Ms. Randall
Regents Chemistry
Lab Activity: Isotopes of Beanium and Atomic Mass

Background: The boxes on the periodic table contain information about the elements atomic number and atomic mass. The smaller number represents the number of protons and is called the atomic number. All atoms of the same element have the same number of protons. The larger number represents the weighted average mass of the naturally occurring isotopes and is called atomic mass. The number for the atomic mass contains decimals because it represents the sum of the masses of the isotopes in their representative percentages (weighted average).
Isotopes are atoms that have the same number of protons but different number of neutrons. The element hydrogen has three naturally occurring isotopes. The three different atoms of hydrogen are:

Hydrogen-1 (^{1}H)----------atom with 1 proton and 0 neutrons called protium
Hydrogen-2 (^{2}H)----------atom with 1 proton and 1 neutron called deuterium
Hydrogen-3 (^{3}H)----------atom with 1 proton and 2 neutrons called tritium

The atomic mass for the element hydrogen can be found by following equation:

$$\text{Atomic Mass} = \frac{\%(\text{Mass of } {}^{1}H) + \%(\text{Mass of } {}^{2}H) + \%(\text{Mass of } {}^{3}H)}{100}$$

Mass values in parentheses do not represent a weighted average. This value represents the mass number of the most common or stable isotope of that radioactive element. The mass number is the number of protons and neutrons in an atom.

Pre-Lab (Show all work!)

1. What is the basic atomic difference between isotopes of the same element?

2. If there are 100 kidney beans, 27 pinto beans and 173 black eye peas in a container, what is the percent composition of the container by type of bean?

3. If your chemistry grade is broken down so that 70% of it is based on exams, 20% on lab reports and 10% on homework, and your average scores (out of 100 points in each area) are: exams 85, labs 75, and homework 96. What would your weighted average score be?

Objective: In this lab, you will calculate the average atomic mass of the rare element, Beanium by a calculating a weighted average of its naturally occurring isotopes.

Materials: navy beans, pinto beans, kidney beans, plastic bags, scale

Safety and Waste Disposal: Safety goggles are not required for this lab

Procedure:

1) Obtain the mass of the weighing dish marked navy. Then obtain 10 navy beans from the large plastic bag at the central lab table and place into the dish. Obtain the mass of the weighing dish and beans. Record in the first data table.
2) Repeat step 1 for the pinto beans and then the kidney beans.
3) Look at the small plastic bag. (Do not open!) This represents a sample of the element Beanium. Count the number of each type of bean in the bag and record in the second data table.

Data Table: (Use proper significant figures in each column)

Data:

Finding the Average Mass for Each Bean Isotope

Bean Isotope	Mass of Weighing Dish	Mass of 10 Beans and Weighing Dish	Mass of 10 Bean Isotopes	Average Atomic Mass for ***one*** Bean Isotope
Navy beans				
Pinto beans				
Kidney beans				

Bean Isotope Type	Number of this type of Bean Isotope in element sample
Navy Beans (Isotope 1)	
Pinto Beans (Isotope 2)	
Kidney Beans (Isotope 3)	

Total Number of Beans in Bean Element Bag _____ Beans

Calculations:

1.

Finding the Percent Abundance for Each Bean Isotope

Percent Abundance of Navy Bean Isotope	Percent Abundance of Pinto Bean Isotope	Percent Abundance of Kidney Bean Isotope

Hint: Percent abundance is the same as percent composition. (Reference Table T)

2. Solve to find the average atomic mass of the element Beanium

Average atomic mass=(% x average mass of Navy) +(% x average mass of Pinto) +(% x average mass of Kidney)

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<u>Lab Conclusion:</u> Isotopes of Beanium and Atomic Mass

1. Write a paragraph summarizing what you have learned about the scientific concept of the lab from doing the lab. Back up your statement with details from your lab experience.

2. **Atoms of different isotopes of the same element differ in their total number of**

a) Protons
b) Neutrons
c) valence electrons
d) electrons

3. **Isotopes of an element must have different**

a) atomic numbers
b) number of protons
c) mass numbers
d) number of electrons

4. **What information is necessary to determine the atomic mass of the element chlorine**?

a) The atomic mass of each artificially produced isotope of chlorine only.
b) The relative abundance of each naturally occurring isotope of chlorine only.
c) The atomic mass and relative abundance of each naturally occurring isotope of chlorine.
d) The atomic mass and relative abundance of each naturally occurring and artificially produced isotope of chlorine.

5. ***Copper has 2 naturally occurring isotopes. Information about the two isotopes is shown in the table below.***

<u>Naturally Occurring Isotopes of Copper</u>

Isotope	**Atomic Mass** *Atomic mass units(amu)*	**Percent Natural Abundance (%)**
Cu-63	62.93	69.17
Cu-65	64.93	30.83

In the space below, show the numerical set-up for calculating the atomic mass of copper.