Average Atomic Mass

Aim
• to calculate the average mass of an element

Notes

Atomic mass
★ The relative mass of an atom is the sum of its protons and neutrons
★ Examples
★ Carbon 12 has 6 protons and 6 neutrons (6 + 6 = 12)
★ Carbon 14 has 6 protons and 8 neutrons (6 + 8 = 14)
★ The relative mass of any isotope is an integer

Average atomic mass
★ The masses of the elements listed on the Periodic Table are not integers
★ The masses of the elements listed on the Periodic Table are the average masses of the isotopes of each element
★ The average mass of an element is a weighted average
★ Both the mass of the isotopes and the percentage of each effect the average mass
★ Procedure
★ The percentage, expressed as a decimal, is multiplied by the mass to get the product
★ The products are added together to get the total

\[ x_{AVG} = \sum_{y=1}^{n} p_y x_y = p_1 x_1 + p_2 x_2 + \ldots + p_n x_n \]

★ Example

Average Mass of Nitrogen

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Percentage</th>
<th>Mass</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen-14</td>
<td>0.9963</td>
<td>14</td>
<td>13.95</td>
</tr>
<tr>
<td>Nitrogen-15</td>
<td>0.0037</td>
<td>15</td>
<td>0.06</td>
</tr>
</tbody>
</table>

\[ 14.01 \]

Answer the questions below by circling the number of the correct response

1. The common isotopes of hydrogen have masses of 1 amu, 2amu, 3 amu. The average atomic mass of hydrogen is 1.00794 amu. This shows that the most common isotope has a mass of
   (1) 1 amu, (2) 2 amu, (3) 3 amu, (4) 4 amu

2. Chlorine occurs naturally as two common isotopes, $^{35}\text{Cl}$ and $^{37}\text{Cl}$. Which of the following percentages results in the average mass of about 35.5 amu? (1) 20 percent $^{35}\text{Cl}$ and 80 percent $^{37}\text{Cl}$, (2) 50 percent $^{35}\text{Cl}$ and 50 percent $^{37}\text{Cl}$, (3) 75 percent $^{35}\text{Cl}$ and 25 percent $^{37}\text{Cl}$, (4) 85 percent $^{35}\text{Cl}$ and 15 percent $^{37}\text{Cl}$

3. A new element, unbiennium, has been synthesized. A typical sample contains 22.50 percent Ube–323 and 77.50 percent Ube–325. What is the average mass? (1) 324.6 amu, (2) 323.4 amu, (3) 324.0 amu, (4) 325.2 amu

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