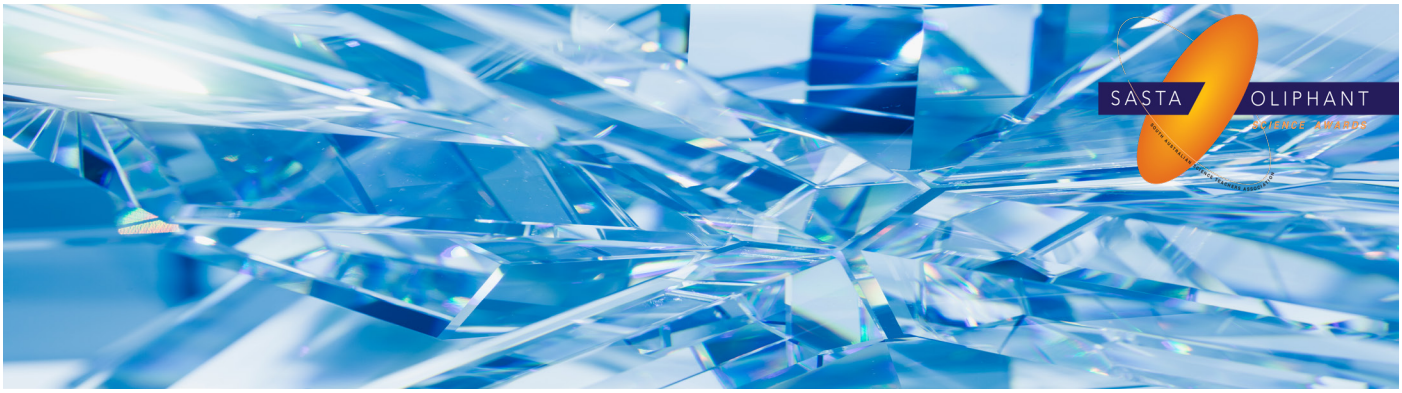
SASTA OLIPHANT
SCIENCE AWARDS
SOUTH AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

2022

crystal guide for teachers
(this is a suggested guide only)

SA'S LARGEST SCIENCE COMPETITION



Growing Crystals - Teacher Notes

The Material

Potassium aluminium sulphate (potash or common alum) – $KAl(SO_4)2.12H_2O$ – is reported to have a sweet, astringent taste and a relatively low toxicity. Do not consume. If accidentally ingested induce vomiting.

An MSDS is available at this link : https://fscimage.fishersci.com/msds/19200.htm

The potash alum needed for crystal growing is inexpensive and easily obtained if it is not in your school. Each student or group should require no more than 150 grams of the alum.

Suppliers include

- Ace Chemical Co. Ph. 83760844 (www.acechem.com.au),
- Omega Scientific Pty Ltd. Ph. 82894311 (www.omegascientific.com.au),
- AIM Scientific Ph. 8342 5870 (www.aimscientific.com.au).

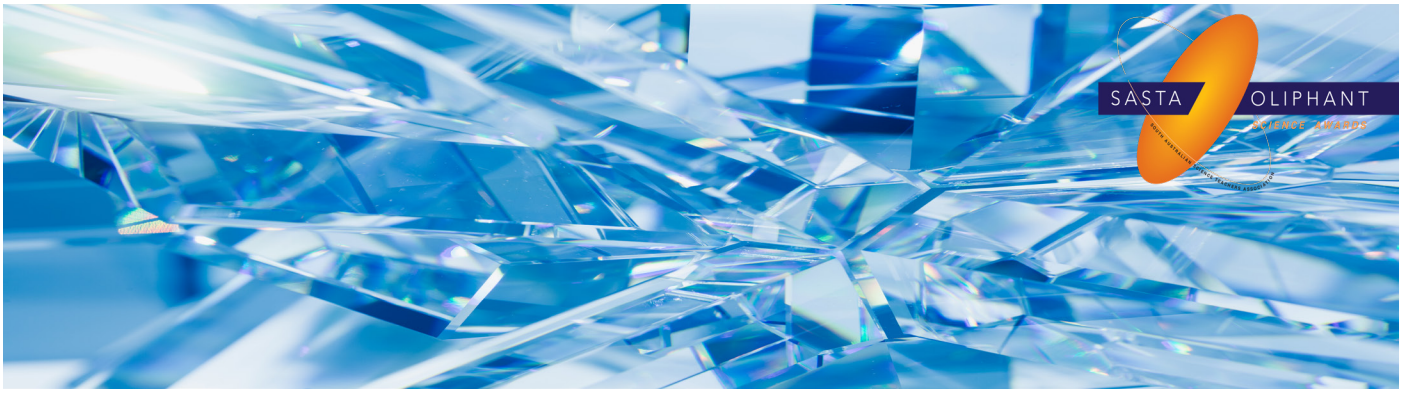
Costs and amounts available vary between suppliers.

Time constraints

Growing large, good quality crystals requires some patience (including resilience for repeating if needed!). The exercise may take as long as 10 weeks maybe a school term to get optimal size and quality from the quantities given. Attempts to speed up the process by using a warm or a ventilated site to enhance evaporation rate may cause problems with crystal quality or spontaneous seeding like the original step.

Care during growing of the crystal (bottom of container)

Periodic weekly turning or inverting of the growing crystal may help a more regular growth pattern, but the disturbance often induces additional seeding, leading to the growth of “babies” and hence slower growth of the main crystal. Accidental damage of the growing crystal may also induce budding, leading to irregular crystals. Although the problem of unwanted growth may be overcome as set out in students’ instructions, the handling process may induce flaws in the main crystal. Certainly it is easier and may be better to let the crystal grow undisturbed even though this will prevent growth of the bottom face and that produce a truncated crystal.



Growing by suspension (alternative method)

To ensure a more regular three dimensional crystal growth is to suspend the growing seed crystal in the saturated solution. If a seed of reasonable size is chosen then it may be attached by a water-fast glue or by tying to a thin thread or hair and then suspended from a pencil placed across the lip of the beaker. This allows unimpeded growth on all sides and permits the full symmetry of the natural growth habit to be displayed.
Care must be taken not to touch crystals with bare fingers (gloves or tissues). Using glue is tricky – large globs must be avoided so that the aesthetic quality is not affected. Participants should understand that the inclusion of a hair or thread is NOT penalised by the judges.

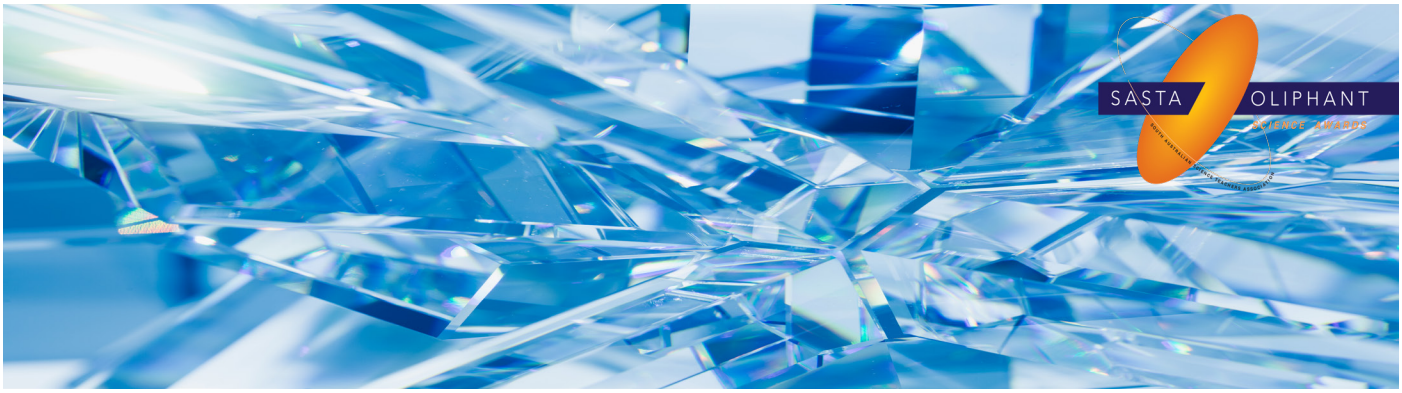
The alum crystal shape

There is a variety of gross (macroscopic) forms for the alum crystal. These are crystallographically equivalent. More commonly, multi-faceted forms are produced for this competition but a careful choice of seed may lead to the octahedral form. It is entries with the octahedral form that have tended to be awarded the major prizes.

Handling of the final crystal

Alum crystals are relatively soft and brittle, and readily chip or break. Handling may cause etching or fogging of surfaces. Exposure to very low humidity air (<20%) can cause efflorescence – or whiteness and flaking at the edges. Hence storage in airtight conditions as soon after completion is recommended.

Advice can be sought from Ian McMahon (ian.mcmahon@tsc.sa.edu.au) in the first instance.



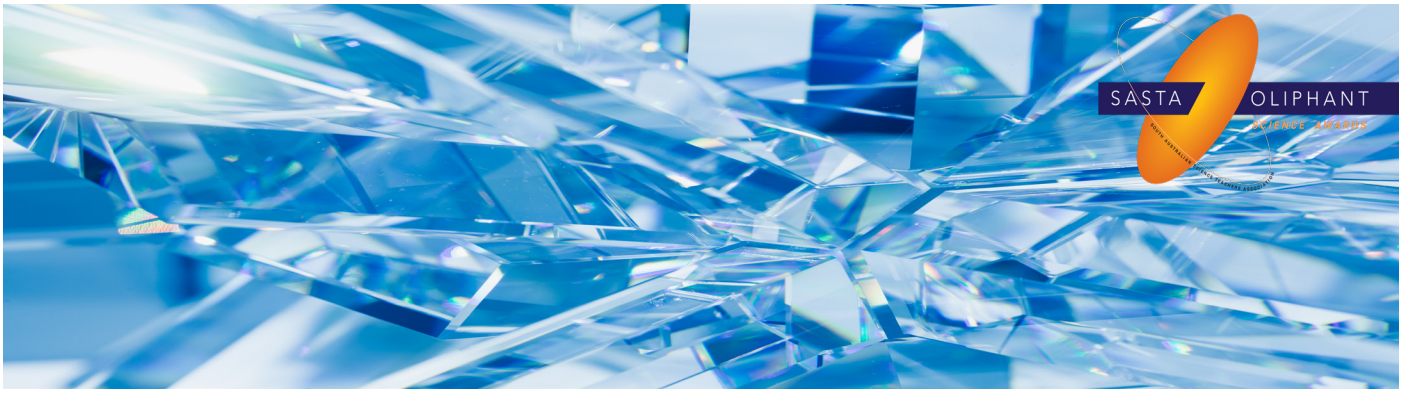
Growing Crystals

Note to student

- Read this whole document before starting!
- Always prepare your space.
- Thoroughly clean all tools and table before starting.
- Make sure you are growing your crystals in clear filtered solutions

What you will need

- potash alum
- 3 large beakers (500ml would be good)
- scales (that can measure less than 50g)
- hot water
- filter paper or kitchen paper towel
- a fine sieve
- stirrer (spoon)
- forceps/ tweezers
- marker pen (sharpie)
- tissues
- large syringe or Pastuer pipette



Making the first seed crystal

1. Measure 30 g of potash alum
2. Add potash alum to a large beaker
3. Add 200 mL of hot water.
4. Stir the mixture until all the crystals have dissolved.

* Depending on the technical grade of the potash alum, your mixture might look cloudy. That's ok. The less cloudy, the more pure the powder.

5. Using the filter paper or paper towel, line a sieve and pour the warm solution into the second beaker. This filters the mixture.
6. Cover this solution with a new filter/kitchen paper, set aside in a cool sheltered place and allow to sit overnight.

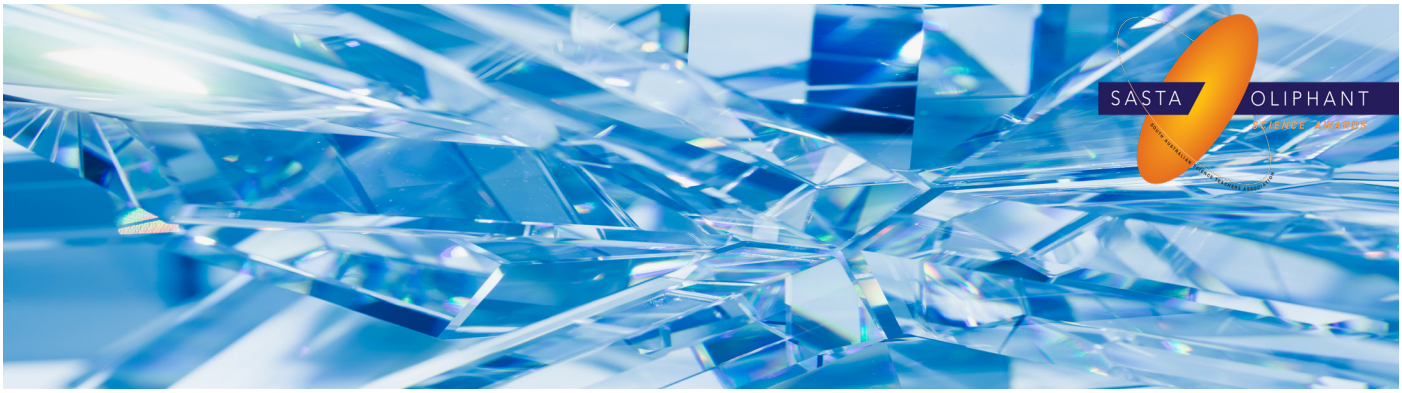
*Don't touch the beaker now, leave it be undisturbed and still.

7. After at least 12 hours, you should see a layer of tiny crystals at the bottom of the beaker
8. Carefully decant (pour off) the clear solution into another beaker, leaving the crystals behind. You can also use a syringe or Pasteur pipette to carefullly draw off the top layer of water without having to disturb your crystals at the bottom of the beaker.
9. Keep the decanted solution- you'll need it later.

*If no crystals have formed add a crystal from the original stock and let the solution stand until crystals have formed.

10. Choose a nice, solid, single crystal, or decent small group of crystal. This is your seed crystal

*If necessary break up the mat of crystals to obtain a good one



3. Growing your crystal

11. Using your or forceps or tweezers, transfer the seed crystal to the decanted solution (beaker 3), trying to place it centrally in the beaker.

*Careful not to squish your crystal. You can always scoop it with a spoon if you're worried.

12. Mark the level of the solution (on the outside of the beaker) and record the date in your logbook.

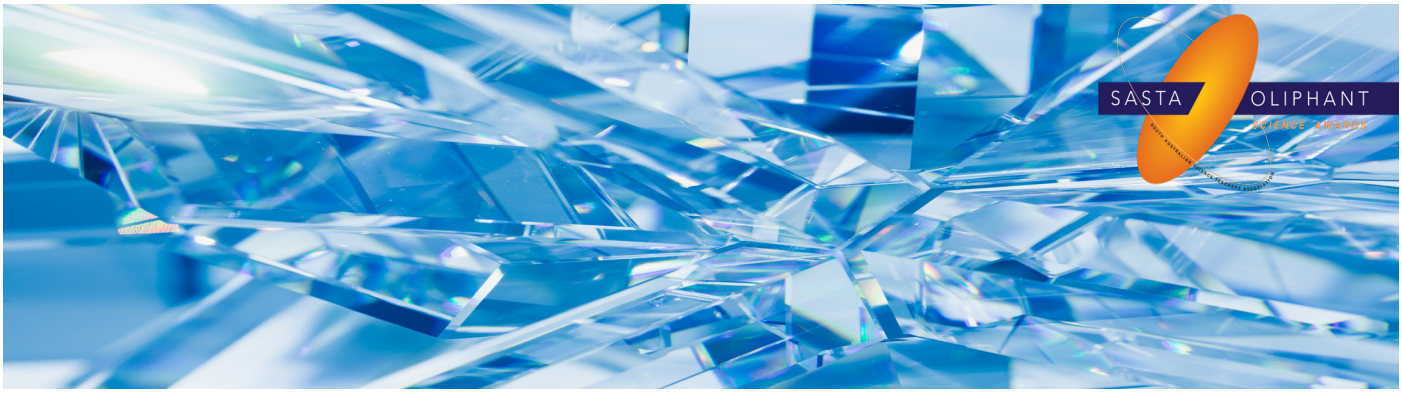
13. Cover the solution with a piece of paper towel in a way that lets water evaporate but also keeps out dust etc.

14. Allow the solution to stand undisturbed out of direct sunlight, perhaps on a bench where temperature won't change much (ie near the oven might **not** be great!).

15. 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.

* SEE NOTE FOR PROTECTING MAIN CRYSTAL ON THE NEXT PAGE *

16. 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.

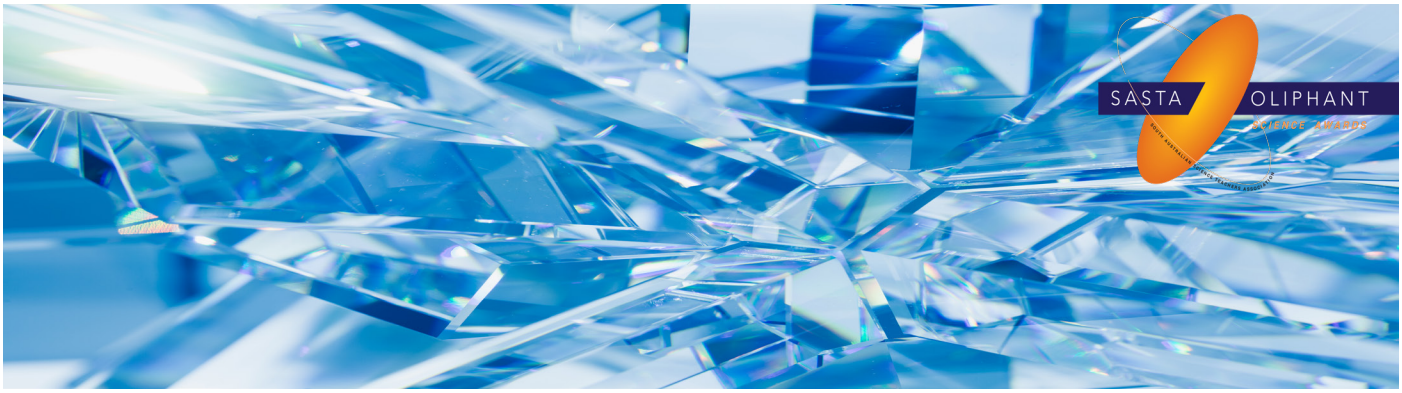


A note to protect the main crystal

Removing additional crystals:

- If small crystals appear around the seed crystal, carefully remove them.
- If small crystals are now growing on the main seed crystal, remove the main crystal, dry with tissues and remove the additional crystal buds.
- Do not touch the crystal with fingers.
- The crystal is brittle so do not drop or bump it.
- Set your seed crystal on a small plate while you warm your solution containing any other small crystals by partial immersion of the beaker in a bath of warm to hot water (see image below). This could also be done over the stove, in a saucepan instead of a bowl.

- Stir gently until the small crystals have all dissolved.
- Do not heat more than necessary.
- Immediately after 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.



Final steps

17. When you feel you are ready, you can stop your experiment.
18. Decant the remaining alum solution from the crystal (remember how you did this in earlier steps? Go back to step 8 to see how.)
19. CAREFULLY remove the crystal and pat it dry with tissues.
20. Wrap the crystal loosely in 1 or 2 tissues and then placed in airtight zip-lock bag.
21. The bag should be well labelled with the name(s) of the participant(s), year level and school name.
22. Ensure you include the logbook with the entry and give to your teacher for submission.

An alternative method

Growing crystals by suspension

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