Name _____ Date _____ Class _____

10.1 THE MOLE: A MEASUREMENT OF MATTER

Section Review

Objectives

- Relate Avogadro's number to a mole of a substance
- Calculate the mass of a mole of any substance
- Describe methods of measuring the amount of something
- Compare and contrast the atomic mass of an element and its molar mass

Vocabulary

- mole (mol)
- Avogadro's number
- representative particle
- molar mass

Key Equations

- moles = representative particles $\times \dfrac{1 \text{ mole}}{6.02 \times 10^{23} \text{ representative particles}}$
- representative particles = moles $\times \dfrac{6.02 \times 10^{23} \text{ representative particles}}{1 \text{ mole}}$

Part A Completion

Use this completion exercise to check your knowledge of the terms and your understanding of the concepts introduced in this section. Each blank can be completed with a term, short phrase, or number.

Chemists relate units of counting, of mass, and of volume to a single quantity called the ___1___. The number of representative particles in a mole of a substance is ___2___.

To find the mass of a mole of a compound, scientists add together the ___3___ of the atoms making up the compound. When you substitute the unit *grams* for amu, you obtain the ___4___ of the compound. There are ___5___ representative particles in a mole of any substance.

1. _____
2. _____
3. _____
4. _____
5. _____

Name _____ Date _____ Class _____

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

_____ **6.** A mole of a pure substance contains 6.02×10^{23} atoms.

_____ **7.** The representative particle of a compound is the molecule.

_____ **8.** A mole of CCl_4 is composed of one atom of carbon and four atoms of chlorine.

_____ **9.** A mole of carbon atoms has a mass approximately three times as great as the mass of a mole of helium atoms.

_____ **10.** The molar mass of nitrogen gas is 14.0 g.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A	Column B
_____ **11.** Avogadro's number	**a.** the atoms, molecules, or ions present in a substance
_____ **12.** molar mass	**b.** 6.02×10^{23}
_____ **13.** mole	**c.** the mass of one mole of a substance
_____ **14.** representative particles	**d.** SI unit that measures the amount of a substance

Part D Problems

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

15. How many moles of Pb is 9.3×10^{15} atoms of Pb?

16. What is the molar mass of ethane, C_2H_6?

17. Find the mass of 3.65×10^{-2} mol K_2SO_4.

18. How many representative particles are in 2.5 mol H_2O_2?

Name _____ Date _____ Class _____

10.2 MOLE-MASS AND MOLE-VOLUME RELATIONSHIPS

Section Review

Objectives

- Convert the mass of a substance to the number of moles of a substance, and the number of moles of a substance to mass
- Calculate the volume of a quantity of gas at STP

Vocabulary

- Avogadro's hypothesis
- standard temperature and pressure (STP)
- molar volume

Key Equations

- $\text{mass (grams)} = \text{number of moles} \times \frac{\text{mass (grams)}}{1 \text{ mole}}$
- $\text{moles} = \text{mass (grams)} \times \frac{1 \text{ mole}}{\text{mass (grams)}}$
- $\frac{\text{grams}}{\text{mole}} = \frac{\text{grams}}{\text{L}} \times \frac{22.4 \text{ L}}{1 \text{ mole}}$
- $\text{volume of gas} = \text{moles of gas} \times \frac{22.4 \text{ L}}{1 \text{ mole}}$

Part A Completion

Use this completion exercise to check your knowledge of the terms and your understanding of the concepts introduced in this section. Each blank can be completed with a term, short phrase, or number.

At STP (0°C and 1 atmosphere pressure), one mole of any gas occupies a volume of ___1___ L. This quantity is known as the ___2___ of the gas. To determine the volume in liters of 2.00 mol of SO_2 gas at STP, you would use ___3___ as a conversion factor. ___4___, expressed in the units g/L, is used as a conversion factor when converting from volume to molar mass. When converting between numbers of representative particles, masses, and volumes, you must always convert to ___5___ as an intermediate step.

1. _____
2. _____
3. _____
4. _____
5. _____

Name _____ Date _____ Class _____

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

_____ **6.** One mole of any gas occupies a volume of 22.4 L.

_____ **7.** For a substance of known molar mass, the number of moles of a sample can be calculated from the mass of the sample.

_____ **8.** The volume occupied by one mole of a gas is dependent on the molar mass of the gas.

_____ **9.** The volume of a gas at STP can be calculated from the number of molecules of the gas.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A	Column B
_____ **10.** molar mass	**a.** 22.4 L of a gas at STP
_____ **11.** standard temperature	**b.** 101.3 kPa or 1 atm
_____ **12.** molar volume	**c.** 0°C
_____ **13.** standard pressure	**d.** mass (in grams) of one mole of a substance
_____ **14.** molar road map	**e.** a means of relating mass, number of representative particles, and gaseous volume of a substance

Part D Problems

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

15. What is the density of N_2O, a gas, at STP?

16. What is the mass of two moles of NaCl?

17. How many moles are in 16 grams of O_2?

18. What is the volume of 16 grams of O_2 at STP?

Name _____ Date _____ Class _____

10.3 PERCENT COMPOSITION AND CHEMICAL FORMULAS

Section Review

Objectives

- Calculate the percent by mass of an element in a compound
- Interpret an empirical formula
- Compare and contrast empirical and molecular formulas

Vocabulary

- percent composition
- empirical formula

Key Equation

- $\%\ \text{mass of element} = \frac{\text{mass of element}}{\text{mass of compound}} \times 100\%$

Part A Completion

Use this completion exercise to check your knowledge of the terms and your understanding of the concepts introduced in this section. Each blank can be completed with a term, short phrase, or number.

The __1__ of a compound is the percent by mass of each element in a compound. The percent by mass of an element in a compound is the number of grams of the element per __2__ g of the compound, multiplied by 100%. To calculate the percent by mass of an element in a known compound, divide the mass of the element in one mole by the __3__ and multiply by 100%.

A(n) __4__ formula represents the lowest __5__ ratio of the elements in a compound. It can be calculated from a compound's percent composition. The __6__ formula of a compound is either the same as its empirical formula, or it is some whole-number multiple of it.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Name _____ Date _____ Class _____

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

_____ **7.** It is necessary to know the formula of a compound in order to calculate its percent composition.

_____ **8.** If the percent by mass of carbon in methane, CH_4, is 75%, then 100 grams of methane contain 25.0 grams of hydrogen.

_____ **9.** The formula for methane, CH_4, is both a molecular and an empirical formula.

_____ **10.** The empirical formula for glucose, $C_6H_{12}O_6$, is $C_2H_4O_2$.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A	Column B
_____ **11.** percent composition	**a.** describes the actual number of atoms of each element in a molecule of a compound
_____ **12.** empirical formula	**b.** the lowest whole-number ratio of atoms of the elements in a compound
_____ **13.** molecular formula	**c.** the percent by mass of each element in a compound

Part D Problems

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

14. What is the percent composition of each of the following?

a. Cr_2O_3

b. $Mn_2P_2O_7$

c. HgS

d. $Ca(NO_3)_2$

15. Determine the empirical formula of the compound with the percent composition of 29.1% Na, 40.5% S, and 30.4% O.

16. How many kilograms of iron can be recovered from 639 kilograms of the ore Fe_2O_3?