

TEACHING SUGGESTIONS

■ GETTING STARTED

1. Introduce categories of hazardous substances.

Read the introduction in the Student Book, and in Procedure Step 1 review with the class the categories of hazardous materials shown in the table, “Labeling Hazardous Materials.” Clarify any categories students are unfamiliar with. As you review the categories, identify places or situations in which students might have encountered such substances.

2. Demonstrate “corrosive” and “flammable.”

To show students two of the hazard categories they will read about in this activity you will conduct two demonstrations to show them corrosive and flammable liquids.

Explain that a substance is **corrosive** if it reacts with a solid material. Put on goggles. To demonstrate corrosion, place four aluminum washers in a beaker with approximately 4-mL of copper chloride solution. Place another four aluminum washers in a beaker with 4mL of ethanol, and another four washers in a third beaker with 4-mL of water. Be sure to label the containers with the name of the solutions and stress to students the importance of labeling containers. Place both cups over a white sheet of paper in order to more easily see what is happening in each cup. Ask students to compare what is occurring in the three beakers as you ask, **What do you observe in each beaker?** Draw students’ attention to the bubbles that appear and the copper that begins to form as the aluminum metal and copper chloride in the solution react. The copper chloride solution is corroding the aluminum washer. Point out that in contrast, there is no evidence of a chemical reaction (in this case corrosion) in the container with the water or ethanol.

To stop the chemical reaction, use forceps to remove the washers, and dip them in a cup of water. Dispose of the copper containing waste in the waste container. Solid metal pieces should be disposed of in the solid waste garbage. You may reuse the washers in the water and ethanol for subsequent classes.

Take this opportunity to discuss safety precautions that should be used if working with corrosive liquids. Ask the class, **What safety precautions should you follow if working with a corrosive liquid?** Answers should include wearing goggles, aprons, gloves, working through procedures in ways that minimize spills, and contact of solutions with skin or clothing.

Explain that a substance is **flammable** if it catches on fire when exposed to a spark, flame, or heat source. To demonstrate flammability show the class the bottles of copper chloride, ethanol, and water. Ask students to predict, **Which of the liquids are flammable?** After eliciting their predictions, and putting on goggles, dip the looped end of the copper wire in one of the three solutions. Hold the wire loop over a lit candle. If the liquid on the wire loop burns, the solution is flammable. Rinse the copper loop, and repeat with the remaining solutions. The copper chloride and water will not burn. The ethanol is flammable and will ignite when held over the match. Take this opportunity to discuss with the class the safety precautions for working with flammable solids and liquids include storing and handling them away from flames or sources of heat that might cause them to ignite.

This is a good chance to model appropriate disposal, which is key when dealing with hazardous substances. To this end, show students how you will place the copper chloride and ethanol in the waste bucket, use a paper towel to wipe excess solution from the beaker containing the copper chloride, and then rise the beakers with soap and water. Inappropriate disposal can lead to hazardous situations.

3. Introduce the SEPUP 4-2-1 cooperative learning model.

Many of the activities in this book utilize the SEPUP 4-2-1 cooperative learning model. Four students are expected to share certain materials, pairs of students work together to conduct an experiment or solve a problem, and each student is responsible for recording data and observations.

Before students begin working with their partner in Procedure Step 2 explain the importance of and

Activity 2 • Types of Hazards

your expectations for students as they work together. In this activity students work in pairs to classify chemicals. In most laboratory activities, each pair of students within a group of four is expected to complete the procedure. For this reason, the equipment kit typically contains materials in either sets of 16 (for each pair of students in a class of 32 students) or 8 (to be shared among a group of four).

Pairs of students within a group of four are expected to talk to each other and discuss discrepancies in data or observations as often occurs in scientific communities. Stress that the other pair in a group is the first source for solutions to minor problems, and students may correct misunderstandings or incorrectly understood procedures without teacher involvement. In science, collaboration is essential to the development of new ideas and to a better understanding of scientific concepts and should not be considered “cheating.” Students may have difficulty distinguishing when working together is appropriate, so be sure to clarify which situations are appropriate for collaboration and which are appropriate for working independently.

■ DOING THE ACTIVITY

4. Students review the Chemical Data Cards and sort substances into hazard groups.

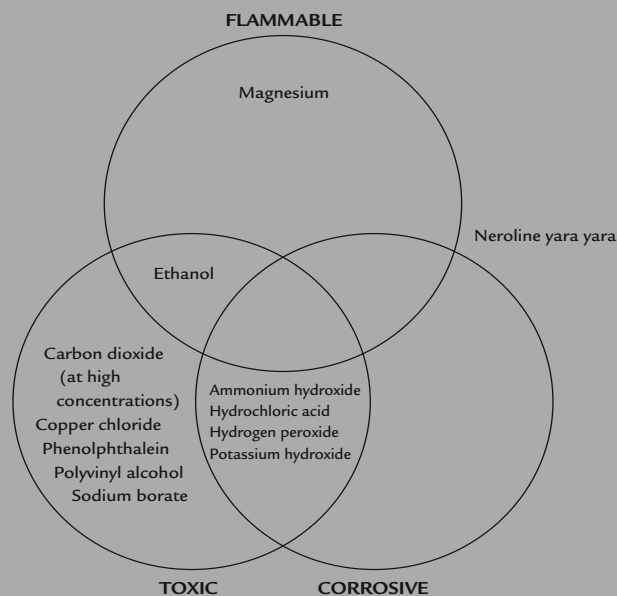
The set of 12 cards that students work with in Activity 2 are representative of the chemical substances they will work with over the course of the unit. Let students know that they will need to be prepared to safely and appropriately handle and dispose of these classroom substances.

Before beginning the work with the cards, review with the class the pronunciation of each chemical. Point out that in the chemical notation for sodium borate ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$) the dot indicates that it is a hydrate, meaning there are water molecules interspersed with the sodium borate molecules.

Each pair of students reviews six of the cards and fills out Student Sheet 2.1, “Classroom Substances,” as they work. Then each pair exchanges cards and reviews the other six. Explain that the hazards described may occur if the substances are handled

improperly, especially in large volumes. To determine the appropriate hazard class(es) students should compare the “hazards” information provided on the cards with the categories presented in the table, “Labeling Hazardous Materials” in the Student Book. To determine the safety precautions they should work with their partner, and group if necessary, to infer ways to minimize hazardous consequences. Note that with among the twelve substances, the necessary precautions vary slightly. This is because uniform precautions can be taken with all potentially hazardous substances. Sample responses are provided on the next page.

Using the information on Student Sheet 2.1, groups sort the 12 Chemical Data Cards into hazard groups in the Venn diagram on Student Sheet 2.2, “Classroom Substances Venn Diagram.” A sample diagram is shown below.



Review with the class students’ responses to Student Sheet 2.2, “Classroom Substances.” Compare students’ sorts and agree on hazard categories and safety precautions for each of the 12 substances. Discuss what students would do if they were working with substances in each of the hazard categories. Since these are substances they may encounter while working with *Issues and Physical Science*, any new guidelines that are mentioned can be added to the list of classroom safety guidelines constructed in Teaching Step 4 of Activity 1, “Handling Hazardous Materials.”