Unit 5 Chemical Bonding Name _____

Growing Crystals Lab Block _____

Experiment 1: Ionic Crystal Formation

1. Place approximately 50 mL of distilled water in a clean beaker, and begin heating. Be sure to keep the water below boiling temperature.

2. Slowly add solid sodium chloride, and allow it to dissolve while stirring.

3. Continue to add the salt until no more will dissolve and a small amount of undissolved solid remains in the bottom of the beaker. This is now a saturated solution.

4. Filter the hot solution into a clean, dry beaker, and cover with a watch glass, leaving a small opening for evaporation to take place.

5. Set the beaker aside, and do not disturb it until the crystals have completely formed.

6. When the crystals have completely formed, observe their structure under the stereoscope.

7. Repeat the above procedure with copper(II) sulfate pentahydrate and again with potassium aluminum sulfate.

Experiment 2: Metallic Crystal Formation

1. Place a small piece of clean copper wire on a watch glass, and place under the stereoscope.

2. Use a plastic pipette to add a small amount of silver nitrate solution ($AgNO_3$) to the copper metal, and observe the growth of silver (Ag) crystals. The reaction is expressed as $2\ AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2\ Ag$. CAUTION! $AgNO_3$ causes skin discoloration.

3. Observe the growth of the metal crystals under the stereoscope.

4. Repeat the above procedure with aluminum wire and a copper(II) nitrate [$Cu(NO_3)_2$] solution. The reaction is expressed as $3\ Cu(NO_3)_2 + 2\ Al \rightarrow 2\ Al(NO_3)_3 + 3\ Cu$.

Experiment 3: Supersaturated Solution Crystal Formation

1. Fill a large, clean test tube slightly more than half full with sodium thiosulfate ($Na_2S_2O_3 \bullet 5\ H_2O$) crystals. Sodium thiosulfate is a ***hydrated crystal***: it contains water molecules chemically bonded to the crystal-lattice structure.

2. Using a utility clamp, heat the test tube containing the sodium thiosulfate. As you heat the substance, the water will come out of the crystals, and then the rest of the substance will dissolve in the water. Heat the test tube until all of the crystals dissolve.

3. When the solution begins to boil, heat it gently so it will not shoot out of the test tube. CAUTION! Do not point the test tube at anyone, including yourself. Boil the solution for a few seconds to rinse any remaining crystals from the upper part of the test tube; then turn off the burner.

4. At this point, you will have a saturated solution. Hold the test tube of hot liquid very still under cold running water, or place it in a beaker of cold water. Do not shake or stir the solution. Do not let any water run into the

solution, as this would dilute it. Cool the liquid for several minutes, and then slowly remove the test tube from the running water or water bath. Wait about 10 seconds. If the test tube still feels warm, cool it a little longer; if it feels cool, stop cooling it.

5. By cooling the saturated solution rapidly and carefully, you have created a supersaturated solution. The cooled solution actually contains more solid than it should contain at that temperature. This is a very unstable solution, and it will not stay supersaturated very long. It can be easily changed by dropping in a seed crystal of the solid.

6. Place the test tube of cool liquid in a bright window or near a good light. Be careful not to shake or disturb the solution at this point. Drop a single crystal of sodium thiosulfate into the liquid in the test tube, and observe what happens. Feel the sides of the test tube for the release of heat energy as the crystal-lattice structure forms.

7. Repeat this process several times with the same test tube and contents. Each time, you create a more supersaturated solution, and crystallization will occur more rapidly.

8. Clean up your test tube as directed by your instructor. (You may have to throw it away.)

Observations and Conclusions

1. Observe your crystals under the stereoscope, and draw the crystal structures you see.
2. Describe the differences and similarities between the ionic and metallic crystals you have made.
3. Use the Venn Diagram below to show the similarities/differences between ionic/metallic crystals.