LAD 2.3 (pg 1 of 2) Separating a Mixture – Physical Properties

Introduction:

Most natural materials are mixtures. The air, rocks, your jewelry, the ocean, your blood, your bodily wastes.....just about anything you find. They are substances held together by physical forces, not chemical. There are an infinite amount of mixtures. Anything you can combine is a mixture. Think of everything you eat; salad, chips & salsa, soup, and green bean casserole are all mixtures. Solutions are mixtures, such as a glass of water with other things dissolved inside, maybe kool-aid, even tap water itself is a mixture of water with dissolved chloride ions, fluoride and small amount of metal ions. You can always tell a mixture because each of the substances can be separated by various physical methods. Each of the substances in a glass of kool-aid keeps its own original chemical properties. With a solution, you can boil off the water (or allow it to evaporate) and still have those dissolved substances left over.

Three requirements to be a mixture:

1. There must be at least <u>two or more substances</u> present to be a mixture, and those substances can be either elements or compounds. The 14 carat gold that your jewelry is made of is a mixture of at least two (maybe three) different metallic elements. Mixtures made of metals have a special name, an alloy. The stainless steel on your supper table is also an alloy. Kool-aid is a mixture made of compounds, since the water is a compound, H_2O, the sugar is a compound, $C_6H_{12}O_6$, and any other dyes or colors are compounds also.
2. It is important to realize that a mixture can be <u>put together in most any proportions</u>. You can make salad out of a lot of lettuce and a little tomato, or you can have equal amounts, or you can have lots of tomato and a little lettuce. The ratio of the substances is completely variable, just as it is with kool-aid and water..
3. The last important requirement of a mixture is that the substances are <u>NOT chemically combined</u>, they are simply mixed, or physically combined, and can be (usually easily) separated by physical means.

PreLAD - This must be done BEFORE class.

Read the procedure and processing the data sections carefully to set up a data and results table. Do this in a spreadsheet program such as excel. Review the handout: "What makes a good data/results table" on the chapter 2 documents page.

Procedure: – *Use a marker to write your name on the scrap paper on the tray.*

In this lab you will make a mixture of salt, sand, iron filings (that's as in file, not fill), foam beads, and metal shot (shot is teeny-tiny balls of metal, hence the name "shot gun" for hunting birds). First measure the starting mass of all five substances. For ease and speed, learn to use the TARE button on the balance. Tare the empty beaker, then add one substance. Record the mass of that substance, then tare again, and add another substance into the beaker with the previous substance. Continue this way until you have weighed all five substances. Do NOT put the materials back in their envelopes after measuring their mass – the five materials will all end up in the same beaker as a mixture. Return the empty envelopes to the center lab bench in the pink tub. Mix up your five substances in the 250 ml beaker and now the challenge will be to separate the mixture back into its five components. Avoid using too many beakers – use scrap paper boats/plastic trays instead. Do all your work over a lunch tray so you can easily catch any spilled materials.

Limitations – What you can and can't do as separation techniques.

Since chemists cannot individually pick apart atoms or molecules, and this lab is a model, you MAY NOT use your fingers, spatula, or tweezers to *individually separate* the components. You may use a spatula to gather or move large amounts of materials from container to container. There will be a variety of lab equipment available for you to use. You should conference with a neighboring lab group or the teacher before attempting a technique that you are not sure of.

After separating any of the five components, measure it substances final mass. Check to see if the final mass of each substance recovered, matches its original starting mass. If a substance gets wet in the separation process, it should be dried first before taking its mass – this may mean leaving it overnight to dry. Return the iron filing, copper shot and plastic beads to the center lab bench placing each on the appropriate tray. Sand and salt should be put into the trash (Do not put sand down the sink.)

Clean-up

Clean-up: Place all labware used on your tray and leave at the lab bench.

Process the data:

Calculate the percent yield of each material. This will be a % which tells us how well you did.

Remember that percentage is always: $percent = \frac{part}{total} \times 100$

- Calculate % yield by dividing the mass of each material recovered by the mass of each material started with then multiply by 100. (Make this calculation embedded in the excel spreadsheet.)
- Report this % yield in your data/results table.

Post-LAD Questions - you should be discussing and thinking about these while working the LAD.

1. Ideally, what should the percent yield be? What does a yield over 100 % indicate? What does a yield under 100 % indicate? Do your percent yields give any indication of what happened during the separation procedures?
2. What does the tare button on the balance do? Why is it useful to improve ease, speed, and efficiency in the lab?

These next two questions will be answered directly on your flow chart as directed below.

3. Describe some of the differing physical properties of the materials that were useful to aid in the separation of this mixture.
4. What issues in the procedure produced lab error, and describe whether the error cause the material to end up higher or lower.

Post LAD − to be turned in.

1. Data Table
   - Be sure you review the "What Makes a Good Data Table" to be sure your data/results table is in order.
   - Any issues with your PRE-LAD table should be corrected before handing in for the POST-LAD
   - Be sure you have embedded your calculations.
2. Flow Chart − It should fill a whole page, and only one page (8.5" x 11", held portrait or landscape)
   - The chart should be neat, clear and easy to read and it should fit on ONE single 8.5 x 11 page. (Use a ruler, write neatly, please consider typing: learn to use text boxes, objects, etc.)
   - Indicate the tools or method used for separation (green box).
   - Indicate the physical property that allowed the separation (bulleted points in **bold**).
   - Comment on any problems that made the separation less than perfect (bulleted points in *italics*).
   - The box containing each of the five items after their final separation should be highlighted in some way (not how each item was highlighted to make it easy to follow throughout the flow chart.)
   - Use the partial flow chart demonstrated below as a guide.