Empirical & Molecular Formula

1) The empirical formula of a substance is CH_2O. Molar mass is 180 g/mol. What is the molecular formula?

2) Sample (3.585 g) contains 1.388 g of C, 0.345 g of H, 1.850 g O, and its molar mass is 62 g. What is the molecular formula of this substance?

3) The empirical formula of a compound is CH_2. Its molecular mass is 70 g/mol. What is its molecular formula?

4) A compound with an empirical formula of C_2H_4O and a molar mass of 88 grams/mole. What is the molecular formula of this compound?

5) A compound with an empirical formula of C_4H_4O and a molar mass of 136 grams per mole. What is the molecular formula of this compound?

Empirical & Molecular Formula

Answers

1) The empirical formula of a substance is CH_2O. Molar mass is 180 g/mol. What is the molecular formula?

Empirical formula mass = (12.01 g/mol × 1) + (1.01 g/mol × 2) + (16 g/mol × 1)
= 30.03 g/mol

Ratio = Molar mass/Empirical formula mass = 180 g/mol / 30.03 g/mol = 6

Molecular formula = $(CH_2O)_6 = C_6H_{12}O_6$

2) Sample (3.585 g) contains 1.388 g of C, 0.345 g of H, 1.850 g O, and its molar mass is 62 g. What is the molecular formula of this substance?

Moles of C = 1.388 g / 12.01 g/mol = 0.1157 moles

Moles of H = 0.345 g / 1.01 g/mol = 0.3416 moles

Moles of O = 1.850 g / 16.00 g/mol = 0.1156 moles

Empirical formula mass = (1 × 12.01) + (3 × 1.01) + (1 × 16.00) = 31.04 g/mol

Ratio = Molar mass/Empirical formula mass = 62 g / 31.04 g/mol = 2

$(C_1H_3O_1)_2 = C_2H_6O_2$

3) The empirical formula of a compound is CH_2. Its molecular mass is 70 g/mol. What is its molecular formula?

Empirical formula mass = 12.01 g/mol x 1 + 1.01 g/mol x 2 = 14.03 g/mol

Ratio = 70 g/mol/14.03 g/mol = 5

Molecular formula = $(CH_2)_5 = C_5H_{10}$

4) A compound with an empirical formula of C_2H_4O and a molar mass of 88 grams/mole. What is the molecular formula of this compound?

Empirical formula mass = 12.01 g/mol x 2 + 1.01 g/mol x 4 + 16 g/mol x 1 = 44 g/mol

Ratio = 88 g/mol/44 g/mol = 2

Molecular formula = $(C_2H_4O)_2 = C_4H_8O_2$

5) A compound with an empirical formula of C_4H_4O and a molar mass of 136 grams per mole. What is the molecular formula of this compound?

Empirical formula mass = 12.01 g/mol x 4 + 1.01 g/mol x 4 + 16 g/mol x 1 = 68 g/mol

Ratio = 136 g/mol/68 g/mol = 2

Molecular formula = $(C_4H_4O)_2 = C_8H_8O_2$