

# Empirical Formula

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Determine the empirical formula for the following compounds:

a. A compound containing 0.0130 mol carbon, 0.0390 mol hydrogen, and 0.0065 mol oxygen.

b. A compound containing 72.7% magnesium and 27.8% nitrogen by mass.

c. Glucose contains 40% carbon, 6.7% hydrogen, and 53.3% oxygen by mass.

d. A compound contains 63.52 % iron and 36.48% sulfur

e. A compound containing 26.56% potassium, 35.41% chromium, and the remainder oxygen.

# Empirical Formula

## Answers

a. A compound containing 0.0130 mol carbon, 0.0390 mol hydrogen, and 0.0065 mol oxygen.

$$\text{C: } 0.0130 \text{ mol} / 0.0065 \text{ mol} = 2$$

$$\text{H: } 0.0390 \text{ mol} / 0.0065 \text{ mol} = 6$$

$$\text{O: } 0.0065 \text{ mol} / 0.0065 \text{ mol} = 1$$

The empirical formula is  $\text{C}_2\text{H}_6\text{O}$ .

b. A compound containing 72.7% magnesium and 27.8% nitrogen by mass.

$$\text{Mg: } 72.7 \text{ g} / 24.31 \text{ g mol}^{-1} = 2.97 \text{ mol} / 1.984 \text{ mol} \rightarrow 1.5 \times 2 = 3$$

$$\text{N: } 27.8 \text{ g} / 14.01 \text{ g mol}^{-1} = 1.984 \text{ mol} / 1.984 \text{ mol} \rightarrow 1 \times 2 = 2$$

The empirical formula is  $\text{Mg}_3\text{N}_2$ .

c. Glucose contains 40% carbon, 6.7% hydrogen, and 53.3% oxygen by mass.

$$\text{C: } 40 \text{ g} / 12.01 \text{ g mol}^{-1} = 3.331 \text{ mol} / 3.331 \text{ mol} \rightarrow 1$$

$$\text{H: } 6.7 \text{ g} / 1.01 \text{ g mol}^{-1} = 6.334 \text{ mol} / 3.331 \text{ mol} \rightarrow 2$$

$$\text{O: } 53.3 \text{ g} / 16.00 \text{ g mol}^{-1} = 3.331 \text{ mol} / 3.331 \text{ mol} \rightarrow 1$$

The empirical formula is  $\text{CH}_2\text{O}$ .

d. A compound contains 63.52 % iron and 36.48% sulfur

$$\text{Fe: } 63.52 \text{ g} / 56 \text{ g mol}^{-1} = 1.134 \text{ mol} \rightarrow 1$$

$$\text{S: } 36.48 \text{ g} / 32 \text{ g mol}^{-1} = 1.14 \text{ mol} \rightarrow 1$$

The empirical formula is  $\text{FeS}$ .

e. A compound containing 26.56% potassium, 35.41% chromium, and the remainder oxygen.

$$\text{Amount of O} = 100 - (26.56 + 35.41) = 38.03\%$$

$$\text{K: } 26.56 \text{ g} / 39 \text{ g mol}^{-1} = 0.681 \text{ mol} / 0.681 \text{ mol} \rightarrow 1 \times 2 = 2$$

$$\text{Cr: } 35.41 \text{ g} / 52 \text{ g mol}^{-1} = 0.681 \text{ mol} / 0.681 \text{ mol} \rightarrow 1 \times 2 = 2$$

$$\text{O: } 38.03 \text{ g} / 16 \text{ g mol}^{-1} = 2.377 \text{ mol} / 0.681 \text{ mol} \rightarrow 3.5 \times 2 = 7$$

The empirical formula is  $\text{K}_2\text{Cr}_2\text{O}_7$