

EMPIRICAL AND MOLECULAR Formula Worksheets

Answers

1. If 4.04 g of nitrogen combine with 11.46 g of oxygen to produce a compound with a molar mass of 108 g, what is the molecular formula of this compound?

$$\text{N: } 4.04 \text{ g} / 14 \text{ g mol}^{-1} = 0.289 \text{ mol} / 0.289 \text{ mol} \rightarrow 1 \times 2 = 2 \quad \left| \quad \text{N: } 2 \times 14 \text{ g} = 28 \text{ g} \right.$$

$$\text{O: } 11.46 \text{ g} / 16 \text{ g mol}^{-1} = 0.716 \text{ mol} / 0.289 \text{ mol} \rightarrow 2.48 \times 2 = 5 \quad \left| \quad \text{O: } 5 \times 16 \text{ g} = 80 \text{ g} \right.$$

$$\text{Empirical formula mass} = 28 \text{ g} + 80 \text{ g} = 108 \text{ g} = \text{Molar mass}$$

The molecular formula is N_2O_5

2. The molar mass of a compound is 92 g. Analysis of the sample indicates that it contains 0.606 g N and 1.390 g O. Find the compound's molecular formula.

$$\text{N: } 0.606 \text{ g} / 14 \text{ g mol}^{-1} = 0.0433 \text{ mol} / 0.0433 \text{ mol} \rightarrow 1$$

$$\text{O: } 1.390 \text{ g} / 16 \text{ g mol}^{-1} = 0.0869 \text{ mol} / 0.0433 \text{ mol} \rightarrow 2$$

$$\text{Empirical formula mass} = 14 \text{ g} + 2 \times 16 \text{ g} = 46 \text{ g}$$

$$\text{Ratio} = \text{Molar mass} / \text{Empirical formula mass} = 92 \text{ g} / 46 \text{ g} = 2$$

$$\text{Molecular formula} = (\text{NO}_2)_2 = \text{N}_2\text{O}_4$$

3. The empirical formula of a substance is CH_6O . Molar mass is 180. What is the molecular formula?

$$\text{Empirical formula mass} = (12.01 \times 1) + (1.01 \times 6) + (16.00 \times 1) = 30.03 \text{ g/mol}$$

$$\text{Ratio} = \text{Molar mass} / \text{Empirical formula mass} = 180 \text{ g/mol} / 30.03 \text{ g/mol} = 6$$

$$\text{Molecular formula} = (\text{CH}_6\text{O})_6 = \text{C}_6\text{H}_{12}\text{O}_6$$

4. 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?

$$\text{Moles of C} = 1.388 \text{ g} / 12.01 \text{ g/mol} = 0.1157 \text{ moles}$$

$$\text{Moles of H} = 0.345 \text{ g} / 1.01 \text{ g/mol} = 0.3416 \text{ moles}$$

$$\text{Moles of O} = 1.850 \text{ g} / 16.00 \text{ g/mol} = 0.1156 \text{ moles}$$

$$\text{Empirical formula mass} = (1 \times 12.01) + (3 \times 1.01) + (1 \times 16.00) = 31.04 \text{ g/mol}$$

$$\text{Ratio} = \text{Molar mass} / \text{Empirical formula mass} = 62 \text{ g} / 31.04 \text{ g/mol} = 2$$

$$\text{Molecular formula} = (\text{CH}_3\text{O})_2 = \text{C}_2\text{H}_6\text{O}_2$$

Name : _____ Date : _____