***Introduction:*** In this lab, you will be introduced to another key concept of Stoichiometry. We will discuss the concept more fully after you have completed the lab.

The balanced reaction that you will perform is:

CaCl2 *(aq)* + Pb(NO3)2 *(aq)* 🡪 PbCl2 *(s)* + Ca(NO3)2 *(aq)*

In this equation, the physical states of the reactants and products are also given: *(aq)* means aqueous/dissolved in water, and *(s)* means solid. Solids that form in double displacement reactions involving aqueous solutions are called precipitates.

**Supplies:**

*Group Supplies*: Three 250 mL beakers or Erlenmeyer flasks; stir rod; ring stand with ring; funnel; filter paper; one 50 or 100 mL beaker; 100 mL graduated cylinder

*Shared Supplies*: wash bottle filled w/ distilled water; balances;

**Procedure:**

1. Get your supplies, clean them with tap water, and then rinse them distilled water. Dry the outsides of all materials with paper towels.
2. Acquire your chemicals and get setup:
   1. Place one of your 250 mL beakers on a balance and hit the tare (zero) button. Into this beaker, measure out approximately 3.00 grams (2.80 to 3.20 grams) of Calcium Chloride. How much did you acquire? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ grams
   2. Place one of your 250 mL beakers on a balance and hit the tare (zero) button. Into this beaker, measure out approximately 3.00 grams (2.80 to 3.20 grams) of Lead (II) Nitrate. How much did you acquire? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ grams
   3. Get one filter paper, fold it to fit in a funnel, tear one corner as instructed and find its mass. With a pencil, write the paper’s mass on the top edge of the filter paper and also record the mass here? \_\_\_\_\_\_\_\_\_\_ grams
3. Install your filter paper into a funnel as instructed. Place your empty 250 mL beaker under the funnel.
4. Dissolve each of your solids by adding 50 mL of distilled water to each beaker/flask. Swirl until the solids are dissolved. Make sure that you know which beaker contains which reactant.
5. Using your graduated cylinder, measure out twenty (20) milliliters of the calcium chloride solution. Transfer this solution into the beaker containing the lead (II) nitrate solution.
   1. What do you observe? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Carefully pour the results of this reaction through the filter making sure not to let the filter overflow. Swirl you beaker to make sure all precipitate is washed into the filter. The solution that has flowed through the paper is called the ***filtrate***.
7. After all the filtrate has passed through, place the now empty lead (II) nitrate beaker under the funnel. Measure out another fifteen (15) mL of the sodium chloride solution into the graduated cylinder. Pour this into the filtrate beaker. Did you observe the chemical reaction again? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. If a reaction occurred, follow the next step.
   2. If no reaction occurred, skip to procedure step **10.**
8. Filter the precipitate you produced again. Make sure to rinse with distilled water to get all the precipitate.
9. After it is done filtering, switch your empty beaker with the “new” filtrate beaker. Measure out another **ten (10) mL** of the sodium chloride solution into a graduated cylinder. Pour this into the filtrate beaker. Did you observe a chemical reaction? \_\_\_\_\_\_\_\_\_
   1. If a reaction occurred, repeat steps 8 and 9.
   2. If no reaction occurred, skip to procedure step **10.**
10. Carefully remove your filter paper and precipitate from the funnel. Place the filter paper in a small beaker and tape a strip of paper with the names of your group members and period number on it. Place the small beaker/filter paper in the drying oven according to your teacher’s instructions.
11. Approximately how much of the Calcium chloride solution was remaining? \_\_\_\_\_\_\_\_\_\_\_\_ mL
12. Clean up your equipment (the remaining liquids can be washed down the drain with plenty of water) and return them to the locations where you acquired them.
13. Answer the questions for day 1 below.

***Day 1 Questions:***

1. How much of the Lead (II) Nitrate was remaining? \_\_\_\_\_\_\_\_\_
   1. Explain how you came to this conclusion?
2. Review the definitions for “Limiting Reactant” and “Excess Reactant”. In this reaction…
   1. The Limiting Reactant is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. The Excess Reactant is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. If you repeated the experiment but used 4.0 grams of the reactant Calcium Chloride, how would the results of today’s work be different?

***Day 1 Homework:*** *This must be done prior to working on the day two activities.*

1. Use the initial mass of the limiting reactant (you have to choose from procedure step 2a or 2b) to predict how much of the precipitate (PbCl2) can be made by doing this reaction. Show your work.

***Day 2:***

1. Remove your beaker/filter paper from the drying oven (***Caution, it will be warm***). Allow it to cool to room temperature.
2. Use a balance to find the new mass of the filter paper and precipitate. What is this mass? \_\_\_\_\_\_\_\_\_\_\_\_ grams.
3. What is the mass of only the precipitate? \_\_\_\_\_\_\_\_\_\_\_ grams.
4. Dispose of the filter paper as instructed by your teacher.

***Day 2 Questions:***

1. Compare your results in procedure step 20 to what your predicted value in procedure step 17. Did you collect the same amount, more, or less than the stoichiometry calculation predicted? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. If you collected more than the stoichiometry predicted, explain how this is possible.
   2. If you collected the same amount as stoichiometry predicted, congratulations you have done really awesome!
   3. If you collected less, what could be a cause for you to get a lesser amount than what stoichiometry predicted? (“I messed up” is not an acceptable or complete answer!)
2. What have you have learned about doing laboratory experiments through this lab?