

Laboratory Exercise: Synthesis of Zinc Iodide

In this exercise we will synthesize the compound Zinc Iodide from the elemental substances Zinc and Iodine. Our eventual purpose will be to determine the chemical formula of this compound; Zn_xI_y , where x and y represent the relative numbers of atoms of each of these elements in the compound. However, our immediate goal will be to reconfirm the Law of Conservation of Mass and to determine the elemental composition, %Zn and %I, of the compound.

Zinc is a reasonably active metallic substance that will readily react with any of the Halogens. Iodine is a shiny purple crystalline solid that is typically sold as an alcoholic tincture.

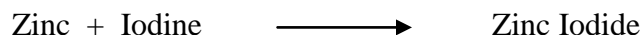


(Zinc)

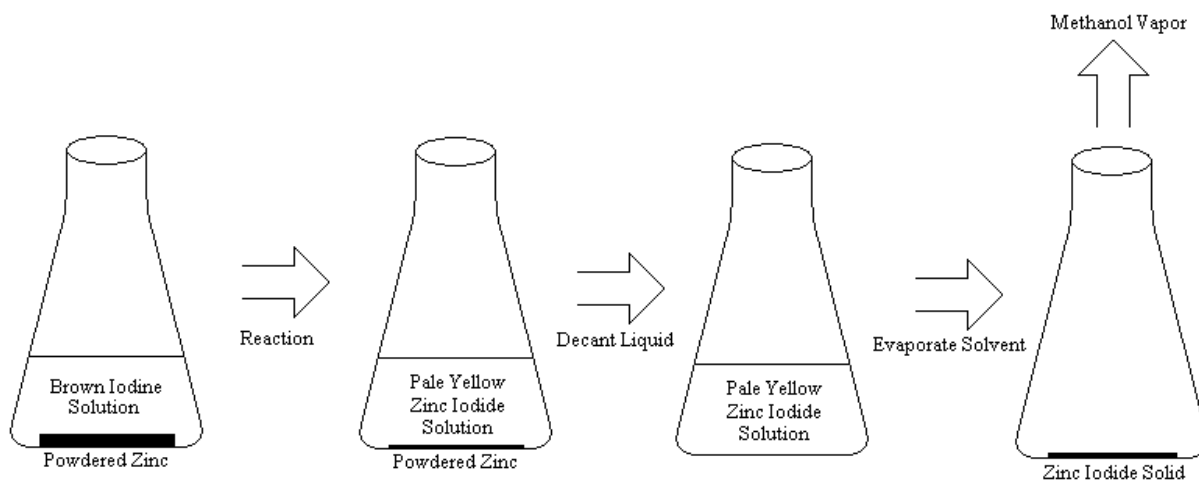


(Iodine)

These elements, Atomic Numbers 30 and 53 respectively, will react to form a white powdery solid. This solid, Zinc Iodide, is very hygroscopic (absorbs Water from the Air) and is very soluble in Water.



Powdered Zinc and crystalline Iodine will be mixed with a solvent, Methanol, in an Erlenmeyer flask. The Iodine will dissolve in the solvent and then subsequently react with the Zinc. The resulting Zinc Iodide will remain in solution. Because the Zinc is used in excess, some powdered Zinc will remain at the bottom of the flask even after all the dark brown color of the Iodine has cleared. Zinc Iodide will form a pale yellow solution in Methanol. The solution can be poured off the remaining Zinc and the Methanol subsequently evaporated to give pure Zinc Iodide as a solid.



By weighing the amount of Zinc and Iodine we start with and then weighing the excess Zinc and Zinc Iodide formed, we should be able to confirm the Law of Conservation of Mass. Also, by knowing how much Zinc and Iodine are required to form the compound, we can determine the elemental composition of Zinc Iodide.

Procedure

All your measurements must be made to the correct number of significant figures and must have the unit of measurement indicated.

Some Precautions should be observed during this lab. Iodine can cause skin burns. Breathing Zinc dust should be avoided. Methanol is flammable and toxic. Work in the Fume Hood when directed to do so.

1. Obtain and weigh a 125 mL Erlenmeyer Flask.
2. Weigh 2.0g 20 mesh granular Zinc metal on glazed weighing paper. Add this to the Erlenmeyer Flask.
3. Weigh 2.0g of Iodine crystals on glazed weighing paper. Add this to the Erlenmeyer Flask.

Working in a Fume Hood:

4. Add 25 mL Methanol to the flask. Put an aluminum foil cap on the flask.
5. Place the flask on the hot plate in a fume hood. Add a couple of toothpicks to the flask to help promote bubble formation during the heating of the solvent. Adjust the temperature to a low level and bring the Methanol to a boil. Swirl the flask occasionally.
6. After 15-20 minutes the dark Iodine color should have disappeared and been replaced by the pale yellow color of the Zinc Iodide.
7. Weigh a clean, dry 250 mL Beaker.
8. When the reaction is complete, remove the Flask from the hot plate. Remove the Aluminum cap. Using a stirring rod to guide the solution, decant the warm liquid into the Beaker, leaving the unreacted Zinc behind. Add 5 mL Methanol to the flask, swirl and allow the Zinc to settle. Decant the liquid into the Beaker as before. Repeat the washing once more.
9. Place the Erlenmeyer on the hot plate to dry the remaining Zinc metal. When the metal is dry, re-weigh the Flask.
10. Place the Beaker on the hot plate, add a couple of toothpicks and heat the solution to evaporate the solvent. Evaporate the solvent and allow the solid to continue to heat until dry.
11. Re-weigh the Beaker containing the Zinc Iodide.

Data Sheet

Observations

Zinc Metal:

Iodine Crystals:

Masses

125 mL Flask = _____

250 mL Beaker = _____

Zinc Powder = _____

Iodine Crystals = _____

Observations

During Reaction:

Masses

Flask & Zinc = _____

Beaker & Product = _____

Observations

Excess Zinc:

Zinc Iodide:

Name: _____

Date: _____

Signature: _____

Data Analysis

1. Calculate the Total Mass of Zinc and Iodine before the Reaction.
2. Calculate the Total Mass of the excess Zinc and Zinc Iodide after the Reaction.
3. Is this data consistent with the Law of Conservation of Mass? Explain.
4. Calculate the Mass of Zinc that reacted with the Iodine.
5. Determine the Percentage Zinc and Percentage Iodine in the Zinc Iodide.

Post Lab Questions:

1. What are the chemical formulas of elemental Zinc and Iodine?
2. Use an appropriate reference source to determine the melting points of Zinc, Iodine and Zinc Iodide.
3. How would the % Zn change if some product is lost during the washings? Be specific.
4. Why have we capped the flask with Aluminum Foil during this reaction? Why have we not simply put a Rubber Stopper in the flask to cap it?
5. Why have we heated the reaction mixture during the reaction?