# *STOICHIOMETRY: THE MASS AND MOLE RELATIONSHIPS IN A CHEMICAL REACTION*

**Prelab (done in lab)**
In order to complete the calculations in this laboratory, it is required that you calculate the *molar mass* (also known as the *formula weight or molecular mass*) for three inorganic compounds. As always, please prepare your lab notebook by entering the title of the lab, your name, the "*Purpose,*" date, and your lab partners name. Make a table in your notebook similar to the one below and complete the information; enter this information under the "*Prelab*" heading after the "*Purpose*" heading:

| **Inorganic compound** | **Name of this compound** | **Cation in this compound** | **Anion in this compound** | **Molar mass (g/mol)** *show your work in notebook* |
|---|---|---|---|---|
| $Na_2CO_3$ | | | | |
| $NaHCO_3$ | | | | |
| NaCl | | | | |

Next you will need to write out the chemical reactions under a heading of "**Chemical Reactions**." The chemical reactions are written below in words. In your prelab you will write the chemical reactions as balanced chemical equations, complete with the physical states [(s) – for solids, (aq) – for aqueous, (l) – for liquid, and (g) – for gas].

***Example reaction***: 2 Al (s) + 6 HCl (aq) → 2 $AlCl_3$ (aq) + 3 $H_2$ (g)

***Reaction 1***: Solid $Na_2CO_3$ is reacted with aqueous hydrochloric acid to form aqueous sodium chloride, liquid water and carbon dioxide gas. Balance this chemical reaction.
***Reaction 2***: Solid $NaHCO_3$ is reacted with aqueous hydrochloric acid to form aqueous sodium chloride, liquid water and carbon dioxide gas. Balance this chemical reaction.

***NOTE: This lab uses HCl, a strong acid. Avoid skin contact and clean up any spills immediately. The HCl is dispensed in dropper bottles to minimize spillage, gloves are NOT recommended.***

**PURPOSE**
The purpose of this lab activity is to investigate a chemical reaction with specific attention paid to the relationship between the mass of a substance/reactant and the moles of this substance/reactant. This relationship is generally referred to as the reaction ***stoichiometry***. As a part of learning about reaction stoichiometry, you will also be introduced to balanced chemical reactions. The lab activity will introduce you to the use of the Bunsen/Tirrill burner and another opportunity to hone your skills in using the top-loading balance (***PLEASE clean up any spills***). It is again important to document all of your laboratory activities in your lab notebook.

**INTRODUCTION**
You will be given one sample labeled **A** or **B**. This sample is either sodium carbonate ($Na_2CO_3$) or sodium bicarbonate ($NaHCO_3$). The goal of the experiment is to determine which compound you have been given. Both compounds react with HCl to form NaCl, water, and carbon dioxide, but they form different amounts of NaCl. You can calculate the expected grams of NaCl using stoichiometry and the balance chemical reaction.

**EXPERIMENTAL**
- Measure the mass of a 250 mL Erlenmeyer flask to the nearest 0.01 g. ***Record the mass in your lab notebook.*** Place approximately 2 g of your unknown solid (A or B) in the flask. You can use any amount of solid between 1.8 g and 2.2 g, but you need to know the exact mass of solid that you use. Record the combined mass of the flask and solid to the nearest 0.01 g ***in your lab notebook.***
- Return to your lab bench with your flask and unknown solid. Slowly add dropwise 3 M HCl into the flask containing the unknown solid until no more $CO_2$ (no more bubbles) is given off. Swirl the sample while adding HCl to make sure the contents is well mixed.
- Place the flask on a ring stand as shown in lab-lecture. Gently heat the mixture with a small flame until only dry solid remains. It is possible that some material will splatter out of the flask if you heat too quickly, so be cautious.
- Allow flask and NaCl to cool for ~5 minutes; when you can pick it up with your hand, it is cool enough. Determine the mass of the flask to the nearest 0.01 g and record your data in your lab notebook.
- Clean and return all glassware to your drawer.
- Once you have entered all data into your lab notebook, cleaned and rinsed all glassware with RO water, returned glassware to your drawer, then request a "Reporting Sheet."

**WASTE MANAGEMENT**
None of the products generated in today's experiment are toxic and therefore all waste may be poured into the sink.