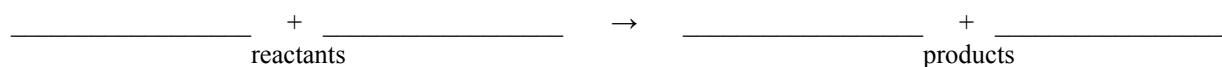


**Introduction:**

The law of conservation of mass is one of the few pieces of hard evidence behind the original theory of atoms. This lab will attempt to demonstrate this law. One of the postulates of Dalton's Atomic Theory states that chemical reactions are simply a rearrangement of atoms to make new molecules, so it should make sense that the mass of the original arrangement (reactants) would have the same mass as the final rearrangement (products). The reaction in this lab will be between two "salts." (Salt is a general term for any ionic compound, that is to say, a compound made out of a metal and a nonmetal.) The reactant salts are potassium iodide, and lead(II) nitrate. The product salts formed are yellow lead(II) iodide and white potassium nitrate.

**PRELAD:**

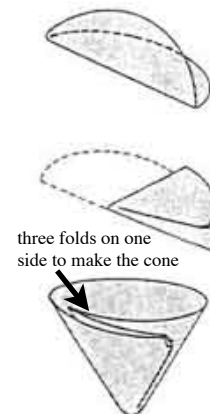
1. Make a data/results table using excel. (Hint: there should be 13 rows in your table.)
2. What are the measurements and calculations that should be compared in order to verify the law of conservation of mass?
3. Read the New Concepts, Skills & Ideas questions on page 3 and work on the questions (in pencil). You will continue to work on these questions while working on the lab.
4. Re-read the introduction and then write the equation in words that represents the chemical reaction that occurs in this LAD.

**General Procedure: Day # 1 Goggles are not optional.**

1. Using a permanent marker, write your initials on a clean 100 ml beaker, and determine the mass of this 100 ml beaker. Then use the tare button to measure more than 0.5 g but less than 1 g of lead nitrate into one beaker, and an equal mass of potassium iodide into the other beaker (no need to weigh the 50 ml beaker itself). While the amounts do not have to be any particular amount, it is important that they are nearly the same (within 0.05 would be great) and to record whatever is the exact amount. Learn to be efficient in your massing technique by using the scoop and the "tap-tap" method **as demonstrated in class**.

**ALERT, ALERT:** It is important to avoid contaminating the reactants – do not move a stirring rod or scoop from one beaker to the other without rinsing it off.

2. Dissolve the salts each in about 15 ml of distilled water. (No need to accurately measure or record this amount – just approximate it using the lines on the side of the beaker.) Set the beakers on the lab bench and swirl **as demonstrated in class**. The lead (II) nitrate may be a bit pesky, don't worry if every last crystal does not dissolve.
3. Try to avoid using too much water for the next several steps or it will take you far too long to filter. Once the salts have dissolved, pour the smaller beaker into the larger beaker. Rinse the "emptied" beaker with a wee bit more deionized water and add this rinse water to the "full" beaker. Swirl (DO NOT SPILL) the beaker containing the two solutions. Observe carefully for evidence of a possible reaction.
4. Use a pencil to write your initials on the edge of a piece of filter paper and then mass the filter paper. Fold the filter paper into quarters as demonstrated in the diagram to the right. Be sure the folds are creased well and tightly flattened down, and wet the paper with deionized water, after placing it in the funnel. The moisture will hold the paper in place, and then you are ready to start filtering.
5. Put your name and period # on a clean dry 125 ml flask, then determine its mass. Put the flask below the funnel to catch the filtrate. Raise or lower the ring on the ring stand to be sure the stem of the funnel is just inside the flask, but will not get submerged by the *filtrate*. Pour the liquid into the filter paper slowly after the liquid starts to drain through, pour the solid into the paper. The entire contents may not be able to fit into the filter paper at one time, be patient and be sure not to pour the solution near the top of the filter paper. After getting as much of the solid as possible out of the beaker and into the filter paper, use the squirt bottle to rinse the beaker, pouring the rinse water into the filter paper. **Learn how to tip and squirt at the same time to facilitate getting most of the solid out of the beaker as demonstrated in class.**
6. Gently rinse the solid in the filter paper with a wee bit more wash water to wash all dissolved particles through the paper and not leave any of those dissolved particles behind on the wet precipitate or wet filter paper.
7. Remove the filter paper and place it into the 100 ml beaker. Put the filter paper/beaker and the 125 ml flask with the filtrate on the tray provided on the center lab bench. They will be placed in the oven overnight to dry.



**General Procedure: Day # 2**

Determine the mass of the dried filter paper with the yellow lead(II) iodide on it. Determine the mass of the 125 ml flask with the dried potassium nitrate in it.

**Disposal & Clean-up:**

Return the vials with the original samples to the tray leaving any unused salt in the vials.

After day 2, the salt in the 125 ml flask and the yellow salt in its filter paper should be placed on the tray marked on the center lab bench. All other glassware should be returned to the trays on your lab bench.

**Processing the Data / Calculations**

1. Calculate the mass of each of the two products; lead(II) iodide (this is the yellow stuff on the filter paper) and potassium nitrate (this is the stuff in the flask). A simple subtraction of the containers they were in will take care of this calculation.
2. Calculate the sum of the total mass of the reactants and calculate the sum of the total mass of products.
3. Calculate any difference between them. (Take note as to which is lower, the reactants or the products.)
4. Calculate % error, using the sum of the reactants as the theoretical value, and the sum of the products as the experimental value.

Report the mass of each of both reactants and the mass of each of both products to the class data table using the data entry page on the website.

**Post-LAD Questions**

1. The remains on the filter paper:
  - a. What was the color of the solid lead iodide on the filter paper?
  - b. Filter paper obviously has holes in it, what can you conclude about the size of the holes in the paper compared to the size of the solid yellow particles stuck on the paper?
2. When ionic compounds dissolve, they dissociate (separate into parts). So on Day 1 when you dissolved lead(II) nitrate and sodium iodide, how did this help them react and form the products?
3. The remains in the flask:
  - a. What color was the filtrate as it was draining into your flask on day 1? What color should it be?
  - b. On day 2, was there solid in the flask? Where did the solid come from?
  - c. The color of potassium nitrate is white (in dissolved form potassium nitrate is colorless). Was there any yellow in your flask? If you did not rip or go over the top of your filter paper, where did the yellow come from? If the color of the filtrate that went through the paper was colorless, what can you say about the color of dissolved lead(II) iodide compared to solid (undissolved) lead(II) iodide?
  - d. What can you conclude about the size of the holes in the paper compared to the size of the undissolved solid particles, the size of the water molecules and the size of the dissolved particles that went through the filter paper?
4. Why was it not important to know the exact amount of water that the salts were dissolved in, and also not necessary to measure the amount of extra squirt water used to rinse the beakers?
5. What two changes give evidence that a chemical reaction occurs in this lab?
6. State the law of conservation of mass.

**Error Discussion**

7. Comment on the accuracy and precision of the class data.
8. Is there any pattern to the error with the results? Any pattern to the error with the results implies systematic error.
9. Suggest a source of error that could make the mass of the products larger, and suggest a source of error that could make the mass of the products smaller.
10. Do the class results seem to verify the law of conservation of mass?

**New Concepts, Skills & Ideas**

Each one of these excerpts is from the lab. Read the excerpt and its corresponding question, so that you can be thinking of the answers while performing the lab.

1. "...Using the permanent marker, write your initials on clean, dry 50 ml, 100 ml beakers and an 125 ml flask. Determine the mass of all three containers." -Why might it be important to write your name on the beaker **before** massing?
2. "100 ml beaker." -Do the gradations on the side reach 100 ml? Why might it called a 100 ml beaker?
3. "0.75 g of sodium iodide into the other beaker. While the amounts do not have be exactly the amount directed, what is the most important issue and why?
4. "...Be sure and clean the scoop or stirring rod between different chemicals." -Why might it be necessary to clean the scoop or stirring rod between chemicals?
5. "...Dissolve the salts each in about 20 ml of deionized water." - How much is meant by the word "about"?
6. "...20 ml of deionized water." -What is deionized water? Where do you get it? How do you refill the squirt bottle if it becomes low? Why might it be important to use deionized water instead of tap water?
7. "...gently heat the solution(s)" -What is meant by the word gently? Should you let the solution get hot enough to boil?
8. "...rinse the 'emptied' beaker with a bit more deionized water and add this rinse water to the "full" beaker." -Why is it important that all the wash water gets into the "full" beaker? What's in the wash water? Do you know that the rinse bottle is a lab tool and if you use it in an inappropriate way, you may be removed from the lab, and perhaps from the class?
9. "...Swirl (DO NOT SPILL) the beaker containing the two solutions." -What is meant by the term "swirl", and why is it so important not to spill? Why might it be better to swirl rather than using the stirring rod?
10. "...Wet the filter paper with squirt water so that it will stay in the funnel." -Why is it helpful to wet the paper before adding the material to be filtered?
11. "...Put the 125 ml flask below the funnel to catch the filtrate. Be sure the stem of the funnel will not get submerged by the filtrate." -Why is it a good idea to not have the funnel stem "dragging" in the filtrate?
12. "... Pour the liquid into the filter paper slowly after the liquid starts to drain through, pour the solid into the paper. The entire contents may not be able to fit into the filter paper at one time, be patient and be sure not to pour the solution above the top of the filter paper." -Why is it important not to pour the entire lump of solid into the filter paper in one big whoosh?
13. "...Gently rinse the solid in the filter paper." -What are you trying to rinse off the solid and the filter paper?