

▶————— Determining —————◀

Empirical & Molecular Formula

1) What is the molecular formula of a molecule with an empirical formula of CH_2O and a molar mass of 120.1 g/mol?

2) What is the molecular formula of the molecule with an empirical formula of CH_2Cl and a molar mass of 247.5 g/mol?

3) Determine the formula for the hydrate from the given information.

a. 0.391 g Li_2SiF_6 , 0.0903 g H_2O

b. 76.9% CaSO_3 , 23.11% g H_2O

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Determining Empirical & Molecular Formula

Answers

1) What is the molecular formula of a molecule with an empirical formula of CH_2O and a molar mass of 120.1 g/mol?

$$\text{Empirical formula mass} = (1 \times 12.01 \text{ g/mol}) + (2 \times 1.01 \text{ g/mol}) + (1 \times 16.00 \text{ g/mol}) \\ = 30.03 \text{ g/mol}$$

$$\text{Ratio} = \text{Molar mass} / \text{Empirical formula mass} = 120.1 \text{ g/mol} / 30.03 \text{ g/mol} = 4$$

$$\text{Molecular formula} = (\text{CH}_2\text{O})_4 = \text{C}_4\text{H}_8\text{O}_4$$

2) What is the molecular formula of the molecule with an empirical formula of CH_2Cl and a molar mass of 247.5 g/mol?

$$\text{Empirical formula mass} = (1 \times 12.01 \text{ g/mol}) + (2 \times 1.01 \text{ g/mol}) + (1 \times 35.5 \text{ g/mol}) \\ = 49.48 \text{ g/mol}$$

$$\text{Ratio} = 247.5 \text{ g/mol} / 49.48 \text{ g/mol} = 5$$

$$\text{Molecular formula} = (\text{CH}_2\text{Cl})_5 = \text{C}_5\text{H}_{10}\text{Cl}_5$$

3) Determine the formula for the hydrate from the given information.

a. 0.391 g Li_2SiF_6 , 0.0903 g H_2O

$$\text{Moles of } \text{Li}_2\text{SiF}_6 = 0.391 \text{ g} / 155.97 \text{ g/mol} = 2.5069 \times 10^{-3} \text{ mol} / 2.5069 \times 10^{-3} \text{ mol} = 1$$

$$\text{Moles of } \text{H}_2\text{O} = 0.0903 \text{ g} / 18.02 \text{ g/mol} = 5.011 \times 10^{-3} \text{ mol} / 2.5069 \times 10^{-3} \text{ mol} = 2$$

$$\text{Formula} = \text{Li}_2\text{SiF}_6 \cdot 2\text{H}_2\text{O}$$

b. 76.9% CaSO_3 , 23.11% g H_2O

$$\text{Moles of } \text{CaSO}_3 = 76.9 \text{ g} / 120.15 \text{ g/mol} = 0.640 \text{ mol} / 0.640 \text{ mol} = 1$$

$$\text{Moles of } \text{H}_2\text{O} = 23.11 \text{ g} / 18.02 \text{ g/mol} = 1.2819 \text{ mol} / 0.640 \text{ mol} = 2$$

$$\text{Formula} = \text{CaSO}_3 \cdot 2\text{H}_2\text{O}$$

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