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 table is shown in Figure 2:

**Figure 2: Alternative Periodic Table**

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, 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**

![Graph of potassium ionization energies](image)

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

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

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

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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).

   a) What is the most abundant metal?
   b) What is the most abundant nonmetal?
   c) What is the most abundant metalloid?
   d) Which of the transition elements is most abundant?
   e) How many halogens are considered on this plot, and which is most abundant?

Figure 4: Relative abundance of elements

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:

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

a) Arrange these elements into a periodic table
b) 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?
c) Are there any elements that have not yet been discovered? If so, what would their properties be?

Chapter 7:

49) Assign a set of four quantum numbers for:
   a. Each electron in a nitrogen atom
   b. The valence electron in a sodium atom
   c. A 3d electron in a nickel atom

50) One electron has the set of quantum numbers, n = 3, l = 1, m_l = -1 and m_s = +½; another electron has the set n = 3, l = 1, m_l = 1, and m_s = +½.
   a. Could the electrons be in the same atom? Explain
   b. Could they be in the same orbital? Explain

65) Write the electron configurations for these atoms.
   a) Strontium (Sr), named for a town in Scotland
   b) 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 Cl \(^-\)
   b) Ca or Ca \(^{+2}\)
   c) Al or N
   d) In or Sn
   e) Cl \(^-\) or 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 Mg \(^{+2}\) ion has an argon electron configuration.
   e) An N \(^{-3}\) ion and a 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\(^4\).