

# AVERAGE ATOMIC MASS LAB

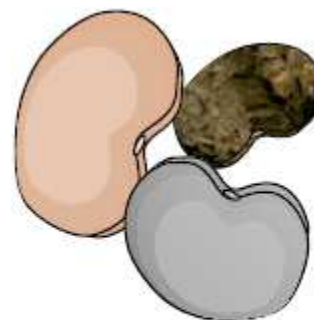
## “BEANIUM”

Name \_\_\_\_\_ Per \_\_\_\_\_ Date \_\_\_\_\_

The majority of the elements on the Periodic Table exist in at least two isotopic forms. *Isotopes* are atoms with the same atomic number but with different mass numbers due to varying numbers of neutrons. The atomic mass shown on the Periodic Table for each element, is actually an average of all the isotopes of that element, weighted by the percentage of the abundance in which they occur.

### NEWS FLASH!!! A NEW ELEMENT HAS BEEN DISCOVERED.

Springfield USA—Nuclear Chemists, performing basic research on food products at Springfield Power Plant, have discovered what is believed to be a new element. Mr. Burns, the plant’s owner, says, “We have tentatively named this element Beanium.” Mr. Smithers, assistant to Mr. Burns adds, “We derived this element from the protein nodules we put into our chili.”



“Beanium atoms” look strangely like bean seeds

Further research of the new element will be conducted in more suitable surroundings, namely laboratories in a nearby school. Because Springfield apparently only has an elementary school, research work has been contracted to neighboring Cohasset High School. “Student excitement regarding this discovery is running at a fever pitch!” says Lisa Simpson, student. Many chemistry students have generously volunteered their time and expertise to help with the follow-up experiments involving the new element.

Professor Reardon, who will be overseeing this operation, says her team at Cohasset High School will determine how many isotopes of this element exist. Next they will determine the mass of each isotope. They will then determine the percent abundance of each isotope. The final calculations will discover the average atomic mass of the new element.

“One unique property of Beanium should make these experiments particularly easy—unlike normal atoms, Beanium atoms are very large.” says Mr. Smithers. “They can be easily seen, and different isotopes can be sorted by hand.”

Scientists are expecting a complete, comprehensive summary of this new element within two days, including diagrams and collected data tables.

“This is the most exciting Chemistry discovery this century!” exclaimed Mr. Burns.

**PURPOSE:**

To determine the average atomic mass of the element Beanium.

**MATERIALS:**

Sample of Beanium

Balance

Calculator

**PROCEDURE:**

- Sort the Beanium sample into the different isotopes Draw a colored example each isotope.

Isotope A	Isotope B	Isotope C
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- Pick one of the isotopes to be A. Record the **MASS of all isotope A**.
- Count the number of atoms of isotope A and record in the data table. Verify this number by having your lab partner count again. If you do not agree on the number, count them again together.
- Calculate the **average mass of one atom of isotope A** by dividing the total mass of isotope A by the number of atoms of isotope A
- When you are through with isotope A, put it back into the zip-lock baggie. Be careful not to spill any atoms on the floor!
- Repeat the same procedures for isotopes B, and C. Be sure to record the mass of each isotope and the exact number of each isotope. Record the average mass of each isotope.

**Data:**

(Total Mass /# Atoms)		
Total Mass isotope A:	# atoms A:	Avg Mass A:
Total Mass isotope B:	# atoms B:	Avg mass B:
Total Mass isotope C:	# atoms C:	Avg mass C:

7. Now you will calculate the **percent abundance** of each of the isotopes.

- a. First find the total number of atoms present by adding up the middle column of the data table. Total Atoms =
- b. Next divide the # of atoms A by the total atoms. This is the percent abundance of isotope A as a decimal. .
- c. Do the same thing for isotope B and C, each time making the numerator the value that goes with that particular isotope.

% Abundance Isotope A	Avg Mass A:	% A x Avg Mass of A
% Abundance Isotope B	Avg mass B:	% B x Avg Mass of B
% Abundance Isotope C	Avg mass C:	% C x Avg Mass of C

- 8. Before moving on, does your column of percentages add up to 100% (100% as a Decimal is 1.00) ? If so, continue.
- 9. To complete the middle column, import the average mass of each isotope from the previous data table so we have everything we need in one place.
- 10. To complete the last column, multiply the first two columns together.
- 11. Lastly, determine the average atomic mass of Bermanium to be placed on the Periodic Table. To do this add up the last column of the data table and divide by 100%.

ATOMIC MASS OF BERMANIUM: \_\_\_\_\_

**Conclusion Questions:**

- 1. Of your three isotopes, which is closest to the atomic mass of bermanium? Does this make sense?
  
  
  
  
  
  
  
  
- 2. Why is the atomic mass of most elements on the *Periodic Table* a decimal number and not an integer? Explain.

3. If the heaviest isotope were more abundant, how would that affect the atomic mass of beryllium? Why?
  
4. Magnesium has three isotopes: 79% exists as Mg-24, 10% exists as Mg-25, and 11% exists as Mg-26. Determine the atomic mass of magnesium that appears on the periodic table. Show your work below and check your result with a periodic table.
  
5. Silicon also has three isotopes: 92.2% exists as Si-28, 4.7% exists as Si-29, and 3.1% exists as Si-30. Determine the atomic mass of silicon on the periodic table and check your result.
  
6. Chromium exists in four isotopic forms: 4.3% as Cr-50, 83.8% as Cr-52, 9.5% as Cr-53, and a certain percentage exists as Cr-54.
  - a. What percentage of naturally occurring chromium is Cr-54?
  - b. How many protons does Cr-54 have? How many neutrons?
  - c. How is Cr-54 the same as Cr-50?
  - d. How is Cr-54 different from Cr-50?
  - e. What is the atomic mass of chromium that appears on the periodic table?