Name_____ Date_____

1st Half Chemistry Review

1. Significant Figures: How many significant figures does each number have?
   a. 0.00000000001000000000000000000000000000000000000000000000000 [48]
   b. 1450000000000 [3]
   c. 45,000000.0 [9]

2. Scientific Notation: Change the following numbers into scientific notation.
   a. 68472374.96848 [$6.847237496848 \times 10^{7}$]
   b. .00000000000000000000000000000987 [9.87×10^{-31}]

3. Metric System: Convert the following problems. KHDBDCM
   a. 4738.0987 hg to dg

$$\frac{10\ dg}{1\ g} \left| \frac{100\ g}{1\ hg} \right| 4738.0987\ hg = 4738098.7\ dg$$

   b. .123456789 mm to km

$$\frac{1\ Km}{1000\ m} \left| \frac{1\ m}{1000\ mm} \right| 0.123452789\ mm = 1.23456789 \times 10^{-7}\ Km$$

4. Density: Solve the following.
   a. A graduated cylinder contained 20 mL of water. When 137 grams of brass shot was added to the cylinder, the water lever rose to 52.16 mL. What is the density of the brass shot?

$$D = \frac{M}{V} = \frac{137\ g}{32.16\ mL} = 4.26\ g/mL$$ [4 g/mL]

Vol: 52.16 mL − 20 mL = 32.16 mL

   b. A sample of copper has a density of 8.92 g/cm3 and measures 4 cm long, .2mm high and 1.03 dm thick. What is the mass of this block of copper metal?

$$M = D \cdot V$$
$$= \left(8.92\ \frac{g}{cm^3}\right)(0.8\ cm^3) = 7.9$$

4 cm
0.2 mm = 0.02 cm
1.03 dm = 10.3 cm
$V = 0.824\ cm^3$
$= 0.8\ cm^3$

5. Balancing Equations: Balance the following.
   a. $Al_2(SO_4)_3 + Ca_3(PO_4)_2 \rightarrow 2AlPO_4 + 3CaSO_4$
   b. $2(NH_4)_3PO_4 + 3Ba(OH)_2 \rightarrow Ba_3(PO_4)_2 + 6NH_4OH$

6. Naming: Name the following… don't forget your rules!

ide-ic
ate-ic ite-ous

   a. Lead (II) sulfate (+2 −2) [$PbSO_4$]
   b. Hypochlorous acid [HClO]
   c. H_2S [Hydrosulfuric Acid]
   d. Si_3N_4 [Trisilicon Tetranitride]

7. Percent Composition
   a. What percent of $Ca_3(PO_4)_2$ is calcium?

$$\frac{120.24\text{ g Ca}}{310.18\text{ g } Ca_3(PO_4)_2} \times 100 = \boxed{38.76\%\ Ca \text{ in } Ca_3(PO_4)_2}$$

8. Mole Conversions
   a. Find the number of molecules in 115 grams of nitrogen dioxide. NO_2

$$\frac{6.02 \times 10^{23}\text{ molecules } NO_2}{1\text{ mol } NO_2} \left| \frac{1\text{ mol } NO_2}{46.01\text{ g } NO_2} \right| \frac{115\text{ g } NO_2}{} = \boxed{1.50 \times 10^{24}\text{ molecules } NO_2}$$

   b. Convert 15.0 grams of C_2H_6 to moles.

$$\frac{1\text{ mol } C_2H_6}{30.08\text{ g } C_2H_6} \left| \frac{15.0\text{ g } C_2H_6}{} \right. = \boxed{0.499\text{ mol } C_2H_6}$$

9. Empirical Formulas/Molecular Formulas
   a. What is the empirical formula of a compound that consists of 74.1% carbon, 8.6% hydrogen, and 17.3% nitrogen by mass. Then, find the molecular formula given its molar mass is about 160 g/mol.

$$\frac{1\text{ mol C}}{12.01\text{ g C}} \left| \frac{74.1\text{ g C}}{} \right. = \frac{6.1699\text{ mol C}}{1.2348} = 5 \qquad \frac{1\text{ mol N}}{14.01\text{ g N}} \left| \frac{17.3\text{ g N}}{} \right. = \frac{1.2348\text{ mol N}}{1.2348} = 1$$

$$\frac{1\text{ mol H}}{1.01\text{ g H}} \left| \frac{8.6\text{ g H}}{} \right. = \frac{8.5149\text{ mol H}}{1.2348} = 7$$

$C_5H_7N = 81.13\text{ g}$

$\frac{160\text{ g}}{81.13\text{ g}} = 2$ $\boxed{C_{10}H_{14}N_2 \text{ Molecular}}$

10. Hydrates: Solve the following.
   a. What is the formula for the hydrate from the given information: 76.9% $CaSO_3$ and 23.1% H_2O.

$$\frac{1\text{ mol } CaSO_3}{120.15\text{ g } CaSO_3} \left| \frac{76.9\text{ g } CaSO_3}{} \right. = \frac{0.6400\text{ mol } CaSO_3}{0.6400} = 1$$

$$\frac{1\text{ mol } H_2O}{18.02\text{ g } H_2O} \left| \frac{23.1\text{ g } H_2O}{} \right. = \frac{1.2819\text{ mol } H_2O}{0.6400} \quad 2$$

$\boxed{CaSO_3 \cdot 2H_2O}$

11. Mass-Mass Problems
   a. Sodium oxide reacts with water to produce sodium hydroxide. What mass of sodium oxide must be used to produce 275 grams of sodium hydroxide?

$$\overset{?\,g}{Na_2O} + \overset{HOH}{H_2O} \rightarrow 2\overset{275\,g}{NaOH}$$

$$\frac{61.98\text{ g } Na_2O}{1\text{ mol } Na_2O} \left| \frac{1\text{ mol } Na_2O}{2\text{ mol NaOH}} \right| \frac{1\text{ mol NaOH}}{40\text{ g NaOH}} \left| \frac{275\text{ g NaOH}}{} \right. = \boxed{213\text{ g } Na_2O}$$

12. Electron Configuration: What is the electron configuration for the following.
   a. Al $1s^2 2s^2 2p^6 3s^2 3p^1$ – OR – $[Ne]\ 3s^2 3p^1$
   b. Mn $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$ – OR – $[Ar]\ 4s^2 3d^5$
   c. Tm $[Xe]\ 6s^2 4f^{13}$
   d. Ba $[Xe]\ 6s^2$
   e. Lu $[Xe]\ 6s^2 4f^{14} 5d^1$

13. Energy Problem:
   a. Calculate the energy in Joules of a quantum of radiant energy whose frequency is 4.23×10^{18} Hz.

$$E = (6.626 \times 10^{-34}\ J \cdot s)(4.23 \times 10^{18}\ \tfrac{1}{s})$$

$$\boxed{E = 2.80 \times 10^{-15}\ J}$$