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CHAPTER 11 STUDY GUIDE FOR CONTENT MASTERY

Section 11.4 Empirical and Molecular Formulas

In your textbook, read about percent composition.

Answer the following questions.

1. What is the percent composition of a compound?

   The percent composition of a compound is the percent by mass of each of the elements in a compound.

2. Describe how to find the percent composition of a compound if you know the mass of a sample of a compound and the mass of each element in the sample.

   Divide the mass of each element in the sample by the mass of the sample. Then multiply each quotient by 100.

In your textbook, read about empirical and molecular formulas.

Circle the letter of the choice that best answers the question.

3. Which information about a compound can you use to begin to determine the empirical and molecular formulas of the compound?
   a. mass of the compound
   (c.) percent composition of the compound
   b. number of elements in the compound
   d. volume of the compound

4. You have determined that a compound is composed of 0.300 moles of carbon and 0.600 moles of oxygen. What must you do to determine the mole ratio of the elements in the empirical formula of the compound?
   a. Multiply each mole value by 0.300 mol.
   (c.) Divide each mole value by 0.300 mol.
   b. Multiply each mole value by 0.600 mol.
   d. Divide each mole value by 0.600 mol.

5. The mole ratio of carbon to hydrogen to oxygen in a compound is 1 mol C : 2 mol H : 1 mol O. What is the empirical formula of the compound?
   a. CHO
   (b.) CH_2O
   c. C_2HO_2
   d. $C_2H_2O_2$

6. You calculate the mole ratio of oxygen to aluminum in a compound to be 1.5 mol O : 1 mol Al. What should you do to determine the mole ratio in the empirical formula of the compound?
   a. Multiply each mole value by 1.5.
   c. Divide each mole value by 1.5.
   (b.) Multiply each mole value by 2.
   d. Divide each mole value by 2.

7. What is the relationship between the molecular formula and the empirical formula of a compound?
   a. (molecular formula)(empirical formula) = n
   b. molecular formula = $\frac{\text{empirical formula}}{n}$
   (c.) molecular formula = (empirical formula)n
   d. molecular formula = $\frac{n}{\text{empirical formula}}$

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Section 11.4 *continued*

8. You know that the empirical formula of a compound has a molar mass of 30.0 g/mol. The experimental molar mass of this compound is 60.0 g/mol. What must you do to determine the value of n in the relationship between the molecular formula and the empirical formula?
   a. Add 30.0 g/mol and 60.0 g/mol.
   (c.) Divide 60.0 g/mol by 30.0 g/mol.
   b. Divide 30.0 g/mol by 60.0 g/mol.
   d. Multiply 30.0 g/mol by 60.0 g/mol.

9. You know that the experimental molar mass of a compound is three times the molar mass of its empirical formula. If the compound's empirical formula is NO_2, what is its molecular formula?
   a. NO_2
   b. NO_6
   c. N_3O_2
   (d.) N_3O_6

Solve the following problem. Show your work in the space provided.

10. A sample of a compound contains 7.89 g potassium, 2.42 g carbon, and 9.69 g oxygen. Determine the empirical and molecular formulas of this compound, which has a molar mass of 198.22 g/mol.

7.89 ~~g K~~ × 1 mol K/39.10 ~~g K~~ = 0.202 mol K
2.42 ~~g C~~ × 1 mol C/12.01 ~~g C~~ = 0.201 mol C
9.69 ~~g O~~ × 1 mol O/16.00 ~~g O~~ = 0.606 mol O
0.202 mol K/0.201 mol C = 1.00 mol K/1.00 mol C = 1 mol K/1 mol C
0.201 mol C/0.201 mol C = 1.00 mol C/1.00 mol C = 1 mol C/1 mol C
0.606 mol O/0.201 mol C = 3.01 mol O/1.00 mol C = 3 mol O/1 mol C
1 mol K : 1 mol C : 3 mol O
empirical formula: KCO_3
(39.10 g + 12.01 g + 48.00 g) = 99.11 g
molar mass KCO_3 = 99.11 g/mol KCO_3
***n* = *molar mass of molecular formula/molar mass of empirical formula* =**
198.22 ~~g/mol~~/99.11 ~~g/mol~~ = 2
$(KCO_3)n$
The molecular formula of the compound is $K_2C_2O_6$.