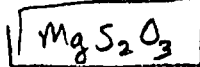


Empirical and Molecular Formulas

Name KEY

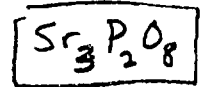
Section A: Empirical Formulas

1. Determine the empirical formula for a compound that is 0.691 g magnesium, 1.824 g of sulfur, and 1.365 g oxygen.
- $$\frac{0.691 \text{ g Mg}}{24.31 \text{ g/mol}} = 0.02842 \text{ mol Mg} \quad \frac{1.824 \text{ g S}}{32.07 \text{ g/mol}} = 0.056875 \text{ mol S} \quad \frac{1.365 \text{ g O}}{16.00 \text{ g/mol}} = 0.08531 \text{ mol O}$$



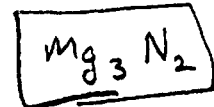
2. Determine the empirical formula for a compound that is 57.6% Sr, 13.8% P, and 28.6% O.

$$\frac{57.6 \text{ g Sr}}{87.62 \text{ g/mol}} = 0.65738 \text{ mol Sr} \quad \frac{13.8 \text{ g P}}{30.97 \text{ g/mol}} = 0.445592 \text{ mol P} \quad \frac{28.6 \text{ g O}}{16.00 \text{ g/mol}} = 1.7875 \text{ mol O}$$



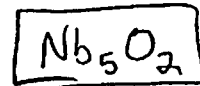
3. A 10 gram sample of a compound contains 7.22 grams of magnesium and 2.78 grams of nitrogen. What is its empirical formula?

$$\frac{7.22 \text{ g Mg}}{24.31 \text{ g/mol}} = 0.296997 \text{ mol Mg} \quad \frac{2.78 \text{ g N}}{14.01 \text{ g/mol}} = 0.198429 \text{ mol N}$$



4. Determine the empirical formula for a compound that is 93.5% Nb and 6.50% O.

$$\frac{93.5 \text{ g Nb}}{92.91 \text{ g/mol}} = 1.00635 \text{ mol Nb} \quad \frac{6.50 \text{ g O}}{16.00 \text{ g/mol}} = 0.40625 \text{ mol O}$$



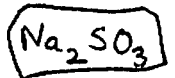
5. In an experiment, 4.14 g of phosphorus combined with chlorine to produce 27.8 g of a white solid compound. What is the empirical formula of the compound?

$$\frac{4.14 \text{ g P}}{30.97 \text{ g/mol}} = 0.13367 \text{ mol P} \quad \frac{23.66 \text{ g Cl}}{35.45 \text{ g/mol}} = 0.66741 \text{ mol Cl}$$



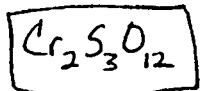
6. A 100 gram sample of compound of sodium contains 36.5 grams of sodium, 25.4 grams of sulfur, and 38.1 grams of oxygen. Does the empirical formula for the compound lead you to believe it is sodium sulfite or sodium sulfate?

$$\frac{36.5 \text{ g Na}}{22.99 \text{ g/mol}} = 1.58764 \text{ mol Na} \quad \frac{25.4 \text{ g S}}{32.07 \text{ g/mol}} = 0.79201 \text{ mol S} \quad \frac{38.1 \text{ g O}}{16.00 \text{ g/mol}} = 2.38125 \text{ mol O}$$



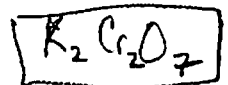
7. A 2.65 g sample of a powder contains 0.70 g of chromium, 0.65 g of sulfur, and 1.30 g of oxygen. What is the empirical formula of the compound?

$$\frac{0.70 \text{ g Cr}}{52.00 \text{ g/mol}} = 0.01346 \text{ mol Cr} \quad \frac{0.65 \text{ g S}}{32.07 \text{ g/mol}} = 0.020268 \text{ mol S} \quad \frac{1.30 \text{ g O}}{16.00 \text{ g/mol}} = 0.08125 \text{ mol O}$$



8. A sample of a substance is determined to be composed of 0.89 grams of potassium, 1.18 grams of chromium, and 1.27 grams of oxygen. Calculate the empirical formula of this substance.

$$\frac{0.89 \text{ g K}}{39.10 \text{ g/mol}} = 0.022762 \text{ mol K} \quad \frac{1.18 \text{ g Cr}}{52.00 \text{ g/mol}} = 0.022692 \text{ mol Cr} \quad \frac{1.27 \text{ g O}}{16.00 \text{ g/mol}} = 0.079375 \text{ mol O}$$



Section B: Molecular Formulas

9. A compound is analyzed and found to be 40.0% carbon, 6.6% hydrogen, and 53.4% oxygen. The molar mass of the compound is found to be 150 g/mol. What is the compound's molecular formula?

$$\frac{40.0\text{g C}}{12.01\text{g/mol}} = 3.33055 \quad \frac{6.6\text{g H}}{1.008\text{g/mol}} = 6.54761 \quad \frac{53.4\text{g O}}{16.00\text{g/mol}} = 3.3375 \quad \text{CH}_2\text{O} = 30.03\text{g/mol}$$

$$1 \quad : \quad 2 \quad : \quad 1 \quad \frac{150\text{g/mol}}{30.03\text{g/mol}} \approx 5 \quad \boxed{\text{C}_5\text{H}_{10}\text{O}_5}$$

10. If the empirical formula for a compound is CH_2 , and the molecular mass is 84.0 g/mol, what is the molecular formula for the compound?

$$\frac{12.01\text{g/mol} + (2 \times 1.008\text{g/mol})}{14.03\text{g/mol}} \quad \frac{84.0\text{g/mol}}{14.03\text{g/mol}} \approx 6 \quad \boxed{\text{C}_6\text{H}_{12}}$$

11. An organic compound with a molecular mass of 140 g/mol is 68.54% carbon, 8.63% hydrogen, and 22.83% oxygen. What is the molecular formula of the compound?

$$\frac{68.54\text{g C}}{12.01\text{g/mol}} = 5.70691 \quad \frac{8.63\text{g H}}{1.008\text{g/mol}} = 8.56150 \quad \frac{22.83\text{g O}}{16.00\text{g/mol}} = 1.4268 \quad \frac{140\text{g/mol}}{70.09\text{g/mol}} \approx 2$$

$$4 \quad : \quad 6 \quad : \quad 1 \quad \text{C}_4\text{H}_6\text{O} \quad \boxed{\text{C}_8\text{H}_{12}\text{O}_2}$$

12. What is the molecular formula for a compound that is 27.3% carbon and 72.7% oxygen if the molecular mass is 43.9 g/mol?

$$\frac{27.3\text{g C}}{12.01\text{g/mol}} = 2.2731 \quad \frac{72.7\text{g O}}{16.00\text{g/mol}} = 4.5437 \quad \text{CO}_2 \quad \frac{43.9\text{g/mol}}{87.8\text{g/mol}} \approx 0.5$$

$$1 \quad : \quad 2 \quad \boxed{\text{CO}_2}$$

13. A compound with an empirical formula of CH_2O has a molecular mass of 180 g/mol. What is the molecular formula?

$$\frac{180\text{g/mol}}{30.026\text{g/mol}} \approx 6 \quad \boxed{\text{C}_6\text{H}_{12}\text{O}_6}$$

14. What is the molecular formula for a compound that is 41.39% carbon, 3.47% hydrogen, and 55.14% oxygen if the molecular mass is 116.07 g/mol?

$$\frac{41.39\text{g C}}{12.01\text{g/mol}} = 3.44629 \quad \frac{3.47\text{g H}}{1.008\text{g/mol}} = 3.44246 \quad \frac{55.14\text{g O}}{16.00\text{g/mol}} = 3.44625 \quad \frac{116.07\text{g/mol}}{29.018\text{g/mol}} \approx 4$$

$$\text{C}_4\text{H}_4\text{O}_4 \quad \boxed{\text{C}_4\text{H}_4\text{O}_4}$$

15. Another compound is found to be 64.27% carbon, 7.19% hydrogen, and 28.54% oxygen. If the molecular mass is 168.1 g/mol, what is the molecular formula?

$$\frac{64.27\text{g C}}{12.01\text{g/mol}} = 5.3513 \quad \frac{7.19\text{g H}}{1.008\text{g/mol}} = 7.1329 \quad \frac{28.54\text{g O}}{16.00\text{g/mol}} = 1.78375 \quad \frac{168.1\text{g/mol}}{56.06\text{g/mol}} \approx 3$$

$$3 \quad : \quad 4 \quad : \quad 1 \quad \boxed{\text{C}_9\text{H}_{12}\text{O}_3}$$