Name _____ Period _____
Partner _____ Date _____

Counting Atoms

Pre-Lab Questions

1. The average mass of one paper clip is 0.39 g. What is the expected mass of 100 paper clips?

2. A paper clip manufacturer finds it more efficient to package paper clips in 100-gram lots. How many paper clips would be contained in a 100-g package?

3. In designing a label for this package of paper clips, how many paper clips would you recommend the label advertise?

Part A. Average Mass of Rice and Beans

1. Label two weighing dishes "10" and "20", respectively.
2. Measure and record the mass of each weighing dish.
3. Count out 10 rice grains into the dish labeled "10" and 20 rice grains into the dish labeled "20."
4. Measure and record the combined mass of each weighing dish and rice sample.
5. Calculate the average mass of one rice grain in each sample "10" and "20."
6. Calculate the "average of the averages" to determine the average mass of a single grain of rice.
7. Discard the rice grains as directed by your instructor.
8. Repeat steps 3-7 using navy beans instead of rice.

Part B. Counting by Weighing

1. Label two weighing dishes "A" and "B" and measure and record the mass of each weighing dish.
2. Use the average mass of a single grain of rice to calculate the predicted mass of 100 rice grains.
3. Measure out two separate samples, each with this predicted mass of rice grains, into weighing dishes A and B, respectively. *Note:* It may not be possible to obtain the exact predicted mass. Get as close as possible—whether above or below the predicted value. Remember to take into account the mass of the weighing dish.
4. Count the actual number of rice grains in each sample A and B.
5. Discard the rice grains as directed by your instructor.
6. Repeat steps 2-5 using navy beans instead of rice.

Data Table A. ***Average Mass of Rice and Beans***

Sample	Mass	Rice	Navy beans
"10"	Weighing dish		
	Weighing dish and sample		
	Sample		
	Average mass of one "particle"		
"20"	Weighing dish		
	Weighing dish and sample		
	Sample		
	Average mass of one "particle"		
Average the two answers for mass of one particle			

Always discard any broken pieces of rice or beans

Data Table B. ***Counting by Weighing***

Sample	Mass	Rice	Navy beans
	Predicted mass of 100 particles		
A	Weighing dish		
	Weighing dish and sample		
	Sample		
	Number of particles		
B	Weighing dish		
	Weighing dish and sample		
	Sample		
	Number of particles		

Post-Lab Questions

1. In Part A, does the average mass depend on the number of particles in the sample?

2. What are the advantages and disadvantages of weighing rather then counting 100 particles?

3. In Part B, what is the average *number of particles* contained in Samples A and B for both rice and beans?

4. Give a possible explanation for any difference in the accuracy of the method for rice and beans.

5. The mass of a mixture containing both rice and navy beans was found to be 143.85g. The rice grains were separated from the navy beans by putting the mixture through a large strainer (the small rice grains fell through the holes, the larger navy beans did not). The mass of the rice the separated out was 4.65 g. Use the results of the above experiment to estimate the number of rice grains and navy beans in the mixture.

6. Express the *ratio* of Navy beans to rice grains in this mixture to the nearest whole number (e.g., 1:2, 2:1, 1:3, etc.).