

Name: _____

Period: ____

Review: The Mole

I. Molar Mass

(1) Determine the molar mass of the following substances.

(a) Al

(b) bromine

(c) $\text{Mg}_3(\text{PO}_3)_2$

(d) copper (I) sulphide

(2) The main component of rubbing alcohol is the chemical isopropanol which has the chemical formula $\text{C}_3\text{H}_8\text{O}$. What is the molar mass of this compound?

II. Mole Calculations

(1) What is the mass of 3.68 moles of aluminum oxide?

(2) How many molecules are contained in 0.075 mol of calcium carbonate? How many atoms are there of each element? How many atoms are there in total?

(3) What is the mass of 5.64×10^{25} molecules of aluminum nitrate?

(4) Determine the number of molecules in 5.45 kg of sodium chloride.

III. Hydrates

(1) Name the hydrate.

(a) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ _____

(b) $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ _____

(2) Write the formula for each hydrate.

(a) strontium iodate monohydrate _____

(b) copper (II) chloride dihydrate _____

IV. Percent Composition

(1) Determine the percent composition for each element in the following compounds.

(a) ammonium nitrate

(b) CuBr_2

(2) Citric acid is the type of acid found in fruits such as lemons and oranges. The chemical formula for citric acid is $\text{C}_6\text{H}_8\text{O}_7$. Determine the percent composition for each element.

(3) Iron (II) nitrate nonahydrate is a compound used in fingerprint analysis.

(a) Write the chemical formula for the compound.

(b) Determine the percent composition for each element in the compound.

(c) Determine the percent composition of water in the compound.

V. Empirical Formulas

(1) Determine the empirical formula for the following compounds. Name each compound.

(a) 25.5% Al, 29.2% P, 45.3% O

(b) 22.1% Al, 25.4% P, 52.5% O

(2) Glycerine is a chemical widely used in the food industry. A 2.55 g sample of glycerine contains 0.998 g of carbon, 0.223 g of hydrogen, and the remainder is oxygen; determine the empirical formula of glycerine.

VI. Molecular Formulas

(1) Borane is used in the manufacture of glassware. A 0.540 g sample of borane was found to contain 0.438 g of boron and 0.102 g of hydrogen. The molecular weight of borane is 53.32 g/mol. Determine the empirical and molecular formula.

(2) Lysine is an amino acid found in high quantities in asparagus and spinach. Lysine contains 49.3% carbon, 9.7% hydrogen, 19.2% nitrogen, and the remainder is oxygen. The molecular weight of lysine is 146.192 g/mol. Determine the empirical and molecular formula.

Answers:

I: Molar Mass

(1) (a) 26.98 g/mol (b) 159.82 g/mol (c) 230.87 g/mol (d) 159.61 g/mol (2) 60.09 g/mol

II: Mole Calculations

(1) 375 g of aluminum oxide (2) 4.5×10^{22} molecules of calcium carbonate, 4.5×10^{22} atoms of calcium, 4.5×10^{22} atoms of carbon, 1.4×10^{23} atoms of oxygen, 2.3×10^{23} atoms total (3) 2.00×10^4 g aluminum nitrate (4) 5.61×10^{25} molecules sodium chloride

III. Hydrates

(1) (a) sodium carbonate decahydrate (b) manganese (II) chloride tetrahydrate (2) (a) $\text{Sr}(\text{IO}_3)_2 \cdot \text{H}_2\text{O}$ (b) $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$

IV. Percent Composition

(1) (a) 35.0% N, 5.0% H, 60.0% O (b) 28.5% Cu, 71.5% Br (2) 37.5% C, 4.2% H, 58.3% O (3) (a) $\text{Fe}(\text{NO}_3)_2 \cdot 9\text{H}_2\text{O}$ (b) 16.3% Fe, 8.2% N, 70.2% O, 5.3% H (c) 47.4% H_2O

V. Empirical Formula

(1) (a) AlPO_3 aluminum phosphite (b) AlPO_4 aluminum phosphate (2) $\text{C}_3\text{H}_8\text{O}_3$

V. Molecular Formula

(1) B_2H_5 ; B_4H_{10} (2) $\text{C}_3\text{H}_7\text{NO}$; $\text{C}_6\text{H}_{14}\text{N}_2\text{O}_2$