Crystal Growing Home Lab Name: _____

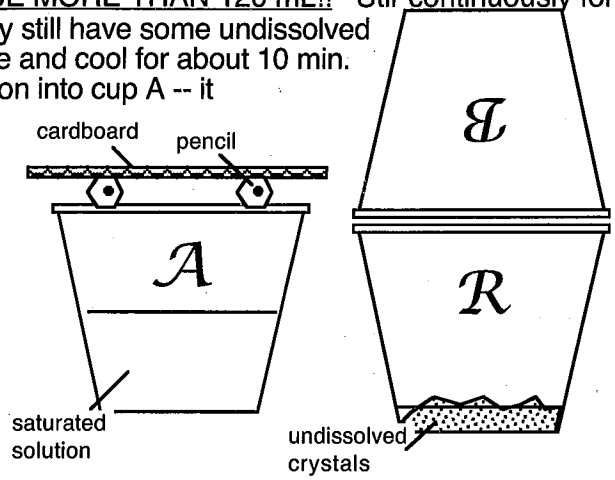
When a salt solution is allowed to evaporate, it is important to realize that it is only the water (solvent) that is evaporating; the salt (solute) is left behind. So what would happen if some of the water in a saturated salt solution is allowed to evaporate? (Suppose the salt being used is not easily "fooled" into becoming supersaturated.) In the space below , write down what you think will happen and why you think it will happen:

Materials:
- 20 g of "alum" [AKA: potassium aluminum sulfate: $KAl(SO_4)_2$] obtained from the instructor
- 3 clear plastic cups -- clear, clean and preferably wide mouth
- water -- tap water works OK, distilled* is even better (*available at supermarkets)
- two pencils, a piece of cardboard or stiff paper, and a plastic spoon

Procedure: This lab project will take A FEW WEEKS to complete. *Start it immediately*! Then spend 4-5 minutes each day attending to the project.

1. **Day 1**--Set up: Label your three cups R, A and B. Place your entire sample of alum in cup R, and add 120 mL (1/2 cup) of warm water. DO NOT USE MORE THAN 120 mL!! Stir continuously for 3 full minutes to try to saturate the solution. (You may still have some undissolved alum at the bottom of the cup.) Let the solution settle and cool for about 10 min. (longer if it appears cloudy). Then decant* the solution into cup A -- it should appear clean and clear. Place the two pencils across the top of cup A and then place the piece of cardboard over the pencils. The cardboard must be larger in size than the mouth of the cup (see Figure at right). The cardboard serves as a dust cover. The pencils serve as spacers to keep the cup open and allow for evaporation. Balance cup B mouth to mouth on top of cup R, to keep dust out of either one.

* Decant means to carefully pour off just the liquid, leaving all the undissolved crystals behind.



2. **Day 2** -- Pick your crystal! Check for crystals on the bottom* of cup A (if none appear, that's OK, just check again the following day). When you finally see crystals, pick one that seems especially clean and clear (if there are zillions of little crystals, just pick any one).

* Sometimes you might actually see crystals forming at the top of the solution, floating even though they're more dense (How is this possible?) If this happens, just use the spoon to knock them down. Place cup B upright on the table, then use the spoon to carefully transfer the one crystal from A to B. Then carefully decant the solution into cup B. place the pencils and cardboard over cup B, and set aside. Add a few mL (1/2 tsp) of water to cup A, swirl around and quickly pour into the recovery cup (R). If some crystals remain in cup A, decant the liquid back from cup R into cup A, swirl and quickly pour. The idea is to clean the extra crystals out of cup A and into the recovery cup using as little additional water as possible. When cup A is clean, place it mouth to mouth on top of cup R as you did before. The set up should now look like the above figure with two exceptions: A and B are switched, and there is a small growing crystal in the cup with the solution.

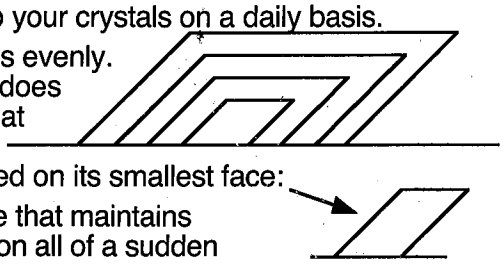
(continued on back)

3. **Days 3 thru...**: Keep it growing! On each successive day, simply use the spoon to transfer the one main crystal from the solution cup (A or B) into the empty cup (B or A), then decant the solution onto that crystal, and rinse any extra little crystals back into the recovery cup R. Replace the pencils and dust cover, just as you did above. Repeat this technique each day, just alternating cups A and B as you go. After several days, the solution level may get a little low. It is important to keep the solution level above the top of the main crystal, so it can continue to grow evenly on all sides. If it starts to get too low, DO NOT ADD WATER TO THE MAIN CRYSTAL CUP (this should be obvious), instead add some of the saturated solution left in the recovery cup. (If there is none, add 10-15 mL of fresh hot water to the crystals in the recovery cup). Stir it well (3 min) to make sure it's saturated, let it sit for a several hours, then if it's still saturated (undissolved salt in the bottom) decant it into the main crystal cup.

Important Tips:

1) To be sure no other crystals get too attached to it, attend to your crystals on a daily basis.

2) Once it gets big enough, rotate your crystal, so that it grows evenly. The bottom side of the crystal touches the cup and therefore does not grow as fast. A crystal that is not rotated will thus end up flat (as shown at right). Once a crystal gets large enough (about the size of a pea) keep rotating it, by always leaving it balanced on its smallest face:

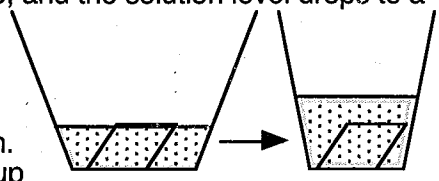


3) Try to keep the crystal growing project in a part of the house that maintains a fairly constant temperature. (What might happen if the solution all of a sudden got really warm?)

4) To maintain crystal clarity, avoid handling the crystals, or getting impurities in the solution or recovery cup, and make sure the spoon stays clean. If you do need to handle the crystal, wash your hands well before (and after!).

5) If any little crystals attach themselves to the main crystals, do your best to brush them off as best you can.

6) Very important: Once you run out of crystals in the recovery cup, and the solution level drops to a point where the main crystal starts to stick out, then you may want to transfer the crystal into a narrower cup, where the same amount of solution will give you a greater depth (see figure at right). This will give you a few more growing days, and let you take better advantage of the entire amount of alum you were given. In the narrower cup, once the crystal has outgrown the narrowest cup possible, then you have grown as large a crystal as you can. (Congratulations!) Take your award-winning (bonus winning?) crystal out, pat it dry with a paper towel, and place it in a plastic bag to keep the crystal from drying out and getting brittle.



On the day the crystal is due to be turned in, whether it is finished growing or not, place it in a plastic bag as described above, then wrap the bag in some tissues and bring it with you to school to turn in, along with the score card (will be handed to you, in class, one day prior to due date).

Your crystal will be graded for 50 points based on:

- size (20 pts)
- clarity (15 pts)
- proportions (15 pts) (how evenly shaped it is)

Good luck!

CRYSTAL DUE DATE: _____