



Hands-On Lab  Small groups  60 minutes over two days

Observe, Grow, and Model Crystals

SEP Developing and Using Models

Students examine and draw table salt crystals, noting their cubic shape. They make their own salt crystals then build a model that predicts how atoms are arranged in a salt crystal.

Safety Information

Remind students to wear safety goggles and aprons, and to be careful handling sharp objects. Remind students to wash their hands after handling the salt and at the end of the lab. Alert students to keep the salt out of their eyes by not touching their face during the lab and by washing their hands after handling the salt. Demonstrate the correct use of the dual eyewash and an alert to students to use the eyewash if they get salt in their eyes.

Setup

- Before the first day of the lab, prepare a saturated saltwater solution by dissolving about 360 g of table salt per liter of water. It will take some time to dissolve this much salt. Use a blender or an automatic stirrer to stir the solution until all the salt is dissolved.
- Pour about a 250 mL of saltwater into smaller cups for each team. The solution can be reused through multiple class sessions. Rock salt or sodium chloride road salt are cheaper alternatives to table salt, but they contain impurities that may not dissolve. Try not to transfer the impurities to the smaller cups.
- Find a place in the classroom where students' crystals can be set aside to dry.

Teardown

- Be sure that students do not discard the saltwater after soaking their paper.
- At the end of day, you can store any remaining saltwater in a clearly marked bottle for future use.
- Stray salt crystals and the paper with the crystals can be placed in the trash.
- Modeling clay should be saved without mixing up the colors. Toothpicks may be saved for future use if desired.



Student Lab Worksheet available online

Name _____

Date _____



HANDS-ON LAB

Observe, Grow, and Model Crystals

In this lab you will examine table salt with a magnifier, noting the shape of each piece, or crystal, of salt. You will then grow your own salt crystals and build a model that shows the arrangement of the atoms in a salt crystal.

DAY 1 Procedure and Analysis

STEP 1 Sprinkle a few pieces of table salt on a strip of dark construction paper. Use a magnifying lens to look at the salt crystals from the top and sides.

STEP 2 Draw Sketch what you observe. Be sure that your drawings are large enough to clearly and accurately represent the appearance of the crystals. Discard the salt crystals when you are done with your drawing. Wash your hands if you handled the salt.

MATERIALS

- clay, modeling, 2 colors
- cup, small
- hand lens
- paper, construction, dark, 3 cm x 8 cm
- salt, table
- saltwater
- toothpicks



Students should draw cubic shapes. Encourage students to make “larger-than-life” drawings instead of trying to draw small shapes that mimic the size of the salt crystals.

STEP 3 To make your own salt crystals, start by soaking the strip of construction paper in salt water for 30 seconds. Write your name on a small cup, and then set the paper over the top of the small cup. Your teacher will tell you where to place your paper and cup so that the paper can dry overnight.

STEP 4 Predict what you will see after the water has evaporated from the paper and just the salt remains.

Answers will vary, but students are likely to predict that their crystals will also be cubic in shape.

DAY 2 Procedure and Analysis

STEP 5 Locate your cup and paper, and carefully take them back to your desk. You may gently remove paper from the cup if needed. Use the magnifying lens to examine your paper. How does your prediction compare to what you see on the paper?

Answers will vary, but students are likely to state that their prediction was mostly accurate.

STEP 6 Discuss the shape of salt crystals with your group. How are the crystals that you grew similar to and different from table salt crystals that you observed yesterday?

Answers will vary. Students may note that the crystals they made have a variety of sizes while the original table salt crystals were all the same size. If students have a hard time remember what the table salt crystals looked like, you may allow them to reexamine samples of table salt.

STEP 7 The saltwater that you used to make salt crystals had two types of atoms among the molecules of water: sodium and chlorine. These atoms came together to form crystals as the water evaporated. Use toothpicks and two different colors of modeling clay to build a model that shows how you think the sodium and chlorine atoms join together to form crystals. These hints will help you build your model:

- In a salt crystal, each atom can only connect to a different kind of atom.
- In a salt crystal, an atom can connect to as many as six different atoms.

Model should show a cubic structure with bonds only on the outside edges of the cube. No sodium or chlorine atoms should be bonded to an atom of the same element. To view the correct structure, go to Exploration 1 in the Student eBook. The second model under the Check Your Learning shows a sodium chloride crystal.

STEP 8 Explain why you arranged the atoms in the way that you did for your model.

Some students may say that they arranged the atoms in cube shapes to mimic the crystals shape. Other students may state that once the hints were taken into account, the cubic shape arose naturally.

Strategies

- If you do not have cups small enough to hold up the paper strips, you can craft sticks or coffee stirrers to support the strips over a larger cup or container. The goal is to allow air to flow around as much of the paper as possible to aid in drying. Make sure the paper is dark to help make the crystals visible.
- If students have difficulty starting to build their models in Step 7, suggest that they begin by making small balls of two different colors of clay, to represent sodium and chlorine, and to link them with a toothpick. They can then add another stick and ball of clay to show another atom, making sure that only atoms of different colors are connected. If students are only building a flat structure, suggest that they add atoms on top of their model so far.
- Limit the model making time to 10–15 minutes, which should be enough time for students to build the key shape.



Social Awareness To help build communication and teamwork, have the class brainstorm phrases used to provide feedback or express disagreement. Add positive examples such as those listed below if students do not suggest them. As a class or in groups, have students classify each example as constructive or not constructive. Students can then use the list of constructive sentence starters as a guide during this lab.

Clarifying:

"I don't understand _____. Can you elaborate?"

"To be clear, are you saying _____?"

"Could you explain how the evidence supports your claim. Is this model showing _____ or _____?"

Disagreement or Constructive Criticism:

"I suggest _____."

"One problem I see is _____."

"One way to improve this might be _____."

Hands-On Scoring Rubric

Points	Criteria
	Students made their predictions and explanations based on evidence.
	Students followed the procedure accurately.
	Students modeled the structure of the crystals using the constraints provided.