

Name _____ Date _____

Formula Mass

Directions: Determine the gram formula mass (the mass of one mole) of each compound below. Show your work for the **ODD** examples only!

1. Iron (II) Sulfide _____

2. $\text{Ca}(\text{NO}_3)_2$ _____

3. Carbonic acid _____

4. Caffeine, $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$ _____

5. Calcium hydroxide _____

6. Chlorine gas _____

7. $\text{Mg}_3(\text{PO}_4)_2$ _____

8. $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ _____

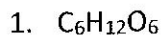
9. Ammonium sulfate _____

10. Copper (II) nitrate pentahydrate _____

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Percent Composition

Directions: Determine the percent composition by mass of each of the following compounds.



C = _____

H = _____

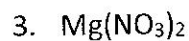
O = _____



N = _____

H = _____

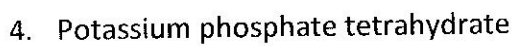
O = _____



Mg = _____

N = _____

O = _____



K = _____

P = _____

O = _____

H = _____



Pb = _____

C = _____

H = _____

O = _____

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Mole Conversions

Directions: Determine the number of **moles** in each of the quantities below.

- 1) 130 g of H_2SO_4
- 2) 87 g of KCl
- 3) 2.8 grams of calcium carbonate

Directions: Determine the number of **grams** in each of the quantities below.

- 4) 3.5 moles of NaCl
- 5) 2.80 moles of KMnO_4
- 6) 1.25 moles of nitrogen gas

Directions: Determine the number of **molecules** in the quantities below.

- 7) 2.2 moles
- 8) 0.17 moles
- 9) 9.43 grams of magnesium chloride
- 10) 7.5 grams of sulfuric acid

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Mixed Mole Conversions

Directions: Solve the following problems.

- 1) How many grams are there in 1.2×10^{26} molecules of CO_2 ?

- 2) What volume would the CO_2 in Problem 1 occupy at STP?

- 3) A sample of NH_3 gas occupies 82.0 liters at STP. How many molecules is this?

- 4) What is the mass of the sample of NH_3 in Problem 3?

- 5) How many moles are there in 1.3×10^{22} molecules of NO_2 ?

- 6) How many atoms are there in 12.7×10^{24} molecules of CO_2 ?

- 7) A 8.1 g sample of O_2 is in a container at STP. What volume is the container?

- 8) How many molecules of O_2 are in the container in Problem 7? How many atoms?

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Empirical Formula

Directions: Determine the empirical formula for each compound below.

1. 74.51% Pb, 25.49% Cl
2. 52.55% Ba, 10.72% N, 36.73% O
3. 29.15% N, 8.41% H, 12.50% C, 49.94% O
4. Glycerol is a thick, sweet liquid obtained as a byproduct of the manufacture of soap. Its percent composition is 39.12% carbon, 8.75% hydrogen, and 52.12% oxygen. What is its empirical formula?
5. Analysis of a compound containing chlorine and lead reveals that the compound is 59.37% lead. What is the empirical formula of this compound?
6. A 15.0g sample of a compound is found to contain 8.83g sodium and 6.17g sulfur. Calculate the empirical formula of this compound.
7. What is the empirical formula for $\text{H}_2\text{C}_2\text{O}_4$?

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Molecular Formula

Directions: Determine the molecular formula for each compound below.

1. empirical formula CH, molar mass 78 g/mol
2. empirical formula NH₂, molar mass 32.06 g/mol
3. empirical formula OCNCl, molar mass 232.41 g/mol
4. A compound with the following composition has a molar mass of 60.10 g/mol: 39.97% carbon, 13.41% hydrogen, 46.62% nitrogen. Find the molecular formula.
5. Determine the molecular formula for ibuprofen, a common headache remedy. Analysis of ibuprofen yields a molar mass of 206 g/mol and a percent composition of 75.7% C, 8.80% H and 15.5% O.
6. A certain compound has an empirical formula for NH₂O and its molar mass is between 55 g/mol and 65 g/mol. What is the possible molecular formula?
 - a. N₂H₄O₂
 - b. N₂H₂O₂
 - c. NH₂O
 - d. Not possible

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Intro Stoichiometry

Directions: Be sure to show all work, correct significant figures and include units.

1. Predict the products and balance the equation for the reaction between sodium bicarbonate and hydrochloric acid.



2. If you use 3.2 moles of sodium bicarbonate in the reaction in question #1,
a. How many moles of HCl would be used?

b. How many moles of each product would be produced?

- 3) Given this equation: $\text{C}_{(s)} + 2\text{Cl}_{2(g)} \rightarrow \text{CCl}_{4(s)}$, write the following molar ratios:

a) Cl_2 to CCl_4

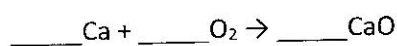
b) C to CCl_4

c) CCl_4 to Cl_2

- 4) Answer the following questions for this equation: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

If you mix 20.0 moles of H_2 with excess O_2 , how many moles of H_2O can you make?

- 5) Balance this equation and use it to answer the following question.



How many moles of oxygen will be required to produce 14.0 mol calcium oxide?

Use this equation: $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$, for the following problems

- a) If 2.5 moles of N_2 react, how many moles of NH_3 can be produced?

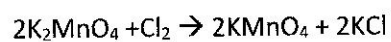
b) If 10.0 moles of NH_3 are produced, how many moles of H_2 would be required?

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Volume Stoichiometry

Directions: Be sure to show all work, correct significant figures and include units.

1. Use the reaction below to answer the question. What volume of chlorine gas at STP is required to react with 4.80 g of K_2MnO_4 ?



2. When 1.6 L of hydrogen gas reacts with excess chlorine gas reacts at STP what volume of hydrogen chloride gas is formed?

3. How many liters of CO_2 can be produced from 0.67 mole of Fe_2O_3 at STP?

