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**An INTRODUCTION to ACIDS and BASES: Lab Investigation**

**GOOGLE** “phet pH scale” and the simulation should be the first link that pops up. <https://phet.colorado.edu/en/simulation/ph-scale>

Introduction:

Acids and bases represent two important classes of chemical compounds. These compounds play a major role in many atmospheric and geological processes. In addition, acid-base reactions affect many of the processes that take place in the human body. Acids and bases have unique properties because of the atomic composition of these compounds.

Some of the unique chemical properties of acids and bases include how they react with indicators, metals and carbonates. An indicator is a dye that changes color when it is mixed with an acid or a base.

In this investigation you will explore:

1. How we classify a solution as an acid or a base from the pH scale
2. What properties are unique to acids and bases
3. How we recognize an acid or a base from a chemical formula
4. What ions are produced in water when an acid or a base dissolves
5. How to distinguish an acid or base from how it reacts with metals, carbonates and indicators

**Part One (REQUIRES PHET):** **Focus Question**- How do we classify a solution as an acid or base from the pH scale?

To answer the focus question, follow the steps and directions below:

1. Open the “pH Scale” simulation from the pHET website and select the macro option from the opening screen.
2. Look at the scale of the left side of the animation. What does this scale measure? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Move the green sensor from the left side of the screen “into” your beaker. Once the sensor is inside the solution it can measure the pH.



1. Test all 11 solutions that are in the drag down menu at the top of the animation. Record the required observations in the on the next page.

**Table One:**

|  |  |  |
| --- | --- | --- |
| **Solution** | **pH** | **Classification**  **Acidic/basic/neutral** |
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1. Use the data in Table One to make the following claims:
   1. The pH range that is considered **acidic**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. The pH range that is considered **basic** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. What pH value is neutral? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ How did you determine this?

**Part Two (REQUIRES PHET):** What ion is responsible for making a solution acidic or basic?

1. At the bottom of the “pH Scale” animation select the micro button.
2. Notice the scale to the left has changed so that it can now COUNT the number of certain ions that are in a given volume of the solution. This is called **Concentration.** Fill in the data in Table Two by testing only the solutions noted. (Note: 6 x 10-2

**Table Two:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Solution Tested | Acid Or Base | pH | Concentration of the H3O+1 ion | Concentration of the OH-1 ion | What’s greater? The H3O+1 or OH-1 |
| Battery Acid |  |  |  |  |  |
| Vomit |  |  |  |  |  |
| Coffee |  |  |  |  |  |
| Hand Soap |  |  |  |  |  |
| Drain Cleaner |  |  |  |  |  |

1. Use the data in Table Two to make the following claims:
   1. When something is an acid it has more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ion.
   2. When something is a base it has more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ion.

**Part Three (NO PHET/NO LAB):** How do we recognize an acid or a base from its chemical formula?

Observe the table below and answer the following questions.

Table Three:

Acids Bases

HCl LiOH

HNO3 Rb(OH)2

H2SO4 Sr(OH)2

HBr

Questions:

1. What do all of the acids in the table above have in common?
2. What do all of the bases listed in the table have in common?
3. Write a general statement that summarizes what to look for when you are asked to distinguish an acid from a base.
4. Acids can also be distinguished based on what the hydrogen is paired with. Try to match each acid from Table Three above to the proper term below. You may wish to research these terms before you classify the acids.

**Binary Acids Oxyacids (Oxoacids)**

Why? Why?

1. Based on your answers to question 3 above, predict which formulas are acids, bases, ionic compounds, or covalent compounds. If it is an acid, classify it as binary or oxyacid.

|  |  |
| --- | --- |
| a. HBr | b. CuSO4 |
| c. HC2H3O2 | d. NaOH |
| e. LiOH | f. C8H18 |