



Crystal Investigation

Year 5

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St Peter's Girls College

OSA 2024 Logbook

Name	Alyssia Moro
Year	Year 5 at St Peter's Girls' School
Experiment	OSA Category: Crystal Investigation
Investigation Question	What will help a crystal form better – growing in a dark environment or under a red light?
Hypothesis	If a crystal is grown under different light conditions, then this may affect the way a crystal grows because the light source might change the way a crystal develops.

Details of equipment and method used	Equipment and Chemicals Used The equipment and chemicals used during this experiment included the following: <ul style="list-style-type: none">• Beaker (labelled with Dark and Red)• Spatula spoon• Tweezers• Funnel• Measuring cylinder• Electronic scales• Thermometer to measure the temperature• Weigh boat• Aluminium potassium sulphate powder – crystal growing powder – $KAl(SO_4)_2$• Distilled water• Filter paper to remove any impurities to grow a clear crystal• Ruler to measure crystal size• Red cellophane paper• Polystyrene base• Aluminium foil (Alfoil)• Plastic knife labelled• Fishing line – (Nylon)• Distilled water (H₂O)
	Method I undertook two (2) separate tests which required two (2) seed crystals. These tests were: <ol style="list-style-type: none">1. Placing the seed crystal in a dark environment, and

	<p>2. Placing the seed crystal under a red light. Observations were then made to see what would happen to the seed crystals in the two (2) environments.</p> <p>At first, I did a practice run on setting up the crystal seeds and placing it in the solution to make sure it was done correctly for the actual experiment. When this was done well, I then started the actual experiment.</p> <p>Step 1: Preparation</p> <ol style="list-style-type: none">1. Water was first heated up in a kettle.2. To make the solution, I poured 100g of Aluminium potassium sulphate powder (Alum) into a beaker. I then measured up 800 ml of boiling water (heated to 70° C) which I added to the Alum powder. Previous studies have shown that heating the distilled water to this temperature allows for the right amount of Alum to be dissolved and create a saturated solution.3. I stirred the powder in the boiling water until the powder was completely dissolved. I then poured the solution through a filter in another clean beaker to filter out any impurities. The solution was then left to cool down to room temperature which was between 15° - 17° C.4. This was done twice as I was undergoing two (2) separate tests at the same time. <p>Step 2: Seed Crystal</p> <ol style="list-style-type: none">1. Given the amount of time remaining for the crystallisation process, for the seed crystals, I was able to choose from seed crystals prepared by the school.2. The two (2) selected appeared to be the most translucent, biggest, and well-formed seed crystals. <p>Step 3: Crystal Making</p> <ol style="list-style-type: none">1. I tied each end of the nylon fishing line to separate seed crystals and the other end to separate plastic knives so that the seed crystal could hang in the beaker. Each cutlery was labelled with 'Dark' and Light'.2. I set up each environment so that there was a dark environment and an environment with the red light shining. The dark environment was inside a cupboard and the red-light environment was set up so that there was a square light beam shining over red cellophane resting over the beaker. Both beakers were placed on a polystyrene to stabilise them and minimise movement.3. Using the liquid that I produced in Step 1, I held the plastic knife and carefully placed the seed crystals in their separate beaker of saturated solution ensuring that the seed crystal was fully emersed, directly centred and not touching the sides. Once finished, the beaker was covered with alfoil to stop any dust from entering the solution.4. The temperature in the lab was at a constant level which was between 15-17° C. This would help with the growing of the crystals. <p>Step 4: Finalisation Process</p> <ol style="list-style-type: none">1. After 9 weeks, the alum seed crystal had enlarged in size forming into a crystal. The teacher removed the crystal from the solution and left it to air dry. She then placed the crystal in an airtight zip lock bag and labelled it with my name,
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school and year level. This was placed in a common sealed bag with other experiments facilitated by the school for dispatchment to the prescribed address.

Dates and times of carrying out the procedures

The observations that I made were undertaken during Term 2 at the school science centre within the science laboratory during my lunch break. This was done twice a week. I continued to undertake observations during the school holidays too however, they were less frequent.

During the school holidays, I undertook observations in the first week however, in week 2 of the holidays, the Teacher at the school leading this process assisted in gathering more observations for me as well as changing the alum solution. During week 3, I was able to make only a single observation.

Discussion of problems encountered

Description of what you did and write about the problems you encountered and solved

- What things do you need?
- Are there different ways of doing your experiment?
- Why have you chosen your way of doing it? Try and talk about the reasoning.

A few problems occurred during the experiment. These problems included the following:

- In the early days of the experiment, I didn't change the solution often (i.e. once in two weeks) which caused the crystal to shrink in size.
- At times there were lots of seed crystals growing at the bottom of the beakers which meant my solution was too concentrated. I added more distilled water to dilute it.
- Baby seed crystals were growing along the fishing line. I had to remove them with tweezers so that they wouldn't affect the growth of the crystal.
- Changing the solution too frequently (i.e. twice a week over the last two weeks) caused the crystal to become cloudier with parasites forming on the red-light crystal.

The experiment could have been done differently. Other ways of approaching it could be as follows:

- Changing the solution the solution once a week to keep the growth steady rather than stimulate it too much. This would have made the crystal more translucent and less cloudy. More edges may have become sharper rather than some sharp and others blunt.
- The temperature was moderate at 15-17 C. Placing the crystal under colder temperatures could be another approach.
- Also, if the temperature was slightly warmer, they may have changed the growth rate too.

- Having several beakers i.e. 5 with different concentrations of the alum powder. This would cause varying levels of the seed crystals to form at the bottom of the beaker which would affect the growth of the crystal.

The reason why I chose to do the experiment the way I did is because I thought that the red-light would supply more energy which would stimulate the crystal growth. It is known that crystals grow well in dark environments, stable temperatures, and no movement, but slower. I thought that by adding light to it and more so, red light, this may speed up the rate of growth.

A summary of findings

Now that I have done this, I found that:

- Think about how the experiment went, did it go as predicted? If not, why do you think not?

- What did you see when you did your investigation?

- What did you observe?

- What is the shape of the crystal & amp; colour

Even though I found this experiment very enjoyable and interesting, unfortunately, it didn't go as predicted because I thought that the red-light crystal would have grown faster and bigger as red light supplies more energy, but instead, I discovered throughout my journey that crystals that grow more slowly tend to be larger.

I also saw that there appeared to be a balance in tiny crystals forming at the bottom of the beaker. Too much alum powder at the bottom makes the solution too concentrated. There needs to be a fine balance to help stimulate growth.

Throughout the investigation I found that less frequent change of the alum solution caused the dark environment crystal to grow slowly while the red-light crystal showed some reduction in size.

The crystal in the dark room also showed more growth initially given the right environment for crystal growth but it looked cloudy and slightly translucent. The red-light crystal showed a slight reduction in size due to the temperature being higher. At this stage of the investigation, the growth wasn't that high as the solution wasn't changed that frequently (one in 1 ½ weeks). Once the solution was changed more frequently (twice a week), the size of the red-light crystal began to grow more. I did observe though that even with the more frequent change in solution, if there were too many crystal seeds at the bottom of the beaker, this would slow down growth as the solution would be too concentrated. There needed to be a fine balance in the change of solution so that too many crystals wouldn't form. It was also noticed that the faster growing rate of the red-light crystal caused it to become cloudier in appearance with parasites forming. Both crystals had sharp edges with very few blunt ones.

Below is a graph which illustrates the size of the crystal in the dark environment and that under the red-light and the dates that the measurements were taken, confirming the above.






In conclusion, the crystal in the dark environment grew better both in size and weight and it was less cloudy however, the Alum solution should not have been changed so frequently. Once a week may have caused it to become more translucent and possibly bigger again in size and weight.



Acknowledgements


I'd like to acknowledge my teacher who assisted and guided me throughout this process together with lab staff who were involved in preparing the alum solution upon request. I'd also like to thank my parents who also supported me throughout this journey.



Crystal Investigation Logbook



Day	Date	Time	Crystal Size	Crystal Weight	Observations	Photos
Friday	31st May	1pm			<p>I poured 100g of Alum powder into a beaker.</p> <p>I then boiled water in a kettle and added 80ml of boiling water to the same beaker as the Alum powder. This was done twice for the two experiments.</p> <p>I stirred the sediments in the boiling water (heated to 70°C) until they dissolved. I then poured the solution through a filter in another clean beaker to filter out any impurities. The solution was then left to cool down to room temperature which was between 10-15°C.</p> <p>I then chose two seed crystals prepared by the school.</p> <p>The two selected appeared to be the most translucent, biggest, and well-formed seed crystals.</p> <p>One was to be used in a dark environment and the other under a red light.</p>	
Friday	7/6/24	1pm			<p>I poured two lots of 400ml of the Alum solution into a 600ml beaker.</p> <p>I tied one end of the fishing line to the seed crystals and the other end to a plastic knife. Holding the plastic knife, I</p>	


				<p>carefully placed the seed crystals in their separate beaker of saturated solution.</p> <p>Once finished, the beaker was covered with alfoil to stop any dust from entering the solution. Any dust can cause slowing down of crystal growth.</p> <p>The temperature in the lab was at a constant level which helped with the growing of the crystals.</p> <p>The seed crystal in the dark environment was placed in a dark cupboard.</p> <p>The seed crystal under the red light was on another bench. The bench had a piece of polystyrene on it with the beaker sitting on top to keep it stable. To generate red light, the teacher helped me set up a light which shined on the red cellophane that was clipped to the light. The beaker was placed under the cellophane.</p>	 
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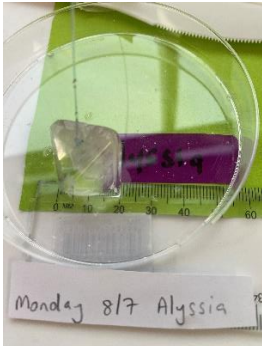
Tuesday	11/6/24	1pm		<p>Dark: 10mm</p> <p>Red light: 12mm</p>	<p><u>Crystal in the dark environment</u> The crystal appeared translucent in some areas and foggy in others.</p> <p>There were little crystals that formed at the bottom of the beaker which means that the solution was too concentrated, so I had to add more distilled water to dilute it.</p> <p>I measured up the seed crystal and it had grown 5mm long from its original size. It is now 10mm (1cm) in length.</p> <p><u>Crystal under the red light</u> This crystal is 12mm (1.2cm) and had little crystals formed on the fishing line and at the bottom of the beaker. The tiny crystals at the bottom of the beaker were bigger than those along the fishing line and therefore, appeared shinier.</p> <p>At the end of the observation, I placed the alfoil cover on the beakers to stop any dust from entering the solution.</p> <p><u>Comparison of Seed Crystal in two environments</u> It appeared that the crystal in the dark environment grew slower than that under the red light. I think this is because the red light is giving off more energy causing the crystal to grow faster.</p> <p>Both crystals had baby seed crystals growing on the fishing line. This didn't happen on my practice crystal because we used a different fishing line. These crystals were removed with tweezers so that it wouldn't affect the growth of the main crystal.</p>	 
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Friday	28/6/24	1pm	Irregular shape and octahedron.	<p>Dark: 5mm</p> <p>Red Light: Not weighed</p>	<p><u>Crystal in the dark environment</u> The crystal in this environment has grown to 5mm. There were lots of seed crystals starting to grow around it, so I had to pick them off with tweezers, so the crystals growth didn't get affected. The shape of the large crystal was irregular and like an octahedron.</p> <p>The crystal appears to be cloudy with slight translucence.</p> <p><u>Crystal under the red light</u> The crystal appears to have reduced in size. I think this has occurred as there are small crystals at the bottom of the larger crystal which concentrating the solution. There were also some crystals growing on the beaker which I think was due to the dryness in temperature and the solution evaporating.</p> <p>The highest temperature recorded was 25 C and the lowest temperature recorded was 22 C.</p> <p>Crystal faces appear to have formed which are translucent. There is still some cloudiness in the appearance.</p> <p>I suggested to the Teacher that the solution be changed. This was done by the Teacher before the next observation.</p>	
Tuesday	2/7/24	9am	Both octahedron in shape.	<p>Dark: 15mm 3.1 grams</p> <p>Red Light: 5mm 1.6 grams</p>	<p><u>Crystal in the dark environment</u> The shape of the crystal is still octahedron. There has been a lot of growth of the crystal since the solution was changed last week.</p>	


					<p>I changed the solution again to maintain a healthy and pristine crystal, so I filtered the water, poured it into the beaker and placed the crystal gently in there. This was prepared and cooled by lab staff in advance of me filtering it.</p> <p>I tried to place the crystal as close to the middle as possible so I could continue to have a crystal full of purity.</p> <p>Continuing to change the solution will provide a 'pure' environment for the crystal to grow causing it to grow larger and quicker.</p> <p>There was a tiny crystal growing on the fishing line close to where the larger crystal was attached. This was removed with a tweezer so that the tiny crystal would not affect the growth of the large crystal.</p> <p>The crystal measured at 15mm long weighting in at 3.1grams.</p> <p>The temperature recorded at its highest was 22° C and lowest at 14° C.</p> <p><u>Crystal under the red light</u> There were lots of little crystals growing at the bottom where the large crystal joins the fishing line. These were removed with a tweezer to prevent them from causing the larger crystal to slowdown in growth.</p> <p>The crystal measured at 5mm long weighing in at 1.6 grams.</p> <p>The temperature recorded at its highest was 22° C and lowest at 14° C.</p>	 
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Wednesday	3/7/24	9.30am		<p>Dark: 15mm 3.9 grams</p> <p>Red light: 13mm 2.3 grams</p>	<p><u>Crystal in the dark environment</u> This crystal has also shown a lot of overnight growth. Last week it was 15mm and now it is measuring in at 16mm. It has grown 1mm overnight. The weight of the crystal is now 3.9g.</p> <p>I noticed that there were more translucent sides that had formed. I also noticed that there was more light shining through it which was coloured depending on the angle that the crystal was held at. I researched this further and understand that this happens when the gem transmits enough wavelengths of light allowing light to shine through it.</p> <p>There are however, some foggy/cloudy sides on the crystal which I also understand is caused by dried calcium deposits on the inside of the glass.</p> <p><u>Crystal under the red light</u> Over the two days, the crystal has displayed lots of purity and growth. There has been a lot of growth of the crystal since my last observation. The last</p>	

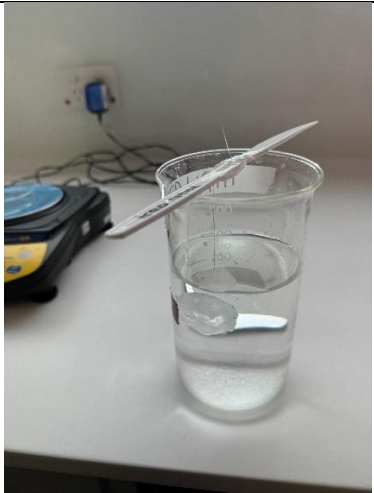
					<p>measurement was 13mm long showing an overnight growth of 2mm. This could be due to a healthier environment with no vibrations/movements and the temperature being constant.</p> <p>The crystal is showing reflection of different coloured light and more sides having been formed which are translucent and little cloud. The outside edges are sharp.</p> <p>The maximum temperature recorded was 30° C and the minimum was 19° C. The weight was recorded at 2.3g.</p> <p>My teacher and I noticed that changing the solution caused the crystal to grow. My teacher helped me prepare some fresh purified solution to try and stimulate more crystal growth.</p> <p>Before I left for the day, the solution was filtered to remove any impurities and left to cool down. Placing the crystal in a warm or hot solution would cause the crystal to dissolve.</p>	
Thursday	4/7/24	8.45am	Both octahedron shape.	<p>Red light 3.8g 6mm</p> <p>Dark: 8.3g 15mm</p>	<p><u>Crystal in the dark environment</u></p> <p>This crystal has rounded edges and appears to be cloudier.</p> <p><u>Crystal under the red light</u></p> <p>This crystal has a cloudy centre, and the outside edges are sharp and straight, except for one corner that is a little blunt.</p> <p>Both crystals are growing well.</p>	


Friday	5/7/24	8.45am	Both octahedron shape.	Red light: 4.6g 18mm Dark: 7.9g 20mm	<p><u>Both crystals (dark environment and under the red light)</u></p> <p>Some of the tips are blunt and they don't have sharp tip edges. There are lots of baby crystals growing on the bottom of the beaker. The teacher replaced the growing solution. The lab staff made fresh stock of saturated alum crystal growing solution and this was filtered and cooled, and the old solution was replaced.</p> <p>Observations to be recorded next Monday to see how much replacing the growing solution can change the size and weight of the crystal.</p>	
Monday	8/7/24	8.45am	Both octahedron shape.	Red light: 3.6g 16mm Dark: 9.5g 22mm	<p><u>Crystal in the dark environment</u></p> <p>No seed crystals appeared to be growing on the bottom of the beaker.</p> <p>The tips of the crystal are still blunt, and the outside is clear.</p> <p><u>Crystal under the red light</u></p> <p>There are two edges that are flat and blunt, and the other sides are still sharp edges.</p> <p>The Teacher asked to have the alum growing solution replaced.</p>	 <p>Monday 8/7 Alyssia</p>

Thursday	11/7/24	8.45am	Both octahedron shape.	<p>Red light: 7.8g 20mm</p> <p>Dark: 15.6g 35mm</p>	<p><u>Crystal in the dark environment and Crystal under the red light</u></p> <p>The crystals still have blunt corners, with seed crystals growing on the bottom of the beaker. I think this is a good sign that there's enough alum in the solution to grow the crystal and this is supported by the crystal gaining weight in grams and growing in length in mm.</p> <p>Both crystals growing in the red light and dark light have grown since Monday.</p> <p>The Teacher replaced the alum solution after the observation. Since changing to this method I have seen my crystals growing better.</p> <p>The alum crystal growing solution was changed. Measurements will be taken tomorrow to see if it makes the crystal grow bigger.</p>	
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Friday	12/7/24	8.45am	Both octahedron shape.	Red light: 9.0g 23mm Dark: 20.4g 30mm	<p><u>Crystal in the dark environment</u></p> <p>The crystal growing in the dark is a mixture of cloudy and clear and it has lots of seed crystals growing on the bottom of the beaker. The Teacher will ask for the alum crystal growing solution to be changed next week.</p> <p><u>Crystal under the red light</u></p> <p>The crystal growing under red light looks clear, translucent and there are still some edges that aren't pointy, but the crystal is growing well. It doesn't have any parasite crystals growing on it and there are lots of seed crystals growing on the bottom of the beaker.</p> <p>The temperature in the room hadn't changed much and it's still a minimum of 19-23 degrees in the room.</p>	
Thursday	18/7/24	9.30am	Both octahedron shape	Red light: 30mm 17.68g Dark: 30mm 32.5g	<p><u>Crystal in the dark environment</u></p> <p>The crystal in the dark environment grew faster than the crystal under red light, but I noticed that it was cloudy in appearance. I think this is because we changed the solution too frequently.</p> <p>The crystal has eight edges with some of the corners being blunt, and some sharp.</p> <p><u>Crystal under the red light</u></p> <p>The crystal under the red light grew 6 times its initial size i.e. from 5mm to 30mm. The Red-light crystal was originally growing translucent with the weekly change in solution but as frequency of change increased, it started to become cloudier.</p> <p>The crystal has 8 sides, however it started to display some parasites growing on the sides of</p>	

					<p>it. These parasites were removed by the Teacher to prevent the crystal from slowing down in growth.</p> <p>At the final stage of observation, there appeared to be a balance in tiny crystals forming at the bottom of the beaker. Too much Alum powder at the bottom makes the solution too concentrated. There needs to be a fine balance to help stimulate the growth.</p>
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