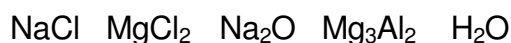


Laboratory 4

Gravimetric Analysis and Nomenclature

Nomenclature: In the chemical laboratory chemicals are named in a systematic manner. The periodic table can be used to assist us in learning most of the names of binary compounds or compounds that consist of two types of elements. A staircase line divides the periodic table. On the left are the metals and on the right are the non-metals. Metals want to lose electrons to become positive ions and have the electron configuration of the Noble Gases (group VIII). Non-metals want to gain electrons to form negative ions in order to have the same electron configuration as the Noble Gases. Group I metals form +1 ions, Group II metals form +2 ions, Aluminum (Group III) forms a +3 ion. Group VII (Halogens) form -1 ions, Group VI form -2 ions, and Group V forms -3 ions. Binary combinations of a metal and a non-metal are called ionic compounds or salts in chemistry. They combine in such a way as to neutralize their ionic charges. The total positive charges must equal the total negative charges. For example:



Some ionic compounds are made up of polyatomic ions. These ions are usually negative and have the following special names.

Acetate	$\text{C}_2\text{H}_3\text{O}_2^-$	Cyanide	CN^-
Ammonium	NH_4^+	Hydroxide	OH^-
Bicarbonate	HCO_3^-	Permanganate	MnO_4^-
Carbonate	CO_3^{-2}	Phosphate	PO_4^{-3}
Perchlorate	ClO_4^-	Nitrate	NO_3^-
Chlorate	ClO_3^-	Nitrite	NO_2^-
Chlorite	ClO_2^-	Sulfate	SO_4^{-2}
Hypochlorite	ClO^-	Sulfite	SO_3^{-2}
Chromate	CrO_4^{-2}	Thiosulfate	$\text{S}_2\text{O}_3^{-2}$
Dichromate	$\text{Cr}_2\text{O}_7^{-2}$		

They combine with metals (or non-metals as in the case of ammonium, NH_4^+) to form ionic compounds or salts to achieve an overall neutral charge.

The names of ionic compounds or salts follow the rules below.

1. Groups I, II or III metals that combine with non-metals begin with the metal name followed by the non-metal ending in -ide. When these metals combine with polyatomic ions they begin with the metal followed by the name of the polyatomic ion.

Examples:	NaCl	sodium chloride
	MgBr_2	magnesium bromide
	KMnO_4	potassium permanganate
	$\text{Ca}_3(\text{PO}_4)_2$	calcium phosphate

2. The transition metals may form several positive ions. When they are used in a compound they begin with the name of the metal followed by the Roman numeral of the charge on the metal ion in parenthesis and followed by the non-metal -ide ending as in rule 1 or with the name of the polyatomic ion. Instead of the Roman numerals, the highest possible charge ion for the metal may use the suffix -ic and the lowest possible charge ion the suffix -ous.

Examples:	FeCl_2	iron(II) chloride or ferrous chloride
	FeCl_3	iron (III) chloride or ferric chloride

3. Binary acids (compounds with an "H" in front) are named starting with hydro- followed by the non-metal ion's name ending in -ic. For example, HCl is hydrochloric acid.
4. Acids using polyatomic ions ending in -ate change their ending to -ic. For example, H_2SO_4 is sulfuric acid, H_3PO_4 is phosphoric acid. Acids using polyatomic ions ending in -ite change their ending to -ous. For example, HNO_2 is nitrous acid, H_2SO_3 is sulfurous acid. Examples of salts are $\text{Ba}(\text{NO}_2)_2$ as barium nitrite and $\text{Sn}(\text{SO}_3)_2$ as tin(IV) sulfite.

Gravimetric Analysis: Gravimetric analysis refers to the use of weights (gravity) to determine how much of a certain material is in a sample. We are going to use the mass of a solid formed from a chemical reaction to determine the amount of the element barium is in an unknown solid sample.

Procedure

1. Measure about 2 g of the unknown solid into a 250 mL beaker. Record the exact mass on your lab report. Also, determine the mass of a dry filter paper and a watch glass .
2. Add about 50 mL of water to dissolve the unknown Barium solid.
3. Add about 20 mL of the dilute (1M) sulfuric acid (H_2SO_4) to the solution. Notice the precipitate (solid) that forms. **Note:** If you try to filter the solid through directly after it forms you will find that it is very fine and a portion of it will go through the filter paper. Digest the precipitate by gently heating for about 30 minutes.
4. Use the Buchner filter set up shown in Unit 2. Add five (5) grams of filter aid (sufficient to cover the filter paper in the Buchner funnel) to help separate the solid from the liquid. Turn on vacuum before, then drizzle sample into the Buchner filter.
5. Remove the filtered solid along with the filter paper and place them in the pre-weighed watch glass.
6. Place filtered solid and filter paper on the watch glass and place in oven for 30 minutes or until dry. Be careful not to overheat and scorch the paper or

Lab 4 Nomenclature and Gravimetric Analysis

the filtrate. If time does not allow, place watch glass and sample in your desk drawer to dry until the next lab period.

7. Cool the beaker by letting it sit for about 15 minutes.
8. Determine the combined mass of the beaker, filtrate, and filter paper and record on your lab report. Dispose in an appropriate waste container.
9. Calculate the % barium using the following formula:

$$\frac{137.327 \text{ g Ba}}{233.3906 \text{ g BaSO}_4} \times \frac{? \text{ g BaSO}_4}{? \text{ g Unknown}} \times 100\% = ? \% \text{ Ba in Unknown}$$

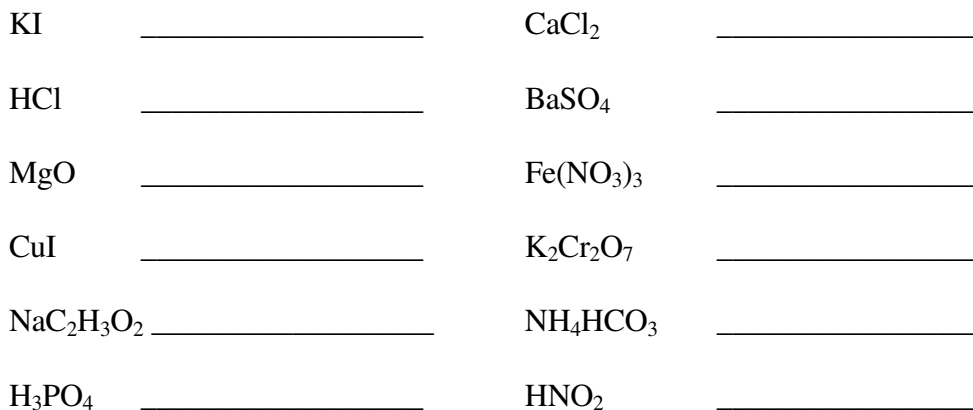
10. What was the percent error in your experiment?

$$\%Error = \frac{Actual - Theoretical}{Theoretical} (100)$$

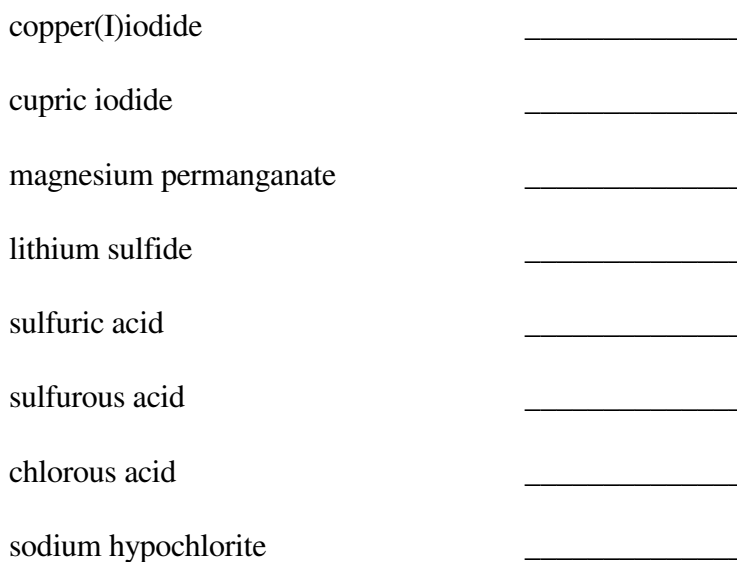
Prelab Exercises Lab 4

Name			
Section		Date	

1. Name the following compounds:



2. Write the formula for the following:



Prelab (Continued)

3. Complete the nomenclature handout provided by your instructor.

Report for Lab 4

Name			
Section		Date	

1. mass of unknown	
2. mass of filter paper	
3. mass of filter aid	
4. mass of watch glass	
5. mass of dried filtrate, beaker and filter paper	
6. mass of ppt	
7. % barium in unknown	

Show all calculations here:

Lab 4 Nomenclature and Gravimetric Analysis

Equipment and Materials:

Unknown Barium compounds 2g per group

1M H₂SO₄ 20 mls per group

Filter Aid 5g per group

Buchner funnels and filter paper

Aspirator hoses