Worksheet: More Molecular Formulas and Hydrates   Name_____

1. The empirical formula of a compound is found to be P_2O_5. Experiments show that the molar mass of the compound is 283.9 g/mol. What is the molecular formula of the compound?

$$P_2O_5 = 141.94 \text{ g/mol} \qquad \frac{283.9 \text{ g/mol}}{141.94 \text{ g/mol}} = 2$$

| Molecular Formula P_4O_{10} |

2. A compound has the following % composition—76.54 % C, 12.13 % H, and 11.33 % O. If its molar mass is 282.5 g/mol, what is its molecular formula?

$$\frac{1 \text{ mol C}}{12.01 \text{ g C}} \bigg| \frac{76.54 \text{ g C}}{} = \frac{6.3730 \text{ mol C}}{0.70813} = 9$$

$$\frac{1 \text{ mol H}}{1.01 \text{ g H}} \bigg| \frac{12.13 \text{ g H}}{} = \frac{12.010 \text{ mol H}}{0.70813} = 17$$

$$\frac{1 \text{ mol O}}{16.00 \text{ g O}} \bigg| \frac{11.33 \text{ g O}}{} = \frac{0.70813 \text{ mol O}}{0.70813} = 1$$

Empirical

$$C_9H_{17}O = 141.26 \text{ g/mol}$$

$$\frac{282.5 \text{ g/mol}}{141.26 \text{ g/mol}} = 2$$

| Molecular Formula $C_{18}H_{34}O_2$ |

3. What is the formula for a hydrate which consists of 90.7 % SrC_2O_4 and 9.30 % H_2O?

$$\frac{1 \text{ mol } SrC_2O_4}{175.64 \text{ g } SrC_2O_4} \bigg| \frac{90.7 \text{ g } SrC_2O_4}{} = \frac{0.51640 \text{ mol } SrC_2O_4}{6.51610} = 1$$

$$\frac{1 \text{ mol } H_2O}{18.02 \text{ g } H_2O} \bigg| \frac{9.30 \text{ g } H_2O}{} = \frac{6.51610 \text{ mol } H_2O}{6.51610} = 1$$

| $SrC_2O_4 \cdot H_2O$ |

Worksheet: Molecular Formulas and Hydrates   Name_____

1. What is the molecular formula of the molecule that has an empirical formula of CH_2O and a molar mass of 120.1 g/mol?

$CH_2O = 30.03\, g/mol$ $\dfrac{120.1\ g/mol}{30.03\ g/mol} = 4$

Molecular Formula $C_4H_8O_4$

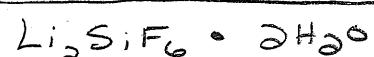2. What is the molecular formula of the molecule that has an empirical formula of CH_2Cl and a molar mass of 247.5 g/mol?

$CH_2Cl = 49.48\ g/mol$ $\dfrac{247.5\ g/mol}{49.48\ g/mol} = 5$

Molecular Formula $C_5H_{10}Cl_5$

3. Determine the formula for the hydrate from the given information:

a. 0.391 g Li_2SiF_6, 0.0903 g H_2O $Li_2SiF_6 \cdot 2H_2O$

$\dfrac{1\ mol\ Li_2SiF_6}{155.97\ g\ Li_2SiF_6}\ \Big|\ \dfrac{0.391\ g\ Li_2SiF_6}{} = \dfrac{2.5069 \times 10^{-3}\ mol\ Li_2SiF_6}{2.5069 \times 10^{-3}} = 1$

$\dfrac{1\ mol\ H_2O}{18.02\ g\ H_2O}\ \Big|\ \dfrac{0.0903\ g\ H_2O}{} = \dfrac{5.0111 \times 10^{-3}\ mol\ H_2O}{2.5069 \times 10^{-3}} = 2$

b. 76.9 % $CaSO_3$, 23.1 % H_2O $CaSO_3 \cdot 2H_2O$

$\dfrac{1\ mol\ CaSO_3}{120.15\ g\ CaSO_3}\ \Big|\ \dfrac{76.9\ g\ CaSO_3}{} = \dfrac{0.64003\ mol\ CaSO_3}{0.64003} = 1$

$\dfrac{1\ mol\ H_2O}{18.02\ g\ H_2O}\ \Big|\ \dfrac{23.1\ g\ H_2O}{} = \dfrac{1.2819\ mol\ H_2O}{0.64003} = 2$