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Crystal Investigation

Hypothesis:

The crystal that was grown in a room with a bigger change in temperature from morning to night would grow larger than the crystal grown in a room with a consistent temperature.

List of materials & equipment:

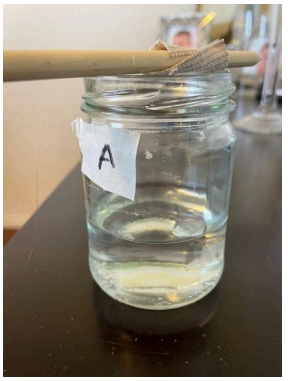
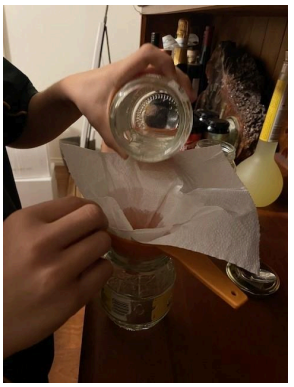
- 200 ml of warm water
- 3 teaspoons of alum
- A kettle
- Nylon thread
- Jar
- Pencil
- One piece of paper towel
- Tweezers
- Masking tape and compression tape

I am going to grow the crystals in four different rooms.
I am going to put A in the study which is on the northern side of the house, and will be facing the winter sun.
B in the laundry, which is right next to a window facing west and has the afternoon sun.
C stayed in the bedroom, with a big window facing east.
D in the lounge room, with not much direct sunlight, but lots of south facing windows.

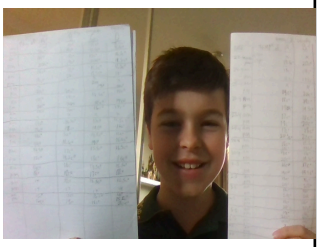
Diary of Crystal Growth

Date	Descriptions of what the student did, problems encountered and solved.	Crystal Characteristics (via photo)	Signed
3/4/24	**Process to make seed crystals** After I had finished setting up my equipment, I got my jar and filled it with 200 ml of room-temperature water. I then poured three teaspoons of alum in the jar. I heated up the solution in the microwave and then cooled it down so the alum would dissolve quickly. I stirred until no more alum could dissolve. I noticed that there was some debris, which made the solution dirty, so I filtered the solution through some paper towel. I left the saturated solution for one night and when I came back in the morning, no seed crystals had appeared.		Hayden Diercks

Date	Descriptions of what the student did, problems encountered and solved.	Crystal Characteristics (via photo)	Signed
4/4/24	I was disappointed that no seed crystals had appeared, but I could try again, so I did. I followed the same procedure by heating up the water and stirring it round, but I added another teaspoon of alum.		Hayden Diercks
5/4/24	I left it again last night, to find in the morning that a layer of crystals had covered the bottom of the jar. This was a big improvement from last time. However, almost all of the crystals in the jar were tiny, deformed ones all grouped together, so I did not benefit from them. Thankfully, there were four larger crystals which I selected. I got the nylon thread and spent a while trying to tie two of my seed crystals up. I tied the other end of the thread to a pencil which I put on the top of the jar and let the crystal dangle in the solution. I did the same with the other crystal.		Hayden Diercks
7/4/24	**Growing crystals from seed crystals** I picked out the other two of my seed crystals and decided to put them in a jar of solution but just have them sitting on the bottom instead of tying them up yet.		Hayden Diercks
8/4/24	As I found out, the problem with putting your seed crystal at the bottom of a saturated solution is that when smaller crystals form at the bottom, some of them will attach themselves to my seed crystal.		Hayden Diercks
10-13/4/24	Over the next few days, I continued to pick off smaller crystals that had attached to my crystals with a paring knife.		Hayden Diercks

Date	Descriptions of what the student did, problems encountered and solved.	Crystal Characteristics (via photo)	Signed
16/4/24	On Tuesday, I tied up another crystal, attached it to a pencil and dunked it in the solution. It was helpful that in a few days the crystal would grow firmly over the thread and stop the crystal from falling off, because it was hard to attach the crystal to the nylon thread and when it did attach it was hardly hanging on.		Hayden Diercks
19-22/4/24	Every now and then, some of the jars needed to be topped-up with solution. So I kept a jar with spare solution in it.		Hayden Diercks
23/4/24	**Recording Crystal Temperatures** Today I began my experiment recording to test my recording. I labelled my crystal jars: A, B, C and D. Then I put A in the study, B in the laundry, C stayed in the bedroom and I put D in the lounge room. I also got out four thermometers and set them up in the four different rooms. Then I got out a piece of paper and ruled up a table. Each day I would record the temperature of the rooms at 7am - when the house was coldest - and 7pm - when the house was still very warm from the day.		Hayden Diercks

Date	Descriptions of what the student did, problems encountered and solved.	Crystal Characteristics (via photo)	Signed
25/4/24	This morning, I tied up my final crystal to a pencil and balanced it over the jar so that the crystal was completely submerged in the solution.		Hayden Diercks
27/4/24	Today I dissolved some spare crystals to add to my spare solution. Then I topped up some of the jars with the solution.		Hayden Diercks
28-30/4/24	Over the next few days, I filtered out my jars when crystals started forming at the bottom. I would filter them out by putting a funnel on top of another jar and putting a piece of paper towel through the funnel. This lets through the liquid solution but not the solid crystals.		Hayden Diercks
7/5/24	Taking the temperature of the crystals has gone well so far, and I am able to identify what rooms were warmer, and what rooms were cooler.		Hayden Diercks
11/5/24	Yesterday, I noticed that one of my crystals had slipped around the pencil and had sunken down to the bottom. I then twisted the pencil backwards and promptly attached the pencil to the lip of the jar, by using a piece of compression tape.		Hayden Diercks

Date	Descriptions of what the student did, problems encountered and solved.	Crystal Characteristics (via photo)	Signed
22/5/24	After filling up my four jars multiple times, I realised that I was running very low on solution. I then made some more solution by adding 50^0C water to some dry crystals sitting in the bottom of a jar. When I had finished stirring and the crystals hadn't all dissolved, I knew that the solution was saturated.		Hayden Diercks
1/6/24	After spending a lot of time monitoring my temperatures in the mornings and nights I decided it was just about time to wrap things up.		Hayden Diercks
7/6/24	This Friday night, I decided to finish recording my crystal temperatures. I recorded from the 23rd of April to the 7th of June, which is 46 days. Please scroll to Appendix 1 to see the results.		Hayden Diercks
13/7/24	Today I judged my four crystals in clarity, size and shape. For size I measured the crystal's length in centimetres usin a ruler, and for the shape and clarity I compared them and used my judgement.		Hayden Diercks

Summary of Findings

My hypothesis: Crystals grown in a room with a greater change in temperature from morning to evening, will grow larger than crystals grown in a room with a smaller change in temperature.
For my crystal recording, I recorded the crystal temperatures at 7am when my house was cool after the night, and at 7pm when my house was still warm from the day's heat.
My hypothesis was unsupported, as the crystal grown in the room with the largest temperature difference between morning and night was the smallest crystal, and vice versa for the crystal grown in the room with the smallest temperature change.

Room		Study			Laundry			Lounge rm			Bedrm	
Time	A am	A pm	Diff	B am	B pm	Diff	C am	C pm	Diff	D am	D pm	Diff
Total T	**703.0**	**820.5**	**93.5**	**730.5**	**842.0**	**86.0**	**703.5**	**815.0**	**83.5**	**716.5**	**802.5**	**63.5**
Average T	**16.7**	**19.1**	**2.4**	**17.4**	**19.6**	**2.2**	**16.8**	**19.0**	**2.1**	**17.1**	**18.7**	**1.6**
Size (mm)		**18**			**26**			**22**			**29**	
Clarity		**OK**			**Worst**			**Best**			**Good**	
Shape		**Worst**			**Good**			**OK**			**Best**	

As you can see on this table, the greatest temperature difference between 7am and 7pm was room A/Study. The temperature was 2.4 degrees higher at night than in the morning. The crystal grown in this room measured 18mm and this was the smallest of the crystals.
The smallest temperature difference was in room D/Bedroom. The temperature was 1.6 degrees higher at night than in the morning. The crystal grown in this room was the largest of the crystals, measuring at 29mm in length.

During the earlier/warmer months of this experiment my solution evaporated a lot quicker than the more recent/cooler months, and I had to keep adding more solution to the jars.
I also think that the crystals grew more during the warmer months. This was probably due to the big drop in temperature from daytime to nighttime and more evaporation in the warmer months.

While experimenting with my four crystals, I noticed that the crystals in the study and lounge room, which didn't have as much access to light, did not grow as well and weren't as clear as the crystals with more light.

This could be used as an experiment for next year, to test if the amount of light in a room affects crystal growth.

In conclusion, to grow larger crystals, the crystal and it's solution should be grown in a room with a consistent temperature and lots of natural light.

Appendix 1

Date	Day	A am	A pm	Difference	B am	B pm	Difference	C am	C pm	Difference	D am	D pm	Difference
23/4	1	X	19.5		X	20		X	20		X	19	
24/4	2	18	18.5	0.5	19	19.5	0.5	18	18	0	16	17	1
25/4	3	X	19		X	20		X	19.5		X	20	
26/4	4	18	18.5	0.5	19	19.5	0.5	19.5	19.5	0	18	19	1
27/4	5	17	19	2	18	20	2	19	19.5	0.5	17	19	2
28/4	6	17	20.5	3.5	18	21	3	19	21	2	16.5	19.5	3
29/4	7	18	19	1	19.5	19	-0.5	19	19.5	0.5	17.5	19	1.5
30/4	8	17	20	3	18	19.5	1.5	18.5	19	0.5	16.5	18	1.5
1/5	9	16	19	3	17	19.5	2.5	17.5	18.5	1	16.5	17.5	1
2/5	10	17	20	3	18	20	2	18	19	1	16.5	19	2.5
3/5	11	17	20	3	18	20	2	17.5	19	1.5	16	18	2
4/5	12	17	20	3	18	20	2	18.5	19	0.5	16.5	18	1.5
5/5	13	17	21	4	18	21	3	19	19.5	0.5	16	21	5
6/5	14	18.5	X		19	X		17	X		19	X	
7/5	15	19	X		19	X		17	X		18.5	X	
8/5	16	19	24.5	5.5	19	22	3	17	20	3	18.5	21	2.5
9/5	17	19	24.5	5.5	19.5	20.5	1	17.5	19	1.5	19	20	1
10/5	18	18.5	19	0.5	19	19	0	17.5	19	1.5	19	20	1
11/5	19	19.5	21	1.5	19	21	2	19	19	0	20	20.5	0.5
12/5	20	18	19	1	18.5	20	1.5	16.5	19	2.5	18	20	2
13/5	21	19	21	2	18	20	2	16.5	18.5	2	17.5	19	1.5
14/5	22	17.5	21	3.5	18	20	2	17	19	2	17	19	2
15/5	23	18	19.5	1.5	18	20.5	2.5	17.5	19	1.5	17	20	3
16/5	24	18	21	3	18.5	20	1.5	17	18.5	1.5	18.5	19.5	1
17/5	25	17	20	3	17.5	19.5	2	16	18	2	17.5	19.5	2
18/5	26	17	17	0	17	18.5	1.5	17	18.5	1.5	17.5	17.5	0
19/5	27	15.5	16	0.5	15.5	20.5	5	15.5	20.5	5	16.5	17.5	1
20/5	28	16.5	18	1.5	17	19	2	17	19	2	18	18	0
21/5	29	17	17	0	18	17.5	-0.5	18	17.5	-0.5	17	17.5	0.5
22/5	30	15.5	18	2.5	15	18.5	3.5	15	18.5	3.5	17	17.5	0.5
23/5	31	15.5	18	2.5	15	24.5	9.5	15	24.5	9.5	16	18	2

24/5	32	X	18		X	19.5		X	19.5		X	18	
25/5	33	15	18	3	15	18.5	3.5	15	18.5	3.5	16	17.5	1.5
26/5	34	15	20	5	15	17.5	2.5	15	17.5	2.5	15.5	19	3.5
27/5	35	15.5	20	4.5	15	17.5	2.5	15	17.5	2.5	15.5	18.5	3
28/5	36	16	19	3	15	20	5	15	20	5	16.5	18.5	2
29/5	37	16	19	3	17	20	3	15.5	18.5	3	17.5	19	1.5
30/5	38	X	20		X	20		X	19		X	20	
31/5	39	18	20	2	19	20	1	14.5	18	3.5	18	19	1
1/6	40	15	X		16	X		16	X		17	X	
2/6	41	14	17	3	16.5	18	1.5	15	19	4	15.5	16	0.5
3/6	42	14	15	1	16	18.5	2.5	14.5	19	4.5	15	16.5	1.5
4/6	43	14.5	15	0.5	17	18.5	1.5	15.5	18	2.5	16.5	16	-0.5
5/6	44	14	18	4	16	18	2	14.5	17	2.5	15.5	18	2.5
6/6	45	14	17	3	17	17	0	15.5	17	1.5	16.5	18	1.5
7/6	46	15	16	1	15	19	4	16	18	2	17	20	3
Total		703	820.5	93.5	730.5	842	86	703.5	815	83.5	716.5	802.5	63.5
Average		16.7	19.1	2.4	17.4	19.6	2.2	16.8	19.0	2.1	17.1	18.7	1.6
Date	Day	A am	A pm	Difference	B am	B pm	Difference	C am	C pm	Difference	D am	D pm	Difference