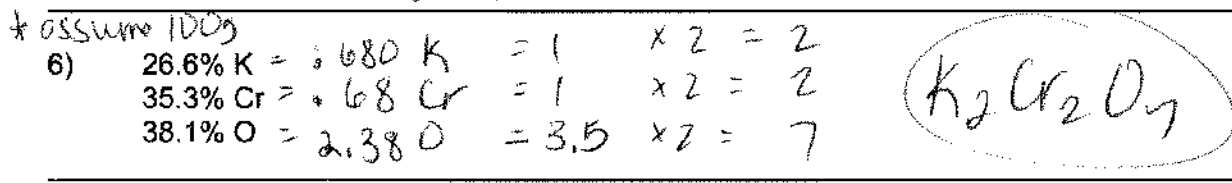
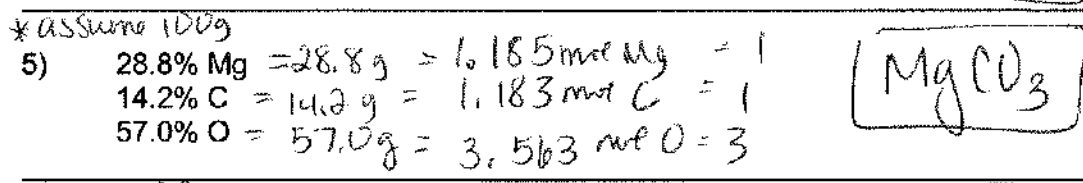
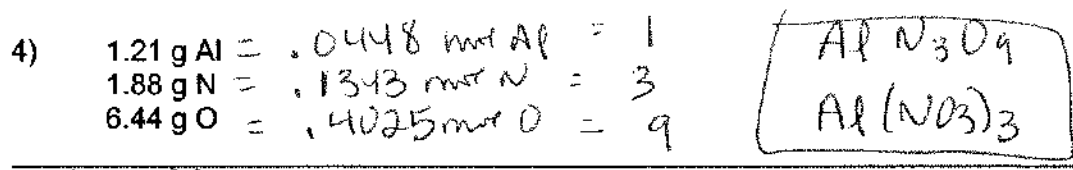
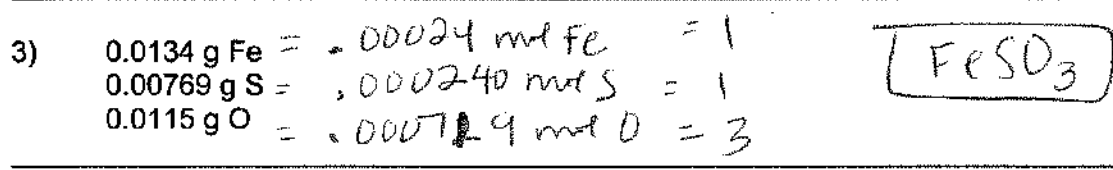
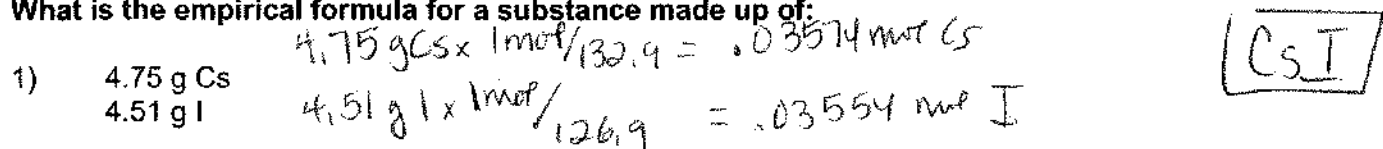


KEY

PROBLEM SET: Empirical and Molecular Formulas

What is the empirical formula for a substance made up of:



What is the percent composition of:

- 7) $\text{Al}_2(\text{SO}_4)_3 = 342.3 \text{ g/mol}$ 15.8% Al; 28.1% S; 56.1% O aluminum sulfate
 8) $\text{H}_2\text{SO}_3 = 82.1 \text{ g/mol}$ 2.4% H; 39.1% S; 58.5% O sulfurous acid
 9) $\text{Mg}(\text{NO}_3)_2 = 148.3 \text{ g/mol}$ 16.4% Mg; 18.9% N; 64.7% O magnesium nitrate
 10) $\text{K}_2\text{CO}_3 = 138.2 \text{ g/mol}$ 56.6% K; 8.7% C; 34.7% O potassium carbonate
 11) $\text{CoC}_2\text{O}_4 = 146.9 \text{ g/mol}$ 40.1% Co; 16.3% C; 43.6% O cobalt oxalate
 12) $\text{Ba}_3(\text{PO}_3)_2 = 569.9 \text{ g/mol}$ 72.3% Ba; 10.9% P; 16.8% O barium phosphite

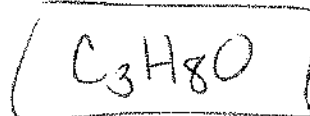
13) Next to your answer for each problem above, write the chemical name of the compound.

✓

More Empirical / Molecular Formula Problems!

14) Chemical analysis of 2-propanol, also known as isopropanol or rubbing alcohol, indicates that it is 60.0% C, 13.4% H, and 26.6% O. What is its empirical formula?

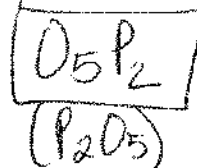
$$\begin{aligned} 60.0 \text{ g C} &= 5.0 \text{ mol C} / 1.66 = 3.0 \text{ C} \\ 13.4 \text{ g H} &= 13.4 \text{ mol H} / 1.66 = 8 \text{ H} \\ 26.6 \text{ g O} &= 1.66 \text{ mol O} / 1.66 = 1 \text{ O} \end{aligned}$$



15) Determine the empirical formula for a compound that contains 5.717 g of O and 4.433 g of P.

$$5.717 \text{ g O} = 0.357 \text{ mol O} / .143 = 2.50 \times 2 = 5$$

$$4.433 \text{ g P} = 0.143 \text{ mol P} / .143 = 1 \text{ P} \times 2 = 2$$

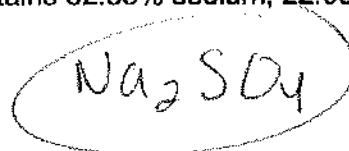


16) What would be the empirical formula for a compound that contains 32.38% sodium, 22.65% sulfur, and 44.99% oxygen?

$$32.38 \text{ g Na} = 1.408 \text{ mol Na} = 2$$

$$22.65 \text{ g S} = 0.706 \text{ mol S} = 1$$

$$44.99 \text{ g O} = 2.82 \text{ mol O} = 4$$



17) The empirical formula of a compound containing phosphorus and oxygen was found to be P_2O_5 .

Experiments show that the molar mass of the compound is 283.89 g/mol. What is the molecular formula of the compound?

$$\text{P}_2\text{O}_5 = 142.0 \text{ g/mol}$$

$$283.89 / 142 = 2, \text{ so } \boxed{\text{P}_4\text{O}_{10}}$$

18) Determine the molecular formula of a compound having an empirical formula of CH and a molar mass of 78.11 g/mol.

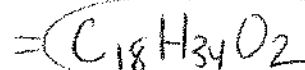
$$\text{CH} = 13 \text{ g/mol} \quad \frac{78.11}{13} = 6.0 (\times \text{CH}) = \boxed{\text{C}_6\text{H}_6}$$

19) A compound has the following composition: 76.54% C, 12.13% H, 11.33% O. If its molar mass is 282.45 g/mol, what is its molecular formula?

$$\begin{aligned} 76.54 \text{ g C} &= 6.38 \text{ mol C} = 9 \\ 12.13 \text{ g H} &= 12.13 \text{ mol H} = 17 \\ 11.33 \text{ g O} &= 0.708 \text{ mol O} = 1 \end{aligned} \quad \left. \begin{array}{l} \text{C}_9\text{H}_{17}\text{O} \\ (= 141 \text{ g/mol}) \end{array} \right\}$$

$$282.45 / 141 \approx 2$$

$$2 \times \text{C}_9\text{H}_{17}\text{O}$$

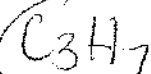


20) Determine the molecular formula for each of the following:

a) a compound with a molar mass of 86.17 g/mol that contains 83.62% C and 16.38% H.

$$83.62 \text{ g C} \times \frac{1 \text{ mol C}}{12 \text{ g}} = 6.97 \text{ mol C} / 6.97 = 1 \times 3 = 3$$

$$16.38 \text{ g H} \times \frac{1 \text{ mol H}}{1 \text{ g}} = 16.38 \text{ mol H} / 6.97 = 2.35 \times 3 = 7$$



$$= 43 \text{ g/mol}$$

b) a compound with a molar mass of 92.01 g/mol that contains 0.608 g N and 1.388 g O.

actual = 86

$$\cancel{0.608 \text{ g N}} \times \frac{1 \text{ mol}}{14 \text{ g}} = .0434 = 1$$

$$\text{NO}_2 = 46 \text{ g/mol}$$

$$\text{actual} = 92.01 \text{ g/mol}$$

$$1.388 \text{ g O} \times \frac{1 \text{ mol}}{16 \text{ g}} = .0868 = 2$$

