

Art and Science of Crystal Growing Competition 2013



July – October 2013

Incorporating National Chemistry Week in July and National Science Week in August



Notes and Instructions

Introduction

Many chemical compounds exist in the form of crystals, like table salt or sugar. Sometimes crystals are very small (microscopic) and sometimes they can be quite large. People who study crystals are called crystallographers.

The aim of “The Art and Science of Crystal Growing” competition is to encourage school children to take an interest in how crystals form and how beautiful they can appear.

Students can take part individually, in teams of up to 5, or as a whole class group (recommended for Grades P-2).

The winners will be judged on (a) how clearly they have reported their observations on the rate of growth, size and shape of their crystals, as well as the size of their finished crystal and (b) how artistic their digital photographs of the crystal they have grown are, using light, shade, reflection, refraction and diffraction patterns.

The best submissions, according to Year level, as decided by a panel of judges, will receive special prizes and winning artwork will be displayed publicly. All students will receive participation certificates.

Notes for teachers and students

Schools will need to order their crude potash alum (aluminium potassium sulphate dodecahydrate) from Rowe Scientific and allow 14 days for delivery. Since the competition is to start during National Chemistry Week, week beginning 22 July 2013, orders can be placed from early July. The order form is attached to these notes. Remember to order the correct grade of material, “LR” grade (AL039 – 500g) which comes in 500g packs. 500g should be enough for 20-30 students working individually.

It can take up to 10 weeks for crystals to grow to their optimum size, so students will need to have started growing their crystals before the end of July. **Reports and pictures must be emailed or posted to the RACI Victoria Office, by Friday 11 October.** Results will be announced by the end of October.

Competition Objectives

The objective of the competition is to grow a large aluminium potassium sulphate dodecahydrate crystal from a solution of crude potash alum, to measure how big it gets and roughly how fast it grows (over a period of up to ten weeks), to describe what it looks like, and to use the crystals to produce a piece of photographic artwork that demonstrates the crystals' properties and behaviour (for instance, the way light is refracted through it, how it distorts images behind it, or the way in which the crystal is grown). The artwork will be judged both on how effective the artwork is and how well the image demonstrates the crystals' properties.

Safety Information

Teachers can read the relevant material safety data sheet at: <http://www.raci.org.au/branches/vic-branch>. Potash alum is relatively innocuous and if the instructions are followed properly, hazards are minimal. Potash alum can irritate the skin and eyes and should be washed off with lots of water. Breathing in any dust should be avoided. If anybody swallows alum solution, they should have their mouth washed out, VOMITING SHOULD **NOT** BE INDUCED, and urgent medical advice should be sought. If possible they should be taken to the nearest hospital for treatment.

Apparatus

Each student/team will need two 250ml beakers, a filter funnel and filter paper, a source of hot water, a stirring rod, tweezers, tongs, spatula or plastic spoon, some fine nylon thread, a watch-glass or paper hat to fit on one of the beakers, a ruler, use of a smart phone or digital camera and a diary or log book to record observations.

Procedure

Make sure all apparatus is clean and dry.

Place approximately 25 g of potash alum in a beaker (250 ml or bigger) and add approximately 170 ml of hot water. Stir the mixture until all the crystals have dissolved. The solution may have a slightly cloudy or milky appearance due to impurities in the technical grade of alum used.

(NOTE: don't use all the alum you have been given – keep a few crystals back in reserve in case you need to "seed" the solution later.)

Filter the warm solution through a filter funnel (in which filter paper has been inserted) into another clean beaker. Cover the beaker of solution with the watch glass or fresh filter paper and set aside in a cool sheltered place and allow it to stand undisturbed overnight. The first beaker and funnel can be washed and dried and the residue and filter paper used for filtration discarded.

The next day, observe the beaker of solution. The bottom should have become covered with a layer of smallish crystals which formed spontaneously as the solution cooled. Carefully decant (pour off) the clear solution above the crystals into a clean beaker and set it aside for later, leaving the crystals behind in the other beaker. If for any reason, no crystals have formed after leaving the solution to stand overnight, the solution can be "seeded" by adding a crystal from the original alum. Let it stand overnight again and observe the formation of crystals. Alternatively, if nothing has happened, crystal growth may also be induced by scratching the bottom of the glass beaker with a glass stirring rod.

From the bed of crystals, one good symmetrical crystal or group of crystals needs to be selected to act as "seed" for your big crystal. Using a plastic spoon, spatula, tongs or tweezers, transfer the selected crystal to the beaker containing the decanted solution, trying to place it centrally in the beaker.

A good technique to promote uniform growth is to suspend the crystal with a nylon thread tied round a stirring rod or pencil resting on the rim of the beaker. This step is not essential, however, and good a crystal can usually be obtained just by leaving the crystal on the bottom of the beaker.

Take a picture (if possible) of the crystal, preferably close to a ruler so that you can measure its size, and mark the level of the liquid in the beaker. Record the date in your diary.

Cover the solution with a loose-fitting paper hat that permits water to evaporate slowly whilst keeping out dust.

Allow the solution to stand in a draft free location, not in direct sunlight or near a heater. The aim is to keep the temperature as constant as possible.

Once a week record in your diary the level of the solution in the beaker and if possible, without disturbing your crystal, take a picture of it close to a ruler so that you can estimate how much it has grown. Try and avoid disturbing crystals during the growth phase as this may induce additional crystals to grow.

If small isolated crystals appear, you may be able to carefully remove them with tweezers. Be careful not to disturb your big crystal. If small crystals grow on the main crystal, remove it, dry it with tissues, and carefully remove the adhering buds. Do not touch the crystal with your fingers. The crystal is likely to be quite fragile, fairly brittle, and easily damaged, so should not be dropped or bumped.

Sometimes, small crystals can be encouraged to re-dissolve (go back into solution) if the beaker is very gently warmed in a bath of warm to hot water. In this case, your large crystal should be carefully removed from the beaker and gently laid on some tissue. The solution should be stirred very gently, whilst being gently heated up in the water bath. The beaker should be removed from the hot water bath immediately the small crystals have dissolved. Allow the beaker to cool back to room temperature (1 to 2 hours, say) before returning your big crystal to solution. Set the beaker aside under its paper hat and continue to allow the crystal to grow. Continue to monitor progress by reporting on the drop in water level, and estimate the size of the crystal.

When no further growth is apparent, and there is still time before the end of the competition, a new saturated solution may be prepared as before (dissolving the crude alum in warm water, filtering off any impurities, and decanting the solution after it has cooled overnight). When the new solution is cool enough, your crystal may be transferred into this new solution and may then continue to grow as it takes up more of the aluminium potassium sulphate salt from the solution.

When it is decided to terminate the experiment (after about 10 weeks or so), remove your crystal very carefully from the beaker, dry it with tissues and with a ruler measure its length, width and height. Compare the measurement, if you can, with the size of the original crystal.
Take a photo of the completed crystal (next to a ruler to confirm the size)

To complete the artistic component, students will digitally photograph the completed crystal, and using the effects of light and shade, colour and other techniques, produce an artwork featuring the crystal and demonstrating the principles of diffraction/ reflection/ dispersion using light and or objects/images (see examples). The ingenuity of students will be encouraged to produce an innovative picture which highlights the crystal.

Each student, if working individually, or team, must also submit a one page A4 report, detailing the growth and artistic processes, which should include:

- A brief account of how their crystal grew
- Including recordings of liquid levels in the beaker
- The estimated size of the crystal, as measured by photographing the crystal in its beaker adjacent to a ruler, say once a week over the duration of the experiment.
- A record of the final dimensions of the crystal at the end of the experiment. (For this, the crystal should be removed from the beaker, dried, carefully laid on a flat surface, and photographed with a ruler next to it.)
- 25 word or less statement detailing how the artwork demonstrates the properties of the crystal

(Note: Grades P-2 are not required to provide one page report, but can submit multiple photographs of the growth stages, with measurements)

What to send on completion of the competition

Together with the **School Entry Form**, for each student/team/class submitting an entry into the competition, you must send:

1 Photo of full grown crystal (next to ruler, to show size)

1 Artistic Photo

One A4 page report

(Note: Grades P-2 are not required to provide report, but can submit multiple photographs of the growth stages, with measurements)

Please ensure that all photographs and reports are clearly marked with the entrant/team/Class name and Grade

Please email completed entries to Caroline Lewington, Victoria Branch Coordinator, at raci-vic@raci.org.au

Or, you can send to the address below (photos on CD or USB stick only please).

YOU ARE NOT REQUIRED TO SEND IN COMPLETED CRYSTALS

Good luck!

How do you find out more information?

Check the RACI website

<http://www.raci.org.au/branches/vic-branch>

Or contact

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