can buy whole milk, low-fat milk, no-fat milk, light cream, or heavy cream. You could conclude that milk and cream are mixtures because there are many different kinds. You might infer that these mixtures are different because they contain different amounts of fat.

You can use the general characteristics of substances and mixtures to tell them apart. The figure below shows how to tell if matter is an element, compound, or mixture.

Key Question How can substances and mixtures be distinguished?
If the composition of a material is fixed, the material is a substance.
If the composition of a material may vary, the material is a mixture.

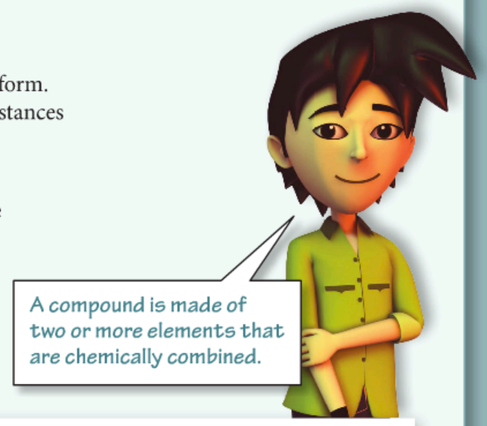
Flowchart for Elements, Compounds, and Mixtures
The flowchart shows how you can decide whether matter is an element, compound, or mixture.



SampleProblem 2.2

Classifying Materials

When a blue-green solid is heated, a colorless gas and a black solid form. All three materials are substances. Is it possible to classify these substances as elements or compounds?



1 Analyze **Identify the relevant concepts.** A compound can be broken down into simpler substances by a chemical change, but an element cannot. Heating can cause a chemical change.

2 Solve **Apply concepts to this situation.**

List the known facts and important concepts.

- A blue-green solid is heated.
- A colorless gas and a black solid appear.

Determine if the substances are elements or compounds.

Blue-green solid: Two substances were produced by heating one substance. It is likely the blue-green solid was broken down. It is a compound.

Colorless gas and black solid: They could be elements or compounds. More tests are needed.

Practice Problems

14. Liquid A and Liquid B are clear liquids. They are placed in open containers and are allowed to evaporate. When evaporation is complete, there is a white solid in Container B. There is no solid in Container A. What can you infer about the two liquids?

Hint: Evaporation is a way of physically separating matter.

15. A clear liquid in an open container is allowed to evaporate. After three days, a solid is left in the container. Was the clear liquid an element, a compound, or a mixture? How do you know?