Percent Composition and Molecular Formula Worksheet

1. What’s the empirical formula of a molecule containing 65.5% carbon, 5.5% hydrogen, and 29.0% oxygen?
2. If the molar mass of the compound in problem 1 is 110 grams/mole, what’s the molecular formula?
3. What’s the empirical formula of a molecule containing 18.7% lithium, 16.3% carbon, and 65.0% oxygen?
4. If the molar mass of the compound in problem 3 is 73.8 grams/mole, what’s the molecular formula?

Write the molecular formulas of the following compounds:

5. A compound with an empirical formula of C₂OH₄ and a molar mass of 88 grams per mole.
6. A compound with an empirical formula of C₃H₄O and a molar mass of 136 grams per mole.
7. A compound with an empirical formula of CFBrO and a molar mass of 254.7 grams per mole.
8. A compound with an empirical formula of C₂H₅N and a molar mass of 46 grams per mole.

Answer the following questions:

9. The percentage composition of acetic acid is found to be 39.9% C, 6.7% H, and 53.4% O. Determine the empirical formula of acetic acid.
10. The molar mass for question #9 was determined by experiment to be 60.0 g/mol. What is the molecular formula?
11. Aniline, a starting material for urethane plastic foams, consists of C, H, and N. Combustion of such compounds yields CO₂, H₂O, and N₂ as products. If the combustion of 9.71 g of aniline yields 6.63 g H₂O and 1.46 g N₂, what is its empirical formula?
12. The molar mass of aniline is 93 g/mol. What is its molecular formula?
13. Calculate the mass percent of carbon, nitrogen and oxygen in acetamide, C₂H₅NO.
14. A 50.51 g sample of a compound made from phosphorus and chlorine is decomposed. Analysis of the products showed that 11.39 g of phosphorus atoms were produced. What is the empirical formula of the compound?
15. When 2.5000 g of an oxide of mercury, (HgxOy) is decomposed into the elements by heating, 2.405 g of mercury are produced. Calculate the empirical formula.
16. The compound benzamide has the following percent composition. What is the empirical formula?
   C = 69.40 %  H= 5.825 %  O = 13.21 %  N= 11.57 %
17. A component of protein called serine has an approximate molar mass of 100 g/mole. If the percent composition is as follows, what is the empirical and molecular formula of serine?
   C = 34.95 %  H= 6.844 %  O = 46.56 %  N= 13.59 %
1. What’s the empirical formula of a molecule containing 65.5% carbon, 5.5% hydrogen, and 29.0% oxygen? \( \text{C}_3\text{H}_3\text{O} \) mass = 55 g/mole
2. If the molar mass of the compound in problem 1 is 110 grams/mole, what’s the molecular formula? \( \text{C}_6\text{H}_6\text{O}_2 \)
3. What’s the empirical formula of a molecule containing 18.7% lithium, 16.3% carbon, and 65.0% oxygen? \( \text{Li}_2\text{CO}_3 \)
4. If the molar mass of the compound in problem 3 is 73.8 grams/mole, what’s the molecular formula? \( \text{Li}_2\text{CO}_3 \)

Write the molecular formulas of the following compounds:

5. A compound with an empirical formula of \( \text{C}_2\text{OH}_4 \) and a molar mass of 88 grams per mole. \( \text{C}_4\text{O}_2\text{H}_8 \)
6. A compound with an empirical formula of \( \text{C}_4\text{H}_4\text{O} \) and a molar mass of 136 grams per mole. \( \text{C}_8\text{H}_8\text{O}_2 \)
7. A compound with an empirical formula of \( \text{CFBrO} \) and a molar mass of 254.7 grams per mole. \( \text{C}_2\text{F}_2\text{Br}_2\text{O}_2 \)
8. A compound with an empirical formula of \( \text{C}_2\text{H}_8\text{N} \) and a molar mass of 46 grams per mole. \( \text{C}_2\text{H}_8\text{N} \)

Answer the following questions:

9. The percentage composition of acetic acid is found to be 39.9% C, 6.7% H, and 53.4% O. Determine the empirical formula of acetic acid. \( \text{CH}_2\text{O} \)
10. The molar mass for question #9 was determined by experiment to be 60.0 g/mol. What is the molecular formula? \( \text{C}_2\text{H}_4\text{O}_2 \)
11. Aniline, a starting material for urethane plastic foams, consists of C, H, and N. Combustion of such compounds yields \( \text{CO}_2 \), \( \text{H}_2\text{O} \), and \( \text{N}_2 \) as products. If the combustion of 9.71 g of aniline yields 6.63 g \( \text{H}_2\text{O} \) and 1.46 g \( \text{N}_2 \), what is its empirical formula? \( \text{C}_6\text{H}_7\text{N} \)
12. The molar mass of aniline is 93 g/mol. What is its molecular formula? \( \text{C}_6\text{H}_7\text{N} \)
13. Calculate the mass percent of carbon, nitrogen and oxygen in acetamide, \( \text{C}_2\text{H}_5\text{NO} \). \( \%\text{C} 40.668 \%\text{H} 8.533 \%\text{N} 23.713 \%\text{O} 27.086 \)
14. A 50.51 g sample of a compound made from phosphorus and chlorine is decomposed. Analysis of the products showed that 11.39 g of phosphorus atoms were produced. What is the empirical formula of the compound? \( \text{PCl}_3 \)
15. When 2.5000 g of an oxide of mercury, \( \text{Hg}_x\text{O}_y \) is decomposed into the elements by heating, 2.405 g of mercury are produced. Calculate the empirical formula. \( \text{Hg}_3\text{O} \)
16. The compound benzamide has the following percent composition. What is the empirical formula? \( \text{C} = 69.40 \%\text{H} = 5.825 \%\text{O} = 13.21 \%\text{N} = 11.57 \% \) \( \text{C}_7\text{H}_7\text{NO} \)
17. A component of protein called serine has an approximate molar mass of 100 g/mole. If the percent composition is as follows, what is the empirical and molecular formula of serine?

\( \text{C} = 34.95 \%\text{H} = 6.844 \%\text{O} = 46.56 \%\text{N} = 13.59 \% \)

\( \text{C}_3\text{H}_7\text{NO}_3 \) empirical formula
\( \text{C}_3\text{H}_7\text{NO}_3 \) molecular formula
Write the molecular formulas of the following compounds:

1) A compound with an empirical formula of C$_2$OH$_4$ and a molar mass of 88 grams per mole. C$_4$O$_2$H$_8$

2) A compound with an empirical formula of C$_4$H$_4$O and a molar mass of 136 grams per mole. C$_8$H$_8$O$_2$

3) A compound with an empirical formula of CFBrO and a molar mass of 254.7 grams per mole. C$_2$F$_2$Br$_2$O$_2$

4) A compound with an empirical formula of C$_2$H$_8$N and a molar mass of 46 grams per mole. C$_2$H$_8$N
Percent Composition and Molecular Formula Worksheet Solutions

1) What’s the empirical formula of a molecule containing 65.5% carbon, 5.5% hydrogen, and 29.0% oxygen?

\[ C_3H_3O \]

2) If the molar mass of the compound in problem 1 is 110 grams/mole, what’s the molecular formula?

\[ C_6H_6O_2 \]

3) What’s the empirical formula of a molecule containing 18.7% lithium, 16.3% carbon, and 65.0% oxygen?

\[ \text{Li}_2\text{CO}_3 \]

4) If the molar mass of the compound in problem 3 is 73.8 grams/mole, what’s the molecular formula?

\[ \text{Li}_2\text{CO}_3 \text{ (In this case, the molecular and empirical formulas are the same, a frequent occurrence for inorganic compounds)} \]

9. The percentage composition of acetic acid is found to be 39.9% C, 6.7% H, and 53.4% O. Determine the empirical formula of acetic acid.

10. The molar mass was determined by experiment to be 60.0 g/mol. What is the molecular formula? \( \text{(C}_2\text{H}_4\text{O}_2) \)

7. Aniline, a starting material for urethane plastic foams, consists of C, H, and N. Combustion of such compounds yields CO2, H2O, and N2 as products. If the combustion of 9.71 g of aniline yields 6.63 g H2O and 1.46 g N2, what is its empirical formula? \( \text{(C}_6\text{H}_7\text{N)} \) The molar mass of aniline is 93 g/mol. What is its molecular formula? \( \text{(C}_6\text{H}_7\text{N)} \)

Chapter 3: Worksheet #1 Mass Relationships

1. Calculate the mass percent of carbon, nitrogen and oxygen in acetamide, \( \text{C}_2\text{H}_5\text{NO} \).

\[ \%\text{C} 40.668 \%\text{H} 8.533 \%\text{N} 23.713 \%\text{O} 27.086 \]

2. A 50.51 g sample of a compound made from phosphorus and chlorine is decomposed. Analysis of the products showed that 11.39 g of phosphorus atoms were produced. What is the empirical formula of the compound?

\[ \text{PCl}_3 \]

3. When 2.5000 g of an oxide of mercury, \( \text{(Hg}_x\text{O}_y \) is decomposed into the elements by heating, 2.405 g of mercury are produced. Calculate the empirical formula.

\[ \text{Hg}_2\text{O} \]

4. The compound benzamide has the following percent composition. What is the empirical formula?

\[ \text{C} = 69.40 \% \text{H} = 5.825 \% \text{O} = 13.21 \% \text{N} = 11.57 \% \]

\[ \text{C}_7\text{H}_7\text{NO} \]

5. A component of protein called serine has an approximate molar mass of 100 g/mole. If the percent composition is as follows, what is the empirical and molecular formula of serine?

\[ \text{C} = 34.95 \% \text{H} = 6.844 \% \text{O} = 46.56 \% \text{N} = 13.59 \% \]
C<sub>3</sub>H<sub>7</sub>NO<sub>3</sub> empirical formula

C<sub>3</sub>H<sub>7</sub>NO<sub>3</sub> molecular formula

6. Balance the following equations:

2 NaCl(aq) + Ba(NO<sub>3</sub>)<sub>2</sub>(aq)  \rightarrow  2 NaNO<sub>3</sub>(aq) + BaCl<sub>2</sub>(aq)

Na<sub>3</sub>PO<sub>4</sub>(aq) + 3 AgNO<sub>3</sub>(aq)  \rightarrow  3 NaNO<sub>3</sub>(aq) + Ag<sub>3</sub>PO<sub>4</sub>(s)

K<sub>2</sub>SO<sub>4</sub>(aq) + BaCl<sub>2</sub>(aq)  \rightarrow  BaSO<sub>4</sub>(s) + 2 KCl(aq)

2 HCl(aq) + Ca(OH)<sub>2</sub>(aq)  \rightarrow  2 H<sub>2</sub>O(l) + CaCl<sub>2</sub>(aq)

2 Na(s) + S(s)  \rightarrow  2 Na<sub>2</sub>S(s)

2 C<sub>2</sub>H<sub>6</sub>(g) + 7 O<sub>2</sub>(g)  \rightarrow  4 CO<sub>2</sub>(g) + 6 H<sub>2</sub>O(l)

2 Li(s) + 2 H<sub>2</sub>O(l)  \rightarrow  2 LiOH (s) + H<sub>2</sub>(g)

Mg(s) + CuCl<sub>2</sub>(aq)  \rightarrow  MgCl<sub>2</sub>(aq) + Cu(s)
\[2 \text{HgO(s)} \rightarrow 2 \text{Hg(l)} + \text{O}_2(g)\]
\[4 \text{FeO(s)} + \text{O}_2(g) \rightarrow 2 \text{Fe}_2\text{O}_3(s)\]
\[\text{Ca(HSO}_3\text{)}_2(s) \rightarrow \text{CaO(s) + H}_2\text{O(l) + 2 SO}_2(g)\]
\[2 \text{Fe(s)} + 3 \text{Br}_2(l) \rightarrow 2 \text{FeBr}_3(s)\]
\[\text{CH}_3\text{CH}_2\text{OH(l) + 3 O}_2 \rightarrow 2 \text{CO}_2(g) + 3 \text{H}_2\text{O(l)}\]