Recognizing Elements, Compounds, and Mixtures

In simple terms, chemistry can be defined as the study of the composition and interaction of matter. Matter is anything that has mass and occupies space. The universe is made up of many types of matter — water, rock, plants, air, people, to name just a few. It is quite easy to think of examples of matter, but it is more important to be able to organize them into groups. In order to better understand matter, chemists have developed a classification scheme for it. See Figure 3A-1 below.

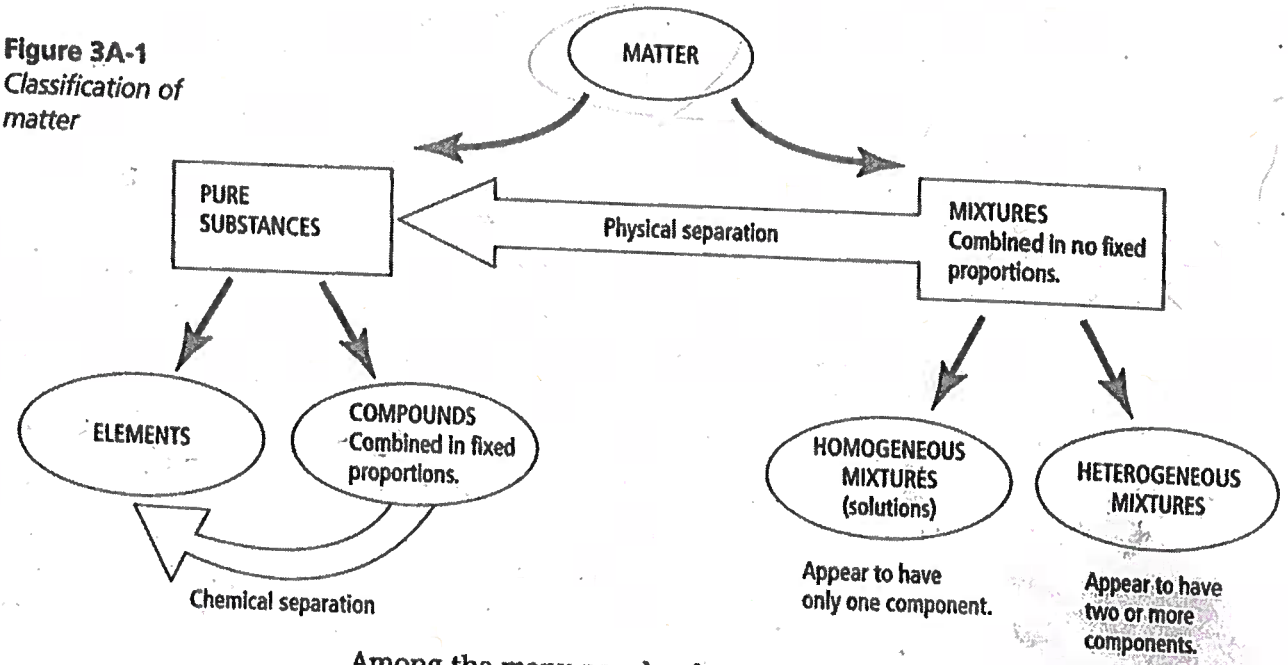

Figure 3A-1 *Classification of matter*

Among the many people who can appreciate the importance of classifying matter are workers in the mining industry. For example, the process for the production of the element copper often begins with the mining of a heterogeneous mixture called "copper ore." See Figure 3A-2 below.

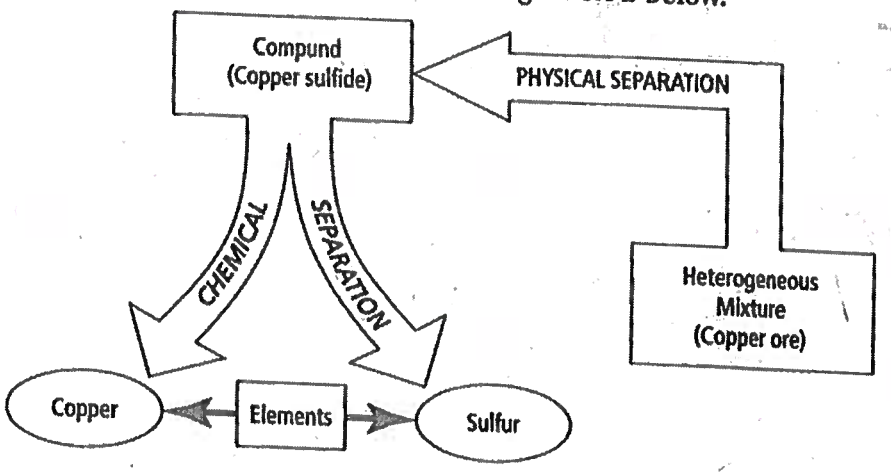

Figure 3A-2 *Copper and sulfur can be recovered from copper ore*

In this experiment, you will act like a chemist by classifying matter. You will be given a number of unknown samples that you will test in various ways. You must decide whether a given sample is an element, a compound, or a mixture. As you know, mixtures consist of two or more substances physically combined in any proportion. Therefore, you will find that mixtures can be separated by physical means such as picking apart the components, selective dissolving, filtration, or evaporation. Compounds, on the other hand, can only be separated into elements by chemical means that are beyond the scope of this experiment.

OBJECTIVES

1. to use simple laboratory procedures to test a set of unknown samples of matter
2. to classify unknown samples of matter as elements, compounds, or mixtures

SUPPLIES

Equipment

tripod magnifier
stereomicroscope (if available)
tweezers
plastic spoon
3 test tubes (13 mm × 100 mm)
test-tube rack
lab burner
evaporating dish
crucible tongs
ring stand and ring support
filter paper and funnel
beaker (250 mL)
lab apron
safety goggles

Chemical Reagents

set of 5 unknown samples

PROCEDURE

1. Put on your lab apron and safety goggles.
2. Obtain a sample of each unknown from your instructor. Take care to number your samples according to your instructor's numbering system. If the unknown is solid, place about one half spoonful on a piece of paper. If the unknown is liquid, fill a test tube half full.
3. Use a data table similar to Table 1 to help organize your observations in your notebook.
4. Observe the unknowns carefully and record their properties.
5. Of the three solid unknowns, one is an element, one is a compound and one is a mixture. Devise a method to separate the components from the mixture then try it.
6. Of the two liquid unknowns, one is a compound and one is a mixture. Devise a means (other than tasting) of classifying them and try it.

You must not taste any of the unknowns as some are poisonous.

7. Clean up according to the reagent disposal instructions.
8. Before leaving the laboratory, wash your hands thoroughly with soap and water.

REAGENT DISPOSAL

Any remaining liquids can be rinsed down the sink with copious amounts of water. Any solid waste should go into the designated waste container.

POST LAB CONSIDERATIONS

Distinguishing between a mixture and a pure substance is fairly straightforward. If the unknown can be separated by physical means such as those available in this experiment, then it is a mixture. However, if the unknown is a pure substance, further tests may be required to determine whether it is an element or a compound.

EXPERIMENTAL RESULTS

Table 1

Unknown	Properties Observed	Possibilities		
		Element	Compound	Mixture
1				
2				
3	COMPLETE IN YOUR NOTEBOOK	COMPLETE IN YOUR NOTEBOOK	COMPLETE IN YOUR NOTEBOOK	COMPLETE IN YOUR NOTEBOOK
4				
5				

ANALYSIS OF RESULTS

1. Classify each of the solid unknowns as an element, compound, or mixture, and explain your decisions. If you are uncertain about any of the unknowns, explain why.
2. Which of the liquids was the compound and which was the mixture? How did you determine this?

FOLLOW-UP QUESTIONS

1. Give one example of each of the following. (Do not use any of the samples from this experiment.)
   a. homogeneous mixture
   b. heterogeneous mixture
   c. solid that is (i) an element (ii) a compound (iii) a mixture
   d. liquid that is (i) an element (ii) a compound (iii) a mixture
   e. gas that is (i) an element (ii) a compound (iii) a mixture
2. In some countries, desalination plants are used to separate salt from seawater. Consult a reference source and describe the process used in these plants. (Use the terms elements, compounds, and mixtures where appropriate in your description.)
3. In this experiment, one of the solids you tested was a compound and one was an element. What further tests would you perform to tell them apart?

CONCLUSION

State the results of Objective 2.

Date:_____ Name:_____

TA: _____

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Safety:
- Must not taste anything as some are poisonous

Data:

Table 1: Observations of the Unknowns

Unknown	*Properties Observed*	*Possibilities*		
		Element	*Compound*	*Mixture*
1				
2				
3				
4				
5				

Analysis of Results:

Follow-Up Questions: