**Chemical Bonding Lab** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Problem:** Are the properties of covalent molecules, ionic compounds, and metals different?

There are 4 Parts of the experiment that you and your partners will be working on. Before each part you will have to go through a tutorial on the computer.

* **Now Start the Tutorial (bonding\_lab) on the computers**

**Part 1: Ionic Compounds**

The ionic bond occurs between a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ atom and a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ atom. When a metal atom loses electrons, it becomes a [positive/negatively] charged ion.

1. At your lab station, place a pinch of NaCl (table salt) directly on the black lab bench, an observe it through a magnifying lens, At the right sketch what you see:

Compare these crystals with larger NaCl crystals on display. What evidence is there that the ions in these crystals are arranged in the specific pattern discussed in the tutorial?

1. Go watch the demo set up in the hood. A test tube filled with NaCl is being heated over a very hot flame. When the NaCl starts melting, observe what’s going on inside the test tube:

1. When the salt is nearly all melted, is the unmelted (solid) NaCl floating at the top or sunk to the bottom of the liquid (molten) NaCl? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Once melted, watch what happens as the molten salt is poured into a beaker. As the molten salt cools, what do you observe?
3. Predict what would happen if the solidified NaCl were bent:
4. Observe what happens when the solid (frozen) salt is bent. What occurred? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Was your prediction correct? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* **Now Go back to the Tutorial (bonding\_lab) on the computers and Learn why ionic substances behave this way**

**Part 2: Covalent Compounds – Network Covalent**

1. There are 2 types of covalent substances: **network covalent** and **molecular**. The example most often used for a network covalent solid is a diamond. Diamond is made up of carbon atoms covalently bonded together to other carbon atoms which in turn are covalently bonded to more carbon atoms. We do not have a class set of diamonds for you to try to melt, but we have plenty of silica. Silica is SiO2 (silicon dioxide – also known as “sand!”). Take a look at the sand under the lens. Aside from having a slightly different color, it looks very much like the salt. What do you think would happen if you repeated part 1, but we put sand in the test tube rather than salt? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Why do you think that will happen?

* **Return to the Tutorial to learn why network covalent substances (like diamond and sand) behave the way they do.**

Why were we not able to melt the sand in class? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part 3: Covalent Compounds - Molecules**

1. Take a large test tube with some wax at the bottom, and clamp it to the ring stand. Heat it about 3 cm over a very small (2-3 cm tall) cool flame. Once the wax is mostly melted, turn off the burner. Does solid wax float or sink in molten way? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Melt some candle wax on the aluminum foil. Pick of the piece and try to bend it. What happens? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ What would happen if you hit a piece of ice with a hammer? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* **Return to the Tutorial and learn more about molecular solids and why they behave this way**



What does IMF stand for? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How do IMFs differ from ionic and covalent bonds? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part 4: Metallic Bonds**

1. Take a new penny (minted after 1982) and file away about 1 cm of the copper along an edge to expose the silvery-gray zinc inside.
2. Light a Bunsen burner, and adjust to a hot flame. Place 400 mL beaker beneath the flame. Use tongs to hold the penny vertically in the hottest part of the flame. Be sure to hold the penny by the top with the exposed zinc edge at the bottom. After 15-25 seconds, you should notice a change! Let the molten zinc drip straight into the beaker below (you may need to give it a little shake). Set the tongs and what’s left of the penny down to cool on the foil. What did you observe?

1. After 30 seconds the zinc in the beaker should be cool. Pick it up and bend it. Observations:
2. Clean up and put the penny in the waste container.

* **Return to the Tutorial to learn more about metallic substances and why they behave this way**

Post-lab Questions

Return to the PowerPoint tutorial if you need help with your questions

1. Ionic, metallic, covalent. Which is the strongest bond? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ The weakest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Salt melts at 801 ˚C, sand melts at