

Empirical Formula

Name - _____

1.) Find the empirical formula for the following compounds.

a.) 15.9% B and 84.1% F

$$\text{Answer - } 15.9 \text{ g B} \times \frac{1 \text{ mol B}}{10.81 \text{ g B}} = 1.47 \text{ mol B} \quad 84.1 \text{ g F} \times \frac{1 \text{ mol F}}{19.00 \text{ g F}} = 4.43 \text{ mol F}$$

$$\frac{1.47 \text{ B}}{1.47} = 1 \text{ B} \quad \frac{4.43 \text{ F}}{1.47} = 3.01 \text{ F} \quad \text{BF}_3$$

b.) 87.5% Si and 12.5% H

$$\text{Answer - } 87.5 \text{ g Si} \times \frac{1 \text{ mol Si}}{28.09 \text{ g Si}} = 3.11 \text{ mol Si} \quad 12.5 \text{ g H} \times \frac{1 \text{ mol H}}{1.01 \text{ g H}} = 12.38 \text{ mol H}$$

$$\frac{3.11 \text{ Si}}{3.11} = 1 \text{ Si} \quad \frac{12.38 \text{ H}}{3.11} = 3.98 \text{ H} \quad \text{SiH}_4$$

c.) 43.7% P and 56.5% O

$$\text{Answer - } 43.7 \text{ g P} \times \frac{1 \text{ mol P}}{30.97 \text{ g P}} = 1.41 \text{ mol P} \quad 56.5 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 3.53 \text{ mol O}$$

$$\frac{1.41 \text{ P}}{1.41} = 1 \times 2 = \text{P} \quad \frac{3.53 \text{ O}}{1.41} = 2.5 \times 2 = 5 \text{ O} \quad \text{P}_2\text{O}_5$$

d.) 77.9% I and 22.1% O

$$\text{Answer - } 77.9 \text{ g I} \times \frac{1 \text{ mol I}}{126.91 \text{ g I}} = 0.614 \text{ mol I} \quad 22.1 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 1.38 \text{ mol O}$$

$$\frac{0.614 \text{ I}}{0.614} = 1 \times 4 = \text{I} \quad \frac{1.38 \text{ O}}{0.614} = 2.25 \times 4 = 8.99 \text{ O} \quad \text{I}_4\text{O}_9$$

e.) 77.7% Fe and 22.3% O

$$\text{Answer - } 77.7 \text{ g Fe} \times \frac{1 \text{ mol Fe}}{55.85 \text{ g Fe}} = 1.39 \text{ mol Fe} \quad 22.3 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 1.39 \text{ mol O}$$

$$\frac{1.39 \text{ O}}{1.39} = 1 \text{ Fe} \quad \frac{1.39 \text{ Fe}}{1.39} = 1 \text{ Fe} \quad \text{FeO}$$

f.) 70.0% Fe and 30.0% O

$$\text{Answer - } 70.0 \text{ g Fe} \times \frac{1 \text{ mol Fe}}{55.85 \text{ g Fe}} = 1.25 \text{ mol Fe} \quad 30.0 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 1.88 \text{ mol O}$$

$$\frac{1.25 \text{ Fe}}{1.25} = 1 \times 2 = 2 \text{ Fe} \quad \frac{1.88 \text{ O}}{1.25} = 1.5 \times 2 = 3 \text{ O} \quad \text{Fe}_2\text{O}_3$$

g.) 72.4% Fe and 27.6% O

$$\text{Answer - } 72.4 \text{ g Fe} \times \frac{1 \text{ mol Fe}}{55.85 \text{ g Fe}} = 1.30 \text{ mol Fe} \quad 27.6 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 1.73 \text{ mol O}$$

$$\frac{1.30 \text{ Fe}}{1.30} = 1 \times 3 = 3 \text{ Fe} \quad \frac{1.73 \text{ O}}{1.30} = 1.33 \times 3 = 4 \text{ O} \quad \text{Fe}_3\text{O}_4$$

h.) 46.3% Li and 53.7% O

$$\text{Answer - } 46.3 \text{ g Li} \times \frac{1 \text{ mol Li}}{6.94 \text{ g Li}} = 6.67 \text{ mol Li} \quad 53.7 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 3.36 \text{ mol O}$$

$$\frac{6.67 \text{ Li}}{3.36} = 2 \text{ Li} \quad \frac{3.36 \text{ O}}{3.36} = 1 \text{ O} \quad \text{Li}_2\text{O}$$

i.) 24.4% C, 3.39% H and 72.2% Cl

$$\text{Answer - } 24.4 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = 2.03 \text{ mol C} \quad 3.39 \text{ g H} \times \frac{1 \text{ mol H}}{1.01 \text{ g H}} = 3.36 \text{ mol H} \quad 72.2 \text{ g Cl} \times \frac{1 \text{ mol Cl}}{35.45 \text{ g Cl}} = 2.03 \text{ mol Cl}$$

$$\frac{2.03 \text{ C}}{2.03} = 1 \times 3 = 3 \text{ C} \quad \frac{3.39 \text{ H}}{2.03} = 1.67 \times 3 = 5 \text{ H} \quad \frac{2.03 \text{ Cl}}{2.03} = 1 \times 3 = 3 \text{ Cl} \quad \text{C}_3\text{H}_5\text{Cl}_3$$

j.) 26.6% K, 35.4% Cr and 38.0% O

$$\text{Answer - } 26.6 \text{ g K} \times \frac{1 \text{ mol K}}{39.10 \text{ g K}} = 0.680 \text{ mol K} \quad 35.4 \text{ g Cr} \times \frac{1 \text{ mol Cr}}{52.00 \text{ g Cr}} = 0.680 \text{ mol Cr} \quad 38.0 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 2.38 \text{ mol O}$$

$$\frac{0.680 \text{ K}}{0.680} = 1 \times 2 = 2 \text{ K} \quad \frac{0.680 \text{ Cr}}{0.680} = 1 \times 2 = 2 \text{ Cr} \quad \frac{2.38 \text{ O}}{0.680} = 3.5 \times 2 = 7 \text{ O} \quad \text{K}_2\text{Cr}_2\text{O}_7$$

k.) 21.8% Mg, 27.9% P and 50.3% O

$$\text{Answer - } 21.8 \text{ g Mg} \times \frac{1 \text{ mol Mg}}{24.31 \text{ g Mg}} = 0.900 \text{ mol Mg} \quad 27.9 \text{ g P} \times \frac{1 \text{ mol P}}{30.97 \text{ g P}} = 0.900 \text{ mol P} \quad 50.3 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 3.15 \text{ mol O}$$

$$\frac{0.900 \text{ Mg}}{0.900} = 1 \times 2 = 2 \text{ Mg} \quad \frac{0.900 \text{ P}}{0.900} = 1 \times 2 = 2 \text{ P} \quad \frac{3.15 \text{ O}}{0.900} = 3.5 \times 2 = 7 \text{ O} \quad \text{Mg}_2\text{P}_2\text{O}_7$$

l.) 3.66% H, 37.8% P and 58.4% O

$$\text{Answer - } 3.66 \text{ g H} \times \frac{1 \text{ mol H}}{1.01 \text{ g H}} = 3.63 \text{ mol H} \quad 37.8 \text{ g P} \times \frac{1 \text{ mol P}}{30.97 \text{ g P}} = 1.22 \text{ mol P} \quad 58.4 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 3.65 \text{ mol O}$$

$$\frac{3.63 \text{ H}}{1.22} = 3 \text{ H} \quad \frac{1.22 \text{ P}}{1.22} = 1 \text{ P} \quad \frac{3.65 \text{ O}}{1.22} = 2.99 \text{ O} \quad \text{H}_3\text{PO}_3$$

m.) 46.55% C, 7.69% H and 45.75% O

$$\text{Answer - } 7.69 \text{ g H} \times \frac{1 \text{ mol H}}{1.01 \text{ g H}} = 7.61 \text{ mol H} \quad 46.55 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = 3.88 \text{ mol C} \quad 45.75 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 2.86 \text{ mol O}$$

$$\frac{7.61 \text{ H}}{2.86} = 2.66 \times 3 = 7.93 \text{ H} \quad \frac{3.88 \text{ C}}{2.86} = 1.37 \times 3 = 4 \text{ C} \quad \frac{2.86 \text{ O}}{2.86} = 1 \times 3 = 3 \text{ O} \quad \text{C}_4\text{H}_8\text{O}_3$$

n.) 50.5% C, 5.26% H and 44.2% N

Answer - $50.5 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = 4.20 \text{ mol C}$ $5.26 \text{ g H} \times \frac{1 \text{ mol H}}{1.01 \text{ g H}} = 5.21 \text{ mol H}$ $44.2 \text{ g N} \times \frac{1 \text{ mol N}}{14.00 \text{ g N}} = 3.16 \text{ mol N}$

$$\frac{4.20 \text{ C}}{3.16} = 1.33 \times 3 = 4 \text{ C} \quad \frac{5.21 \text{ H}}{3.16} = 1.65 \times 3 = 5 \text{ H} \quad \frac{3.16 \text{ N}}{3.16} = 1 \times 3 = 3 \text{ N} \quad \text{C}_4\text{H}_5\text{N}_3$$