Name: _____

Lab Instructor:_____

PREPARATION FOR CHEMISTRY LAB: PRECIPITATION

Solubility rules are given in your textbook.

1. Aqueous solutions of aluminum nitrate, barium acetate, and lithium sulfate are available. Which two of these solutions would form a precipitate when mixed together? Write the name and formula for the precipitate that forms.

2. A 51.9 g sample of potato chips was found to be 3.56% water and contain 375 mg of salt (NaCl).

   What is the dry weight (water not included) of the sample?

   Calculate the percent, by mass, of salt in the sample based on the fresh weight (water included) of the sample.

   Calculate the percent, by mass, of salt in the sample based on the dry weight of the sample.

3. 4.27 grams of precipitate is produced when an excess of silver nitrate is added to an iron(III) chloride solution.

   Write the balanced equation for the reaction that occurs when aqueous solutions of silver nitrate and iron(III) chloride are mixed together.

   How many grams of iron(III) chloride were present in the original solution?

PRECIPITATION

Precipitation: In chemistry, precipitation is the process of removing one or more substances from a solution by adding reagents so that a precipitate (a solid that forms in a solution during a chemical reaction) forms.

INTRODUCTION

Gravimetric analysis is a classical method that is widely used for quantitative work. It simply means measurement by weighing, as opposed to volumetric analysis - the analytical method used in titration where one solution is used to analyze another. Methods, like gravimetric analysis, survive because there are practical applications. In this laboratory you will determine the salt (NaCl) content of soda crackers by precipitating white, insoluble silver chloride from a sodium chloride solution by mixing it with a solution of silver nitrate.

$$NaCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + NaNO_3(aq)$$

Food manufacturers are required by law to give the salt content of foods on the labels of their products because hypertensives, among others, have to control salt in their diet.

Read and/or review Sections 5-5 (pay particular attention to Table 5-3), 7-1, and 7-2 in your textbook. Be sure to bring your textbook to lab with you.

PROCEDURE:

Make written observations as you do this experiment.

Before we can do the analysis, the crackers must be *dry ashed*, during which protein and carbohydrate are destroyed. Sodium chloride and other salts remain in the ash and are extracted with water. Dilute nitric acid is added to prevent the precipitation of phosphates and carbonates. A slight excess of silver nitrate solution is added to cause the reaction given above to occur and to be sure that precipitation is complete.

The mixture is boiled to coagulate the precipitate (ppt) and then filtered. The ppt is washed, dried in an oven, and then weighed.

Part 1: Dry Ashing

Weigh a porcelain evaporating dish and crumble about 5 soda crackers into it.

Weigh the sample.

Put the dish and sample in an oven (180°C) for about 10 min. Remove from the oven and allow to cool on an iron ring that is clamped to a ring stand. Get the dry weight of the sample.

Take the dish and ring stand over to the hood. **Do not remove from hood until you are ready to add the water.** Heat the dish strongly with a burner until the sample is reduced to a charred residue. Once charred, remove the heat source and let the dish cool on the ring stand for about 15 minutes. Gently break up and grind any lumps of charred residue with a pestle.

Transfer the residue to a 250 mL beaker, add 50 mL of water, and stir.

Filter this slurry. Collect the filtrate (the liquid) and save it in another 250 mL beaker.

Part 2: Precipitation of Silver Chloride

Add 5 mL of 6 M HNO_3 to the filtrate in the beaker. Next add 15 mL of 0.2 M silver nitrate. Both solutions are in pre-set pump dispensers.

Bring the beaker's contents to a gentle boil on a burner. Keep a stirring rod in the beaker to reduce the chance of BUMPING! Boil for about a minute. If a **milk-curd like** ppt is present, continue. If not, add a few mL of dilute nitric acid and boil some more.

Separate the **curd-like ppt** by filtration. Use a wash bottle to move any particles of ppt on the walls of the beaker into the filter. Test the filtrate by adding a few drops of silver nitrate solution from a dropper bottle. If the solution remains clear, continue. IF THE SOLUTION BECOMES MILKY AGAIN, add another 15 mL of silver nitrate solution, boil the filtrate and collect the ppt in the same filter as before.

Wash the ppt twice with a few mL of water from a wash bottle. After all the water has drained from the filter, carefully remove it from the funnel and put it on a pyrex watch glass. Dry the product on a hot plate set at low temperature to speed drying. Break up lumps with a stirring rod. Allow the dry product to cool to room temperature before weighing it.

Discard the paper and product in the chemical waste container.

DATA AND ANALYSIS SHEET: PRECIPITATION

Name: _____

Date _____ Lab Partner _____

Part 1:

Mass of dish: _____

Mass of dish and fresh sample: _____(wet weight)

Mass of dish and dry sample: _____(dry weight)

Calculate the percent, by mass, of water (moisture) in the sample.

Part 2:

Mass of the filter paper: _____

Mass of the filter paper and cool, dry ppt: _____

Mass of ppt: _____

Chemical formula of ppt: _____ Molar mass of ppt: _____

Calculate the number of moles of ppt obtained.

Write the balanced equation for the reaction which produced this ppt.

Calculate the number of moles of sodium chloride which produced this ppt.

Molar mass of NaCl: _____

Calculate the number of grams of sodium chloride present in the sample.

Calculate the percent, by mass, of NaCl in the fresh sample.

Calculate the percent, by mass, of NaCl in the dry sample.

NaCl content of crackers based on label information: _____

OBSERVATIONS, REPORT AND CONCLUSIONS

1. Describe the product from ashing procedure.

2. Describe the precipitate obtained.

3. Compare and contrast your experimental result with label information.

4. Explain why reporting the percentage of NaCl in crackers on a dry weight basis is preferred to the percentage of NaCl on a wet weight basis.

5. How are the amount of silver chloride produced and the amount of sodium chloride in the sample related?

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QUESTIONS ABOUT THIS LAB: PRECIPITATION

1. The filtrate containing chloride ions (after dry ashing) is acidified with dilute nitric acid to prevent the precipitation of silver carbonate and silver phosphate. Why is this important?

2. Solutions containing which of the following common anions **would** form a precipitate when mixed with a silver nitrate solution? If the compound formed is slightly soluble, consider it to be insoluble.

   chloride, bromide, iodide, perchlorate, acetate, sulfate, carbonate, phosphate, sulfide, hydroxide

3. Aqueous solutions of calcium nitrate and sodium carbonate are mixed together. Write the complete, balanced equation for the reaction that occurs. Does a precipitate form when these two solutions are mixed together? If so, what is the name and formula of the precipitate?

   If 1.74 grams of precipitate are produced when these two aqueous solutions are mixed together, how many grams of calcium nitrate were present in the original solution? You may assume that calcium nitrate was the limiting reactant.