Chemistry
Chapter 10: Chemical Quantities

Name Key Period _____

~~Chapter 10 Test~~ Review Sheet

Part 1: Molar Mass – Determine the molar mass for the following compounds. Round to the nearest hundredths and remember your units!

a) $ZnCl_2$

Zn: 1(65.39) = 65.39
Cl: 2(35.453) = 70.906
136.296

136.30 g/mol

b) $Fe(NO_3)_3$

Fe: 1(55.845) = 55.845
N: 3(14.007) = 42.021
O: 9(15.999) = 143.991
241.857

241.86 g/mol

Part 2: Conversions between Mass, Volume, & Representative Particles – Complete the following questions/conversions. SHOW ALL WORK. Do you forget correct units. Round to the nearest hundredths.

1. One mole of any element/compound/ion always equals 6.02×10^{23} representative units.
2. One mole of any gas at STP is equal to 22.4 liters.
3. How many molecules are in 8.17 L of HCl at STP?

$$8.17\,L\,HCl \times \frac{1\,mol}{22.4\,L} \times \frac{6.02\times10^{23}\,molecules}{1\,mol} = 2.1956875\times10^{23}$$

2.20×10^{23} molecules HCl

4. How many formula units are in 94 g of NaCl?

$$94\,g\,NaCl \times \frac{1\,mol}{58.443\,g} \times \frac{6.02\times10^{23}\,fu}{1\,mol} = 9.682596718\times10^{23}$$

9.68×10^{23} fu NaCl

5. What is the volume of 325 grams of Krypton at STP?

$$325\,g\,Kr \times \frac{1\,mol}{83.80\,g} \times \frac{22.4\,L}{1\,mol} = 86.87350835$$

86.87 L Kr

6. How many atoms are in 5.48 L of CO_2 at STP?

$$5.48\,L \times \frac{1\,mol}{22.4\,L} \times \frac{6.02\times10^{23}\,molecules}{1\,mol} \times \frac{3\,atoms}{1\,molecule} = 4.41825\times10^{23}$$

4.42×10^{23} atom in CO_2

7. How many sulfur atoms are in 645 grams of S_4N_2?

$$645g\ S_4N_2 \times \frac{1\ mol}{156.274g} \times \frac{6.02\times10^{23}\ molecules}{1\ mol} \times \frac{4\ S\ atoms}{1\ molecule} = 9.938697416\times10^{24}$$

$$\boxed{9.94\times10^{24}\ S\ atoms\ S_4N_2}$$

Part 3: Percent Composition – Determine the percent composition of each element in the following compounds. Round your answer to the nearest tenth of a decimal place. SHOW ALL WORK.

1. Determine the percent composition of lead (Pb) in $PbSO_4$.

$$\frac{207.2}{303.261}\times100 = 68.32398495$$

$$\boxed{68.3\%\ Pb}$$

2. Find the percent composition of each element in the compound containing 13.13 grams potassium, 8.73 grams chromium, and 10.72 grams oxygen.

K: $\frac{13.13}{32.58}\times100$

40.30079804

$\boxed{40.3\%}$

Cr: $\frac{8.73}{32.58}\times100$

26.79558011

$\boxed{26.8\%}$

O: $\frac{10.72}{32.58}\times100$

32.90362185

$\boxed{32.9\%}$

3. Calculate the mass of hydrogen in 112.4 g of propane (C_3H_8). (HINT: Using percent composition as a conversion factor).

$$\frac{8.0632g}{44.0962g}\times112.4g = 20.55287485$$

$$\boxed{20.6g\ H}$$

Part 4: Empirical vs Molecular Formula

1. Butane is a hydrocarbon that is a good source of energy. The formula can be written as C_4H_{10} or C_2H_5. Which formula is the empirical formula? Which is the molecular formula?

C_4H_{10} = molecular

C_2H_5 = empirical

2. A compound contains 75.46% carbon, 4.43% hydrogen, and 20.11% oxygen by mass. It has a molar weight of 318.31 g/mol.
   - The empirical formula of the compound is _____.

$C: 75.46g \times \frac{1mol}{12.011g} = \frac{6.282574307}{1.257} = 5 \times 2 = 10$

$H: 4.43g \times \frac{1mol}{1.0079g} = \frac{4.395277309}{1.257} = 3.5 \times 2 = 7$

$O: 20.11g \times \frac{1mol}{15.999g} = \frac{1.25695356}{1.257} = 1 \times 2 = 2$

$\boxed{C_{10}H_7O_2}$

   - The molecular formula of this compound is $\boxed{C_{20}H_{14}O_4}$.

$\frac{318.31 g/mol}{159.1633 g/mol} = 2$