Lab 04.3a
Isotopes & Atomic Mass

I. PURPOSE
To replicate the method used to determine atomic mass using a fictional element – ‘pennium’ (Pe).

II. MATERIALS
1. 20 penny sample
2. Electronic balance

III. PROCEDURES
1. Count the pennies to verify that the sample contains twenty (20). Determine and record the combined mass of the twenty pennies.
2. Find the mass of each penny separately and record it in the data table, along with the year the penny was minted. Record masses to the nearest 0.01 g.
3. Return all twenty pennies to their original container and return to instructor.
4. Based on the mass of each penny, assign it to either isotope ‘X’ or ‘Y’. X’s should have similar masses. Y’s should have similar masses. Each penny must be assigned to one group or the other. Note the group in the data table.

IV. PRE-LAB QUESTIONS
1. How are pennies like atoms of an element?
2. What are the independent and dependent variables in the experiment?
3. How are isotopes of a particular element alike? How are they different?
4. What is a fractional abundance?

V. DATA & CALCULATIONS
A. DATA
Mass of 20 penny sample: __________ g

Data Table 1 – Mass of Individual Pennies

<table>
<thead>
<tr>
<th>Penny</th>
<th>Year Minted</th>
<th>Mass (g)</th>
<th>Isotope</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

  make rows up to 20

B. CALCULATIONS
1. Calculate the fractional abundance of each isotope in your sample using the formula:

   \[
   \text{Fractional Abundance} = \frac{\# \text{ of pennies for each isotope}}{\text{total \# of pennies}}
   \]

2. Calculate the average atomic mass of each isotope using the formula:

   \[
   \text{Average atomic mass} = \frac{\text{total mass of pennies of each isotope}}{\# \text{ of pennies of that isotope}}
   \]

3. Using the fractional abundance and the average atomic mass of each isotope, calculate the atomic mass of pennium (Pe) using the formula:

   \[
   (\text{average mass of isotope 1}) \times (\text{fractional abundance of isotope 1}) \\
   + (\text{average mass of isotope 2}) \times (\text{fractional abundance of isotope 2})
   \]
VI. QUESTIONS & DISCUSSION OF ERROR

A. QUESTIONS
   1. Why was the collective mass of the twenty pennies not equal to ‘20 x’ the mass of any individual penny?
   2. How can you explain the fact that there are two isotopes of ‘pennium’?
   3. Why are the atomic masses for most elements not whole numbers?
   4. How are the three isotopes of hydrogen (hydrogen-1, hydrogen-2, and hydrogen-3) alike? How are they different?

B. DISCUSSION OF ERROR

VII. CONCLUSION