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Unit 9: The Mole- Funsheets

Part A: Molar Mass – *Write the formula AND determine the molar mass for each of the following. Be sure to include units and round you answer to 2 decimal places.*

1) calcium carbonate
2) magnesium sulfate
3) Diphosphorous pentachloride
4) Tetrasulfur trioxide
5) barium fluoride
6) nitric acid
7) ammonia
8) Sulfuric acid
9) Hydrophosphoric acid
10) iron (III) chloride

Part B: Percent Composition - *Determine the percent composition of each element in the substances listed below. Write your answers in the tables provided. Show ALL of your work for credit.*

1) A 14.80g sample contains 3.83g of iron and 10.97 g bromine.

% Fe=	
% Br=	

2) A 9.14g sample contains 4.77 g of carbon, 1.19 g of hydrogen, and 3.18g of oxygen.

% C=	
% H=	
% O=	

3) A 2.85g sample contains 0.82 g of magnesium, 0.41 g of carbon, and 1.62g of oxygen.

% Mg=	
% C=	
% O=	

4) CaC_2O_4

% Ca=	
% C=	
% O=	

5) $Al_2(SO_4)_3$

% Al =	
% S =	
% O =	

6) $KMnO_4$

% K =	
% Mn =	
% O =	

7) HCl

% H =	
% Cl =	

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8) $Mg(NO_3)_2$

% Mg =	
% N =	
% O =	

9) $(NH_4)_3PO_4$

% N =	
% H =	
% P =	
% O =	

10) H_2O

% H =	
% O =	

11) How many grams of oxygen can be produced form the decomposition of 100.0 g of $KClO_3$?

12) How much iron can be recovered from 25.0g of Fe_2O_3?

13) How much silver can be produced from 125 g of Ag_2S?

Part C: Mass ←→ Moles- *Answer the following questions. Show ALL work for credit.*

1) What is the mass of 3.00 moles of As_2S_3?

2) How many moles are present in 11.5 g of C_2H_5OH?

3) What is the mass of 9.30 moles of SiH_4?

4) How many moles of water are present in 72.3 g of H_2O?

5) What is the mass of 0.560 moles of Fe_2O_3?

6) A sample of K_2S has a mass of 345.92 g. How many moles of K_2S are present in this sample?

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Part D: Volume ←→ Moles- *Answer the following questions. Show ALL work for credit.*

1) A sample of oxygen gas occupies 32.0 L of space at STP. How many moles are in this sample?

2) If a neon light contains 4.67 moles of neon at STP, what volume is the light?

3) How many moles of gas are present in 56.8L of hydrogen gas at STP?

4) What volume does 79.8 moles of water vapor occupy at STP?

5) How many moles of gas are present in a 2.0L sample of carbon dioxide?

6) What volume would a balloon be if it contained 34.7 moles of helium?

Part E: Particles ←→ Moles- *Answer the following questions. Show ALL work for credit.*

1) How many moles are 8.00×10^{20} molecules of H_2?

2) How many molecules are in 0.987 moles of sodium chloride?

3) How many moles are in 5.3×10^{30} molecules of carbon dioxide?

4) How many atoms are in 3.5 moles of tin?

5) How many moles of sulfuric acid are present if there are 3.33×10^{33} molecules of sulfuric acid?

6) If a sample contains 2.5 moles of water, how many atoms of hydrogen are present? (Hint: be sure to calculate molecules of water BEFORE you calculate atoms of hydrogen).

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Part F: Mole Math- *Answer the following questions, be sure to include units. Show ALL work for credit.*

1) How many atoms are contained in 3.46 moles of magnesium?

2) What mass would 4.50L of helium gas be at STP?

3) Convert 256.3 g of Na_2CO_3 to compounds of Na_2CO_3.

4) How many molecules of bromine gas (Br_2) are in 15 L of bromine gas?

5) What is the mass of 12.4 molecules of carbon tetrachloride?

6) How many moles of carbon dioxide would be in 8.93 L of carbon dioxide?

7) How many moles are contained in 0.43 g of Al_2O_3?

8) The volume of 42.1g of carbon dioxide is _____.

9) What is the volume in liters of 9.31×10^{21} atoms of nitrogen gas (N_2)?

10) The mass of 4.67 moles of NaCl is _____.

11) How much space would 0.54 moles of water vapor occupy?

12) How many moles of sodium metal is equal to 6.92×10^{21} atoms of sodium metal?

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Part G: Empirical Formula- *Determine the empirical formula for the following. Show ALL work for credit.*

1) Determine the empirical formula from the molecular formulas:
   a. C_6H_6
   b. C_2H_6
   c. C_3H_8
   d. $Fe_3(CO)_9$
   e. $C_2H_4O_2$
   f. N_2H_4
   g. $CaBr_2$
   h. $C_6H_{12}O_6$
   i. C_6H_3O
   j. Na_2SO_4
   k. C_6H_5N
   l. LiCl
2) Determine the empirical formula from the percent composition for each of the following:
   a. 75% carbon and 25% hydrogen

   b. 52.7% potassium and 47.3% chlorine

   c. 22.1% aluminum, 25.4% phosphorous, and 52.5% oxygen

   d. 13% magnesium and the remainder bromine

   e. 32.4% sodium, 22.5% sulfur, and 45.1% oxygen

3) A compound was analyzed and found to contain 13.5g Ca, 10.8g O, and 0.675g H. What is the empirical formula for the compound?

4) An analysis of an unknown sample was found to contain 97.56g of carbon, 4.878g of hydrogen, 52.03g of oxygen, and 45.53g of nitrogen. Find the empirical formula for this substance.

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Part H: Molecular Formula- *Determine the molecular formula for the following. Show ALL work for credit.*

1) A compound is 79.08% carbon, 5.54% hydrogen, and 15.38% nitrogen. What is the molecular formula of this substance if the molar mass is 273.36 g/mol?

2) A compound found to be 40.0% carbon, 6.7% hydrogen, and 53.5% oxygen. Its molar mass is 60.00 g/mol. What is its molecular formula?

3) A compound is 64.9% carbon, 13.5% hydrogen, and 21.6% oxygen. Its molar mass is 74.14g/mol. What is its molecular formula?

4) A compound is 54.5% carbon, 9.1% hydrogen, and 36.4% oxygen. Its molar mass is 88.00 g/mol, what is its molecular formula?

5) If the empirical formula of a compound is NO_2 and its molar mass is 92.00 g/mole, what is its molecular formula?

6) The empirical formula for a compound of CH_2 has a molar mass of 70.00 g/mole. What is the molecular formula?

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Part I: Vocabulary and Concepts- *Using your notes from class, answer the following questions.*

1) What is the mole (definition and value)?

2) How are a mole and a dozen similar?

3) What is Avogadro's number?

4) Why do scientists use the mole?

5) What is molar mass?

6) Explain how you would calculate the molar mass of H_2O.

7) What are the units of molar mass?

8) What is percent composition?

9) What is the formula for percent composition?

10) What conversion factor is used to convert between mass and moles?

11) What is the difference between an atom and a molecule?

12) When converting between particles and moles, what conversion factor would you use?

13) How many particles are in a mole of substance?

14) When converting between volume and moles, what conversion factor is used?

15) What does STP stand for?

16) What is standard temperature?

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17) What is standard pressure?

18) How much space will one mole of gas occupy at STP?

19) What is wrong with the following set up below?
The student was attempting to convert 5.60 x 10^{21} molecules of water into the mass of water.

$$\frac{5.60\ x\ 10^{21} molecules}{} x\ \frac{6.02\ x\ 10^{23}\ moles}{1\ molecule} x\ \frac{1\ mole}{18.02 g} =$$

20) What is the difference between empirical and molecular formulas?

21) Can the empirical formula be the molecular formula?

22) What are the steps to determining the empirical formula given percent composition?

23) What are the steps to determining the molecular formula?

24) Indicate if the following are true or false. Correct the false statements to make them true.
   a. A mole of sulfur dioxide has 1 mole of sulfur atoms and 1 mole of oxygen atoms. _____
   b. A mole of any element contains 6.02 x 10^{23} atoms. _____
   c. A mole of an ionic compound contains 6.02 x 10^{23} atoms. _____
   d. The molar mass of a substance in g/mole is always equal to the atomic mass in amu._____
   e. One molecule of HNO_3 contains 3 atoms of oxygen. _____