**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Properties of Acids and Bases**

Background Information: Some of our everyday household items are known to be acidic or basic. In middle school we learned acids have pH values below 7 and bases have pH values above 7. But what properties do they have to be classified in that way?

Materials: test tubes and racks, pipettes, spatulas, spot plates, 1M HCl, 1M HC2H3O2, 1M NaOH, 1M LiOH, 2M NaOH, phenolphthalein, litmus paper, pH paper, zinc, magnesium, copper, iron, CaCO3, household chemicals.

Guiding Question: What properties do acids, bases, and salts have? Compare and contrast.

Procedure:

1. Test each solution at this lab station with red and blue litmus paper and pH paper. You must record either “red” or “blue” for the litmus and a number for the pH. Then decide if they are acids or bases.

| **Household chemical** | **Non-neutral Ingredient** | **Red litmus** | **Blue litmus** | **pH paper** | **Acid or Base?** |
| --- | --- | --- | --- | --- | --- |
| Vinegar | HC2H3O2 |  |  |  |  |
| Soda | H2CO3 |  |  |  |  |
| Juice | HC6H7O7 |  |  |  |  |
| Soap | KOH |  |  |  |  |
| Milk of magnesia (like Tums) | Mg(OH)2 |  |  |  |  |
| Draino | NaOH |  |  |  |  |

1. Add about five drops of each of the following to separate depressions on a spot plate. Test them all with litmus paper (record “red” or “blue” only) and phenolphthalein (record colorless or pink). Then decide if they are acids or bases. Clean and dry your spot plate.

| **Substances** | **Red litmus** | **Blue litmus** | **phenolphthalein** | **Acid or Base?** |
| --- | --- | --- | --- | --- |
| 1M NaOH |  |  |  |  |
| 1M LiOH |  |  |  |  |
| 1M HCl |  |  |  |  |
| 1M HC2H3O2 |  |  |  |  |

1. Add small pieces of Zn, Mg, Cu and Fe to separate depressions on your plate. Add a few drops of 1M HCl to each depression. Observe and record their reactivity. Scale their reactivity 0 (not reactive) to 4 (most reactive). Clean and dry your spot plate.

| **Metals** | **Observations** | **Reactivity** |
| --- | --- | --- |
| Zn |  |  |
| Mg |  |  |
| Cu |  |  |
| Fe |  |  |

1. Add small pieces of Zn, Mg, Cu and Fe to separate depressions on your plate. Add a few drops of 1M HC2H3O2 to each depression. Observe and record their reactivity. Scale their reactivity 0 (not reactive) to 4 (most reactive). Clean and dry your spot plate.

| **Metals** | **Observations** | **Reactivity** |
| --- | --- | --- |
| Zn |  |  |
| Mg |  |  |
| Cu |  |  |
| Fe |  |  |

1. Place a small amount of CaCO3 to a test tube. Then add a few drops of HCl. Record your observations. Clean and dry your test tube.

| **Observations:** |  |
| --- | --- |

1. Add about 10 drops of 6M HCl to a clean, dry test tube. Also add one drop of phenolphthalein. To the same test tube, add 0.5 M NaOH slowly, drop by drop, while swirling until the solution turns pink. When it turns pink, the solution is neutralized. Count how many drops you needed to add to obtain the pink color throughout the test tube.

| **Drops needed:** |  |
| --- | --- |

Post Lab Questions:

1. Based on parts 1 and 2. what color will red and blue litmus paper turn
   1. in an acidic solution?
   2. in a basic solution?
   3. in a neutral solution?
2. The table 1 provides the “non-neutral ingredient” of the household chemicals. What similarities can you find in the formula of
   1. all acids?
   2. all bases?
3. Using table 2, create a rule for testing acidic and basic solutions with phenolphthalein?
4. Predict why the HCl reacts more vigorously with the metals than the HC2H3O2 as seen in parts 3 and 4.
5. Does table J confirm your reactivity of the metals as seen in parts 3 and 4? Explain your answer.
6. Write a balanced reaction for HCl reacting with the most reactive metal that we used in part 3 and 4.
7. Write a balanced double replacement equation for the reaction of HCl and CaCO3 that occurred in part 5.
8. H2CO3 is very unstable and breaks down into water and carbon dioxide. Is this fact supported by your observations in step 5? Explain your answer.
9. Write a balanced double replacement reaction for the reaction of HCl and NaOH that occurred in part 6.
10. Recall how phenolphthalein indicates acidic and basic solutions in part 2. Explain what occurred during this reaction to the acidity and basicity of this solution and NaOH was added to the HCl in part 6.
11. Explain why the reaction between the acid and the base is called a **neutralization** reaction in terms of pH values.
12. Explain, in terms of Molarity and concentration, why more drops of NaOH were needed than drops of HCl.