**Name**

**Pre-Lab Interactive Notes**

(This should be done on this page and does not need to go into your lab notebook.)

**New Terms:**

*Terms about the chemicals:*

Metal:

Acid:

Ion:

Chemical Reaction:

List three pieces of evidence you might see if a chemical reaction occurs:

*Terms about the periodic table:*

Period:

Group:

Atomic Property:

Ionization Energy:

**Information**

The H+ ion can be used to attract electrons away from the outer shells of certain metal atoms if its attraction for the electrons is greater than that of the metal atom’s own nucleus for its electrons.

Any time electrons are transferred from one atom to another, it is considered a chemical reaction! You will usually be able to see or feel evidence of this.

The faster the evidence comes, the greater the difference must be between the attractive forces of the H+ and the metal atom’s nucleus.

**Some Concept Questions**

1. Consider some common metals you have seen. Are metals made of atoms or ions? How do you know?
2. Circle all of the ions in the following set:

H H+ Na Na­­+ K K+ Ca Ca2+ Mg Mg2+ Zn Zn2+ Al Al3+

1. Explain what would have to happen in the atom for each of the following changes to occur:

Na 🡪 Na + Al 🡪 Al3+ H+ 🡪 H

1. Explain what is happening (hint: follow the electron) in the following reaction:

H+ + M 🡪 H + M+

1. Use the following data to determine whether element A or element B has a higher “ionization energy”.

H+ + A 🡪 immediate bubbling

H+ + B 🡪 no reaction

Element has a higher ionization energy. I know this because

**The Goal:**

The goal of this lab is to use experimental data to determine patterns of ionization energy within the periodic table.

**Pre-Lab:** Below is an outline for the pre-lab discussion. Take notes from the discussion in your lab notebook.

*Reaction Concepts:*

* Since metals cannot dissolve in water, if they appear to dissolve there must have been a chemical reaction.
* Each of the metals will be tested against the hydrogen ion from an acid.
* Faster/more intense reaction means the metal had low attraction for its own electron.

*Safety:*

* Wear goggles, gloves, and aprons at all times.
* If you get acid on your skin, wash it off immediately with soap and water. It is dilute, but it can still burn you if it stays on your skin.

**Getting Ready:**

1. Read over the Procedure steps and summarize the method in either a short bulleted list or as a flowchart.
2. Read over all directions and make a **data chart** in order to keep track of all observations for each metal. The metals to be tested are **zinc, aluminum, magnesium and calcium**. You will need to rank the reactions, so be sure to include as much detail as possible on the speed and intensity of the reactions.

**Procedure:**

1. Place a 250-mL beaker ~1/2 filled with water on a hot plate at medium-high heat in case you need to do step 6.
2. Use sandpaper to remove the oxide coating on the metal, if needed.
3. Use a spatula to add a SMALL amount of one metal (should just fit on the end of the spatula) to a test tube.
4. Rest the test tube in a rack and then use a dropper to add acid to the test tube up to ~1/3 filled.
5. Observe for 1-2 minutes and record any evidence of reaction.
6. ONLY IF THERE IS NO VISIBLE REACTION, heat the reaction tube in a water bath like this…
   1. Use test tube tongs to hold the test tube in the water bath for 1 minute.
   2. Record any observations (did the metal change or appear to react?)
7. When finished testing each metal, pour any remaining solid into a paper towel in the bottom of the sink. Let water run over it to wash away the acid. DO NOT LET SOLIDS GO DOWN THE DRAIN. Gather the solids in the paper towel and dispose in the trash can.

**Basic Conclusion**

Rank the metals by the speed/intensity of their reactions.

\*Analysis and follow-up questions will be given separately.

**Post-Lab Questions** **Name**

1. Use the results from your data table to rank the metals from LEAST to MOST reactive.
2. Use the answer to question 1 to list the elements in order of increasing ionization energy. (Will it be the same order or the opposite from the previous question?)
3. Which of the tested elements are in the same group on the periodic table?
   1. Assuming these elements represent the larger pattern, does ionization energy of atoms increase or decrease going from the top to the bottom of a periodic table group?
   2. Use the electron configuration for each of these elements to create a Bohr diagram. Place them in the boxes according to their position on the periodic table. For each element, circle the electrons that would be lost if a reaction occurs.

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* 1. Connect Coulomb’s Law with atomic structure to explain WHY the pattern in 3a makes sense.

1. Identify any two elements that are in the same period on the periodic table? (There are two sets.)
   1. Assuming these elements represent the larger pattern, does ionization energy increase or decrease going from left to right across a period of the periodic table?
   2. Use the electron configurations for each of these elements to draw a Bohr diagram. Place them in the boxes in their relative positions on the periodic table. For each element, circle the electrons that would be lost if a reaction occurs.

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* + 1. In which period are these elements placed on the periodic table?
    2. What is the highest major energy level in each of these atoms that contains electrons?
    3. Which atom has more positive charge in its nucleus?
    4. Connect Coulomb’s Law with atomic structure to explain why the pattern in 4a makes sense.

1. Considering the patterns, how would you expect the reactivity of gallium in acid to compare to the reactivity of aluminum in acid? Explain your reasoning.
2. Describe the reaction you would expect with strontium metal in acid? Explain your reasoning.