

Chemistry I

Name \_\_\_\_\_

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

Worksheet #C12: Isotope Problems

Calculating Average Atomic Mass

1. Calculate the average atomic mass of a sample of copper that is 69.17% copper-63 (62.930 amu) and 30.83% copper 65 (64.928 amu).

$$(62.930)(.6917) + (64.928)(.3083) = \underline{63.546 \text{ u}}$$

2. Calculate the average atomic mass of a sample of antimony that is 57.21% antimony-121 (120.938 amu) and ~~47.79%~~<sup>42.79%</sup> antimony-123 (122.904 amu).

$$120.938(.5721) + 122.904(.4279) = \underline{121.779 \text{ u}}$$

3. Calculate the average atomic mass of a sample of lead that is 24.1% lead-206 (205.974 amu), 22.1% lead-207 (206.976 amu) and 53.8% lead 208 (207.977 amu).

$$205.974(.241) + (206.976 (.221)) + 207.977(.538) = \underline{207.273 \text{ u}}$$

4. Calculate the average atomic mass of a sample of chromium that is 4.345% chromium-50 (49.946 amu), 83.789% chromium-52 (51.941 amu), 9.501% chromium-53 (52.941 amu) and 2.365% chromium-54 (53.939 amu).

$$49.946(.04345) + 51.941(.83789) + 52.941(.09501) + 53.939(.02365) \\ = \underline{51.997 \text{ u}}$$

### Calculating The Percents (Two Equations, Two Unknowns)

5. Neon has two isotopes, Ne-22 and Ne-20. The approximate mass of Ne-22 is 22.000 amu and the approximate mass of Ne-20 is 20.000 amu. The atomic mass of neon is 20.1798 amu. Determine the proportions of Ne-22 and Ne-20 in a naturally occurring sample of neon.

$$\begin{array}{l}
 \text{Ne-22} = x \\
 \text{Ne-20} = y
 \end{array}
 \quad
 \begin{array}{l}
 22x + 20y = 20.1798 \\
 22x + 20(1-x) = 20.1798 \\
 22x + 20 - 20x = 20.1798 \\
 2x = 0.1798 \\
 x = 0.0899 \\
 y = 1 - 0.0899 = 0.9101
 \end{array}
 \quad
 \begin{array}{l}
 x + y = 1 \\
 y = 1 - x
 \end{array}$$

8.99% Ne-22 ; 91.01% Ne-20

6. Boron has two isotopes, B-10 and B-11. B-10 has an approximate mass of 10.000 amu, and B-11 has an approximate mass of 11.000 amu. The atomic mass of boron is 10.811 amu. Determine the proportions of B-10 and B-11 in a naturally occurring sample of boron.

$$\begin{array}{l}
 \text{B-10} = x \\
 \text{B-11} = y
 \end{array}
 \quad
 \begin{array}{l}
 10x + 11y = 10.811 \\
 10x + 11(1-x) = 10.811 \\
 10x + 11 - 11x = 10.811 \\
 -x = -0.189 \\
 x = 0.189 \\
 y = 1 - (0.189) = 0.811
 \end{array}
 \quad
 \begin{array}{l}
 x + y = 1 \\
 y = 1 - x
 \end{array}$$

18.9% B-10 ; 81.1% B-11

7. Europium has two isotopes, Eu-151 and Eu-152. Eu-151 has an approximate mass of 151.000 amu and Eu-152 has an approximate mass of 152.000 amu. The atomic mass of europium is 151.964 amu. Determine the proportions of Eu-151 and Eu-152 in a naturally occurring sample of europium.

$$\begin{array}{l}
 \text{Eu-151} = x \\
 \text{Eu-152} = y
 \end{array}
 \quad
 \begin{array}{l}
 151x + 152y = 151.964 \\
 151x + 152(1-x) = 151.964 \\
 151x + 152 - 152x = 151.964 \\
 -x = -0.036 \\
 x = 0.036 \\
 y = 1 - (0.036) = 0.964
 \end{array}
 \quad
 \begin{array}{l}
 x + y = 1 \\
 y = 1 - x
 \end{array}$$

3.6% Eu-151 ; 96.4% Eu-152