Mole Lab #1

Understanding the Mole

Purpose: The purpose of this lab is to become familiar with counting by weighing and to understand why chemists use the mole for counting.

Procedure (Part I):

1. Place the empty weighing cup label “10” on the balance and use the “zero” button to eliminate the mass of the weighing cup.
2. Count out 10 grains of rice and add the grains to the weighing cup.
3. Record this mass to the nearest 0.01 g
4. Place the empty weighing cup label ”20” on the balance and use the “zero” button to eliminate the mass of the weighing cup.
5. Count out 20 grains of rice and add the grains to the weighing cup.
6. Record this mass to the nearest 0.01 g
7. Put the rice grains back for the next class.
8. Repeat steps 1-7 with beans instead of rice.

Data Table I: Rice and Bean Mass

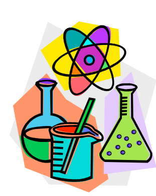
Number	Rice Mass (g)	Beans Mass (g)
10		
20		

Calculations (Part I): ***(These must be done before starting Part II of the lab!)***

1. Calculate the average mass of one rice grain in the 10 grain sample and in the 20 grain sample. Record your average mass of one grain of rice in your **20** grain sample on the class data table.
2. Calculate the average mass of one grain of rice using the class data.
3. Use the class average mass of a single grain of rice to calculate the predicted mass of 150 rice grains.
4. Calculate the average mass of one bean in the 10 bean sample and in the 20 bean sample. Record your average mass of one bean in your 20 bean sample on the class data table.
5. Calculate the average mass of one bean using the class data.
6. Use the class average mass of a single bean to calculate the predicted mass of 150 beans.

Lab Calculations Format

- **Title**
- **Formula**
- **Plug-in** (with **units** and correct significant figures)
- **Final Answer Circled** (with **units** and correct significant figures)



Procedure (Part II):

1. Place the empty weighing cup labeled "A" on the balance and use the "zero" button to eliminate the mass of the weighing cup.
2. Fill the cup with rice until you have the predicted mass of 150 rice grains. (from the calculation #3 above) It may not be possible to obtain the exact predicted mass. Get as close as possible without breaking rice grains.
3. Record this mass to the nearest 0.01 g
4. Repeat steps 1 -3 with the cup labeled "B" so you have data for a second trial.
5. Count the actual number of rice grains in sample "A" and "B". Record this number in your data table.
6. Repeat steps 1 -5 with beans instead of rice.

Data Table II: Rice and Bean Mass and Number

Sample	Rice Mass (g)	Number of grains of rice	Bean Mass (g)	Number of Beans
A				
B				

Calculations (Part II):

1. Calculate the average number of particles contained in samples A and B for both rice and beans.
2. Calculate the percent error in the "counting by weighing" method for both rice and beans. The actual value is the number of grains or beans for your calculated predicted mass.

Post Lab Questions

1. In Part I, does the average mass depend on the number of particles in the sample?
2. What are the advantages of using the average of the class data to calculate the expected mass of 150 particles?
3. Would you expect to get a more or less accurate mass if class data were averaged instead of lab group data?
4. The percent error calculated above describes the accuracy of the "counting by weighing" method. Is this method more accurate for rice or beans? Give a possible explanation for any difference in the accuracy.

Application Calculations

1. The mass of a mixture containing both rice and beans was found to be 143.85 g. The rice grains were separated from the beans by putting the mixture through a large strainer. The mass of the rice that separated out was 4.65 g. Use the results of the experiment to estimate the number of rice grains and beans in the mixture.
2. Express the ratio of rice grains and beans in the mixture to the nearest whole number.
3. The mass of a single rice grain is extremely large compared to the mass of a single atom. (A typical hydrogen atom has a mass of 1.66×10^{-24} g – too small to even imagine) Chemists therefore count atoms in large groups, called moles, where one mole contains 6.02×10^{23} (Avogadro's number) of atoms. Using your data, calculate the mass of one mole of rice.
4. Using your data, calculate the mass of one mole of beans.
5. The average mass of one paper clip is 0.39 g. What is the expected mass of 100 paper clips?
6. A paperclip manufacturer finds it more efficient to package paper clips in 100.0 gram lots. How many paperclips would be contained in a 100.0 g package.
7. In designing a label for this package of paperclips, how many paperclips should the label advertise?

Conclusion: Write one sentence that refers back to your stated purpose.