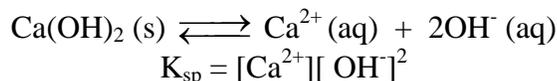


# CHM 152LL: The Solubility Product of Calcium Hydroxide

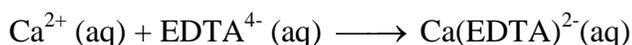
## Introduction:

Calcium hydroxide,  $\text{Ca}(\text{OH})_2$ , is considered a slightly soluble substance in water.



In this experiment, we will measure and concentration of  $\text{Ca}^{2+}$  in a saturated solution of  $\text{Ca}(\text{OH})_2$  and calculate the  $K_{\text{sp}}$ , solubility product constant, for  $\text{Ca}(\text{OH})_2$ .

We are going to obtain a saturated solution of  $\text{Ca}(\text{OH})_2$ . Then filter out the solid  $\text{Ca}(\text{OH})_2$ . The  $[\text{Ca}^{2+}]$  will be obtained through titration with a solution of  $\text{EDTA}^{4-}$  (ethylenediamine tetraacetate).  $\text{EDTA}^{4-}$  and  $\text{Ca}^{2+}$  react to form the complex ion  $\text{Ca}(\text{EDTA})^{2-}$ ,



The indicator Eriochrome Black T (EBT) changes color in the presence of  $\text{Ca}^{2+}$ . Without  $\text{Ca}^{2+}$ , it is blue; with  $\text{Ca}^{2+}$ , it forms a red complex ion.

When  $\text{EDTA}^{4-}$  reacts with all the  $\text{Ca}^{2+}$ , the indicator EBT loses its  $\text{Ca}^{2+}$  and reverts from red back to its original blue. This color change will indicate the endpoint where all the  $\text{Ca}^{2+}$  has reacted with the  $\text{EDTA}^{4-}$ . At this point, we can calculate the moles of EDTA added, the moles of  $\text{Ca}^{2+}$  it reacted with, thus  $[\text{Ca}^{2+}]$ ,  $[\text{OH}^-]$  and  $K_{\text{sp}}$ .

## Material:

125 mL beaker  
125 mL Erlenmeyer flask  
10 mL pipet  
EBT indicator solution  
Saturated  $\text{Ca}(\text{OH})_2$  solution  
\_\_\_\_\_ M EDTA solution

## Experimental Procedure

1. Pour 50 mL of saturated  $\text{Ca}(\text{OH})_2$  solution into a 125 mL beaker. Do not shake up the solution bottle. It is saturated and there is solid on the bottom.
2. Filter your  $\text{Ca}(\text{OH})_2$  solution into a dry 125 mL Erlenmeyer flask.
3. Obtain a 30 mL (or 50 mL) beaker to be used to cover up the Erlenmeyer flask when it is not in use.
4. Measure the temperature of the solution in the Erlenmeyer flask with a clean, dry thermometer.
5. Rinse a clean burette with 5 mL portions of EDTA solution.

6. Fill the burette with the EDTA solution.
7. Pipet 10 mL of the filtered  $\text{Ca}(\text{OH})_2$  solution into another clean 125 mL Erlenmeyer flask. Add 2 drops of EBT indicator.
8. Titrate the  $\text{Ca}(\text{OH})_2$  solution with the EDTA solution until the indicator changes from reddish to a pure blue. (A purplish color is not the end point, but it does show that you are close to the end point.)
9. Repeat the titration (steps 7~8) two more times.

## Experimental Results:

Temperature			
Initial Burette Reading			
Final Burette Reading			
Volume of EDTA soln			
millimoles of EDTA			
millimoles of $\text{Ca}^{2+}$			
Volume of $\text{Ca}(\text{OH})_2$ soln			
$[\text{Ca}^{2+}]$			
$[\text{OH}^-]$			
$K_{sp}$			

Average  $K_{sp}$  \_\_\_\_\_Book value  $K_{sp}$  \_\_\_\_\_

Discussion:

Questions:

1. Based on your experimental  $K_{sp}$  value, How many grams of  $\text{Ca}(\text{OH})_2$  can be dissolved in 1-L solution?

2. Regular strength TUMS® contains 500 mg of Calcium carbonate per tablet. To design an experiment so that each titration would only require ~ 20 mL of the EDTA solution we have, what a portion of the TUMS® we should use for each run?