

CHEMISTRY LAB #1
Average Atomic Mass of Candium
85 MINUTES

PURPOSE: To simulate the process of calculating average atomic mass using a mythical element, *candium* and its three different isotopes..

INTRODUCTION:

Candium is an interesting element found only at Fordham High School for the Arts. We will be using this special new element today to learn about atomic mass calculations. The atomic mass listed on the periodic table for each element is a “weighted” average. Although, for example, sulfur is listed as having an atomic mass of 32.06 amu, there are no sulfur atoms that have a mass of 32.06 amu. Sulfur atoms only have masses of 32, 33, 34, or 36 amu (each of these is called an isotope of sulfur).

Isotopes exist when one element has different versions—each with different numbers of neutrons. For instance, Sulfur-32 has 16 protons and 16 neutrons. Sulfur-33 has 16 protons and 17 neutrons. Sulfur-34 has 16 protons and 18 neutrons. Sulfur 36 has 16 protons and 20 neutrons. To get the number of 32.06 scientists use the **weighted average** of the different masses of Sulfur.

MATERIALS:

- Candium—represented by M & Ms, Reese’s Pieces and Skittles
- Balances

PROCEDURE:

1. Measure the mass of the cup with the laboratory balance. Record in the data and observations section.
2. Separate the candium into 3 “isotopes”—M&M’s, Skittles, and Reeses.
3. Count the total number of pieces of each isotope and record in the table.
4. Put the M&M’s into the cup and measure the mass on the lab balance. Record the mass of the M&Ms in the table. Make sure to subtract out the mass of the cup!
5. Remove the M&M’s from the cup. Repeat step 4 with the Skittles, and then the Reeses.
6. Once you have finished all of your measurements, it is okay to eat your candium sample.

DATA AND OBSERVATIONS:

Fill in the data table. Show calculations below.

	Formulas	M& M’s	Skittles	Reeses	Totals
Number of Pieces	Count the number of each candy				
Average Mass of 1 (g)	$\frac{\text{total mass}}{\# \text{ of pieces}}$				
Relative Frequency	$\frac{\# \text{ of pieces of single type}}{\# \text{ of pieces total}}$				100%
Percent Abundance	Relative frequency x 100%				1

Calculate the average mass of all candium particles by adding the relative masses. This average mass is the atomic mass of candium. Predict what the formula will be and then set it up in your lab notebook. You may CHECK your answer the formula on the next page. Then perform all calculations in your lab notebook.*

PREFORM ALL WORK AND ANSWER ALL QUESTIONS IN YOUR LAB NOTEBOOK!

Determining Atomic Mass Formula:

(mass of 1 M&M)(% of M&M) + (mass of 1 Skittle)(% of Skittle) + (mass of 1 Reeses)(% frequency of Reeses)

ANALYSIS QUESTIONS: Answer in complete sentences.

1. In order to determine the weighted average, why would it not be possible for us to just add up all the masses and divide by the number of candy we have?
2. What would happen to your atomic mass of candium if more M & Ms were used? Explain your reasoning.
3. Explain how the different types of candium are related to isotopes of an element.
4. Give the number of protons, neutrons, and electrons in the atom symbolized by $^{90}_{38}\text{Sr}$. Strontium-90 occurs in fallout from nuclear testing. It can accumulate in bone marrow and may cause leukemia and bone cancer.

Protons: _____ Neutrons: _____ Electrons: _____

5. Write the symbol for the magnesium atom with a mass number of 24. How many neutrons and electrons does this atom have?

Symbol: _____ Neutrons: _____ Electrons: _____

6. Silver has two isotopes, $^{107}_{47}\text{Ag}$ (52.00%), and $^{109}_{47}\text{Ag}$ (48.00%). What is the atomic mass of silver? Show all work.

7. Data for chromium's four naturally occurring isotopes is provided in the table below. Calculate chromium's atomic mass. Show all work.

	Chromium Isotope Data	
Isotope	Percent abundance	Mass (amu)
Cr-50	4.35%	49.946
Cr-52	83.79%	51.941
Cr-53	9.50%	52.941
Cr-54	2.36%	53.939

CONCLUSION:

Directions: In your notebooks, write a one paragraph conclusion that summarizes your results and findings and what that means for average atomic mass. Explain what isotopes are and how they differ from each other. Compare and contrast the isotopes for candium to isotopes for the different elements.

CHEMISTRY LAB #8
Cadium Lab
85 MINUTES
RUBRIC

Data, Observation, Data Analysis	<ul style="list-style-type: none"> <input type="checkbox"/> Data is properly recorded. <input type="checkbox"/> Calculations are correct <input type="checkbox"/> Table is set up in a logical, easy-to-read manner. 	<ul style="list-style-type: none"> <input type="checkbox"/> Data is properly recorded . <input type="checkbox"/> Calculations are correct <input type="checkbox"/> Table is set up but not entirely easy to follow. 	<ul style="list-style-type: none"> <input type="checkbox"/> Data is properly recorded . <input type="checkbox"/> 1 error in calculations <input type="checkbox"/> Table is incomplete. 	<ul style="list-style-type: none"> <input type="checkbox"/> Data is incomplete. <input type="checkbox"/> More than 1 error in calculations <input type="checkbox"/> Results not presented in a table
Analysis Questions	<ul style="list-style-type: none"> <input type="checkbox"/> All answers are correct. <input type="checkbox"/> All answers are thoroughly explained and supported by the experimental data. 	<ul style="list-style-type: none"> <input type="checkbox"/> 4 answers are correct. <input type="checkbox"/> Most answers are thoroughly explained and supported by the experimental data. 	<ul style="list-style-type: none"> <input type="checkbox"/> 3 answers are correct. <input type="checkbox"/> Most answers are thoroughly explained and supported by the experimental data. 	<ul style="list-style-type: none"> <input type="checkbox"/> Less than 3 answers are correct.
Conclusion	<ul style="list-style-type: none"> <input type="checkbox"/> Answers the purpose of the lab <input type="checkbox"/> Summarizes observations clearly. <input type="checkbox"/> Explains a connection to calculating average atomic masses for actual elements. <input type="checkbox"/> Makes a connection to how this procedure could have been changed to more accurately reflect isotopes 	<ul style="list-style-type: none"> <input type="checkbox"/> Answers the purpose of the lab <input type="checkbox"/> Summarizes observations clearly. <input type="checkbox"/> Explains connection to calculating average atomic masses for actual elements. 	<ul style="list-style-type: none"> <input type="checkbox"/> Answers the purpose of the lab <input type="checkbox"/> Summarizes observations clearly. 	<ul style="list-style-type: none"> <input type="checkbox"/> Answers the purpose of the lab

OVERALL LAB: _____/12 POINTS (Scaled to 95)

COMPLETION POINTS: _____/5 POINTS

FINAL SCALED SCORE: _____ Complete! ☺ _____ Need to Revise