



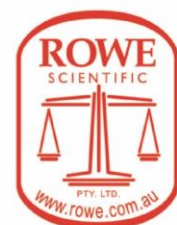
Prize Winner

Crystal Investigation

Year 5-6

Jack Theakstone

Annesley Junior School



The OLIPHANT Science Awards

CATEGORY: CRYSTAL GROWING

PRIZE WINNER



OPERATION NUCLEATION

0018 - 010

Student(s):

Jack Theakstone

Annesley Junior School

Coordinator:

Christiana Schammer

School Phone:

08 8422 2288

Gender:

M

Patent Sought

N

App code:

6605699

Year Level: 5 - 6

Group Entry: N

Students: 1

Category: Crystal Investigation

Project Title:

Operation Nucleation



My hypothesis:

A warm solution will grow a bigger crystal than a cold solution.

Log Book

Date	Time	Description of what the student did, problems encountered and solved	Crystal characteristics
06/06/20	11.00am	<p>I watched some YouTube videos on crystal growing and these websites: https://sciencing.com/dye-crystals-6012423.html</p> <p>https://www.thoughtco.com/growing-a-big-alum-crystal-602197</p> <p>https://raci.org.au/Web/Schools/Crystal-Growing/SA_CrystalGrowing.aspx (I clicked on 'advice to students')</p>	
08/06/20	10.00am	<p>First, I got my equipment ready. I used:</p> <ul style="list-style-type: none">• 2x 1 litre beakers, 1x 500ml beaker, 1x funnel, alum, scales, saucepan, glass stirring rod and a spoon. I also used coffee filter papers and demineralised water from the laundry. <p>Dad got the alum from Ace chemicals.</p> <p>Today I started to grow the seed crystals to test my hypothesis.</p> <p>I put 400ml of demineralised water into the 500ml beaker and I put that in a saucepan that had some cold water half way up the saucepan. I then put the saucepan with the beaker in it on the stove over a small flame to warm the water without putting the beaker onto the stove flame. Dad helped me with the heating.</p> <p>I then started adding tablespoons of alum to the beaker of water that was being warmed. I stirred it with a glass stirring rod to help it dissolve.</p> <p>I weighed each tablespoon of alum and they were 16 grams each. I kept adding alum to the warm water each time it all dissolved.</p> <p>In total, I added 12 tablespoons in total to the warm demineralised water. This was 192 grams.</p>	

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		<p>I then took the solution off the stove and let it cool.</p> <p>I then put a filter paper into the funnel. Dad helped me pour the solution through the filter into a 1 litre beaker. I then placed some alfoil over the beaker and let it cool.</p>	
08/06/20	12.30pm	<p>I saw a layer of tiny crystals on the bottom. The layer was about 5mm thick and there were hundreds of tiny crystals. I did not do anything.</p>	
09/06/20	4.00pm	<p>I poured the solution into a 1 litre beaker and scraped the crystals very carefully out of the beaker onto a sheet of paper to have a look at them. They were all very small and clumped together. I collected 6 of the best tiny seed crystals. I tried using super glue to stick them to the line but the crystals kept falling off. I then tied each of them to a very thin fishing line. This was very fiddly work so Dad helped.</p> <p>I then put the solution in the 1 litre beaker back into the saucepan of warm water to re dissolve the rest of the tiny alum crystals. Once they were all dissolved again, Dad helped me filter it back into the other 1 litre beaker to cool.</p> <p>Once it cooled, more crystals formed on the bottom of the beaker.</p> <p>I then wrapped the fishing line that the seed crystals were tied to around 2 ice cream sticks and hung them in the solution to grow.</p>	<p>The layer of crystals is now about 15mm thick but they are all very small and different shapes.</p>
11/06/20	4.30pm	<p>The layer on the bottom of the beaker had grown to about 15mm thick again. There are lots of tiny crystals floating on the top of the solution. They are also sinking to the bottom.</p> <p>I can also see lots of tiny clear perfect crystals growing up the fishing lines above the bigger seed crystals. They are all about 2-3mm each and perfectly clear and most are shaped like tiny cubes.</p>	<p>The 6 seed crystals have grown much bigger. They are white, cloudy and very spikey. Lots of different shapes have started growing over the seed crystals.</p>

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		<p>I didn't understand what was happening because I was only expecting to see the seed crystals in the beakers and not all the other crystals growing. I looked up YouTube videos on alum crystal growing to see if I could find the answer. One of them said that if you have lots of other crystals growing it could be because there is too much alum in the solution. I then spoke to my Dad about this to see if he thought it might be the problem. After showing him the video on YouTube he said it sounds like it could be the problem.</p> <p>To fix this problem, I removed the fishing lines from the solution and decided to add another 400ml demineralised water to the solution. I removed the first seed crystals from the fishing line and put them in the solution to dissolve with the layer of crystals on the bottom of the beaker.</p> <p>I put the beaker into a saucepan with warm water and warm the solution on the stove again to dissolve the alum.</p> <p>I leave 6 of the biggest and best of the new tiny perfect crystals that have grown on the fishing line in place, and remove all the others, dissolving everything again in warm water.</p> <p>I now have 800ml of solution.</p> <p>I then let the new solution cool. Once it had cooled, I put the 6 tiny perfect crystals on the fishing line in the solution and covered it with alfoil.</p>	
13/06/20	12.00pm	<p>There is now a layer of crystals on the bottom of the beaker but it is only 1-2mm thick. The new seed crystals have grown, but more slowly.</p> <p>There are lots of tiny crystals floating on the top of the solution. Some of the tiny seed crystals have more crystals growing on them making them strange shapes again.</p> <p>There are 5 more perfect crystals growing on the fishing line above the new seed crystals.</p>	

Date	Time	Description of what the student did, problems encountered and solved	Crystal characteristics
		<p>I speak to Dad about all the crystals still growing because I put more water into the solution to fix it. In speaking to Dad I think I didn't put enough water in the first time to stop the other crystals from growing.</p> <p>To fix this problem I need to add more water. I remove the fishing lines with the second lot of seed crystals and keep two of the best seed crystals. I also keep 4 of the best new tiny crystals that have grown on the fishing line.</p> <p>I then add another 200ml of demineralised water to make 1 litre of solution. I warm it on the stove in a saucepan of warm water again to dissolve all the alum. I then let it cool and add the 2 old seed crystals and the 4 new seed crystals on the fishing lines and cover the beaker with alfoil.</p>	
14/06/20	9.30am	<p>All the crystals have grown and there are only 3 tiny new crystals on the bottom of the beaker. No more crystals have formed on the fishing line.</p> <p>I remove the crystals from the solution and divide the solution between 2x 1 litre beakers. I add one large and 2 smaller seed crystals to each beaker, suspend them on fishing line tied to an ice cream stick.</p> <p>I then placed one beaker on a heating pad that is at 35 degrees C, and leave the other beaker on the bench top with no heating.</p> <p>I leave the experiment in the spare bathroom which is cold. It is 17 degrees in the bathroom. Nobody uses this bathroom so there is no movement.</p> <p>I cover both beakers with a paper towel so nothing gets into the solutions.</p>	
15/06/20	4.30pm	<p>All crystals appear to have grown slightly. There are only 3 tiny crystals on the bottom of the beaker that is on the heating pad.</p> <p>Both beakers have 500ml of solution in them.</p> <p>The bathroom temperature is 15 degrees.</p>	

Date	Time	Description of what the student did, problems encountered and solved	Crystal characteristics
18/06/20	4.30pm	All crystals are growing. The water level in the beaker on the heating pad has gone down by about 1mm. There is no change to the water level in the cold beaker.	The 2 larger crystals are not even in shape and have some angles on them. The 4 small crystals are very transparent and have sharp edges and are even in shape.
20/06/20	10.00am	All crystals are growing in both beakers. The bathroom temperature is 15 degrees. The heating pad is still 35 degrees C. I did not need to do anything to the solutions.	
25/06/20	5.00pm	The crystals are growing. The water level in the beaker on the heating pad has gone down by about 4mm from the starting level. The water in the cold beaker has only gone down by about 2mm. The crystals in the heated beaker appear to have grown slightly larger than the cold beaker.	The 2 largest crystals are not even in shape and have notches on the edges. They are cloudy inside. There are 2 small crystals that are transparent with sharp edges and are even in shape. The other 2 smaller crystals are a little bit cloudy inside, but have sharp edges.
27/06/20	10.00am	The crystals are still growing. There are no big changes since 25/6/20. We are going on holiday for 12 days tomorrow. I will leave the experiment running whilst I am away in the bathroom. The heater pad will continue to run at 35 degrees C.	
09/07/20	5.00pm	I am back from holidays. The crystals are much larger. The largest one is in the heated beaker. The next largest one is in the cold beaker. The water in the heated beaker has dropped 11mm from the start. The water in the cold beaker has dropped 7mm from the start.	The large crystals in each beaker are uneven, have big notches on the sides and are cloudy inside. They are both about 30mm. The other 4 smaller crystals are clearer, even in shape and are growing with 8 sides.
15/07/20	4.30pm	The crystals are still growing. There are no big changes since 9/7/20, but the crystals with the notches in them aren't filling in the notch- the crystals are getting bigger but the notches don't seem to be filling in. The other two best crystals (1 in the cold and 1 in the warm) are getting bigger.	The 2 largest crystals have notches in them and are cloudy. The 2 crystals I kept are clear, have smooth sides and even in shape

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		<p>Because the notches are not filling in and they don't look right, I decided I will remove these crystals from the warm and cold beakers and only leave the two best single crystals in each of the beakers to grow on their own as they are even in shape.</p> <p>I removed the notch crystals and put them in another beaker with 200ml of pure demineralised water to make more solution. I mixed it with a glass stirring rod but did not heat it because I did not need crystals to grow. I leave the solution sitting in the bathroom and will use this water to top up the warm and cold beakers when I have to.</p>	
17/07/20	11.30am	The crystals are growing slowly. I did not need to do anything to the solutions in the beakers. The heat pad temperature is still 35 degrees C.	Each of the crystals have smooth sides and sharp edges. Both have some white marks inside them.
20/07/20	5.30pm	The crystals are growing slowly. I did not need to do anything to the solutions in the beakers. The heat pad temperature is still 35 degrees C.	No big changes from 17/07/20.
22/07/20	6.30pm	The crystals are growing slowly. I did not need to do anything to the solutions in the beakers. The heat pad temperature is still 35 degrees C.	Each of the crystals have smooth sides and sharp edges. Both have some white marks inside them.
25/07/20	10.00am	The crystals are growing. The water level in the warm beaker has gone down by about 23mm and the cold beaker has gone down by about 18mm. I decided not to add any top up solution today as the crystals are still covered in solution.	No big changes from 22/07/20.
29/07/20		The crystals are still growing. I did not need to do anything to the solutions.	
01/08/20	11.15am	The crystals are still growing and the water level is getting close to the top of the crystals. I decided to add more solution to both beakers. I carefully pour the cold top up solution into each beaker to raise the solution level up.	Both crystals are growing with sharp edges. Some of the corners are missing from both crystals about 2-3mm. Both crystals have some small white marks inside them.

Date	Time	Description of what the student did, problems encountered and solved	Crystal characteristics
		In this top up solution, the notch crystals have dissolved a little bit and there are some small crystals on the bottom, so I add another 200ml of demineralised water and stir it. I leave it for the next top up. The water in both the cold and warm beakers is now even at 500ml each. There is one crystal growing on a fishing line in each beaker. The warm beaker has 3 small crystals on the bottom. The cold beaker hasn't got any extra crystals in it.	
05/08/20	5.15pm	The crystals are still growing. I do not need to do anything to the solutions in the beakers.	No changes from 01/08/20.
08/08/20	11.00am	The crystals are still growing. I do not need to do anything to the solutions in the beakers.	Both crystals have 8 clean sides and sharp edges with some small bits of the corners missing. The warm crystal is about 28 mm across and the cold crystal is about 20mm across. There are some small white marks inside both of them.
12/08/20		The crystals are growing slowly. I did not need to do anything to the solutions in the beakers. The heat pad temperature is still 35 degrees C.	The tips of the crystals seem to be slowly growing to points.
15/08/20		The crystals are growing slowly. I did not need to do anything to the solutions in the beakers. The heat pad temperature is still 35 degrees C.	Some of the points are now fully formed on the crystal in the warm beaker. The crystal in the cold beaker is missing more of the tips.
18/08/20		Last day. I removed the crystals from both beakers. The biggest crystal is in the warm beaker and it has the best points and edges.	Crystal from warm beaker is 35mm across, has sharp edges and most of the tips have formed. There are white marks inside. Crystal from cold beaker is 28mm across, has sharp edges but has more tips that have not formed. There is white mark inside.

Summary of findings:

Since I started the experiment, I saw that the water level evaporated faster in the warm beaker than the cold beaker and needed to be topped up with more solution than the cold beaker.

The water in the warm beaker evaporated faster and this left more of the alum in the water to build the crystal.

The cold beaker water didn't evaporate as fast so more water could hold more of the alum and stop it from building the crystal as fast.

Both crystals have grown but the one in the warm beaker has grown more than the cold beaker.

This proves my hypothesis was correct.

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