LAD D4 (pg 1 of 2) Separating a Mixture – Physical Properties Name_____Per___

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 calcium and magnesium ions, and maybe fluoride ions. You can always confirm a mixture when 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. In a mixture the substances are <u>NOT chemically combined</u>, they are simply mixed, or physically combined, and can be (usually easily) separated by physical means.
3. A mixture can be <u>put together in most any proportions</u>. You can add a lot of salt or a little salt, and yet the solution is still salt water. The ratio of the substances is completely variable, just as whhen making salad.

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 on a new tab in your Google spreadsheet. Review the handout: "What makes a good data/results table."

Procedure: – *Label the paper on your tray with your names and Period #.*

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 each of the 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 which will now be all together in one beaker. 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 class tray. Mix up your five substances in the 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 your fingers or 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 the substance's 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, that substance must be dried first before taking the mass – this may mean leaving it on your tray overnight to dry. Return the iron filing, copper shot and plastic beads to the cart placing each on the appropriate tray. Sand and salt should be put into the trash (Do not put sand down the sink.)

You should be discussing and thinking about the following questions *and* making notes DURING the Lab as it will be much more work to try and remember this after.

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?
3. Describe 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.

Clean-up

Clean-up: Leave only the substances in any containers on your tray overnight. Leave all other labware used on your tray and leave at the lab bench.

Process the data:

1. Calculate the percent yield of each material recovered out of the total starting mixture. This will be a % which tells us how well you did. Report this % yield in your data/results table.
2. Two pie chart graphs. One representing the mass of each of the five materials at the start, and one representing the mass of each of the five materials after the separation. (This will be the one and only time we will make a graph that is not an xy scatter graph)
    - Plan ahead, if you are not going to print in color, change your pie chart colors to gray tones, so they will show up better. Color coordinate with the colors on your flow chart! (If you do not have a color printer, you should add the color after printing
3. Flow Chart − This flow chart should fill a whole page, and only one page (8.5" × 11", held portrait OR landscape)

   Use the partial flow chart demonstrated below as a guide.

   (a) Lad #, title, and your name at the top and typed.

   (b) The chart should be neat, clear and easy to read and it should fit on ONE single 8.5 × 11 page, typed: learn to use text boxes, objects, etc.)

   (c) Indicate the tools or method used for separation (as demonstrated below in the green box below).

   (d) Indicate the physical property that allowed the separation (demonstrated bulleted points in **bold below**).

   (e) Comment on any problems that made the separation less than perfect (demonstrated bulleted points *in italics below*).

   (f) As a miniumum, comment on your lowest percent yield below 100%, and your highest percent yield above 100%

   (g) Each of the five items should be individually highlighted in some way. Note how each item was highlighted in a different color to make it easy to follow throughout the flow chart. If you do not have a color printer, add some color with colored pencils or markers after you print in black and white. Coordinate this color with your pie chart graph.