WORKING WITH MOLES LAB

STATION #1: AVERAGE MASS OF PLASTIC BAGS

Determine and record the mass of three different plastic bags with labels. Calculate the average mass of one plastic bag.

*Bag #1	_____________	grams
*Bag #2	_____________	grams
*Bag #3	_____________	grams
Average	_____________	grams

STATION #2: COPPER

Determine and record the mass of the plastic bag with the copper. What is the mass of the copper in the bag?
~ Calculate the number of moles of copper in the bag.
~ Calculate the number of atoms of copper in the bag.

* Mass of bag with copper	_____________	grams
Mass of copper	_____________	grams
Moles of copper	_____________	moles
Atoms of copper	_____________	atoms

STATION #3: BAKING SODA (SODIUM BICARBONATE – $NaHCO_3$)

Determine and record the mass of the plastic bag with baking soda. What is the mass of the baking soda in the bag?
~ Calculate the number of moles of baking soda in the bag.
~ Calculate the number of molecules of baking soda in the bag.

*Mass of bag with baking soda	_____________	grams
Mass of baking soda	_____________	grams
Moles of baking soda	_____________	moles
Molecules of baking soda	_____________	molecules

STATION #4: WATER

Fill a clean, unused paper cup about two-thirds full of water. Determine and record the mass of the paper cup and water. Take a drink of the water. Determine and record the mass of the cup and the water left in it. Throw the used cup in the trash.
~ How many moles of water did you drink?
~ How many molecules of water did you drink?

* Mass of cup & water before drinking	_____________	grams
* Mass of cup & water after drinking	_____________	grams
Mass of water	_____________	grams
Moles of water	_____________	moles
Molecules of water	_____________	molecules

STATION #5: CALCIUM SULFATE ($CaSO_4$)
Determine and record the mass of the plastic bag with calcium sulfate.
~ How many moles of calcium sulfate are in the bag?
~ How many moles of oxygen are contained in the calcium sulfate in the bag?

* Mass of bag and calcium sulfate	____________	grams
Mass of calcium sulfate	____________	grams
Moles of calcium sulfate	____________	moles
Moles of oxygen	____________	moles

STATION #6: TABLE SALT (SODIUM CHLORIDE – NaCl)
Record the number of moles of sodium chloride given on the label of the plastic bag with the salt.
Determine and record the mass of the plastic bag with salt in it.
~ How many moles of salt are in the bag?
~ What is your percent error? (Assume that the number given on the bag is the "accepted value".)

* Accepted # of moles of NaCl in bag	____________	moles
* Mass of bag and salt	____________	grams
Mass of salt	____________	grams
Moles of salt	____________	moles
Percent error	____________	%

STATION #7: IRON
Record the number of atoms of iron given on the label of the plastic bag with the iron.
Determine and record the mass of the plastic bag with iron in it.
~ How many moles of iron are in the bag?
~ How many atoms of iron are in the bag?
~ What is your percent error? (Assume that the number given on the bag is the "accepted value".)

* Accepted # of atoms of Fe in bag	____________	atoms
*Mass of bag and iron	____________	grams
Mass of iron	____________	grams
Moles of iron	____________	moles
Atoms of iron	____________	atoms
Percent error	____________	%

UNDERSTANDING THE MOLE LAB

INTRODUCTION

The relative mass of anything is actually how many times heavier the object is compared to the lightest object. The atomic masses of the atoms are all relative masses. They are relative to the lightest element, which is hydrogen. Although modern atomic masses are based on the carbon-12 isotope, hydrogen is still assigned a mass of one and the comparison is still valid for our purposes. Carbon, which has a relative mass of 12, is actually 12 times heavier than hydrogen. In this lab you will be dealing with the relative mass of beans and then you will be asked to draw a parallel to the atomic masses of the elements.

PURPOSE

To better understand the mole system and the table of atomic masses by comparison with a model system

MATERIALS

Part 1: 4 different types of beans, paper cup, balance

Part 2: one mole of each of 5 elements (sulfur, iron, aluminum, zinc, and copper)

Part 1

PROCEDURE

1.) Zero your balance with the paper cup on it.

2.) Count out exactly 100 beans of one type. Discard any beans which differ greatly from an "average" bean. This is important because if you do not do this, your results will not be accurate. Record the mass of the beans in your data table.

3.) Calculate the mass of one bean by dividing the total mass of 100 beans by 100. Do this for each type of bean. Record in the data table.

4.) Determine the relative mass of each type of bean by comparing it to the lightest type of bean. The calculation should look like this:

$$\text{relative mass} = \frac{\text{average mass of bean}}{\text{average mass of lightest bean}}$$

5.) Mass out (do not calculate) the relative mass (in grams) of each kind of bean and count the beans massed. (In other words, if the relative mass is 3.4, then find out how many beans it takes to get a mass of 3.4 grams.) Do not throw away any of the relative mass piles of beans because you will be asked questions about them later.

6.) Now calculate the number of beans in one relative mass of each bean. Do this by dividing the relative mass by the average mass of one bean. Compare this number to the number you got in step 5.

DATA TABLE

		Kidney	Pinto	Navy	Lentil
1.)	Mass of 100 beans (g) (See steps 1-2 in procedure.)				
2.)	Average mass of one bean (g) (See step 3 in procedure.)				
3.)	Relative mass of beans (See step 4 in procedure.)				
4.)	Measured number of beans in one relative mass (See step 5 in procedure.)				
5.)	Calculated number of beans in one relative mass (round to whole #) (See step 6 in procedure.)				

QUESTIONS (Part 1)

1.) What did you find out about the number of beans in one relative mass? Was it the same for each type of bean or different?

2.) How do your calculated values compare to your measured values? Were they the same (within one bean) or different?

3.) Compare the volume of the relative mass piles. Are they the same or different? Why?

4.) What is the average mass of the lightest bean? What is the relative mass of the lightest bean?

5.) Think very hard on this one and give a real logical answer. Why are there always the same number of beans in the relative mass?

6.) Hydrogen is the lightest element and each atom has an average mass of 1.66×10^{-24} grams. This is a very small number, but remember that it is only one atom. What is the relative mass of hydrogen if it is the lightest element?

Part 2

Below is a chart reporting the average masses of individual atoms of different elements. Calculate the relative mass of each element and record it in the chart. Then look up the atomic mass on the Periodic Table and record it in the table.

Atom	Mass of one atom (g)	Relative mass (to hydrogen) (See #4 in Part 1 Procedure.)	Atomic Mass (Periodic Table)	# of atoms in one relative mass (See #3 below.)
hydrogen	1.66×10^{-24}			
sulfur	5.31×10^{-23}			
iron	9.30×10^{-23}			
aluminum	4.49×10^{-23}			
zinc	1.08×10^{-22}			
lead	3.44×10^{-22}			
copper	1.05×10^{-22}			

QUESTIONS (Part 2)

1.) How do the atomic masses found on the Periodic Table compare to the relative masses you calculated? Were they the same or different?

2.) What do you know about the number of atoms of each element in one relative mass? Was it the same or different?

3.) For each of the above elements, find out how many atoms there are in the relative mass you discovered. You will have to divide the relative mass in grams by the mass of one atom in grams. Express your answers in scientific notation.

4.) So, how many atoms are there in an atomic mass of any atom if the unit is grams? (Remember, this number was not really known for many years. The actual number is not important, but what is important is that it was always known that in the same relative masses, you would have the same number. The number, however, is equal to one mole.)

Problem Set #2

Fill in the following chart.

	Symbol	Name	# of p^+	# of e^-	# of n^o	At. #	Mass #	Group	Period
1	$^{65}_{30}Zn^{2+}$								
2					28			6	4
3			55				132		
4	$^{35}_{17}Cl^{-}$								
5							195	10	6
6		Tin - 118							

Problem Set #3

DON'T FORGET…

~ SHOW YOUR WORK

~ ROUND YOUR ANSWERS FOR SIGNIFICANT FIGURES

~ INCLUDE UNITS WITH YOUR ANSWERS

1.) How many moles are equal to 3.723×10^{25} molecules of oxygen difluoride, OF_2?

2.) 357 grams of zinc nitrate, $Zn(NO_3)_2$, is equal to how many moles?

3.) How many molecules are contained in 8.24 moles of silicon tetrafluoride, SiF_4?

4.) What is the mass (in grams) of 2.1×10^{24} molecules of iron (III) oxide, Fe_2O_3?

5.) How many molecules are equal to 135.7 grams of nitrogen tribromide, NBr_3?

6.) What is the mass of 3.9×10^{22} molecules of rubidium carbonate, Rb_2CO_3?