

Kitchen Solids Survey: Build an Identification Key

Investigation question: Eight white solids from the kitchen look nearly the same. Which simple tests sort them apart, and can a key built from the whole class's data name a powder nobody has seen before?

Classroom field investigation

Groups of 4

2 sessions

Setup 5 · Activity 85 · Cleanup 10 min

MS-PS1-2 · practice

Name _____

Group _____

Date _____

Your role today

- ☐ **Protocol keeper:** In session 1 checks that every group member can state the exact amounts and times, and in session 2 flags any home result that did not follow the protocol.
- ☐ **Pooler:** Collects the group's four home sheets into one group tally for each solid and test, and reports it to the class table.
- ☐ **Key builder:** Leads the group in choosing the order of tests for the identification key and draws the flow chart.
- ☐ **Mystery tester:** Runs the water and vinegar tests on the teacher's mystery powder at the class station and walks the result through the key.

Safety

- Use only the eight listed food solids. Never test cleaning products, medicines, garden chemicals or any unlabeled powder, even one that looks the same.
- Do not eat or taste any test sample, even though the solids are food; the cups and spoons have touched vinegar and each other.
- Vinegar stings eyes; keep it away from the face and rinse with water if it splashes. Wash hands after testing.
- An adult should know the testing is happening. Label every cup, keep cups out of reach of small children and pets, and pour everything down the sink with running water when done.
- Baking soda plus vinegar foams up; use only ten drops on a pinch of powder on a plate, never in a closed container.
- At the class station the mystery powder is a food solid, but students treat it as unknown: no tasting, no sniffing, goggles on.

Procedure

1. Session 1 (class, about 20 minutes): read the protocol together and practice it on two solids at the station so everyone has seen 'dissolves clear', 'cloudy' and 'fizz' once. Write the four tests and their exact amounts on the field sheet in your own words.

2. At home or at the station, Test 1 (water): put 1 level teaspoon of the solid into 1/2 cup (120 mL) of room-temperature tap water and stir for 60 seconds. Record: dissolves clear, cloudy, settles to the bottom, or fizzes. Keep the cup for Test 3.
3. Test 2 (vinegar): put a pinch of the dry solid on a plate and add 10 drops of white vinegar. Record whether it fizzes (bubbles of gas) or not.
4. Test 3 (evaporation): with a spoon, place two or three drops of the clear liquid from Test 1 on a dark plate or black paper and let them dry overnight. Record what is left: cube-shaped crystals, needle-shaped crystals, a white powder or crust, a glassy or sticky film, or nothing.
5. Test 4 (magnified look): look at a pinch of the dry solid with a hand lens or phone zoom. Record whether the grains are clear cubes, clear chunks or rods, or a fine soft powder with no visible grains.
6. Repeat Tests 1 to 4 for every solid you can get; rinse cups between solids. Bring the completed field sheet to session 2.
7. Session 2 (class, about 45 minutes): the pooler adds your group's results to the class table as counts (for example, baking soda in water: 18 'dissolves clear', 6 'cloudy'). For any test where the class disagrees, the protocol keeper checks whether the amounts, water temperature or stirring time differed, and the class agrees on one result with a reason.
8. Build the key: choose a first test that splits the eight solids into two groups as evenly as possible, then a second test for each branch, and so on, until every solid sits alone at the end of a path. Draw it as a flow chart of yes/no questions.
9. The mystery tester runs the water test and the vinegar test on powder X at the station, follows the key, and the group writes down the identity and the path of tests that led there. Answer the analysis questions individually.

Record your observations

Lab 3 field sheet: Kitchen solids survey

Home rules — Only the eight listed food solids and white vinegar. Tell an adult what you are doing. Label every cup. No tasting, no sniffing. Keep cups away from small children and pets. Wash hands and rinse everything down the sink with running water when you finish.

Use exactly the amounts in the protocol so your results can be compared with everyone else's: 1 level teaspoon of solid in 1/2 cup (120 mL) of room-temperature water, stirred 60 seconds; 10 drops of vinegar on a pinch of dry solid; drops dried overnight. Write what you actually see, not what you expect.

My field data

Solid	Test 1, water (dissolves clear / cloudy / settles / fizzes)	Test 2, vinegar (fizz: yes / no)	Test 3, dried drop (cubes / needles / crust / glassy film / nothing)	Test 4, grains under the lens
Table salt				
Granulated sugar				
Baking soda				
Baking powder				
Flour				
Cornstarch				
Epsom salt				
Powdered sugar				

Class pooled results (session 2)

Solid	Water test: class decision	Vinegar test: class decision	Dried drop: class decision	Any disagreement? How was it settled?
Table salt				
Granulated sugar				
Baking soda				
Baking powder				
Flour				
Cornstarch				
Epsom salt				
Powdered sugar				

-  Draw your group's identification key as a flow chart. Start with one yes/no test at the top, branch on the answer, and keep going until each of the eight solids sits alone at the end of a path. Write the test question in each box.

1. Mystery powder X: record its water test and vinegar test results, list the path of tests you followed through the key, and name the solid.

Result or step
Water test
Vinegar test
Path through the key (test 1, test 2, ...)
Identity

2. Which single test in your key splits the eight solids most evenly into two groups? Which test was the least useful, and why?

Analysis questions

3. Why does the protocol fix the amount of solid, the amount of water, the temperature and the stirring time? What could go wrong with a solubility comparison if one student used a heaping tablespoon in a quarter cup of cold water?

4. Baking powder fizzed in plain water, but baking soda fizzed only when vinegar was added. What does that tell you about what baking powder contains? Explain why the fizz is a chemical property and not a kind of dissolving.

5. Powdered sugar left a slightly cloudy liquid, while granulated sugar dissolved completely clear. Suggest an explanation and describe one test from this lab that could check it.

6. The dried drop of salt water left tiny cube-shaped crystals. What does this show about what happened to the salt when it dissolved? Use the word substance in your answer.

7. Table salt and granulated sugar both dissolved clear and neither fizzed. Which test in your survey separated them? Then name one property from the lesson that would separate them but that you could not safely measure at home, and give the reason.

8. Different kitchens reported different water-test results for baking soda ('dissolves clear' versus 'cloudy'). List two reasons the results might differ, and explain how the class should decide which result goes in the key.
