**Name: Period: Seat#:** 

**Required Sections:** (Refer to R-15 for guidelines and requirements. Make note of any specific changes given by your teacher in class.)

**Prelab:** Purpose, Materials, Reagent Table, Procedures, and set up Data Tables before you get to class.

**During Lab:** Data section – Fill out your data table that is already set up from the prelab.

**Post-lab:** Calculation section, Post-Lab Questions, Post-Lab Two Pager done on separate Worksheet.

**Background**

Calcium hydroxide is an ionic solid that is sparingly soluble in water. A saturated, aqueous, solution of Ca(OH)2 is represented in equation form as shown below.

**Ca(OH)2 (s) ↔ Ca2+ (aq) + 2OH– (aq)**

The solubility product expression describes, in mathematical terms, the equilibrium that is established between the solid substance and its dissolved ions in an aqueous system. The equilibrium expression for calcium hydroxide is shown below.

***Ksp* = [Ca2+][OH–]2**

The constant that illustrates a substance’s solubility in water is called the *Ksp*. All compounds, even the highly soluble sodium chloride, have a *Ksp*. However, the *Ksp* of a compound is commonly considered only in cases where the compound is very slightly soluble and the amount of dissolved ions is not simple to measure.

Your primary objective in this experiment is to test a saturated solution of calcium hydroxide and use your observations and measurements to calculate the *Ksp* of the compound. You will do this by titrating the prepared Ca(OH)2 solution with a standard hydrochloric acid solution. By determining the molar concentration of dissolved hydroxide ions in the saturated Ca(OH)2 solution, you will have the necessary information to calculate the *Ksp*.

**Objectives**

In this experiment, you will

* Titrate a saturated Ca(OH)2 solution with a standard HCl solution.
* Determine the [OH–] for the saturated Ca(OH)2 solution.
* Calculate the *Ksp* of Ca(OH)2.

**Materials**

Chemicals

* 0.050\* M hydrochloric acid, HCL, solution (\*approximate)
* Saturated calcium hydroxide, Ca(OH)2, solution

Equipment

* Chromebook, Graphical Analysis
* Vernier wireless pH sensor
* Stir station and magnetic stir bar
* Electrode support
* Funnel and ring w/ clamp
* Two 100mL beakers
* Two 250mL beakers
* Two 50mL grad. cylinder
* 50mL burette w/clamp
* Distilled H2O
* Filter paper
* Filter funnel

**Procedure**

1. Obtain and wear goggles.
2. Obtain about 70 mL of a saturated calcium hydroxide solution. **WARNING**: *Calcium hydroxide: Do not eat or drink when using this product—harmful if swallowed. Causes skin irritation*.
3. Set up a Stir Station, ring, filter funnel, and filter paper. Filter your sample of Ca(OH)2 solution into a clean beaker. Measure out about 15 mL of the filtered solution into a 250 mL beaker. Record the precise volume of Ca(OH)2 solution that you are using.
4. Obtain about 200 mL of 0.050 M HCl solution. **WARNING**: *Hydrochloric acid solution,* HCl: *May be harmful if swallowed, inhaled, or in contact with skin. Causes skin and eye irritation*.
5. Launch Graphical Analysis. Connect the pH Sensor to your Chromebook, computer, or mobile device.
6. Set up the beaker of Ca(OH)2 solution on the Stir Station.
7. Use an Electrode Support to suspend the pH Sensor from the Stir Station as shown in Figure 1. Position the pH Sensor in the Ca(OH)2 solution, add a magnetic stirring bar, and adjust the position of the sensor so that it is not struck by the magnetic stirring bar.
8. Connect a burette to the Stir Station. Rinse and fill the buret with the 0.050 M HCl solution.
9. Set up the data-collection mode.
   1. Click or tap Mode to open Data Collection Settings. Change Mode to Event Based.
   2. Enter **Volume** as the Event Name and **mL** as the Units. Click or tap Done.
10. Conduct the titration carefully. The guidelines below are general suggestions; use your judgment in conducting the titrations to get the best results.
    1. Click or tap Collect to start data collection.
    2. Before you have added any of the HCl titrant, click or tap Keep and enter **0** as the buret volume in mL. Click or tap Keep Point to continue.
    3. Add a small amount of the titrant, up to 0.50 mL. When the pH stabilizes, select Keep. Enter the current burette reading, and then click or tap Keep Point to continue.
    4. Continue adding the HCl solution in increments that lower the pH consistently, and enter the buret reading after each increment.
    5. When you reach the equivalence point, continue adding the HCl solution until the pH value remains constant.
11. Click or tap Stop to stop data collection and view a graph of pH *vs*. volume. Dispose of the reaction mixture as directed. Rinse the pH Sensor with distilled water in preparation for a second titration.
12. Examine your titration data to identify the region where the pH made the greatest decrease. The equivalence point is in this region.
    1. To examine the data pairs on the displayed graph, click or tap any data point. As you tap each data point, the pH and volume values are displayed. **Note**: You can also adjust the Examine line by dragging the line.
    2. Identify the equivalence point as accurately as possible and record this information.
13. Repeat the necessary steps to titrate a second, and/or third, sample of the filtered Ca(OH)2 solution. **Note**: The previous data set is automatically saved.
14. Export, download, or print a graph of each titration.

**Data Table**

1. Make your own data table! Remember, you need to make sure your data table has all required elements!

| Trial | Equivalence point  (mL) |
| --- | --- |
| 1 |  |
| 2 |  |

1. Glue in a copy of your Logger Pro graph below your data table.

**Calculations** - Record any, and all, manipulation of numbers in your calculation section.

1. Calculate the [OH–] from the results of your titrations.
2. Calculate the [Ca2+].
3. Calculate the *Ksp* for calcium hydroxide.
4. Find the accepted value of the *Ksp* for calcium hydroxide and compare it with your value..