



Prize Winner

Crystal Investigation

Year 3-4

Chloe Lambden

Walkerville Primary School

PRIZE WINNER



Crystal Growing Competition
Watch your crystal grow

OLIPHANT SCIENCE AWARDS

CATEGORY: CRYSTAL GROWING

Supported by the SA Branch of the Royal Australian Chemical Institute
and
The RACI Chemical Education Group (S.A.)



raci

Royal Australian Chemical Institute

LOG BOOK

STUDENT NAME(S): Chloe Piper Lambden

YEAR LEVEL: 4

SCHOOL: Wakerville Primary

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 more clear and well-formed?
- Does an incubator help grow bigger crystals in a given time period?

MY HYPOTHESIS: One crystal per beaker will grow better than two crystals per beaker.

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, 3-5 age groups, what teachers or parents did.
- Acknowledgement of any crystal growing advice from books or websites

Date/Time	Descriptions of what the student(s) did, problems encountered and solved	Crystal characteristics	signed
1-3-20 2:45 pm	measured 30g of Potash Alum. Poured the Potash Alum into a beaker. Added 200ml of hot water into the beaker. mixed all Potash Alum until dissolved. Filtered solution into another beaker. covered beaker with paper towel and transferred into kitchen cupboard.		mum Poured hot water. tambden chloe L
5-3-20 6:50	Made more solution for 3 more beakers. needed mum to purchase more Potash Alum for me for the 5th beaker which will hold 2 crystals. Selected 6 crystals to grow and mum helped tie to nylon string.		tambden chloe L
7-3-20 4:00 pm	Transferred crystals into new solution individually.	see observation table 7-3-20	chloe L
22-3-20 7:15 pm	completed crystal observation.		chloe L
29-3-20 4:50 pm	Removed crystal number 6 because it was too cloudy. Filtered number 6 solution. selected another crystal seed. mum helped tie to nylon string.	New crystal, size: half the size of my pinkie finger nail. perfectly clear.	chloe L tambden



Crystal Observation 7-3-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	5mm high and 7mm wide	All is clear except one little point	—	There is one Sharp Point	Two nice flat faces with the rest of it looking like a baby tooth	baby tooth shape	The Solution Level is 170mL high.
2	3mm high and 8mm wide	All is clear on crystal	—	—	—	Tiny Footy ball	" "
3	8mm high 8mm wide	A mix of cloudy and clear	—	—	one flat face	irregular 3D Polygon	165mL
4	7mm high 5mm wide	all clear	6 edges	—	5 faces	" "	130mL
5	7mm high 13mm wide	" "	8 Straight edges	—	3 faces	irregular rectangular Prism	150mL
6	6mm high 15mm wide	mainly clear slightly cloudy in the centre	16 Straight edges	—	6 faces	irregular triangular Prism	" "

Crystal Observation 22-3-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	15mm high 12mm wide	Little cloudy in the middle clear on the outside	13	1 at the bottom	8	Octahedral	150mL
2	14mm high 10mm wide	"	12	1 sharp point	"	Slightly off an octahedral	"
3	20mm high 20mm wide	"	"	2 sharp points	"	octahedral	140mL
4	15mm High 15mm wide	"	"	0	9	Squashed octahedral	115mL couple crystals on 6
5	17mm High 20mm wide	"	"	"	7	"	120mL couple crystals on 1
6	30mm High 30mm wide	Fully cloudy	0	0	6	No clear shape	200mL lots of crystals on the bottom

Date/Time	Descriptions of what the student(s) did, problems encountered and solved	Crystal characteristics	signed
5-4-20 3:00 pm	Completed crystal observations. Made more solution.	crystal levels on ④ and ⑤ are too low.	chloe L
6-4-20 6:00 pm	Topped up crystal solution from one to five, to 140ml		chloe L
19-4-20 12:30 pm	Completed crystal observation Solution level dropped on all of them. Crystals 1 and 2 did not show growth but the rest all showed growth		
	This supports my hypothesis so far.		chloe L
26-4-20 11:30 am	Made more solution, let it cool. Topped up solution levels from crystals ① to ③ to 140ml and from numbers ④ to ⑥ to 150ml. Lowered crystal number ⑥		chloe L
3-5-20 11:15 am	Cut off extra crystals on the bottom of number ① Completed crystal observation removed crystal seeds from ④, ⑤ and ⑥		
	replaced crystal ④ with a new crystal seed because it was all cloudy		thambsden chloe L

Crystal Observation 5-4-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	2 cm h 1.5 cm w	little cloudy in the middle clear on the outsides	12	4	8	Octahedral	130 mL
2	2 cm h 1.5 cm w	"	12		8 bumpy faces	Octal with a couple bumpy Points	"
3	2 cm h 2.3 cm w	"	12	1 at the top	8	Octahedral	120 mL
4	2 cm h 1.5 cm w	"	10		8	Squashed octahedral with a bit on...	95 mL
5	2 cm h 2 cm w	"	13		8	Squashed octahedral	95 mL
replaced 29- 3-20 6	0.8 cm h 0.5 cm w	Fully Clear	Too small	Too small	too small	Footy ball	150 mL

Crystal Observation 19-4-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	2cm h 1.5cm w	little cloudy in the middle clear on the outside	12	0 Points no longer sharp	8	octahedral	125ml
2	2cm h 1.8cm w	" "	12	0	8 bumpy faces	Oval with a couple bumpy Points	125ml
3	2.5 cm h 2.3 cm w	" "	12	0	8	octahedral	130ml
4	2 cm h 1.8 cm w	All cloudy	12	0	8	Squashed octahedral	130ml
5	2.4cm h 2.5cm w	little cloudy in the middle clear on the outside	14	0	8	" "	130ml
6	1cm h 0.9cm w	Fully clear	13	0	7	Foody ball with edges	130ml



Crystal 3



Crystal 6



Crystal 2

119-4-20



Crystal 5



Crystal 1



Crystal 4

Crystal Observation 3-5-2020

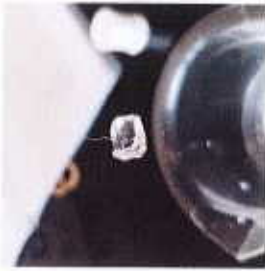
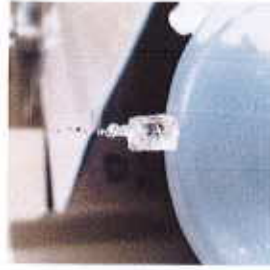
Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	2.5cm h 2cm w	Little cloudy in the middle clear on the outside.	12	0	8	Octahedral	140mL
2	2.2cm h 2cm w	"	12	0	8	Octahedral with bumpy points	140mL
3	2.6cm h 2.5cm w	"	12	0	8	Octahedral	140mL some crystals on bottom
4	2.5cm h 2cm w	All cloudy	12	0	8	Squashed Octahedral	150mL some crystals on bottom
5	2.5cm h 2.8cm w	Little cloudy in the middle clear on the outside.	14	0	8	Squashed Octahedral	150mL some crystals on the bottom
6	1 cm h 1 cm w	All clear	17	0	8	Foofy ball with edges	150mL Some crystals on the bottom

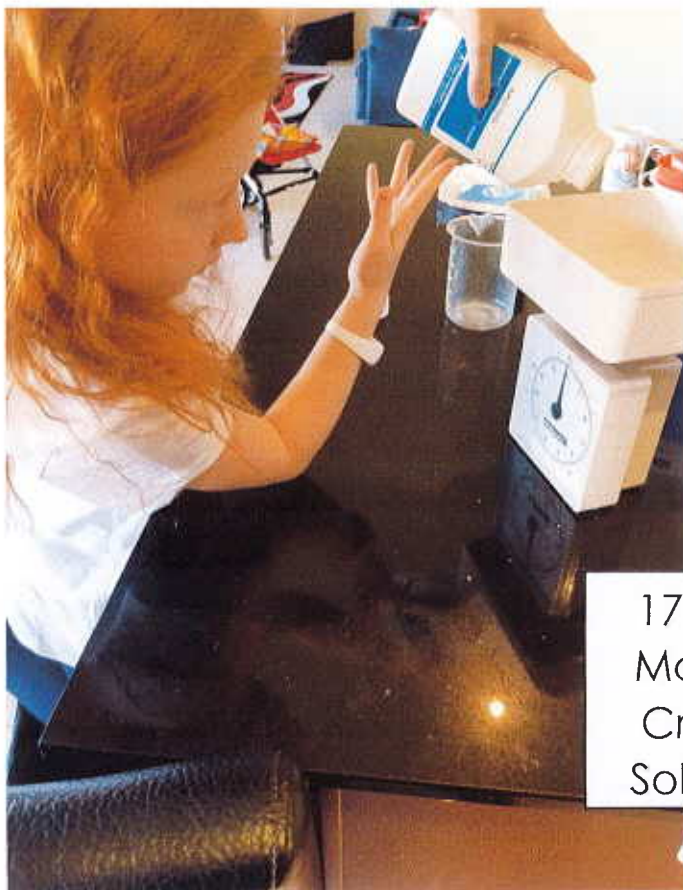
Crystal Observation 17-5-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	2.5cm h 2 cm w	clear on the outside cloudy in the centre	12	2 one at the bottom one at the top	8	Octahedral	125ml crystals on the bottom
2	2.5cm h 2 cm w	"a little more cloudy than number 1"	12	0	8	Bumpy octahedral	125ml crystals on the bottom
3	2.6cm h 2.5cm w	"a little more cloudy than number 1"	12	0	8	Octahedral	130ml crystals on the bottom
replaced 4 crystal	0.7cm h 1cm w	All clear	12	0	8	flat octahedral	120ml crystals on the bottom
5	2.5cm h 2.8cm w	clear on the outside cloudy in the middle	14	1	8	Squashed octahedral	130ml crystals on the bottom
6	1.3cm h 1.3cm w	Fully clear	17	0	8 with flat corners	Octahedral	125ml some crystals at the bottom

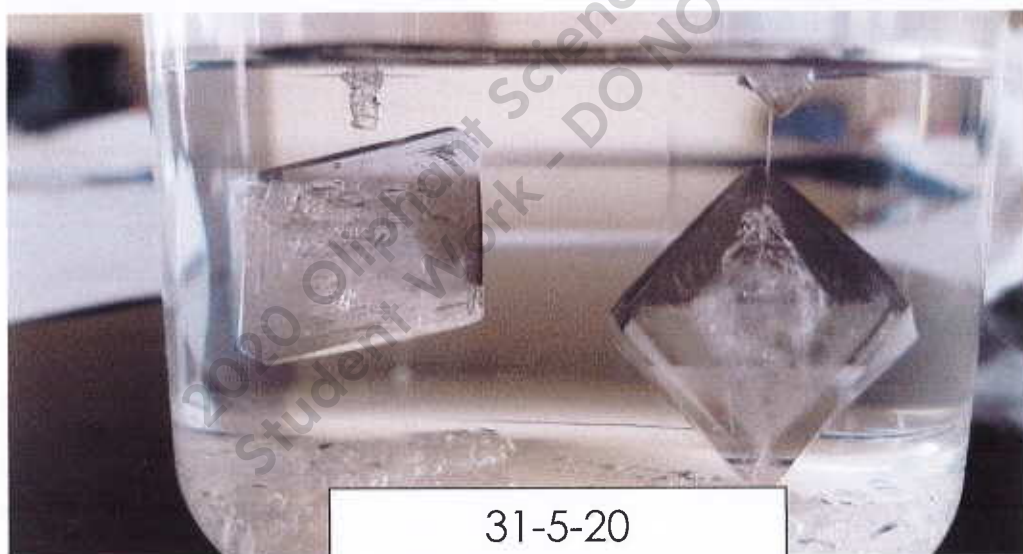
Crystal Observation 31-5-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	2.7cm h 2.3cm w	clear on the outside and cloudy in the middle.	12	2 1 at the bottom and 1 at the top.	8	Octahedral	140ml A few crystals on the bottom
2	2.6cm h 2.3cm w	" (little more cloudy than number 1)	12	0	8	Bumpy octahedral	140ml A few crystals on the bottom
3	3cm h 2.5cm w	"	12	0	8	Octahedral	140ml crystals on the bottom
4	0.8cm h 1cm w	Fully clear	12	0	8	Squashed octahedral	155ml crystals at bottom
5	2.6cm h 2.8cm w	clear on the outside cloudy in the middle.	15	0	8	Squashed octahedral	140ml A few crystals on the bottom
6	1.4cm h 1.3cm w	Fully clear	17	0	8 with flat corners	Octahedral	140ml A few crystals on the bottom

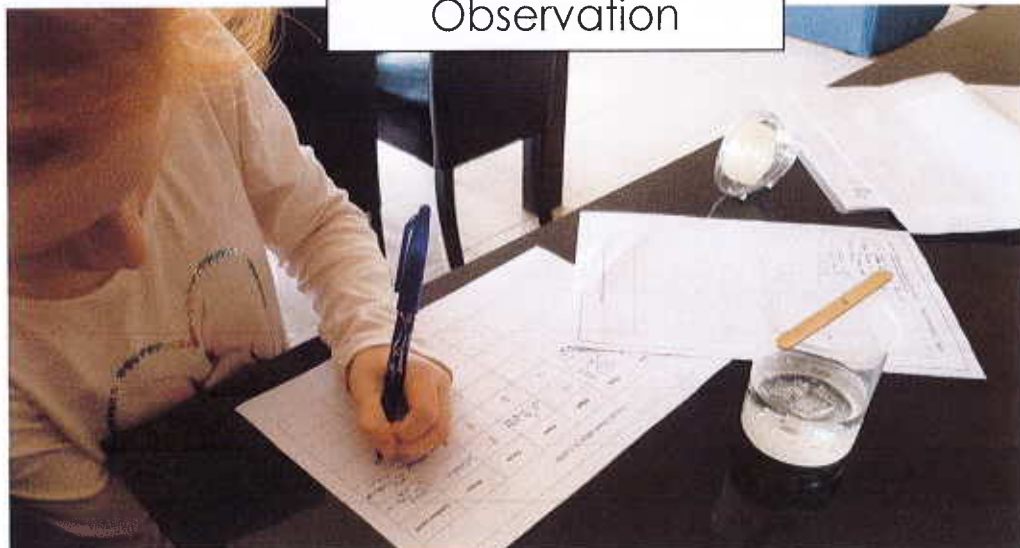
	Crystal 1			Crystal 3		Crystal 4		Crystal 5	No Photo		Crystal 6	
3-5-20												
17-5-20												
31-5-20												



17-5-20
Making
Crystal
Solution



31-5-20
Completing Crystal
Observation



Date/Time	Descriptions of what the student(s) did, problems encountered and solved	Crystal characteristics	signed
17-5-20 11:00 AM 7:30 pm	Completed crystal Observation. made more solution let it cool. Topped up crystals ①, ②, ③ and ⑤ to 150ml and number ④ to 180 mL.		chloe L
31-5-20 11:00am	completed crystal observation. with crystals ① and ② growing in size I have to be careful not to let them touch		chloe L
14-6-20 6:00pm	Completed crystal observation made more solution		chloe L
15-6-20 5:30	Topped up solution level on ①, ②, ③ and ⑤ to 150ml and ⑥ to 16ml.		chloe L
28-6-20 7:30 pm	Completed crystal observations Noticed the solution levels remained the same except for number ④ and ⑥ which were smaller crystals.		chloe L
15-7-20 10:00 am	Completed crystal observation ①, ④ and ⑥ only grew a little bit while the other crystals remained the same. Crystals dropped 10ml and ⑥ dropped 20ml. When a different side is measured then you can have a different height or width. I needed to try measure the same sides.		chloe L
			th

Crystal Observation 14-6-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	2.7 cm h 2.4 cm w	clear on the outside cloudy in the middle	12	2	8	Octahedral	125ml A few crystals on the bottom
2	2.7 cm h 2.3 cm w	" (A little more cloudy than the first)	12	0	8	Bumpy Octahedral	125ml A few crystals on the bottom
3	3 cm h 2.5 cm w	"	12	0	8	Octahedral	125ml crystals on the bottom
4	1.1 cm h 1.1 cm w	fully clear	12	0	8	Squashed octahedral	150ml A few crystals on the bottom
5	3 cm h 2.8 cm w	clear on the outside cloudy in the middle	15	0	8	"	120ml A few crystals on the bottom
6	1.4 cm h 1.5 cm w	Fully clear with spider looking shape in the middle	17	0	8 with flat corners	Octahedral	120ml A few crystals on the bottom

Crystal Observation 28-6-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	2.8 cm h 2.4 cm w	Same as 14-6-20	12	0 not sure why top and bottom lost if's points	8	Same as 14-6-20	150 ml
2	2.8 cm h 2.3 cm w	"	12	0	8	Same as 14-6-20	150 ml
3	3 cm h 2.5 cm w	"	15 3 points are flat edges	0	8	Same as 14-6-20	150 ml
4	1.1 cm h 1.1 cm w	Same as 14-6-20	12	0	8	Same as 14-6-20	140 ml
5	3 cm h 2.9 cm w	Same as 14-6-20	16 4 points are flat edges	0	8	"	150 ml
6	1.4 cm h 1.5 cm w	Same as 14-6-20	17	0	8	flattened octahedral	150 ml

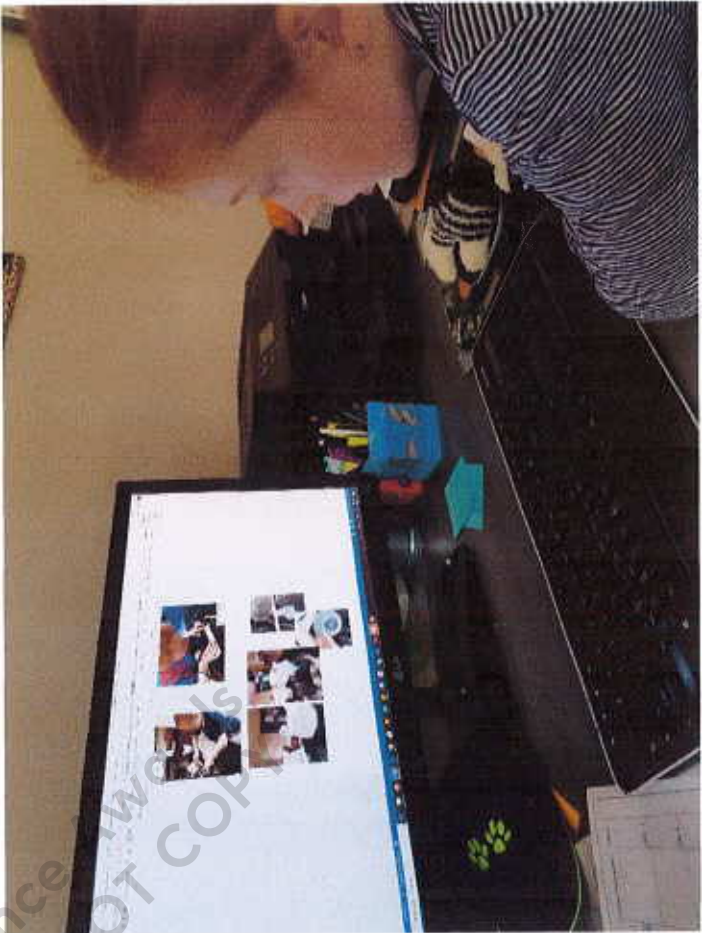
Crystal Observation 15-7-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	2.9 cm h 2.4 cm w	Same as 28-6-20	12	0	8	Octahedral	140ml
2	2.8 cm h 2.3 cm w	" "	12	0	8	Octahedral	140ml
3	3 cm h 2.5 cm w	" "	15	0	8	Octahedral	140ml
4	1.1 cm h 1.2 cm w	Fully clear	12	0	8	Squashed octahedral	130ml
5	3.1 cm h	Same as 28-6-20	16	0	8	" "	140ml
6	2.9 cm w 1.6 cm h 1.5 cm w	Fully clear	17	0	8	Flattened Octahedral	130ml

	Crystal 1	Crystal 2	Crystal 3	Crystal 4	Crystal 5	Crystal 6
14-6-20						
28-6-20						
15-7-20						



15-7-20



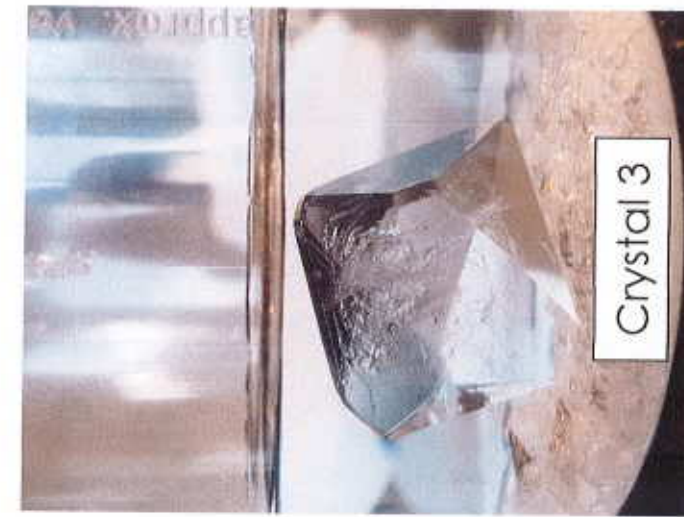
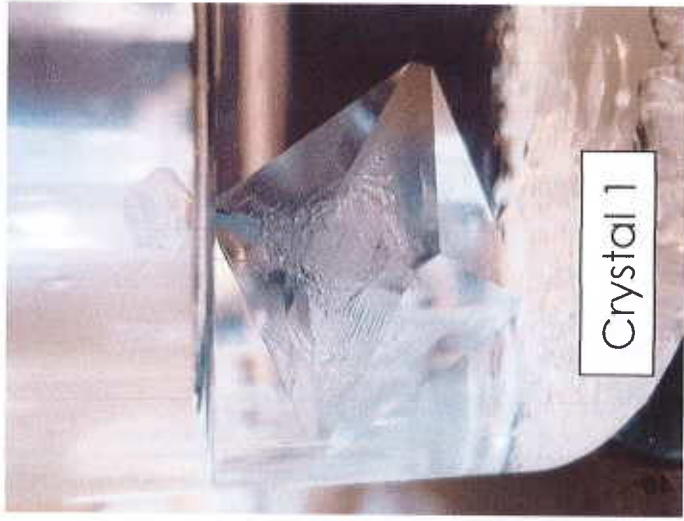
28-6-20

Date/Time	Descriptions of what the student(s) did, problems encountered and solved	Crystal characteristics	signed
2-8-20 4:30pm	Completed crystal observation Solution levels dropped 20mL in very beaker. No significant changes in size and shape. cut crystals of string and	See observation table 2-8-20	chloe L
	dried in paper towel. Compared this years crystals to last years. This years crystals look better because I used nylon.		
	String instead of cotton.		

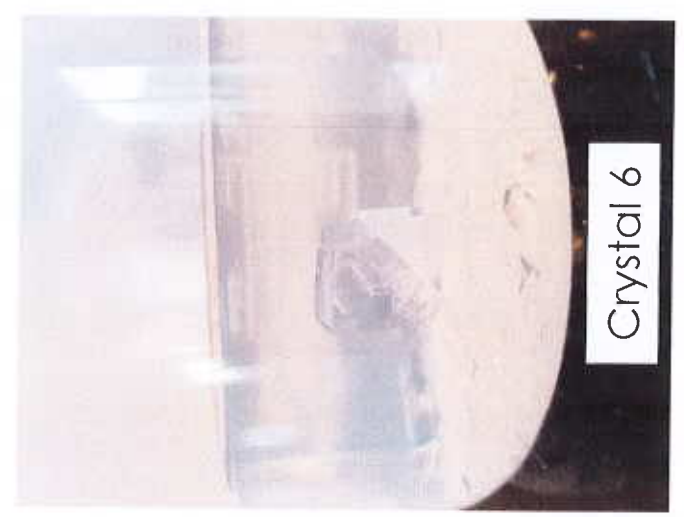
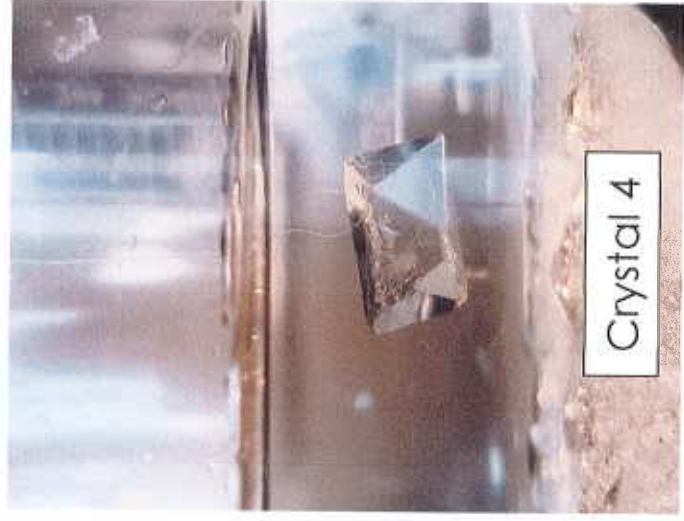
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Crystal Observation 2-8-2020

Crystal	Size	Clarity	Edges	Points	Faces	Shape	Solution Level
1	3 cm h 2.4 cm w	Clear on the outside, cloudy in the middle	12		8	Octahedral	120ml
2	3 cm h 2.3 cm w	" (A little more cloudy)	12		8	"	120ml
3	3 cm h 2.6 cm w	little more cloudy than number 1	15		8	"	120ml
4	1.1 cm h 1.2 cm w	Fully Clear	14 points are flat edges		8	Squashed octahedral	110ml
5	3.1 cm h 2.9 cm w	Clear on the outside, cloudy in the middle	16		8	"	115ml
6	1.6 cm h 1.5 cm w	Fully Clear	17		8	Flattened octahedral	110ml

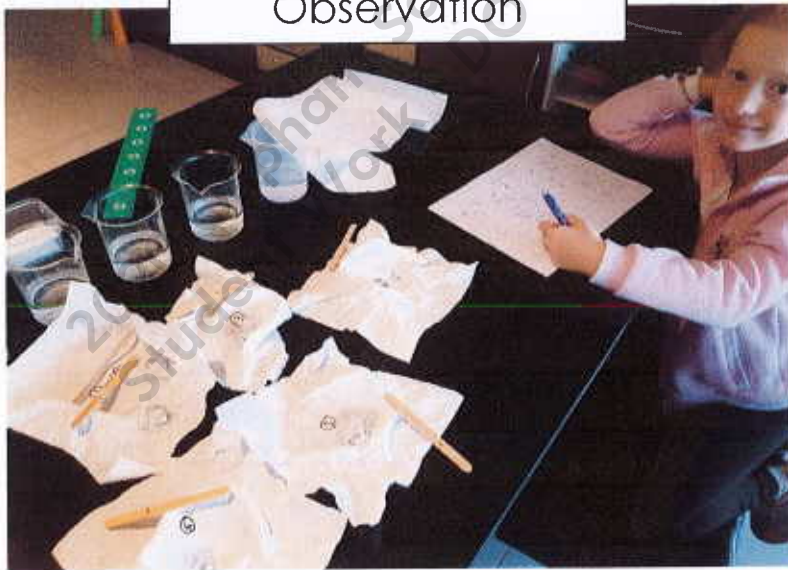


2-8-20





2-8-20
Final Crystal
Observation





Crystal 1



Crystal 2



Crystal 3



Crystal 4



Crystal 5



Crystal 6

2-8-20



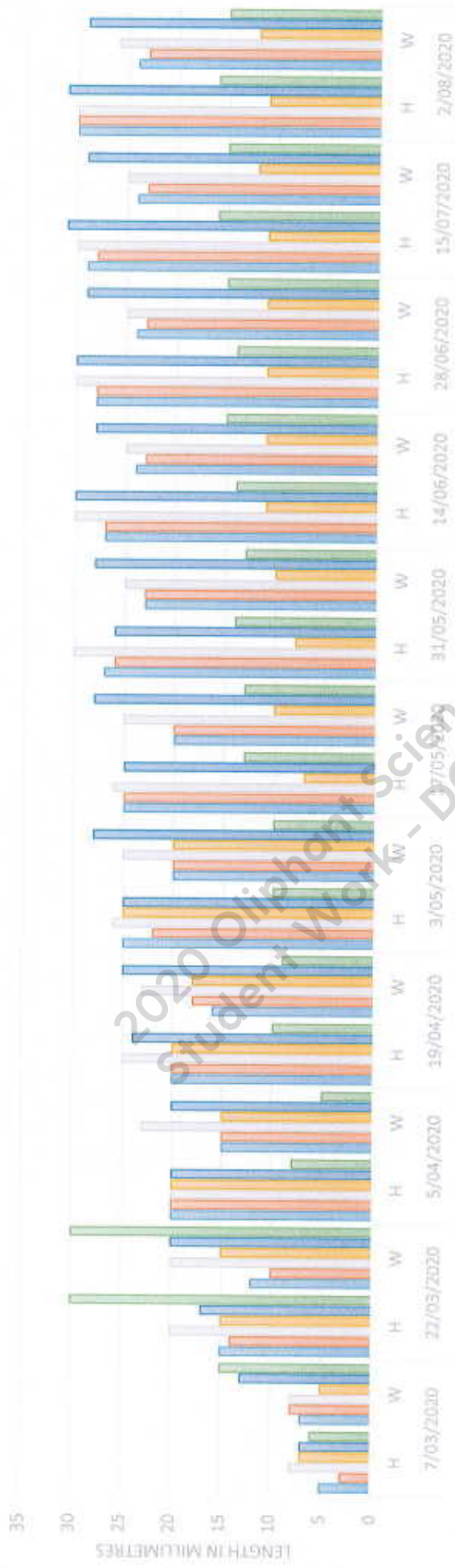
Crystal Growth Graph – Size

H = Height (mm), W = Width (mm)

		1	2	3	4	5	6
7/03/2020	H	5	3	8	7	7	6
	W	7	8	8	5	13	15
22/03/2020	H	15	14	20	15	17	30
	W	12	10	20	15	20	30
5/04/2020	H	20	20	20	20	20	8
	W	15	15	23	15	20	5
19/04/2020	H	20	20	25	20	24	10
	W	16	18	23	18	25	9
3/05/2020	H	25	22	26	25	25	10
	W	20	20	25	20	28	10
17/05/2020	H	25	25	26	7	25	13
	W	20	20	25	10	28	13
31/05/2020	H	27	26	30	8	26	14
	W	23	23	25	10	28	13
14/06/2020	H	27	27	30	11	30	14
	W	24	23	25	11	28	15
28/06/2020	H	28	28	30	11	30	14
	W	24	23	25	11	29	15
15/07/2020	H	29	28	30	11	31	16
	W	24	23	25	12	29	15
2/08/2020	H	30	30	30	11	31	16
	W	24	23	26	12	29	15

replaced with new crystal seed

CRYSTAL SIZE



CRYSTAL NUMBER 1 2 3 4 5 6

2020 Oliphant Science Awards
Student Work - DO NOT COPY

Summary of Findings

My hypothesis this year is that one crystal per beaker will grow better than two crystals per beaker. Last year all 12 of my crystals were divided by two and split into 6 beakers/glass jars. I noticed that most of the crystals became cloudy, and a couple of them grew only a little bit. I wondered if I put one crystal per beaker the crystal would grow better.

Over the last couple years by doing the crystal investigations, I learnt:

- It is better to use Raci solution instead of the D. Katz solution,
- to store the crystals in a dark, cool and sheltered place,
- it is better to use nylon string instead of cotton string, and
- it is best to check on the crystals every 2 weeks so the solution level does not go to low.

To start my crystal investigation I made the Raci solution and waited overnight so the crystal seeds could form on the bottom. I made more solution for the beakers that the crystals were going to be placed in. Then I selected 6 crystal seeds. Mum supported me to tie the crystal seeds to nylon string. I put one crystal in each beaker except for beaker one which had two crystals instead to test my hypothesis.

From early March, all the crystals grew well. On the 5-4-20, I had to replace crystal number six because it grew really big and went really cloudy, I am not sure why. All of the crystals kept growing well. On the 17-5-20 I had to replace number 4 because it also became very cloudy. Over 5 ½ months my best crystal was number 1.

Every fortnight I checked my crystals, I observed their size, clarity, edges, points, faces, shape and solution level. It only took about 20 minutes every fortnight to do my observation notes. I also took photos of each crystal so I could visually remember the growth. I graphed the crystal size growth.

In my observations, I noticed the width was bigger when the crystals were on their own. Their growth was also similar. I needed to be aware that when measuring width I might not always be on the same side. I could not find a solution to this problem.

I discovered that every fortnight the solution level was dropping about 20mL. It did not matter if it had two crystals or one crystal per beaker. My crystals stopped growing as much when we entered the colder months. So I think that during the warmer months they grow better and slow down their growth during the colder months. I could test this next year.

I discovered that even though my best crystal was number 1, crystal number 1 was sharing with crystal number 2 in one beaker. Crystal 1 turned out mostly clear, a nice size and a very nice octahedral shape (with no points). Only numbers 3, 4, 5 and 6 were individual. Number 2 was 'ok' but not as good as number 1. As crystal number 1 was sharing a beaker with crystal number 2, I also discovered that even though the crystals can take all the solution they need (want), they can still get fairly big when sharing a beaker.

My hypothesis was one crystal per beaker will grow better than two crystals per beaker. From this investigation, I learnt that one crystal per beaker is not always better than two crystals per beaker. My hypothesis this year was not supported, but I could re-test this theory again next year to confirm it.

Resources

Raci Website

<http://www.raci.org.au/branches/sa-branch/chemical-education>

- Advice to students
- Crystal Investigation Judging Rubric

Chloe Lambden

My 2018 Crystal Investigation - Best Crystal Location

My 2019 Crystal Investigation – Observation
Frequency

Microsoft Word and Excel

My mum reminded me how to make a graph

Photographs

I took photos of my observations

Mum took photos of me working

Crystal Investigation Judging Rubric

Rules and presentation:

- The crystal must be Potassium Aluminium Sulphate (Potash Alum)
- Students are expected to carry out all manipulations of the material but may be assisted by a teacher or guardian as appropriate. Assistance must be acknowledged in the logbook.
- Crystals are judged upon:
 - Regularity i.e. sharpness of edges,
 - Smoothness of faces
 - Clarity - overall aesthetic appeal

- Size is no longer a major criterion
 - Crystals whose largest dimension is less than 9 mm will not be considered for certificates of merit under the RACI national competition guidelines
- Where very similar crystals are difficult to rank for prizes or certificates then the logbooks and the hypotheses proposed will be considered to make a decision. The logbook should state dates from the start to the finish of the growing period and each entry dated and countersigned where possible.

Crystal - Regularity	Crystal shows excellent regularity of edges, and symmetrical growth (Diamond shape)	Crystal shows mostly good regularity of edges, with only small imperfections evident. Shows mostly symmetrical growth	Regularity of edges somewhat uneven or chipped. May be somewhat asymmetrical	Poor regularity of edges Crystal highly asymmetrical (not diamond shaped or lop-sided growth)
Crystal - Faces	Faces are highly light-reflective and smooth (no growth lines evident)	Faces are mostly light-reflective and fairly smooth (may be slightly uneven)	Faces are poorly light-reflective, demonstrate minimal growth lines or patterning and/or may show minimal evidence of efflorescence (whitening of crystal)	Faces exhibit little to no light reflection, high levels of uneven growth or patterning and/or high levels of efflorescence (whitening of crystal)
Crystal - Clarity	Excellent clarity of crystal. Highly transparent through the crystal. Crystal is clear (without imperfections) throughout Excellent overall aesthetic appeal	Good clarity of crystal. May have some small imperfections throughout. Good overall aesthetic appeal	Reasonable clarity of crystal. Some small amount of opacity in the centre of the crystal or discolouration throughout or a large number of imperfections. Reasonable aesthetic appeal	Crystal demonstrates high levels of opacity and or discolouration Poor aesthetic appeal
Logbook - Hypothesis	Original and creative hypothesis. Clearly and concisely states scientific purpose. Very accurate use of scientific terminology	Mostly creative hypothesis. Scientific purpose stated well. Accurate use of scientific terminology	Hypothesis shows some originality and/or creativity. Fair expression of scientific purpose although may be somewhat inaccurate with science content. Uses some scientific terminology or terminology has some errors	Unoriginal hypothesis. Unclear scientific purpose or inaccurate. Hypothesis may be stated as a question Scientific terminology inaccurate or poorly expressed
Logbook - Evaluation and analysis	Science content is accurate and highly relevant Excellent grammatical skills. Analysis and conclusions are highly logical and strongly evidence based. Shows excellent analysis.	Scientific content is mostly accurate with some content lacking depth and relevance Good grammatical skills with very few errors. Analysis and Conclusions are logical and evidence based to a sound level.	Scientific content not always accurate with content lacking depth and relevance Sound grammatical skills shown but with occasional errors. Some attempt at analysis with indication of conclusions being evidence based.	Minimal scientific content evident Poorly written with many errors. Analysis and conclusions are missing, or not supported by evidence.

CRYSTAL GROWING: ADVICE TO STUDENTS



1. Introductory note

When growing crystals of potash (common) alum, or any crystals for the matter, you need to ensure that

- All apparatus is as clean as possible
- Crystal are grown in clear filtered solutions

2. Preparing the seed crystal

- Place approx. 30 g of potash alum in a beaker (larger than 250 mL) and add 200 mL of hot water. Stir the mixture until all the crystals have dissolved. The solution may have a slight milky appearance due to impurities if the technical grade (or less) has been used.
- Filter the warm solution into another beaker. Cover it with a filter/kitchen paper, set aside in a cool sheltered place and allow to stand undisturbed overnight.
- Next day the bottom of the beaker should have become covered by a layer of smallish crystals which formed spontaneously as the solution cooled. Carefully decant (pour off) the clear solution into another beaker, leaving the crystals behind. (if no crystals have formed add a crystal from the original stock and let the solution stand until crystals have formed.

3. Growing your crystal

- Now select a single symmetrical crystal or crystal group to act as a seed. (If necessary break up the mat of crystals to obtain a good one). Using a plastic spoon or forceps, transfer the seed crystal to the decanted solution, trying to place it centrally in the beaker. Mark the level of the solution and record the date. Cover the solution with a loose-fitting paper hat that permits water to evaporate slowly whilst keeping out dust etc. Allow the solution to stand undisturbed in a draft-free location (but not in direct sunlight) where temperature fluctuations are minimal.
- Observe regularly every few days, marking the liquid level and recording the date. Avoid disturbing the crystal as this may induce additional crystals to grow.

A first aid procedure for removing additional crystals:

If small isolated crystals appear carefully remove them. If small crystals grow on the main crystal, remove the main crystal, dry with tissues and remove the adhering buds. Do not touch the crystal with fingers. The crystal is brittle so do not drop or bump it. Warm your solution containing the small crystals by partial immersion of the beaker in a bath of warm to hot water. Stir gently until the small crystals have all dissolved. Do not heat more than necessary. Immediately the small crystals have dissolved, remove the beaker from the water bath and allow the solution to cool almost to room temperature (1 to 2 hours).

Then gently and carefully return the large crystal to the solution. Do not drop the crystal in as it may break. Cover the beaker as before and set it aside to allow the crystal to continue to grow.

iii. When no further growth is apparent a new saturated solution may be prepared as before, using more stock. When that is at room temperature transfer your crystal to it. You may wish to repeat this process several times over the total growing period.

4. Final preparation

At some point you will decide to terminate the growth process and prepare your crystal for submission for judging. Decant the remaining alum solution from the crystal, remove the crystal and dry it with tissues.

It may be wrapped loosely in 1 or 2 facial tissues and then placed in airtight zip-lock bag. The bag should be well labelled with the name(s) of the participant(s), year level and school name. Ensure you include the logbook with the entry and give to your teacher or send to the appropriate address for the competition.

5. Growing crystals by suspension

An alternative method of growing a crystal by suspension may be described by your teacher (teacher notes)

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