

Chemistry

Name _____

Activity: Atomic and Isotopic Mass

Date _____

Block _____

Introduction: If atoms were as large as beans, they could be sorted, counted and weighed. In this activity, the analogy is made between atoms and beans, with different types of beans representing different isotopes of the same element.

Objective: To illustrate the relationship between isotopic mass, isotopic abundance, and atomic mass.

Materials and equipment: beaker (or cup), balance, beans (Atoms)

Procedure:

1. Obtain a container of beans. (Each different type of bean represents a different isotope.)
2. Record the total number of beans and the mass of all of the beans.
3. Sort the beans (isotopes) into groups. Record the mass and number of each isotope (bean).
4. Divide the total mass of each isotope by the number of atoms in that particular sample to find the mass of a single atom of the isotope.
5. Determine the percent abundance of each type of isotope (number of atoms of isotope/total number of atoms in the sample).
6. Determine the atomic mass for the element based on the isotopic abundances and isotopic masses.

$$\text{Atomic Mass} = (\% \text{ of isotope \#1})(\text{mass of one atom of isotope \#1}) + (\% \text{ of isotope \#2})(\text{mass of isotope \#2}) + \dots\dots\dots$$

Data:

- Total mass of all beans: _____ g
- Total number of all beans _____

Isotopic Information:

Type of Bean	Number of Beans	Mass of Beans
(a) _____	_____	_____
(b) _____	_____	_____
(c) _____	_____	_____

Questions: Show all work.

1. How many atoms of each type do you have?

2. What is the isotopic mass of each isotope?

3. What is the % abundance of each isotope?
4. What is the atomic mass of the element?

Related Questions: Show all work.

5. Chlorine exists in nature as chlorine-35 (isotopic mass = 34.96774, % abundance = 75.00%) and chlorine-37 (isotopic mass = 36.96590, % abundance = 25.00%). Calculate the atomic mass of chlorine.
6. What is the essential difference in the structure between the chlorine atoms found in question Number 5?
7. Oxygen gas consists of isotopes with atomic masses of 16.00, 17.00, and 18.00 amu. Their abundances are 99.76%, 0.040%, and 0.20% respectively. What is the atomic mass of oxygen?
8. Nitrogen has two isotopes, N-14 and N-15, with masses of 14.0031 amu and 15.001 amu respectively. If the atomic mass of nitrogen is 14.00674 amu, what is the abundance of each isotope?