Mole Lab

The sections of this lab may be completed in any order. You will be working in pairs, but materials will be distributed by table.

Part 1: S'more Stoichiometry

If you used the following symbols for the components of a S'more, what would the "formula" for a S'more be?
Graham Cracker: S
Marshmallow: Mm
Chocolate Piece: Or

1st Step: Write a chemical equation using the following symbols:
Graham Cracker: S
Marshmallow: Mm
Chocolate Piece: Or
S'more: S_2MmOr_3

2nd Step: Balance the equation: Re-write the balanced equation.
Based on your balanced equation, how many s'mores do you think you can make with the materials for your group only? Explain your reasoning.

How many s'mores could you make with one bag of marshmallows? Explain your reasoning.

If you had 1000 of each of your s'more supplies, how many s'mores could you make? Which ingredient would limit that number? How do you know?

Measure the actual masses of your various materials, then calculate the unit mass of the S'more (S_2MmOr_3)below:

Substance	Symbol	Unit Mass (Avg)	Unit Mass (Actual)
Graham Cracker	S	7.00 g	
Marshmallow	Mm	7.10 g	
Chocolate Pieces	Or	3.30 g	
S'more	S_2MmOr_3		

3rd Step: Calculating the number of units (or moles) given:

Look at your bag of marshmallows and determine its mass. How many marshmallows should be in the bag? Show your work.

4th Step: Finding the units of other substances in the reaction:

Based on the number of marshmallows you have, how many chocolate pieces and graham crackers do you need to make the maximum number of S'mores?

5th Step: Convert your numbers of graham crackers and chocolate segments into mass (gram) values:

Use the mass of each material that you found at the beginning of the lab.

6th Step: Finally-convert the masses into your needed units.

In this case, if a box of graham crackers has a mass of 254 g, how many boxes do you need? Also, if one chocolate bar has a mass of 49.5 g, how many bars do you need?

Post Lab Questions for Part 1:

Now we will transfer this process into the language of chemical reactions.

If we were to add a piece of solid Cu to an aqueous solution of silver nitrate, the Silver would be replaced in a single replacement reaction forming aqueous copper (II) nitrate and solid silver. How much silver is produced if 15.00 grams of Cu is added to the solution of excess silver nitrate? Show all work and don't forget to use significant figures.

Steps 1 and 2: Write and balance the chemical equation:

Step 3: Convert g Cu to moles Cu:

Step 4: Convert moles of Cu to moles of Ag produced:

Step 5: Convert moles Ag to grams of Ag produced:

Step 6: If silver metal sells for %4.50/ounce, could you get rich from this lab? (How much would it be worth?) Conversion factor: (1 gram = 0.0353 oz)

Extra: Try writing this entire stoichiometric process on one line. Remember to cancel out all necessary units! (Use dimensional analysis!)

Part 2: The Molar Mass of Your Name

1. Mass a piece of ordinary chalk (use a weigh boat and zero the balance befor the chalk massing).

2. Using this same piece of chalk, write your name on the wall.

3. Mass the chalk again after writing your name. Remember to record all masses!

4. **Repeat steps 1, 2, and 3, attempting to write your name approximately the same way (size, pressure, etc) each time.**

5. Calculate the average mass of chalk used in these two trials and record this average.

6. Determine the number of moles of calcium carbonate you left on the wall!

7. Record all data in your lab notebook. You should have a chart that looks like this:

Trial #	Beginning Mass of Chalk (g)	Ending Mass of Chalk (g)	Mass Difference (g)
1			
2			
Average			

Post Lab Questions for Part 2:

Part 1: Calculations and Analysis:

1. Chalk is made of **calcium carbonate**. Determine the formula and formula mass for this compound.

   Formula = _____ Mass = _____grams

2. One mole of calcium carbonate = _____ grams/1 mole

3. Number of Moles of calcium carbonate in Trial 1 = _____moles

4. Number of Moles of calcium carbonate in Trial 2 = _____moles

5. Average # of Moles of calcium carbonate = _____moles

6. What is the average number of calcium carbonate formula units (molecules) that you used to write your name on the chalk board?

Part 3: Comparing Rice and Lentils

1. Obtain 2 weigh boats. You should find stock containers (bags) of rice and lentils at your lab table.

2. In one weigh boat (or dish) add about 5 teaspoons of rice grains and in the other add about 5 teaspoons of lentils.

3. Measure the mass of each weigh boat with its contents of either rice or lentils. **Don't forget to zero/tare the balance with just the weigh boat on it before adding the lentils or rice.**
   Remember to record your measurements on your lab report!

4. Each weigh dish holds 5 teaspoons of rice and lentils. Using your graduated cylinder, find the volume in mL of the rice and then the lentils.

5. Measure the mass of ONLY 10 grains of rice. Then measure the mass of ONLY 10 lentils. Record your measurements.

6. Use your measurements to CALCULATE the mass of **one** rice grain and just **one** lentil.

7. **Calculate the number** of pieces of rice and lentils in each weighing dish.

8. **Now count** the rice grains and then count the lentils in each of your weigh dishes.

9. Record all data in your lab notebook. You should have a table that looks like this:

(Remember units on answers!)	Work	Rice	Lentils
Mass of 1/8 cup of rice or lentils			
Volume of each			
Mass of the weigh dish only			
Mass of ten pieces			
Mass of one piece (CALCULATE this)			
Number of pieces (CALCULATE this)			
Number of pieces (COUNTED ONLY)			

Overall Post Lab Questions:
Solve the following problems – <u>SHOW YOUR WORK</u>.

1. Calculate the number of moles if you had 280 grams of iron.

2. Calculate the mass of 5.0 moles of Carbon.

3. Calculate the number of atoms in 8.1 moles of Gold.

4. Calculate the number of moles if you have 3.01×10^{23} atoms of Tin.

5. Calculate the number of atoms in 24.0 grams of silver.

6. Calculate the mass in grams of 1.204×10^{24} atoms of Copper.

7. You have one mole of NaCl and one mole of KCl. Which one weighs more?
EXPLAIN your answer!

8. *Ricin is a very toxic compound (ricin comes from castor beans) in small amounts. Ricin's* LD_{50} *(lethal dose) is 3.0 micrograms per kilogram. This means the lethal dose for a 150 lb. person is abo 200 micrograms.*

A. If the molecular mass (molar mass) of ricin is 6.0×10^{4} grams/mole, how many moles of ricin are in a lethal dose? (HINT: a microgram is equal to 1×10^{-6} grams)

B. How many molecules of ricin are in a lethal dose?