Place the open bottle and dropper top on the balance. Explain that you will put 1 mL of copper chloride solution and 1 aluminum washer in the bottle. Drop 1 aluminum washer into the reaction bottle and use the dropper to obtain 1 mL of copper chloride. Record on the board the initial mass of the system. Then ask students, ***What do you think will happen to the mass of the system—the bottle and reactants—as the reaction occurs? Will it increase, decrease, or stay the same?*** Poll the class by a show of hands, and record their predictions on the board. Run the reaction by squeezing the copper chloride into the reaction bottle with the bottle sitting squarely on the balance so that students can monitor the change in mass as the reaction occurs. The reaction should take no more than five minutes. As it is reacting, point out that this reaction is **exothermic**, meaning it releases energy as the reactants interact chemically, and this can be felt as heat. Other exothermic reactions include combustion (burning) and rusting (oxidation). This is an important new concept introduced in this activity. It is doubly important for them to understand it now so that they do not grip their reaction chambers while conducting the reactions in closed systems. Make sure that students are cautious if handling the jar while the reaction is taking place.

When the reaction has stopped, record the final mass on the board. Show students how to calculate a change in mass. Ask students, ***What evidence have you observed that indicates a chemical reaction occurred?*** Students' responses should include: formation of a new solid, formation of bubbles, change in color of the solution, and heat generated. Ask students, ***What happened to the mass?*** Expect to see a 0.0 - 0.3 g change in mass.

Repeat the entire process from prediction to calculation of change in mass, this time with 1 mL 100,000 ppm copper chloride solution and 3 mLs of sodium hydrogen phosphate solution. The reaction will be complete in approximately two minutes. Stress that this reaction is not exothermic. Ask students, ***What evidence have you observed that indicates a chemical reaction occurred?*** Students will observe a change in the color as a light blue viscous liquid forms. In this reaction the change in mass observed will be approximately 0.0 - 0.3 g.

Next ask the class to predict, ***What will happen if we conduct the chemical reactions in closed containers?*** Prompt them to explain why they think there might be a difference in what they will observe with the closed containers. Explain that they will conduct the same chemical reactions that you conducted, but in closed systems.

DOING THE ACTIVITY

3. Students measure the mass before and after two chemical reactions in closed systems.

Review the use of balances to measure mass. Go over the instructions specific to the types of classroom balances they will be using and their accuracy (to the nearest 1/10 or 1/100 of a gram). Explain to students that they will record the mass of the reactants and products to the nearest 1/10.

Before students begin the procedure demonstrate using the dropper in the reaction bottle to measure 1 mL of copper chloride.

Stress to students that they must not allow the two reactants to mix before they have done the initial measurement of mass. Reaction bottles should be removed from the balances before beginning the reactions. Advise students not to hold the reaction bottles while the reactions are occurring as the aluminum/copper chloride reaction is exothermic.

While students are observing the reactions in closed containers, circulate around the room, and encourage students to record detailed observations. Expect that students' results will show a change in mass of 0.0 - 0.1 g.