Chem 102B
Quiz 1

January 25, 2007
Section # BQ

Name: Key

Read each question thoroughly and show all work when answering a problem. Please keep track of significant figures and label units when appropriate. Conversion units you might need: 1 meter = 1.0936 yards, 1 inch = 2.54 cm, 1 kg = 2.205 lbs

1. Solve the following problems. (1/2 pt each)

   a. \[ \frac{6.022 \times 10^{23} \times \frac{53.64}{14.62 + 0.042}}{14.62 + 0.0421} = \frac{2.203 \times 10^{24}}{14.60} \approx 45 \text{ g/mols} \]

   b. \[ \frac{1400 \times 0.2004}{1.30 - 0.03} = \frac{220}{1.27} \approx 174 \text{ (2 s.f. g/mols based on 1400)} \]

2. Using the periodic table, give the symbol or name of the following elements: (1/2 pt each)

   a. The Alkali metal in period 5 \( \text{Rb, Rubidium} \)
   
   b. The Halogen in period 3 \( \text{Cl, Chlorine} \)
   
   c. The Noble gas in period 4 \( \text{Kr, Krypton} \)
   
   d. The Alkaline Earth metal in period 6 \( \text{Ba, Barium} \)

3. Answer the following questions True or False: (1/2 pt each)

   a. The cathode ray tube provided evidence for a dense positive nucleus. \( \text{F} \)
   
   b. The nucleus of an atom is made up of neutrons and electrons. \( \text{F} \)
   
   c. A theory describes what happens, and a law describes why. \( \text{F} \)
   
   d. Electrons make up the majority of the mass of an atom. \( \text{F} \)

4. Write the symbol in the form of \( \frac{2}{5} X \) for the only two stable isotopes of Br, bromine-79 and bromine-81. (a,b,c = \( \frac{1}{2} \) pt, symbols = \( \frac{1}{2} \) pt each, d = 1 pt)

   a. How many protons does bromine-81 have? \( 35 \)
   
   b. How many neutrons does bromine-79 have? \( 44 \)
   
   c. How many electrons does bromine-81 have when it forms KBr? \( 36 \) \( \text{Br}^{-} \)
   
   d. If bromine-79 makes up 50.5% of the atomic abundance and has a mass of 78.9183 amu, what is the exact mass of bromine-81 if the average mass of bromine is 79.907.

   \[ \text{average mass} = \left( \frac{50.5\%}{100\%} \times 78.9183 \right) + \left( \frac{49.5\%}{100\%} \times 80.916 \right) \]

   \[ 79.907 = 39.561 + 0.495x \]

   \[ x = 80.916 = 80.9 \text{ to 3 s.f.} \]
5. Use the Periodic Table to solve the following questions:
   a. Calculate the molar mass of H$_2$SO$_3$. (1/2 pt)
   \[ \text{MM} = (2 \times 1.008) + (1 \times 32.07) + (3 \times 16.00) = \frac{82.086 \text{ g/mol}}{82.093 \text{ g/mol}} \]

   b. How many atoms of oxygen are there in 1.2 x 10$^{-2}$ grams of H$_2$SO$_3$? (1 pt)
   \[ 1.2 \times 10^{-2} \text{ g H}_2\text{SO}_3 \times \frac{1 \text{ mole H}_2\text{SO}_3}{82.093 \text{ g}} \times \frac{6.022 \times 10^{23} \text{ molecules H}_2\text{SO}_3}{1 \text{ mole H}_2\text{SO}_3} \Rightarrow \]
   \[ \Rightarrow \times \frac{3 \text{ atoms O}}{1 \text{ mole H}_2\text{SO}_3} = 2.6 \times 10^{20} \text{ atoms O} \]

6. Aluminum oxide has a density of 3.97 g/cm$^3$ (1 cm$^3$ = 1 mL). How many Al atoms are in 0.500 mL of aluminum oxide? (2 pts)
   \[ \text{Al}_2\text{O}_3 \text{ MM} = (27.3258) + (1 \times 15.999 \times 3) = 101.96 \text{ g/mol} \]
   \[ 0.500 \text{ mL Al}_2\text{O}_3 \times \frac{1 \text{ cm}^3}{1 \text{ mL}} \times \frac{3.97 \text{ g Al}_2\text{O}_3}{1 \text{ cm}^3} \times \frac{1 \text{ mole Al}_2\text{O}_3}{101.96 \text{ g}} \times \frac{2 \text{ atoms Al}}{1 \text{ mole Al}_2\text{O}_3} = 2.21 \times 10^{20} \text{ atoms Al} \]

7. Fill in the following table: (1 pt each row, spelling counts)

<table>
<thead>
<tr>
<th>Name of Compound</th>
<th>Chemical Formula</th>
<th>Is it ionic or covalent?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur difluoride</td>
<td>SF$_2$</td>
<td>covalent</td>
</tr>
<tr>
<td>Mercury (II) phosphate</td>
<td>Hg$_3$(PO$_4$)$_2$</td>
<td>ionic</td>
</tr>
<tr>
<td>Calcium sulfide</td>
<td>CaS</td>
<td>ionic</td>
</tr>
<tr>
<td>Diphosphorous decachloride</td>
<td>P$<em>2$Cl$</em>{10}$</td>
<td>covalent</td>
</tr>
<tr>
<td>Ammonium acetate</td>
<td>NH$_4$C$_2$H$_5$O$_2$</td>
<td>ionic</td>
</tr>
<tr>
<td>Calcium hydrogen phosphate</td>
<td>CaHPO$_4$</td>
<td>ionic</td>
</tr>
</tbody>
</table>

8. Peyton Manning had 4,397 yards of passing this regular season, what is this value in nanometers (nm). (Use scientific notation to display your answer) (1 pt)
   \[ 4,397 \text{ yards} \times \frac{1 \text{ meter}}{1.094 \text{ yards}} \times \frac{1 \text{ nm}}{1 \times 10^{-9} \text{ m}} = 4.02 \times 10^{12} \text{ nm} \]

9. The Bears offensive line weighs an average of 304 lbs with an average volume of 146 liters. What is their average density in grams/mL? (1 pt)
   \[ 146 \text{ L} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} \]
   \[ 304 \text{ lbs} \times \frac{1 \text{ kg}}{2.205 \text{ lbs}} \times \frac{1 \text{ g}}{1 \times 10^{-3} \text{ kg}} = 13,780 \text{ g} \]
   \[ \text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{13,780 \text{ g}}{146,000 \text{ mL}} = 0.0944 \text{ g/mL} \]