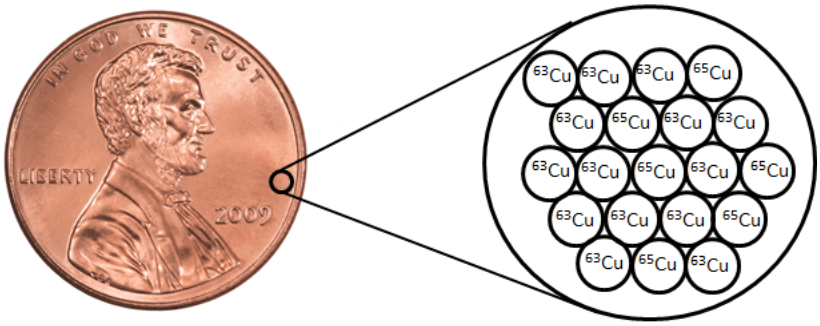
WKS 3-1 – Atomic Mass, Avogadro's Number & Molar Mass, Molecular Mass, Mass Spectrometry **Name:** _____

Isotopes of copper

Magnified 1 billion times ($\times 10^9$)



A. Does the sample contain identical atoms of copper?

B. Use the picture above to determine the percent of ^{63}Cu in the sample. What is the percent of ^{65}Cu?

C. What is the atomic mass of Cu from the periodic table? Is it closer to 63 amu or 65 amu?

D. How does the picture above explain the answer to the previous question?

3.5 The atomic masses of $^{35}_{17}$Cl (75.53%) and $^{37}_{17}$Cl (24.47%) are 34.968 amu and 36.956 amu, respectively Calculate the average atomic mass of chlorine.

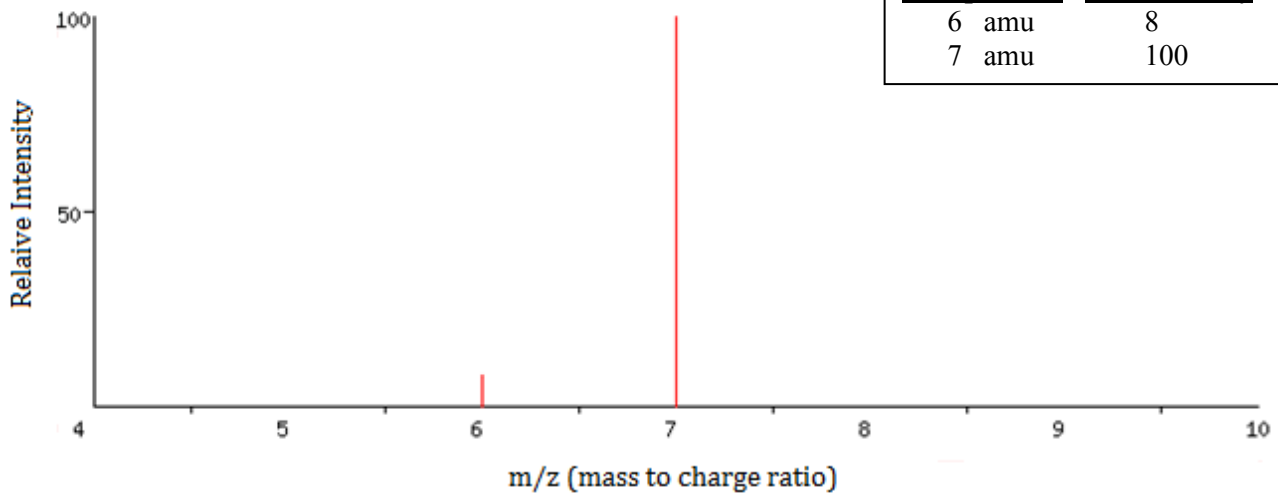
3.6 The atomic masses of $^{6}_{3}$Li and $^{7}_{3}$Li are 6.0151 and 7.0160 amu, respectively. Calculate the natural abundances of these two isotopes. The average atomic mass of Li is 6.941 amu.
(HINT: let x = fractional abundance of ^6Li. Thus, $1 - x$ = fractional abundance of ^7Li)

3.31 Describe the operation of a mass spectrometer.

3.32 Describe how you would determine the isotopic abundance of an element from it mass spectrum.

The graph below was produced when an element, lithium, was analyzed in a mass spectrometer. Use the graph to answer the questions below.

Isotope mass	Rel. Intensity
6 amu	8
7 amu	100



Mass spectrum of Lithium

E. According to the mass spectrum, how many isotopes of Lithium exist?

F. Label the each peak with the nuclide symbol for each isotope

G. Without performing any calculations, predict the approximate atomic mass for lithium. Explain the basis for your prediction.

H. Now calculate the average atomic mass of the element from the mass spectrum data. The height of each peak is the relative intensity, not the % abundance. You will first need to calculate the % abundance and then the average atomic mass.

a) What is the % of the intensity of each peak? $\left(\% = \frac{\text{Peak Intensity}}{\text{Total Intensity}} \times 100\% \right)$

b) You've just determined the % abundance for each isotope of the element. Use this data and the isotope masses to calculate the average atomic mass of the element.

3.14 How many moles of cobalt (Co) atoms are there in 6.00×10^9 (6 billion) Co atoms?

3.16 How may grams of gold (Au) are there in 15.3 moles of Au?

3.18 What is the mass in grams of a single atom of each of the following elements?
(a) As:

(b) Ni:

3.20 How many atoms are present in 3.14 g of copper (Cu)?

3.22 Which of the following has a greater mass: 2 atoms of lead or 5.1×10^{-23} moles of helium?

3.24 Calculate the molar mass of the following substances:
(a) Li_2CO_3

(b) CS_2

(c) $CHCl_3$

(d) $C_6H_8O_6$

(e) KNO_3

(f) Mg_3N_2

3.26 How many molecules of ethane (C_2H_6) are present in 0.334 g of C_2H_6?

3.28 Urea [$(NH_2)_2CO$] is used for fertilizer and may other things. Calculate the number of N, C, O, and H atoms in 1.68×10^4 g of urea.

3.30 The density of water is 1.00 g/mL at 4°C. How many water molecules are present in 2.56 mL of water at this temperature?

Answers: 3.5) 35.45 amu; 3.6) 7.5% (^{6}Li); 92.5% (^{7}Li); H(a) 7.40%, 92.6%; 3.14) 9.96×10^{-15} mol Co; 3.16) 3.01×10^3 g Au; 3.18(a) 1.244×10^{-22} g/As atom; 3.18(b) 9.746×10^{-23} g/Ni atom; 3.20) 2.98×10^{22} atoms Cu; 3.22) 6.811×10^{-22} g Pb, 2.0×10^{-22} g He; 3.24(a) 73.89 g/mol; 3.24(b) 76.14 g/mol; 3.24(c) 119.37 g/mol; 3.24(d) 176.12 g/mol; 3.24(e) 101.11 g/mol; 3.24(f) 100.95 g/mol; 3.26) 6.69×10^{21} molecules; 3.28) 3.37×10^{26} atoms N, 1.69×10^{26} atoms C, 1.69×10^{26} atoms O, 6.74×10^{26} atoms H; 3.30) 8.56×10^{22} mlcls