Oliphant Science Awards

Crystal Investigation

Year 9-10

Bastien Alexander-Backe

Unley High School

Using this Log Book

The log book in this form is **only advisory** but students should try to document the following:

- Date and time for each handling of the crystal procedure
- Describe exactly what they did on each occasion (should include measurements of volume and temperature made at any time)
- What has happened to the selected crystal on each viewing (changes)

- Description of the crystal characteristics – clarity, regularity (smooth faces, sharp edges), and size (can be assisted by sketches or digital photos)
- What problems were encountered and how they were solved – may include summaries of discussions with teachers/mentors
- Acknowledgment of manual assistance by others e.g. for competitors from the R-2, 3-4 age groups, what teachers or parents did.
- Acknowledgement of any crystal growing advice from books or websites.
-

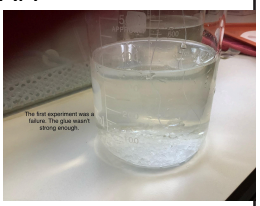
Please note: the use of this version of a log book is **not mandatory**. There will be no penalty for not using it.

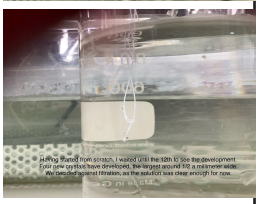
However, the student(s) who are preparing a crystal will need to provide evidence of their ongoing efforts by comments related to the criteria suggested in this log book model.

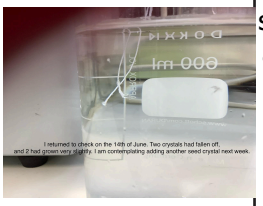
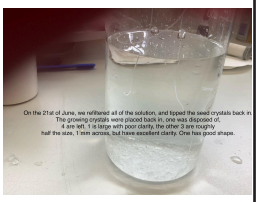
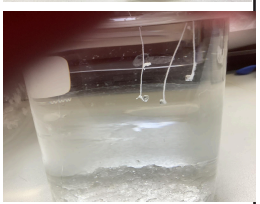
The competition instructions suggest that the crystal growers formulate an hypothesis that they can test while growing the crystal(s)

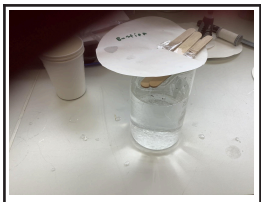
Examples of questions that could be expressed as a prediction or hypothesis are:

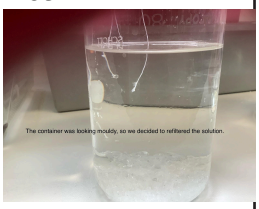
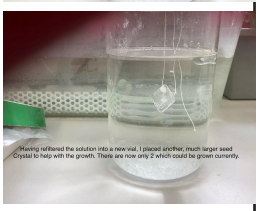
- Can my crystal grow to the required 9 mm in 3 weeks?
- Does leaving my crystal in a dark place help it to grow better?
- Does more or less attention help my crystal to be clearer and more well-formed?
- Does an incubator help grow bigger crystals in a given time period?

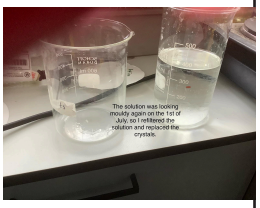
Date/Time/image	Descriptions of what the student(s) did, problems encountered and solved	Crystal characteristics
6 June 2024, 8.25 AM 	SUMMARY I started this experiment with the goal of creating a large and clean crystal by any means necessary. To achieve this, I started with a diluted Alum solution, and tipped it into a beaker. Melna provided me with some seed crystals to leave at the bottom of the beaker to start the growth. I then picked out 2 starter crystals from a pile of potential starters, based on their clarity and cuts. They were both ½ a millimeter wide. They were attached with adhesive glue to string,	2 clean cut ½ millimeter crystals with mediocre clarity

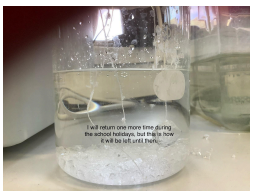
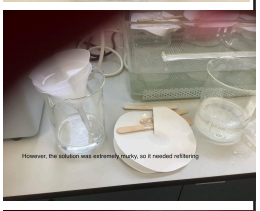
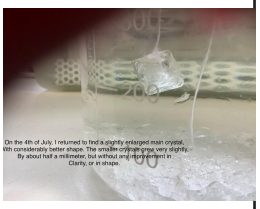
	then tied to popsicle sticks and hung around the rim of the beaker, with the crystals inside the Alum solution. They soon fell off the string however, so the experiment needed to be redone a week later. PROCESS • Opened a case with a large number of possible seed crystals • Selected 3 crystals based on ideal characteristics, such as clarity and clean cuts • Attached seed crystals to string using adhesives, attached them to popsicle sticks, and placed them on a clean surface • Poured a large quantity of alum crystal solution into a beaker with other crystals to help with future growth • Took circular growth paper and cut a line through it to its centre, then slid the popsicle sticks through the gap • Placed the filter paper and popsicle sticks into the beaker, ensuring total submersion of the 3 crystals • Placed the full beaker in a Bain-Marie at 25 degrees Celsius • Cleaned away all equipment used during the process, including leftover seed and starter crystals.	
12 June 2024, 12.54 PM  	SUMMARY I restarted the process after the initial failure with stronger glue, picking out 3 select starter crystals based on shape, clarity, and brilliance, and stuck each of them to a string tied around a popsicle stick. These were placed into a beaker with a growth solution in a tub held at a constant temperature of 25 degrees Celsius. After photographing these crystals, I left them to sit. PROCESS • Opened a case with a large number of possible seed crystals • Selected 4 crystals based on ideal characteristics, such as clarity and clean cuts • Attached seed crystals to string using adhesives, attached them to popsicle	4 crystals, 3 under ½ a millimeter, one at exactly ½ a millimeter. All had slightly jaded edges and no clouds.

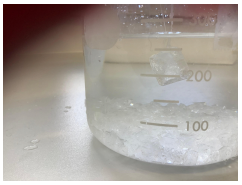
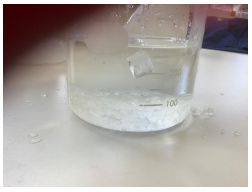
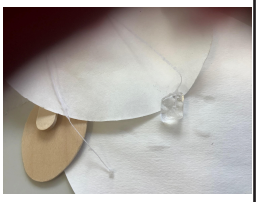
	sticks, and placed them on a clean surface • Poured a large quantity of alum crystal solution distilled to XXXXX into a beaker with other crystals to help with future growth • Took circular growth paper and cut a line through it to its centre, then slid the popsicle sticks through the gap • Placed the filter paper and popsicle sticks into the beaker, ensuring total submersion of the 3 crystals • Placed the full beaker in a Bain-Marie at 25 degrees Celsius • Cleaned away other equipment, including scissors, leftover string, and filter paper, and sanitised bench	
14th June 2024, 12.59 PM  	SUMMARY I visited the crystals 2 days after their initial setup. 2 of the starter crystals had fallen off, and the other 2 had enjoyed a slight growth. I contemplated adding another starter crystal to the group next week. PROCESS • Removed the beaker from the Bain-Marie • Placed the beaker on a clean surface, and removed the crystals to place them on paper • Took note of the dimensions of the crystals • Placed the crystals back in the beaker, ensuring total submersion • Replaced the beaker in the Bain-Marie • Cleaned the surface and disposed of the paper.	2 at 1mm wide, with jaded edges and respectable clarity.
21 June, 2024, 12.54 PM  	SUMMARY On the 21st of June, I refiltered the solution aided by Melna. This meant passing the solution through filter paper through a funnel and into a new beaker, removing the growing crystals and transferring the seed crystals into the new beaker. I noticed some new crystals forming along the string. 1 crystal had poor clarity and shape, so it was removed. The other 4 continue to grow. PROCESS • Set aside a clean wooden spoon, a beaker identical to the original one, a funnel and filter paper to filter the solution	1 at 2mm wide, 3 at 1mm. The largest has very poor clarity, the others have much better clarity but poor shape.

	• Folded filter paper in half twice, so that a quarter was left, and found a fold in the paper that when opened, formed a dome shape • Placed the filter paper in a funnel and removed popsicle sticks and the cover paper from the current experiment • Placed the funnel inside the new beaker, and tipped the alum solution slowly through the filter paper and tunnel into the new solution, ensuring the funnel never overflowed • Removed the filter paper from the funnel and disposed of it, then took the funnel out of the beaker and washed it • Took the clean wooden spoon and forced it into the crystals that were forming at the bottom of the beaker until they loosened, then tipped them into the new beaker • Disposed of the wooden spoon, then carefully placed the seed crystals on popsicle sticks in the new beaker • Ensured total submersion, then tucked the popsicle sticks back through the cut filter paper • Placed the new beaker in the Bain-Marie	

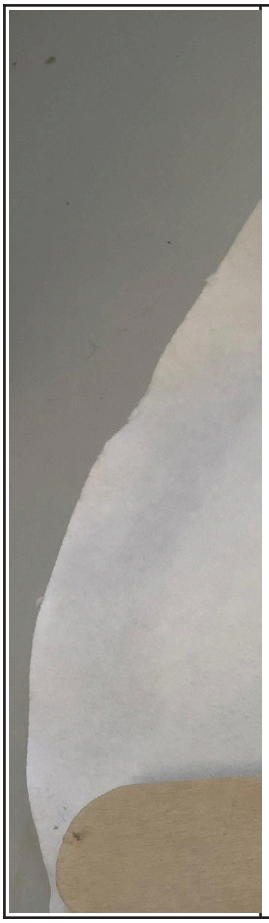
Date/Time/image	Descriptions of what the student(s) did, problems encountered and solved	Crystal characteristics	Signed
26 June 2024, 1.09 PM   	SUMMARY The solution was filtered again, as it looked mouldy and cloudy. Filter paper was placed inside a funnel, and the solution was then put in a new beaker. To help with the growth, Melna donated a large crystal, and my goal became to improve its lacking clarity and shape. There are now only 3 crystals growing. PROCESS • Set aside a clean wooden spoon, equally sized beaker, a funnel and filter paper to filter the solution, as well as a popsicle stick, string, and adhesive glue for another crystal • Folded filter paper in half twice, so that a quarter was left, and found a fold in the paper that when opened, formed a dome shape	2 at around 2 mm, with poor shape and decent clarity, one donor crystal 12 mm wide, with poor shape and poor clarity.	

	• Placed the filter paper in a funnel and removed popsicle sticks and the cover paper from the current experiment • Placed the funnel inside the new beaker, and tipped the alum solution slowly through the filter paper and tunnel into the new solution, ensuring the funnel never overflows • Removed the filter paper from the funnel and disposed of it, then took the funnel out of the beaker and washed it • Took the clean wooden spoon and forced it into the crystals that were forming at the bottom of the beaker until they loosened, then tipped them into the new beaker • Disposed of the wooden spoon, then carefully placed the seed crystals on popsicle sticks in the new beaker • Took loose large seed crystal and attached it to fine string using adhesive glue • Tied string around a popsicle stick and ensured it was secure • Placed large seed crystal in the beaker alongside the other crystals • Ensured total submersion, then tucked the popsicle sticks back through the cut filter paper • Placed the new beaker in the Bain-Marie		
1 July 2024, 1.15 PM   	SUMMARY The largest crystal had slowly been improving its shape since the last check-in, but was still struggling with clarity. The solution seemed moldy, with large clouds gathering inside the beaker, so it was promptly refiltered. Melna supplied a new beaker to filter into. PROCESS • Retrieved beaker with growing crystals from Bain-Marie, and placed it on a clean countertop • Removed the crystals carefully by securely grasping the covering paper with the popsicle sticks attached • Placed the crystals on the counter and took measurements • Set aside a clean wooden spoon, equally sized beaker, a funnel and	Largest crystal was 11mm wide, with improved shape and defined cuts on all but one side. It is lacking clarity. The two smaller crystals were unimpressive, and had poor shape and cuts, as well as small size.	

	filter paper to filter the solution • Folded filter paper in half twice, so that a quarter was left, and found a fold in the paper that when opened, formed a dome shape • Placed the filter paper in a funnel and removed popsicle sticks and the cover paper from the current experiment • Placed the funnel inside the new beaker, and tipped the alum solution slowly through the filter paper and tunnel into the new solution, ensuring the funnel never overflowed • Removed the filter paper from the funnel and disposed of it, then took the funnel out of the beaker and washed it • Took the clean wooden spoon and forced it into the crystals that were forming at the bottom of the beaker until they loosened, then tipped them into the new beaker • Disposed of the wooden spoon, then carefully placed the seed crystals on popsicle sticks in the new beaker • Ensured total submersion, then tucked the popsicle sticks back through the cut filter paper • Placed the new beaker in the Bain-Marie		
4 July 2024, 12.57 PM    	SUMMARY I returned to find a slightly enlarged main crystal with improved shape, though the two smaller crystals experienced around ½ a millimeter of growth and no genuine quality improvement. I also found the solution to be murky, so it was refiltered, and the crystals were placed in a new beaker. This concluded my last visit during school time. PROCESS • Retrieved beaker with growing crystals from Bain-Marie, and placed it on a clean countertop • Removed the crystals carefully by securely grasping the covering paper with the popsicle sticks attached • Placed the crystals on the counter and took measurements • Set aside a clean wooden spoon,	1 large crystal around 12mm wide, with improved shape and lacking clarity. One corner was jaded, and there were some white clouds inside. 2 small crystals both around 2.5 mm wide with poor shape and cuts. One looked like a tooth.	

	equally sized beaker, a funnel and filter paper to filter the solution • Folded filter paper in half twice, so that a quarter was left, and found a fold in the paper that when opened, formed a dome shape • Placed the filter paper in a funnel and removed popsicle sticks and the cover paper from the current experiment • Placed the funnel inside the new beaker, and tipped the alum solution slowly through the filter paper and tunnel into the new solution, ensuring the funnel never overflows • Removed the filter paper from the funnel and disposed of it, then took the funnel out of the beaker and washed it • Took the clean wooden spoon and forced it into the crystals that were forming at the bottom of the beaker until they loosened, then tipped them into the new beaker • Disposed of the wooden spoon, then carefully placed the seed crystals on popsicle sticks in the new beaker • Ensured total submersion, then tucked the popsicle sticks back through the cut filter paper • Placed the new beaker in the Bain-Marie		
22 July 2024, 1.09 PM   	SUMMARY Upon returning after the school holidays, one of the two smaller crystals had fallen off the string, and the other had barely grown, less than half of a millimetre. The largest crystal still enjoyed an improved shape, and is therefore the crystal that will be sent to the awards. The solution was looking murky, so I still wanted to refiltered again to improve the alum solution and bring out even cleaner cuts from the crystal. PROCESS • Retrieved beaker with growing crystals from Bain-Marie, and placed it on a clean countertop • Removed the crystals carefully by securely grasping the covering paper with the popsicle sticks attached • Placed the crystals on the counter and took measurements • Took photos to update the log book	1 large crystal around 12 mm, with excellent cuts on all but one side, and improved clarity, with slight fog on the top side of the crystal. 1 small crystal, poorly defined and about 3 mm wide, with poor cuts and clarity	

	• Set aside a clean wooden spoon, equally sized beaker, a funnel and filter paper to filter the solution • Folded filter paper in half twice, so that a quarter was left, and found a fold in the paper that when opened, formed a dome shape • Placed the filter paper in a funnel and removed popsicle sticks and the cover paper from the current experiment • Placed the funnel inside the new beaker, and tipped the alum solution slowly through the filter paper and tunnel into the new solution, ensuring the funnel never overflows • Removed the filter paper from the funnel and disposed of it, then took the funnel out of the beaker and washed it • Took the clean wooden spoon and forced it into the crystals that were forming at the bottom of the beaker until they loosened, then tipped them into the new beaker • Disposed of the wooden spoon, then carefully placed the seed crystals on popsicle sticks in the new beaker • Ensured total submersion, then tucked the popsicle sticks back through the cut filter paper • Placed the new beaker in the Bain-Marie		
23 July 2024, 12.57 PM	SUMMARY This was the final check in before submission. I found the crystal with extremely slight improvements since yesterday in clarity and in shape. I am extremely happy with the result. After taking an image, I returned the crystal to its beaker to wait until it was submitted. PROCESS • Removed beaker from Bain-Marie carefully • Unstuck the tape from the sides of the beaker, then removed the lid with the crystals attached. • Took the lid to the side and checked the crystal's measurements • Took a photo for the investigation logbook • Picked up the lid delicately then placed it on the beaker, ensuring crystal submersion • Taped the lid closed	1 small crystal with poor clarity and shape, with winded edges, around 3 mm wide 1 large crystal with excellent clarity and clean, defined cuts, around 12 mm wide and long.	

	• Returned the beaker to the Bain-Marie.		

Conclusions

Using evidence from the experiment, it could be concluded that the Alum solution aided developing crystals to improve their cuts and clarity, due to the improved shape and clarity of the main crystal that is being sent to the awards.

Acknowledgement of Help/Resources

Melna was a guide throughout the entire process, and supplied all of the necessary materials, including the alum solution, starter crystals, and beaker.