PERIODIC TRENDS

The structure of the periodic table is such that elements with similar properties are aligned vertically in columns called “groups “or “families”. As you will learn in class, this leads to smoothly varying trends in properties such as ionization energy and atomic radius, as one moves both down within a specific group or horizontally. The reactivity of the elements also follow well-defined trends both within the group and across a given row. In this experiment, you will explore these trends in reactivity for the elements.

Elements in the Periodic Table are organized by increasing atomic number. As atomic number increases so does the number of electrons. Electrons, and specifically valence electrons, are important in determining how an atom interacts with other atoms. The elements in a group (vertical column) have similar properties because they have valence electrons in similar configurations. The elements in the periodic table are divided into categories. Not only is this system useful for finding element but much can be predicted about an element based on its position on the periodic table.

Aim: To explore trends in the periodic table

Part 1: Trends in Properties within Groups

1. Place a small strip of magnesium in a test tube and cover with water. Look closely and observe what happens

2. Place a small piece of calcium in a test tube with several milliliters of water. Record your observations.

Part 2 - Activity Series of Some Metals in HCl

1. Obtain a small sample of zinc and tin.
   You may reuse the magnesium from Part 1. Dump out the water from the test tube containing the magnesium but keep the magnesium in the test tube. Place zinc and tin in separate tubes.
2. Add a small amount of 1.0M HCl to each test tube, just enough to cover the sample. Record your observations.

List the four metals from most reactive to least reactive. Use data from your lab to support your answer.

In general, is there a relationship between the locations of metals on the Periodic Table and their relative activity? Explain why.

Part 3 - Density Trends in a Group

Silicon (Si), tin (Sn), and lead (Pb) are all in the same group. The density of silicon is about 2.33 g/cm^3 and the density of Pb is 11.34 g/cm^3.

Based on this trend, what do you estimate about the density of tin?

Determine the density of tin. Use the water displacement technique to find the density. Use a large piece of tin, not the small pieces in the fume hood.

Data

Mass of sample

Volume of water before adding sample

Volume of water after adding sample

Volume of sample of tin

Density of tin

Do your results support your estimate? Explain.

When elements are organized in the periodic table, various trends appear. Describe some of the trends that you learned about from this lab.

Part 4. Acid-base properties of oxides

1. Fill a round bottom flask with tap water. Place three drops of *universal indicator* solution into the flask. Using a straw, exhale into the first test for one to two minutes. Use the air from deep in your lungs. Record any color changes to the solution.

2. Fill a round bottom flask with deionized water. Place three drops of *universal indicator* solution into the flask. Using a straw, exhale into the first test for one to two minutes. Use the air from deep in your lungs. Record any color changes to the solution.

Some Acid-Base Indicators	**Color in Acidic Solutions**	**Color in Basic Solutions**
Phenolphthalein	colorless	pink
Litmus	red	blue
Bromothymol blue	yellow	blue
*Universal indicator	Red →orange→yellow	blue→indigo→violet

*for universal indicator, the progression in from more acidic to more basic since there are several colors. The most acidic solutions are red. Solutions that are less acidic are orange and then yellow. Solutions that are basic are blue. The most basic solutions are violet.

Explain your observations: