

Skills and Strategies

- Planning and conducting
- Processing and Analyzing
- Evaluating
- Communicating

Safety

- Review safety rules for working with a hot plate before you begin.

What You Need

- 6 test tubes with stoppers
- 6 samples of compounds
- glass plate or watch glass
- scoop
- plastic water bottle
- hot plate or laboratory burner
- distilled water
- conductivity tester
- tongs

Properties of Ionic and Covalent Compounds

Physical properties such as hardness and melting point can help you classify compounds as ionic or covalent. In this investigation, test six different compounds to determine whether they are ionic or covalent.

Question

How can you use properties to classify compounds as ionic or covalent?

Procedure

1. Label six test tubes A to F. Place samples of six different compounds in the test tubes. Use enough of each compound to fill the rounded bottom of the test tube.
2. Prepare a table like the one shown. It should take up one full page so you have enough space for all your observations. Give your table a title.
3. Perform the following tests on each compound. At each test step, analyze all the compounds before moving on to the next test. If a substance responds like a covalent compound, record a score of one (1). If a substance responds like an ionic compound, record a score of zero (0). Also record short, descriptive observations for each test in your table.
4. When you are finished, clean up and dispose of materials as directed by your teacher.

Crush/Hardness Test

Place one or two grains of the compound on a glass plate or watch glass. Press on the compound with a scoop or another metal tool. Ionic compounds withstand considerable force and then crush suddenly into a gritty powder (score 0). Solid molecular compounds are often more flexible and crush like wax or plastic (score 1).

Solubility Test

Each test tube should still contain most of the original substance. Add 10 mL of distilled water to each of the test tubes. Stopper each test tube. Keeping your fingers on the stopper and test tube, gently shake or swirl the water and substance together. Many ionic compounds will dissolve in water, although there are exceptions (score 0). Many molecular solids are insoluble in water (score 1), although again there are exceptions.

Process and Analyze

1. Add up the scores for each compound. A low score, near 0, indicates that a compound is ionic. A high score, near 5, indicates that the compound is covalent. What patterns do you see?
2. If a compound has a score of 2 or 3, use your descriptive observations to help you decide whether it is ionic or covalent.

Evaluate and Communicate

3. Summarize your classification of each substance, including a rationale for each decision.
4. What was the purpose of assigning a number to each test? Did the numbers have any scientific meaning?

Melting Test

Your teacher will use a hot plate or laboratory burner to test whether the compounds will melt. Observe carefully. Among the compounds that do melt, compare the time it took. Do any compounds vaporize? Ionic compounds do not melt except at very high temperatures (score 0). Many covalent compounds melt at relatively low temperatures (score 1).

Conductivity Test

Use a conductivity tester to test the conductivity of the solution in each test tube. When ionic compounds dissolve, the resulting solution will conduct electric current (score 0). When molecular compounds dissolve, the resulting solution will usually not conduct electric current (score 1). Make sure that you clean the probes of the conductivity tester between readings.

5. If you could perform only two tests to identify ionic and covalent compounds, which two tests would you choose? Explain your thinking. If these tests are more important than the others for classifying, how could you reflect that in the scoring system if you were to perform the investigation again?
6. Your teacher will tell you the names and formulas of the compounds. What do the names and formulas tell you, if anything, about the compounds?
7. Examine the element symbols in the chemical formulas. What do you notice about the elements that are in the formulas for the ionic compounds compared to the elements that are in the formulas for the covalent compounds?