

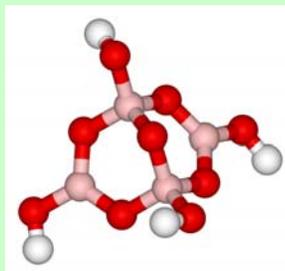


Crystal Stars

Demonstrators Additional Information Sheet

Borax

- Borax is sodium tetraborate decahydrate
- The chemical formula can best be written $\text{Na}_2[\text{B}_4\text{O}_5(\text{OH})_4] \cdot 8\text{H}_2\text{O}$
- The structure of the anion $[\text{B}_4\text{O}_5(\text{OH})_4]^{2-}$ is:



(Boron in pink, Oxygen in red, Hydrogen in white):

Making the Borax Solution

The procedure for making the saturated borax solution depends on whether the borax is granular or powdered.

- Commercially available borax (sold in supermarkets and pharmacies as a 'natural' cleaning product) is usually granular and gives better results than the powdered form. In this case for best results 100 g of borax should be dissolved in 500 ml of boiling water.
- When using powdered borax (typically that from chemical suppliers) the amount of borax should be reduced to 75 g per 500 ml of boiling water.

Making the crystals

The size and number of borax crystals forming on the pipe cleaner depends on how rapidly the solution is cooled. We have two protocols, one optimised for rapid formation of small crystals, the other for formation of fewer, larger crystals

Rapid crystal formation

- After dissolving the borax in boiling water the solution is cooled to 40 °C in a bath of cold water. Crystal formation is very temperature dependent, therefore once the solution has reached 40 °C it should be stored in a thermos flask.
- The pipecleaner should be seeded with borax powder (seeding does not work if the solution is hotter than 40 °C as the seeds dissolve).
- The rate of crystal formation depends upon the temperature of the room - at 18 °C crystals up to 0.5 mm in size should be seen in less than 30 minutes. In a warmer room crystals will form more slowly.

Large crystal formation

- To form larger crystals the borax solution should be cooled to 60 - 70 °C, rather than 40 °C.
- The pipecleaner shape should be then be added to the solution without seeding and the crystallisation experiment allowed to cool to room temperature. For best results, once the crystallisation experiment has reached room temperature it should be placed in a fridge/ice box.
- Crystals ranging in size from 0.5 to 4 mm should develop overnight.

Food colouring can be added to colour the outside of the crystals, however we preferred the results without food colouring.