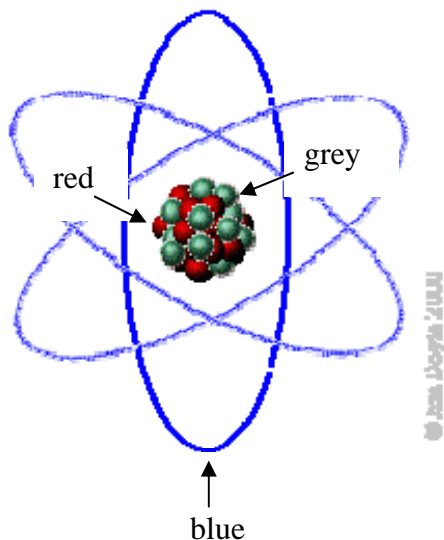


Figure 1 was designed to represent an atom. Critique the model by answering the following questions:

**Figure 1: Representation of an Atom**



- 1) What are the red and grey spheres in the middle supposed to represent?
- 2) What are the blue ovals supposed to represent?
- 3) Describe at least three ways in which this drawing misrepresents an atom.

An alternative periodic tables is shown in Figure 2:

**Figure 2: Alternative Periodic Table**

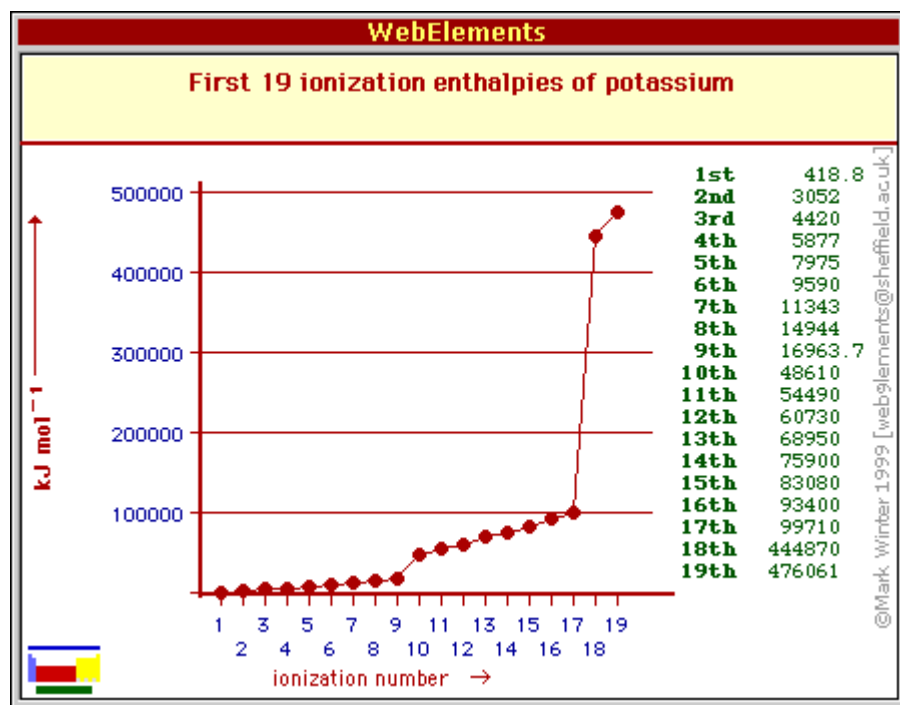
H He																	
Li Be		B C N O F Ne															
Na Mg		Al Si P S Cl Ar															
K Ca Sc		Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr															
Rb Sr Y		Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe															
Cs Ba La		Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn															
Fr Ra Ac		Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr Rf Ha Sg Ns Hs Mt 110 111 112															

- 4) Write 1-2 sentences describing how this table is assembled.
- 5) Write 2-3 sentences advocating for either this table (the triangle table) or the traditional periodic table (found in your book) as easier to use.

6) Draw pictures showing how the  $p_x$ , and  $d_{yz}$  orbitals look when viewed along the x, y, and z axes (some views may look the same).

7) Figure 3 shows the nineteen ionization energies of potassium

**Figure 3: Potassium ionization energies<sup>1</sup>**



a) Write the chemical equation for the fifth ionization of potassium.

b) Explain the large jumps in ionization energy between the 9<sup>th</sup> and the 10<sup>th</sup> and the 17<sup>th</sup> and the 18<sup>th</sup>.

8) In class, you saw the reaction of potassium with water? Is this chemical reaction represented in Figure 3? If so, where?

9). Is the first ionization energy of calcium higher or lower than that of potassium? Why?

10) Sketch a graph showing the twenty ionization energies of calcium, labeling any large increases.

Moore, Stanitski, and Jurs: Chapter 2: 82, 88, 112;

Chapter 7: 49, 51, 65, 95, 103, 109, 127, 137

<sup>1</sup> Webelements <http://www.webelements.com/webelements/elements/text/K/ionz.html> (Accessed September 2006)

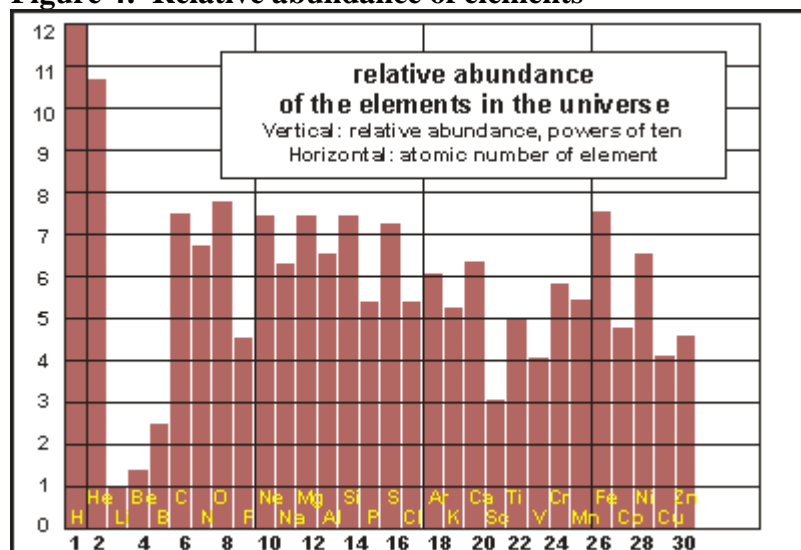
## Chapter 2:

82) How many elements are there in Group 4A of the periodic table? Give the name and symbol of each of these elements. Tell whether each is a metal, metalloid, or nonmetal.

88) The following chart is a plot of the logarithm of the relative abundances of elements 1 through 36 in the solar system. The abundances are given on a scale that assigns silicon a relative value of  $1.00 \times 10^6$  (the logarithm of which is 6).

- What is the most abundant metal?
- What is the most abundant nonmetal?
- What is the most abundant metalloid?
- Which of the transition elements is most abundant?
- How many halogens are considered on this plot, and which is most abundant?

**Figure 4: Relative abundance of elements<sup>2</sup>**



<sup>2</sup> <http://www.seafriends.org.nz/oceano/ocean23.gif> (Accessed September 2006)

112) A group of astronauts in a spaceship accidentally encounters a space warp that traps them in an alternative universe where the chemical elements are quite different from the ones they are used to. The astronauts find these properties for the elements they have discovered:

Atomic Symbol	Atomic Weight	State	Color	Electrical Conductivity	Electrical Reactivity
A	3.2	Solid	Silvery	High	Medium
D	13.5	Gas	Colorless	Very low	Very High
E	5.31	Solid	Silvery	Very high	Medium
G	15.43	Solid	Silvery	High	Medium
J	27.89	Solid	Colorless	High	Medium
L	21.57	Liquid	Colorless	Very low	Medium
M	11.23	Gas	Colorless	Very low	Very low
Q	8.97	Liquid	Colorless	Very low	Medium
R	1.02	Gas	Colorless	Very low	Very High
T	33.85	Solid	Colorless	Very low	Medium
X	23.68	Gas	Colorless	Very low	Very low
Z	36.2	Gas	Colorless	Very low	Medium
Ab	29.85	solid	golden	Very high	Medium

- Arrange these elements into a periodic table
- If a new element, X, with atomic weight 25.84 is discovered, what would its properties be? Where would it fit in the periodic table you constructed?
- Are there any elements that have not yet been discovered? If so, what would their properties be?

Chapter 7:

- Assign a set of four quantum numbers for:
  - Each electron in a nitrogen atom
  - The valence electron in a sodium atom
  - A 3d electron in a nickel atom
- One electron has the set of quantum numbers,  $n=3$ ,  $l=1$ ,  $m_l = -1$  and  $m_s = +\frac{1}{2}$ ; another electron has the set  $n=3$ ,  $l=1$ ,  $m_l = 1$ , and  $m_s = +\frac{1}{2}$ .
  - Could the electrons be in the same atom? Explain
  - Could they be in the same orbital? Explain
- Write the electron configurations for these atoms.
  - Strontium (Sr), named for a town in Scotland
  - Tin (Sn), a metal used in the ancient world. Alloys of tin (solder, bronze, and pewter) are important

95) Select the atom or ion in each pair that has the larger radius.

- a) Cl or  $\text{Cl}^-$
- b) Ca or  $\text{Ca}^{+2}$
- c) Al or N
- d) In or Sn
- e)  $\text{Cl}^-$  or  $\text{K}^+$

103) Compare the elements Li, K, C, N

- a) Which had the largest atomic radius?
- b) Place the elements in order of increasing ionization energy.

109) Which group of the periodic table has elements with high first ionization potentials *and* very negative electron affinities? Explain this behavior.

127) Classify these statements as being either true or false. If a statement is false, correct it to make it true.

- a) A 3f orbital can hold a maximum of 14 electrons
- b) The ground state electron configuration of a sulfur atom is  $1s^2 2s^2 2p^6 3s^2 3p^4$ .
- c) A ground state sulfur atom has four unpaired electrons.
- d) A  $\text{Mg}^{+2}$  ion has an argon electron configuration.
- e) An  $\text{N}^{-3}$  ion and a  $\text{P}^{-3}$  ion have the same ground-state electron configuration.

137) Write the formula for the compound that most likely forms between potassium and element Z if element Z has the electronic configuration  $1s^2 2s^2 2p^6 3s^2 3p^4$ .