Growing Crystals

Sue Anne Nothstine

Topic

Variations in crystal growth

Time

45 minutes for procedure; 2 to 3 days until completion

Safety

Please click on the safety icon to view the safety precautions. Do not drink or eat any of the substances or solutions used in the following procedures.
Dispose of all solutions by pouring them down the sink or flushing them down the toilet. Be careful when handling heated water and solutions.

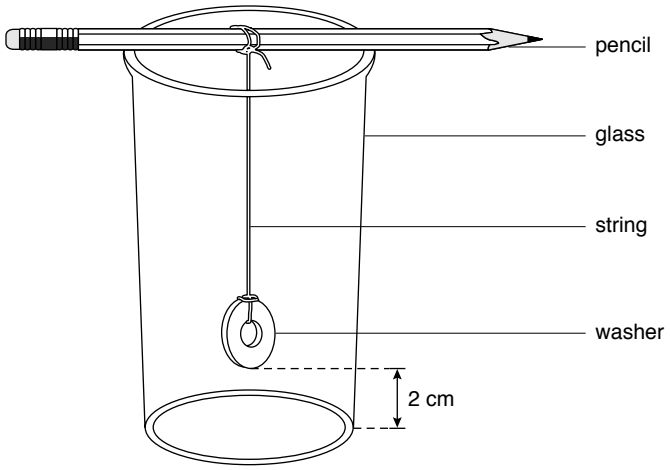
Materials

salt
heat source
alum (available at the drugstore or in the spice section of grocery stores)
ceramic or Pyrex™ saucepan or other large, heat-resistant vessel
tall drinking glass
masking tape
pencil
marker pen
large washer
stirring rod
string
dark-colored construction paper
six petri dishes or saucers
aluminum foil
measuring cup with milliliter markings
scissors
water
microscope (optional)
measured tablespoon
magnifying glass

Procedure

1. Bring 400 mL water to a boil in the saucepan.
2. While waiting for the water to boil, number the six petri dishes, using the masking tape and marker.
3. Cut a piece of string ¾ the height of the glass you are using. Tie one end of the string to the center of the pencil. Tie the washer to the other end of the string. Adjust the string so that the washer hangs approximately 2 cm from the bottom of the glass, as shown in the illustration. Remove the pencil from the glass.
4. Cut two circles of paper the size of the bottom of the petri dishes. Place the circles in dishes 2 and 5.
5. While the water is boiling, add 20 teaspoons (tsp) of alum to it, 1 tsp at a time, and stir.

6. Turn the heat source off, and allow the solution to cool for a few minutes.
7. Fill the glass about ¾ full. Place the pencil across it so that the string is suspended in the solution. Set the glass aside where it will not be disturbed.



8. Place 2 tablespoons (tbs) each of the solution in each of the dishes 1, 2, and 3.
9. On the data table, record the contents of the three dishes. Rinse the saucepan and the measuring spoon.
10. Bring 200 mL water to a boil, and add 10 tsp salt to it, stirring carefully.
11. Remove the salt solution from the heat, and allow it to cool for a few minutes.
12. Put 2 tbs salt solution into the remaining three dishes. Record the contents of these numbered dishes on the data table.

DATA TABLE

Dish	Contents	Results
1.		
2. With paper		
3. Covered		
4.		
5. With paper		
6. Covered		

13. Place all six dishes on a level surface where they will not be disturbed. Cover dish 3, containing alum, and dish 6, containing salt, with aluminum foil.
14. After 72 hrs, observe the contents of the dishes and the glass. Record your observations on the data table.
15. How did the crystals in the different dishes and the glass vary (in size, shape, color, etc.)?

16. Were all the alum crystals the same size? Were all the salt crystals the same size?
17. Were all the alum crystals the same shape? What about the salt crystals? (Use the magnifying glass to help determine this. If you have access to a microscope, try looking at the crystals through it.)
18. Did all the dishes have the same amount of crystals in them?
19. How could you tell the difference between alum and salt crystals if the dishes were not labeled?

What's Going On

The crystals were different sizes and shapes. The crystals in the glass were very large. The size of the crystals in the dishes varied. Both the alum and the salt crystals varied in size. The alum crystals are all six-sided: hexagonal. The salt crystals are all different-size cubes. Even the opaque white salt crystals that form around the rim of the dish are made up of tiny cubes, as a microscope reveals. The covered dishes had fewer crystals because not all the solution evaporated. You can recognize the crystals of salt and alum by their characteristic shapes, which never vary, despite the difference in the size of the crystals. Many solid substances, for example rocks such as granite and quartz, are made up of repeated, orderly forms with definite shapes, edges, and angles. These forms are called *crystals*. The sizes and shapes of crystals vary, depending on the substance and on the conditions during which they were formed. In this experiment you investigated the different types of crystals formed by evaporating solutions of common household substances.

Connections

Did you ever wonder what helps light up the display area in calculators or digital watches? Liquid crystals are molecules that lie between a solid and a liquid form. They become transparent with a high-frequency current and opaque with the opposite current. Therefore, with a voltage current, no light is emitted from the display area of a watch, and with the absence of a voltage current, a watch display area lights.

Safety Precautions

READ AND COPY BEFORE STARTING ANY EXPERIMENT

Experimental science can be dangerous. Events can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. Basic safety procedures help prevent serious accidents. Be sure to follow additional safety precautions and adult supervision requirements for each experiment. If you are working in a lab or in the field, do not work alone.

This book assumes that you will read the safety precautions that follow, as well as those at the start of each experiment you perform, and that you will *remember* them. These precautions will not always be repeated in the instructions for the procedures. It is up to you to use good judgment and pay attention when performing potentially dangerous procedures. Just because the book does not always say "be careful with hot liquids" or "don't cut yourself with the knife" does not mean that you should be careless when simmering water or stripping an electrical wire. It *does* mean that when you see a special note to be careful, it is extremely important that you pay attention to it. If you ever have a question about whether a procedure or material is dangerous, stop to find out for sure that it is safe before continuing the experiment. To avoid accidents, always pay close attention to your work, take your time, and practice the general safety procedures listed below.

PREPARE

- Clear all surfaces before beginning work.
- Read through the whole experiment before you start.
- Identify hazardous procedures and anticipate dangers.

PROTECT YOURSELF

- Follow all directions step by step; do only one procedure at a time.
- Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eyewash, and first-aid kit.
- Make sure that there is adequate ventilation.
- Do not horseplay.
- Wear an apron and goggles.
- Do not wear contact lenses, open shoes, and loose clothing; do not wear your hair loose.
- Keep floor and work space neat, clean, and dry.
- Clean up spills immediately.
- Never eat, drink, or smoke in the laboratory or near the work space.
- Do not taste any substances tested unless expressly permitted to do so by a science teacher in charge.

USE EQUIPMENT WITH CARE

- Set up apparatus far from the edge of the desk.
- Use knives and other sharp or pointed instruments with caution; always cut away from yourself and others.
- Pull plugs, not cords, when inserting and removing electrical plugs.
- Don't use your mouth to pipette; use a suction bulb.
- Clean glassware before and after use.
- Check glassware for scratches, cracks, and sharp edges.
- Clean up broken glassware immediately.

- Do not use reflected sunlight to illuminate your microscope.
- Do not touch metal conductors.
- Use only low-voltage and low-current materials.
- Be careful when using stepstools, chairs, and ladders.

USING CHEMICALS

- Never taste or inhale chemicals.
- Label all bottles and apparatus containing chemicals.
- Read all labels carefully.
- Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves).
- Do not touch chemical solutions.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

HEATING INSTRUCTIONS

- Use goggles, apron, and gloves when boiling liquids.
- Keep your face away from test tubes and beakers.
- Never leave heating apparatus unattended.
- Use safety tongs and heat-resistant mittens.
- Turn off hot plates, bunsen burners, and gas when you are done.
- Keep flammable substances away from heat.
- Have a fire extinguisher on hand.

WORKING WITH MICROORGANISMS

- Assume that all microorganisms are infectious; handle them with care.
- Sterilize all equipment being used to handle microorganisms.

GOING ON FIELD TRIPS

- Do not go on a field trip by yourself.
- Tell a responsible adult where you are going, and maintain that route.
- Know the area and its potential hazards, such as poisonous plants, deep water, and rapids.
- Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold).
- Bring along a first-aid kit.
- Do not drink water or eat plants found in the wild.
- Use the buddy system; do not experiment outdoors alone.

FINISHING UP

- Thoroughly clean your work area and glassware.
- Be careful not to return chemicals or contaminated reagents to the wrong containers.
- Don't dispose of materials in the sink unless instructed to do so.
- Wash your hands thoroughly.
- Clean up all residue, and containerize it for proper disposal.
- Dispose of all chemicals according to local, state, and federal laws.

BE SAFETY-CONSCIOUS AT ALL TIMES