

SECTION E, SCIENCE EDUCATION

Growth of Cupric Sulfate Hydrate Crystals as a Quantitative Experiment in High School Chemistry Classes

HOWARD A. KIVETT

Solution and crystallization are better understood by the high school student if attacked from a quantitative angle. Holden and Singer (1960) have outlined techniques for growing several kinds of crystals in fruit jars, but these techniques are too time consuming for high school laboratories. The technique below can be completed in two or three laboratory periods of 50 minutes each.

A supersaturated solution is made by dissolving 100g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in 200 g of water. This is best done over a hot-water bath as direct heating will result in loss of some accuracy due to water boiled off. The solution is then allowed to cool overnight in an area of fairly constant temperature. Due to the high degree of supersaturation, crystals form in the bottom of the container and, if carefully filtered out and weighed, give a fairly accurate value for the solubility of the salt at the final temperature. By choosing several different growing climates; e.g., refrigerator, room temperature, incubator, and warming oven, a rough solubility curve can be achieved by the entire class.

A more spectacular result can be achieved by resupersaturating the saturated solution in the ratio of 1g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ crystals to each 10g of saturated solution. This solution is more stable and may be filtered after cooling without causing crystals to form. If a small clean seed crystal is suspended in this solution, a perfect crystal up to approximately 25g in mass is the result. Seed crystals may be found in the supply bottle but are more perfect when grown by evaporation in a flat pan covered with a non-linting cloth. The seed crystal may be suspended in the solution with a fine thread which is tied around it, then triple-threaded through a cardboard undercover insert. To assure that the crystal is clean and has no tiny invisible seeds to cause an imperfect final result, it may be dipped in distilled water for a few minutes before immersion in the growing solution. Once in the solution, the crystal's position is carefully adjusted to the center of the growing area by pulling on the loose end of the thread.

SUMMARY

This experiment has been successful in more than 80 per cent of the cases attempted in the past three years. Crystals are usually good, and student reports demonstrate understanding of principles involved. The experiment is especially useful to teachers who prefer an essay-type experiment report. However, the following precautions should be followed. Technical grade $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is satisfactory but better results would probably come from higher purity. Above all, students should be warned that the hot solution can cause serious burns.

LITERATURE CITED

Holden, Allen and Phyllis Singer. 1960. Crystals and crystal growing. Anchor Books, Doubleday and Co., Garden City, N. Y. 320 pp.