

Exercise 3.7

Percent Composition & Formulas

Name: _____

Date: _____ Per: _____

1. In 1987 the first substance to act as a superconductor at a temperature above that of liquid nitrogen (77 K) was discovered. The approximate formula of this substance is $\text{YBa}_2\text{Cu}_3\text{O}_7$. Calculate the percent composition by mass of this substance.

2. Hemoglobin is the protein that transports oxygen in mammals. Hemoglobin is 0.347% Fe by mass, and each hemoglobin molecule contains four iron atoms. Calculate the molar mass of hemoglobin.

3. The most common form of nylon (nylon-6) is 63.68% carbon, 12.38% nitrogen, 9.80% hydrogen, and 14.14% oxygen. Calculate the empirical formula for nylon-6.

4. The compound adrenaline contains 56.79% C, 6.56% H, 28.37% O, and 8.28% N by mass. What is the empirical formula for adrenaline?

5. Adipic acid is an organic compound composed of 49.31% C, 43.79% O, and the rest hydrogen. If the molar mass of adipic acid is 146.1 g/mol, what are the empirical and molecular formulas of adipic acid?

6. Terephthalic acid is an important chemical used in the manufacture of polyesters and plasticizers. It contains only C, H, and O. Combustion of 19.81 mg terephthalic acid produces 41.98 mg CO_2 and 6.45 mg H_2O . If 0.250 mole of terephthalic acid has a mass of 41.5 g, determine the molecular formula for terephthalic acid.

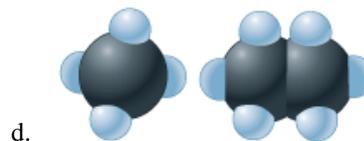
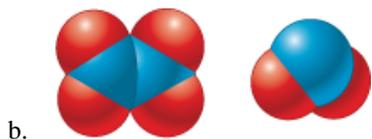
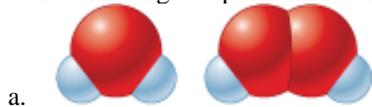
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Which of the following compounds have the same empirical formulas?



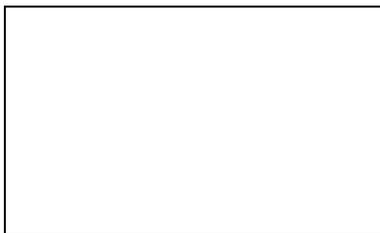
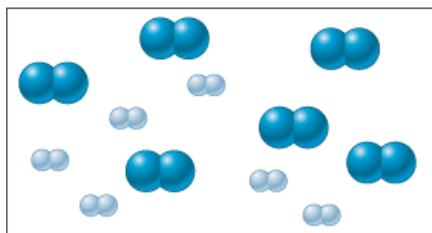
7. One of the relatively few reactions that takes place directly between two solids at room temperature is



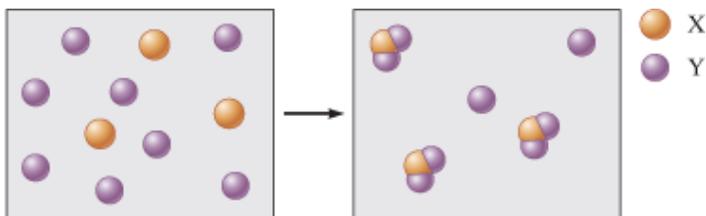
In this equation, the $\cdot 8\text{H}_2\text{O}$ in $\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$ indicates the presence of eight water molecules. This compound is called barium hydroxide octahydrate.

- a. Balance the equation: _____
- b. What mass of ammonium thiocyanate (NH_4SCN) must be used if it is to react completely with 6.5 g barium hydroxide octahydrate?

8. Nitrogen gas (N_2) and hydrogen gas (H_2) react to form ammonia gas (NH_3). Consider the mixture of N_2 and H_2 in closed container as illustrated below: (N_2 is larger than H_2 .) Assuming the reaction goes to completion, draw a representation of the product mixture. Explain how you arrived at this representation.



9. The reaction of element X with element Y is represented in the following diagram. Which of the equations best describes this reaction?



- a. $3\text{X} + 8\text{Y} \rightarrow \text{X}_3\text{Y}_8$ b. $3\text{X} + 6\text{Y} \rightarrow \text{X}_3\text{Y}_6$ c. $\text{X} + 2\text{Y} \rightarrow \text{XY}_2$ d. $3\text{X} + 8\text{Y} \rightarrow 3\text{XY}_2 + 2\text{Y}$