Empirical & Molecular Formula

1. Determine the molecular formula for each compound whose percentage composition is 84.9% Hg and the remainder Cl, with a molecular weight of 472.2 g/mol.

2. The empirical formula of a compound is P2O5. Experiments show that the molar mass of the compound is 283.9 g/mol. What is the molecular formula of the compound?

3. A compound has the following composition – 76.54% C, 12.13% H, and 11.33% O. If its molar mass is 282.5 g/mol, what is its molecular formula?

4. What is the formula for a hydrate which consists of 90.7% SrC_2O_4 and 9.3% H_2O?"

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Answers

1. Determine the molecular formula for each compound whose percentage composition is 84.9% Hg and the remainder Cl, with a molecular weight of 472.2 g/mol.

Moles of Hg = 84.9 g / 200.59 g/mol = 0.423 moles/0.423 moles = 1

Moles of Cl = (100 g - 84.9 g) / 35.45 g/mol = 0.430 moles/0.423 moles = 1

Empirical formula = Hg_2Cl_2

Empirical formula mass = (1 × 200.59 g/mol) + (1.02 × 35.45 g/mol) = 236.67 g/mol

Ratio = Molecular mass/ Empirical formula mass = 472.2 g/mol/ 236.67 g/mol = 2

Molecular formula = $(HgCl)_2 = Hg_2Cl_2$

2. The empirical formula of a compound is P2O5. Experiments show that the molar mass of the compound is 283.9 g/mol. What is the molecular formula of the compound?

Molar mass of P = 30.97 g/mol

Molar mass of O = 16.00 g/mol

Empirical mass of P_2O_5 = (2 × 30.97 g/mol) + (5 × 16.00 g/mol) = 141.94 g/mol

Ratio = 283.9 g/mol/141.94 g/mol = 2

Molecular formula = $(P_2O_5)_2 = P_4O_{10}$

3. A compound has the following composition – 76.54% C, 12.13% H, and 11.33% O. If its molar mass is 282.5 g/mol, what is its molecular formula?

Moles of C = 76.54 g / 12.01 g/mol = 6.373 moles/0.708 moles = 9

Moles of H = 12.13 g / 1.01 g/mol = 12.01 moles/0.708 moles = 17

Empirical formula = $C_9H_{17}O$

Moles of O = 11.33 g / 16.00 g/mol = 0.708 moles/0.708 moles = 1

Empirical formula mass = (9 × 12.01 g/mol) + (17 × 1.01 g/mol) + (1 × 16.00 g/mol) = 141.26 g/mol

Ratio = 282.5 g/mol/141.26 g/mol = 1. Molecular formula = $C_9H_{17}O$

4. What is the formula for a hydrate which consists of 90.7% SrC_2O_4 and 9.3% H_2O?"

Moles of SrC_2O_4 = 90.7 g / 175.64 g/mol = 0.516 moles /0.516 moles = 1

Moles of H_2O = 9.3 g / 18.02 g/mol = 0.516 moles /0.516 moles = 1

Formula = $SrC_2O_4 \cdot H_2O$

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