Making Observations

Observations are an important component of the scientific method, a means whereby scientists solve problems. The scientific method is cyclical in nature. First, a scientist makes observations and analyzes them in a search for patterns or relationships. Having discovered a relationship, the scientist checks it by making predictions of the outcomes of further tests. In doing these further tests, the scientist naturally makes more observations, and so on.

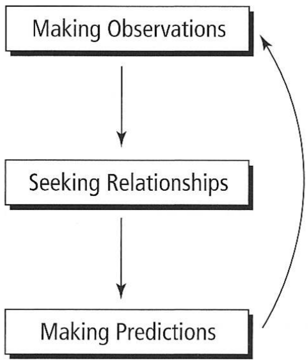

Figure 2A-1 *Primary activities of the scientific method*

In chemistry, you will constantly be checking for changes when you do experiments. Sometimes you will observe that no change occurs. This type of observation is just as important as one in which a change does occur.

"Observing" is often associated only with "seeing" – that is, "using your eyes." However, in science, "observing" implies using any or all of the senses of sight, touch, smell, hearing, and taste. Obviously, in a chemistry lab no unauthorized observations, particularly those involving touch, smell, or taste, should be conducted. Since the unaided senses are limited, scientists rely on special laboratory equipment such as thermometers and balances to extend their senses. Scientific equipment is used extensively in homes to monitor and control temperatures in ovens, refrigerators, and rooms, as well as in industries such as chemical processing and services such as health care.

Observations are classed as one of two types: qualitative and quantitative. Qualitative observations tend to be rather general and use words, not numbers, to describe an object or event. An example of a qualitative observation would be, "A car drove quickly down the street." Quantitative observations are more specific and usually describe something in terms of numbers. The observation above is quantitative when expressed as, "A car drove down the street at 50 km/h." Because quantitative observations are more specific than qualitative ones, they are generally more useful in science.

In this experiment, you will practice making both qualitative and quantitative observations while doing two activities: combining two different metals with water (Part I), and placing aluminum foil in copper(II) chloride solution (Part II).

OBJECTIVES

1. to make observations while watching materials interact and undergo change
2. to record and classify these observations as qualitative or quantitative

SUPPLIES

Equipment
3 beakers (250 mL)
2 test tubes (16 mm × 150 mm)
thermometer
centigram balance
metric ruler
tweezers
lab apron
safety goggles

Chemical Reagents
mossy zinc
calcium metal
phenolphthalein solution
aluminum foil
1*M* copper(II) chloride solution

PROCEDURE

Part I: Combining Two Different Metals With Water

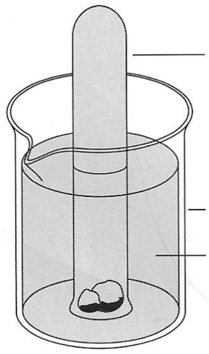

Figure 2A-2
Experimental setup for Part I

1. Put on your lab apron and safety goggles.
2. Obtain two 250 mL beakers and fill each of them with about 150 mL of tap water. Label one beaker A and the other B.
3. Next fill two test tubes (16 mm × 150 mm) with tap water. Fill them to the brim so that no air remains in them.
4. With your thumb covering the open end, invert each test tube one at a time. Place one in beaker A and one in beaker B. Leave each test tube filled with water upside down in the beaker; as in Figure 2A-2.
5. Place a piece of mossy zinc in beaker A and immediately shift the test tube over to cover the metal. Hold the test tube in place and record your observations in your copy of Table 1 in your notebook.
6. Add 2 drops of phenolphthalein to beaker A and record your observations in Table 1.
7. Repeat Steps 5 and 6, this time adding a chunk of calcium metal to beaker B. Do not touch the calcium; use tweezers to pick it up. Record your observations in Table 2.
8. Repeat any steps of your choice in order to obtain quantitative observations. Use any lab equipment that has been made available to you, as well as your imagination! Before going ahead, however, check your procedure with your instructor.
9. Refer to the section on reagent disposal which follows and clean up your equipment.

Part II: Aluminum Foil in Copper(II) Chloride Solution

1. Place ~~100~~ 25mL mL of copper(II) chloride solution in a clean ~~250~~ 100 mL beaker, and record the temperature of the solution.
2. Cut a square of aluminum foil (approximately ~~15~~ 7 cm × ~~15~~ 7 cm) and roll it into a tube. To form the tube, you can roll the foil on a pencil.
3. Place the tube of aluminum foil in the beaker containing copper(II) chloride solution and immediately start recording your observations in your copy of Table 3.

CAUTION

Copper(II) chloride is poisonous. Wash away any spills or splashes with plenty of water.

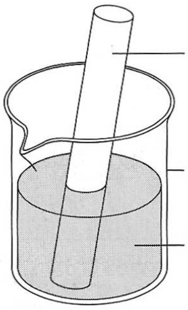

Figure 2A-3 *Experimental setup for Part II*

4. When no further changes appear, record the temperature of the remaining solution in Table 3.
5. Refer to the section on reagent disposal and clean up your equipment.
6. Before you leave the laboratory, wash your hands thoroughly with soap and water.

REAGENT DISPOSAL

After Part I, pour all liquids down the sink and follow with plenty of water. Place the remaining zinc and the remaining calcium into the designated containers. After Part II, place all liquids and the remaining solids in the designated container(s).

POST LAB CONSIDERATIONS

Because of the nature of this experiment, you might well have expected a variety of observations. Did you use all your senses? Where possible, you should have tried to obtain some quantitative observations to extend your qualitative observations.

An interesting activity at this point would be to compare your observations with those of another lab group.

EXPERIMENTAL RESULTS

Part I: Combining Two Different Metals with Water

Table 1 Zinc Metal in Water

Qualitative Observations	Corresponding Quantitative Observations (if any)
COMPLETE IN YOUR NOTEBOOK	COMPLETE IN YOUR NOTEBOOK

Table 2 Calcium Metal in Water

Qualitative Observations	Corresponding Quantitative Observations (if any)
COMPLETE IN YOUR NOTEBOOK	COMPLETE IN YOUR NOTEBOOK

Part II: Aluminum Foil in Copper(II) Chloride Solution

Table 3

Qualitative Observations	Corresponding Quantitative Observations (if any)
COMPLETE IN YOUR NOTEBOOK	COMPLETE IN YOUR NOTEBOOK

ANALYSIS OF RESULTS

1. In which of the tests did you observe a color change?
2. **a.** In which tests did you observe the formation of gas?
   b. Which observations allowed you to conclude that a gas was produced?
3. In which test(s) did you observe no change taking place?

FOLLOW-UP QUESTIONS

1. Suppose you want to collect and measure the volume of a gas produced in a chemical reaction. How would you do this?
2. Find out what phenolphthalein is and what it is commonly used for.

CONCLUSION

Report a significant qualitative and quantitative observation for each test you did.