



Module: Material Structure
Focus: *Hydrogen Bonding & Crystallization.*
Duration: 43 minute period



- Objectives:**
1. Students will be able to illustrate that a material's performance is connected to its structure.
 2. Students will be able to list and discuss the various types of intermolecular bonding.
 3. Students will develop a working understanding of hydrogen bonding.
 4. Students will be able to observe and demonstrate the process of growing crystals.

Materials:

Water	Copper Sulfate
Cup	Petri Dish
Petri Dish	Water
Paper Clip	

- Procedures:**
1. Students will perform a lab on observing hydrogen bonding.
 2. Review students' data.
 3. Students will perform part 1 of their lab making and observing crystals.

Assignment: 1. Complete lab write up.

Assessment: 1. Laboratory Experiments, Classroom Participation, Quizzes & Test.

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Teacher Notes:

For their first lab, have the students take a Petri dish and partly fill it with water. Have them try to float a paper clip on top of the water. This should be very difficult to do.

Have the students fill the Petri dish to the top with water. Looking at the Petri dish from the side, they are to add even more water. They should observe the water forming what looks like a contact lens above the rim of the Petri dish. Now have them try to float the paper clip on top of the water. With a little skill, they should be more successful. This lab illustrates the hydrogen bonding that exist between molecules of water.

For today's second lab, have the students mix a solution of copper sulfate. When completed, have each student pour their solution into a Petri dish. Leave uncovered but labeled in a sunny +/- or warm location. To insure crystal growth, you may have to place a very small piece of copper sulfate in each Petri dish to act as a "seed" crystal.

I came across another crystal growing exercise on the Internet, compliments of Gregory Vogt +/- or the International Union Crystallography. In this activity, students make crystalline trees. They first make tree skeletons out of notebook cardboard. The "trees" are placed in aluminum pie dishes containing a solution of

- 2 tablespoons of laundry bluing
- 2 tablespoons of table salt (no iodine)
- ½ tablespoon of ammonia
- 2 tablespoons of water
- Water based food coloring.

I will try this later this fall; it looks like a cool experiment.

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