THE MIXTURE SEPARATION CHALLENGE

LEARNING TO BE AN ANALYTICAL CHEMIST

INTRODUCTION:

One of the many important skills of a chemist is to be able to determine the composition of unknown substances by separating them into their individual parts.

A chemist specializing in **analytical chemistry**, also called a separation scientist or process chemist, analyzes complex mixtures to determine their component parts using techniques like chromatography, distillation, and extraction. These chemists often work in quality control, research and development, or manufacturing, applying their expertise to ensure product purity and identify unknown substances in industries ranging from pharmaceuticals to environmental testing.

You will be given a cup full of a mixture of several different substances**. The challenge: separate the **mixture** into each of the substances that make it up using their **physical properties** and/or **chemical properties**. Accurately find the amount (**mass)** of each substance in your cup.

Your **experimental data** will be compared with the **theoretical data** to calculate **percent error**. This lab is an exercise in problem solving, experimental design and measurement. Remember, **accuracy** and **precision** matter! The challenge is to have the lowest percent error in your class.

***NOTE: Lab mixture will be different for Chemistry and Honors Chemistry*
Chemistry: Mixture contains - Table Salt, Copper BB's, Iron Filings, Sand
Honors Chemistry: Mixture contains - Poppy Seeds, Table Salt, Copper BB's, Iron Filings, Sand

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Purpose: Write an introduction outlining the purpose of the lab.

Safety Concerns: (List them according to your instructions for the lab)

Background: Define each of the bold words in the paragraphs of the Introduction. Explain any/all background information or knowledge needed to perform and understand this lab.

Pre-Lab Questions:

Using the internet, research the chemical and/or physical properties for each of the components below and write any properties that will help you separate them out of your mixture by each number.

1. Copper BB's (Elemental symbol for copper is "Cu") (note: BB's are not solid copper)
2. Iron (Elemental symbol = Fe)
3. Table Salt (Table salt is sodium chloride, the chemical formula is NaCl)
4. Sand (you will be given pure white sand)
5. Poppy Seeds

Procedure: Work with your lab partner to write a <u>detailed</u> procedure outlining how you are going to perform this lab. Think critically about the different physical and chemical properties of the different substances in your mixture and come up with creative ways to use those properties to separate them.
Include a list of the equipment you will need (reference your Lab Equipment Sheet). This should be a detailed 'recipe' that I could follow to replicate the process you went through to separate your mixture.
(Note: You may use a max of 3 dixie cups and 3 coffee filters. There is no limit on paper towels. You may <u>not</u> heat anything in glassware, but you <u>may</u> heat things in an evaporating dish if you need to)

For example:

1. Using the electronic balance, measure the mass of the cup and mixture. Record in notebook.
2. Place the…..

If you need to alter your procedure on lab day, be sure to alter this section as well.

**(Hint: Always get the mass of the entire mixture and the cup before you start. Once you start separating, you will never be able to go back in time to get this measurement and you may need it!)

Data and Observations: Collect data on EVERYTHING! You never know if you will need the data later!

Post-Lab Questions:

1. Copy the data table below into your lab notebook. It must be exactly like my example data table below because this is how I will grade your accuracy in separation. Calculate % error on the left hand page.

Cup Number_____

	Cu shot (g)	Fe (g)	NaCl (g)	Sand (g)	Poppy Seeds (g) *honors only
Experimental data					
Actual					
% error					

Average percent error_____

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2. In complete sentences: For each of your % error calculations that are greater than 5% error, explain any/all errors in your procedure that might have led to error in your data.

Conclusion:
RSVCP
Write a paragraph in RSVCP format that describes the results of the lab.
This paragraph should clearly outline what you did well and what you would do differently if you hand the chance to redo. Be sure to use data in your explanations, not just your thoughts for feelings.

- Restate the purpose of the lab.

- Verify conclusions by providing 3 or more results. This should include all numerical findings and their significance.

- Provide a counterclaim by addressing specific experimental errors and suggest possible experimental improvements.

- Provide importance to the experimental process by providing a specific real-world application.