

# Chemistry Unit 5 - Empirical Formula Lab

## Introduction

In this experiment, a measured amount of zinc will be allowed to react with hydrochloric acid, HCl. One of the reaction products will be zinc chloride. You will obtain data that will enable you to determine the empirical formula of zinc chloride,  $Zn_xCl_y$ . Empirical means “based on experimental evidence”.

## Procedure - Day 1

1. Find the mass of a clean, dry, labeled beaker (to the nearest 0.01g)
2. Add the number of zinc pieces as instructed by your teacher. Find the mass of the beaker and zinc to the nearest 0.01g.
3. Add 50 mL of 3M HCl. Record your observations.
4. Place your labeled beaker on one of the hot plates in the fume hood.

## Procedure - Day 2

5. Set up a bunsen burner, ring stand, ring and wire screen so you can heat the beaker.
6. Zinc chloride absorbs water readily from the air. In order to remove the water, heat the beaker and contents for a minute or two. As long as the contents appear to bubble, water is evaporating. However, when the contents begin to smoke, stop heating *immediately*. Remove the beaker (use tongs, it's hot) and allow it to cool on the metal base of the ring stand. Note how the zinc chloride solidifies from the molten state.
7. When the beaker is cool enough to handle, find the mass of the beaker and zinc chloride. (1)
8. Repeat steps 6 and 7. (2)
  - a. If this second mass is more than 0.02g lighter than the previous mass, repeat steps 6 and 7 once more. (3, if needed)
  - b. If the mass is unchanged, wash out the contents of the beaker as instructed by your teacher.

## Data

Mass of labeled beaker \_\_\_\_\_ g

Mass of beaker + zinc \_\_\_\_\_ g

Mass of beaker + zinc chloride (1) \_\_\_\_\_ g

Mass of beaker + zinc chloride (2) \_\_\_\_\_ g

Mass of beaker + zinc chloride (3, if needed) \_\_\_\_\_ g

Observations



## Calculations

1. Determine the mass of zinc reacted.
2. Determine the mass of zinc chloride (guess which one you should use).
3. Determine the mass of chlorine in the zinc chloride.
4. Determine the number of moles of zinc, then the number of moles of chlorine.
5. Determine the ratio:  $\frac{\text{moles Cl}}{\text{moles Zn}}$

## Conclusion

1. Since you believe that atoms combine in simple, whole-number ratios, what do you think is the likely ratio:  $\frac{\text{atoms Cl}}{\text{atoms Zn}}$  ?
2. Based on your findings, what is the empirical formula of zinc chloride?
3. Suppose that you had not driven off all the water from the zinc chloride. How would this error have affected the ratio in calculation 5? Show evidence for your prediction by repeating calculations 2 – 5 using the next to the last value for the mass of the beaker and zinc chloride.