

Percent Composition

① $\text{CaCl}_2 : 40.1 + 2(35.5) = 111.1 \text{ g/mol}$

$\text{Ca} : 40.1 \text{ g/mol}$

$2\text{Cl} : 2(35.5) = 71 \text{ g/mol}$

Calcium $\frac{40.1}{111.1} \times 100 = 36.1\%$

Chlorine $\frac{71}{111.1} \times 100 = 63.9\%$

② $\text{Na}_2\text{SO}_4 : 2(23.0) + 32.1 + 4(16.0) = 142.1 \text{ g/mol}$

$2\text{Na} : 2(23.0) = 46 \text{ g/mol}$

$\text{S} : 32.1 \text{ g/mol}$

$4\text{O} : 4(16.0) = 64 \text{ g/mol}$

Sodium $\frac{46}{142.1} \times 100 = 32.4\%$

Sulfur $\frac{32.1}{142.1} \times 100 = 22.6\%$

Oxygen $\frac{64}{142.1} \times 100 = 45\%$

③

$$\text{H}_2\text{SO}_3 : 2(1.01) + 32.1 + 3(16.0) = 82.12 \text{ g/mol}$$

$$\text{S} : 32.1 \text{ g/mol}$$

$$\% : \frac{32.1}{82.12} \times 100 = 39.1\%$$

$$\text{H}_2\text{S}_2\text{O}_8 : 2(1.01) + 2(32.1) + 8(16.0) = 194.22 \text{ g/mol}$$

$$2\text{S} : 2(32.1) = 64.2 \text{ g/mol}$$

$$\% : \frac{64.2}{194.22} \times 100 = 33.1\%$$

H_2SO_3 has the larger % of sulfur

④

$$\text{H}_3\text{PO}_4 : 3(1.01) + (31.0) + 4(16.0) = 98.03 \text{ g/mol}$$

$$3\text{H} : 3(1.01) = 3.03 \text{ g/mol}$$

$$\text{P} : 31.0 \text{ g/mol}$$

$$4\text{O} : 4(16.0) = 64 \text{ g/mol}$$

$$\text{Hydrogen} : \frac{3.03}{98.03} \times 100 = 3.1\%$$

$$\text{phosphorus} : \frac{31.0}{98.03} \times 100 = 31.6\%$$

$$\text{oxygen} : \frac{64}{98.03} \times 100 = 65.3\%$$

$$\textcircled{5} \quad \text{N: } \frac{36.84 \text{ g}}{14.0 \text{ g/mol}} = 2.631 \text{ mol}$$

$$\text{O: } \frac{66.16 \text{ g}}{16.0 \text{ g/mol}} = 3.948 \text{ mol}$$

$$\frac{2.631}{2.631} = 1 \text{ mol N}$$

$$\frac{3.948}{2.631} = 1.5 \text{ mol O}$$

multiply both by 2 to get whole numbers:

2 mol N, 3 mol O



$$\textcircled{6} \quad \text{Al: } \frac{35.98 \text{ g}}{27.0 \text{ g/mol}} = 1.333 \text{ mol}$$

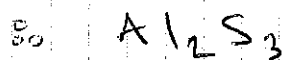
$$\text{S: } \frac{64.02 \text{ g}}{32.1 \text{ g/mol}} = 1.994 \text{ mol}$$

$$\frac{1.333}{1.333} = 1 \text{ mol Al}$$

$$\frac{1.994}{1.333} = 1.5 \text{ mol S}$$

multiply by 2 to get whole numbers

2 mol Al, 3 mol S



$$\textcircled{7} \quad \text{C} = \frac{81.82 \text{ g}}{12.0 \text{ g/mol}} = 6.818 \text{ mol}$$

$$\text{H} = \frac{18.18 \text{ g}}{1.01 \text{ g/mol}} = 18 \text{ mol}$$

$$\frac{6.818}{6.818} = 1 \text{ mol C}$$

$$\frac{18}{6.818} = 2.64 \text{ mol H}$$

2.64 is approx 2.666... multiplying by 3 will give a whole number (approximately)

$$3 \text{ mol C} \quad 8 \text{ mol H}$$



$$\textcircled{8} \quad \text{C} = \frac{60 \text{ g}}{12 \text{ g/mol}} = 5 \text{ mol}$$

$$\text{H} = \frac{4.44 \text{ g}}{1.01 \text{ g/mol}} = 4.396 \text{ mol}$$

$$\text{O} = \frac{35.56 \text{ g}}{16.0 \text{ g/mol}} = 2.223 \text{ mol}$$

$$\frac{5}{2.223} = 2.250 \text{ mol C}$$

$$\frac{4.396}{2.223} = 1.978 \text{ mol H}$$

↑ approx 2

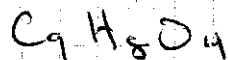
$$\frac{2.223}{2.223} = 1 \text{ mol O}$$

multiply by 4

$$9 \text{ mol C}$$

$$8 \text{ mol H}$$

$$4 \text{ mol O}$$



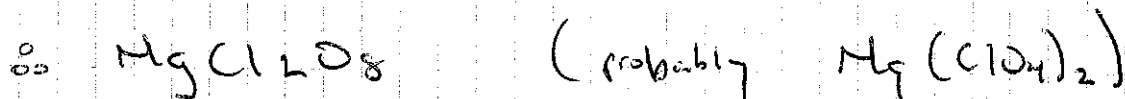
$$\textcircled{9} \quad \text{Mg} = \frac{10.89 \text{ g}}{24.3 \text{ g/mol}} = 0.448 \text{ mol}$$

$$\text{Cl} = \frac{31.77 \text{ g}}{35.5 \text{ g/mol}} = 0.895 \text{ mol}$$

$$\text{O} = \frac{57.64 \text{ g}}{16.0 \text{ g/mol}} = 3.584 \text{ mol}$$

$$\frac{0.448}{0.448} = 1 \text{ mol Mg} \quad \frac{0.895}{0.448} = 2 \text{ mol Cl}$$

$$\frac{3.584}{0.448} = 8 \text{ mol O}$$



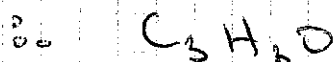
$$\textcircled{10} \quad \text{C} = \frac{65.45 \text{ g}}{12.0 \text{ g/mol}} = 5.454 \text{ mol}$$

$$\text{H} = \frac{5.45 \text{ g}}{1.01 \text{ g/mol}} = 5.396 \text{ mol}$$

$$\text{O} = \frac{29.09 \text{ g}}{16.0 \text{ g/mol}} = 1.818 \text{ mol}$$

$$\frac{5.454}{1.818} = 3 \text{ mol C} \quad \frac{5.396}{1.818} = 2.97 \text{ mol H} \\ (3 \text{ mol H})$$

$$\frac{1.818}{1.818} = 1 \text{ mol O}$$



$$\textcircled{11} \quad \text{total mass} = 49.98 + 10.47 = 60.45 \text{ g}$$

$$\% \text{ C} = \frac{49.98 \text{ g}}{60.45 \text{ g}} \times 100 = 82.7\%$$

$$\% \text{ H} = \frac{10.47 \text{ g}}{60.45 \text{ g}} \times 100 = 17.3\%$$

$$\frac{82.7 \text{ g}}{12 \text{ g/mol}} = 6.892 \text{ mol}$$

$$\frac{17.3 \text{ g}}{1.01 \text{ g/mol}} = 17.129 \text{ mol}$$

$$\frac{6.892}{6.892} = 1 \text{ mol C}$$

$$\frac{17.129}{6.892} = 2.5 \text{ mol H}$$

multiply by 2

empirical formula: C_2H_5

$$\text{mass: } 2(12.0) + 5(1.01) = 29.05 \text{ g/mol}$$

$$\frac{58.12}{29.05} = 2$$

\therefore molecular formula C_4H_{10}

$$\textcircled{12} \quad \text{N: } \frac{46.68}{14.0} = 3.334 \text{ mol}$$

$$\text{O: } \frac{53.32}{16.0} = 3.333 \text{ mol}$$

$$\frac{3.334}{3.333} = 1 \text{ mol } \checkmark$$

$$\frac{3.333}{3.333} = 1 \text{ mol } \checkmark$$

empirical: NO

$$\text{mass: } 14.0 + 16.0 = 30 \text{ g/mol}$$

$$\frac{60.01 \text{ g/mol}}{30 \text{ g/mol}} = 2$$

molecular: N_2O_2