CH 221 Practice Problem Set #2

*This is a **practice problem set** and not the actual graded problem set that you will turn in for credit.*
Answers to each problem can be found at the end of this assignment.

Covering: **Chapter Two, Chapter 3.1** *and* **Chapter Guide Two**
Important Tables and/or Constants: 1 mol = 6.022 x 10^{23}

1. Give the mass number of each of the following atoms: a. magnesium with 15 neutrons, b. titanium with 26 neutrons, and c. zinc with 32 neutrons.

2. Give the complete symbol ($^A_Z X$) for each of the following atoms: a. potassium with 20 neutrons, b. krypton with 48 neutrons, and c. cobalt with 33 neutrons.

3. Thallium has two stable isotopes, ^{203}Tl and ^{205}Tl. Knowing that the atomic weight of thallium is 204.4, which isotope is the more abundant of the two?

4. Silver (Ag) has two stable isotopes, ^{107}Ag and ^{109}Ag. The isotopic mass of ^{107}Ag is 106.9051 and the isotopic mass of ^{109}Ag is 108.9047. The atomic weight of Ag, from the periodic table, is 107.868. Estimate the percentage of ^{107}Ag in a sample of the element.
    a. 0%   b. 25%   c. 50%   d. 75%

5. Gallium has two naturally occurring isotopes, ^{69}Ga and ^{71}Ga, with masses of 68.9257 u and 70.9249 u, respectively. Calculate the percent abundances of these isotopes of gallium.

6. Calculate the mass in grams of:
    a. 2.5 mol aluminum   b. 1.25 x 10^{-3} mol of iron
    c. 0.015 mol of calcium   d. 653 mol of neon

7. Calculate the amount (moles) represented by each of the following:
    a. 127.08 g of Cu   b. 0.012 g of lithium
    c. 5.0 mg of americium   d. 6.75 g of Al

8. Classify the following elements as metals, metalloids, or nonmetals: N, Na, Ni, Ne, and Np.

9. Fill in the blanks in the table (one column per element):

Symbol	^{58}Ni	^{33}S		
Number of protons			10	
Number of neutrons			10	30
Number of electrons in the neutral atom				25
Name of the element				

10. Put the following elements in order from smallest to largest mass:
    a. 3.79 x 10^{24} atoms Fe   b. 19.921 mol H_2 c. 8.576 mol C   d. 7.4 mol Si
    e. 9.221 mol Na   f. 4.07 x 10^{24} atoms Al   g. 9.2 mol Cl_2

11. Dilithium is the fuel for the *Starship Enterprise*. Because its density is quite low, however, you need a large space to store a large mass. To estimate the volume required, we shall use the element lithium. If you need 256 mol for an interplanetary trip, what must the volume of the piece of lithium be? If the piece of lithium is a cube, what is the dimension of an edge of the cube? (The density for the element lithium is 0.534 g/cm³ at 20 °C.)

12. A cylindrical piece of sodium is 12.00 cm long and has a diameter of 4.5 cm. The density of sodium is 0.971 g/cm³. How many atoms does the piece of sodium contain? (The volume of a cylinder is $V = \pi$ x r² x length.)

13. To estimate the radius of a lead atom:
   a. You are given a cube of lead that is 1.000 cm on each side. The density of lead is 11.35 g/cm³. How many atoms of lead are in the sample?
   b. Atoms are spherical; therefore, the lead atoms in this sample cannot fill all the available space. As an approximation, assume that 60% of the space of the cube is filled with spherical lead atoms. Calculate the volume of one lead atom from this information. From the calculated volume (V), and the formula $V = \frac{4}{3} \pi r^3$, estimate the radius (r) of a lead atom.

14. Reviewing the periodic table.
   a. Name an element in Group 2A.
   b. Name an element in the third period.
   c. Which element is in the second period in Group 4A?
   d. Which element is in the third period in Group 6A?
   e. Which halogen is in the fifth period?
   f. Which alkaline earth element is in the third period?
   g. Which noble gas element is in the fourth period?
   h. Name the nonmetal in Group 6A and the third period.
   i. Name a metalloid in the fourth period.

Answers to the Practice Problem Set:

1. a. 27   b. 48   c. 62
2. a. $^{39}_{19}$K   b. $^{84}_{36}$Kr   c. $^{60}_{27}$Co
3. Thallium-205
4. 50%
5. ^{69}Ga abundance is 60.12%, ^{71}Ga abundance is 39.88%
6. a. 68 g Al   b. 0.0698 g Fe   c. 0.60 g Ca   d. 1.32 x 10^4 g Ne
7. a. 1.9998 mol Cu   b. 1.7 x 10^{-2} mol Li   c. 2.1 x 10^{-5} mol Am   d. 0.250 mol Al
8. Metals: Na Ni Np   Nonmetals: N, Ne
9. (left to right): Nickel-58, sulfur-33, neon-20, manganese-55
10. H$_2$ (b) < C (c) < Al (f) < Si (d) < Na (e) < Fe (a) < Cl$_2$ (g)
11. 3.33 x 10^3 cm^3 and 14.9 cm
12. 190 cm^3 and 4.9 x 10^{24} atoms
13. 3.299 x 10^{22} atoms and 1.631 x 10^{-8} cm
14. *Possible* answers: a. Ba   b. Si   c. C   d. S   e. I   f. Mg   g. Kr   h. S   i. As