SHOW ***ALL WORK***, ALL EQUATIONS, and ALL UNITS Name: _____
Empirical Formula, Molecular Formula, and Hydrates:

DETERMINE Empirical and Molecular Formula for the compound.

1. The compound benzene has two formulas, CH and C_6H_6. Which is the empirical formula and which is the molecular formula?

CH is the empirical formula (smallest whole-number ratio) and C_6H_6 is the molecular formula (because it is NOT the smallest whole number ratio)…

Whole-Number ratio refers to the "Mole Ratio" – Subscripts within formula

2. Rust, or iron oxide can exist as either iron(II)oxide or as iron(III)oxide. If you analyzed the sample by isolating the iron from the oxygen and found that you had 272.1 grams of iron – which type of iron oxide are you looking at if you started with 350 grams of rust?

3. A form of phosphorus called red phosphorus is used in match heads. When 0.062 grams of red phosphorus burns, 0.142 grams of phosphorus oxide is formed. What is the empirical formula of this oxide?

0.142 grams ($P_?O_?$) - 0.062 grams Phosphorus = 0.08 grams of Oxygen

P: $\frac{0.062\ grams}{} \times \frac{1\ mol\ P}{30.97\ grams} = 2.0\times10^{-3}\ mol\ ;\ \frac{2.0\times10^{-3}\ mol}{2.0\times10^{-3}\ mol} = 1.0\times2=2$

O: $\frac{0.08\ grams}{} \times \frac{1\ mol\ O}{16.00\ grams} = 5.0\times10^{-3}\ mol\ ;\ \frac{5.0\times10^{-3}\ mol}{2.0\times10^{-3}\ mol} = 2\frac{1}{2}\times2 = 5$

P_2O_5, phosphorus pentoxide

4. A compound is composed of 7.20 grams of carbon, 1.20 grams of hydrogen, and 9.60 grams of oxygen. The molar mass of the compound of the compound is 180 grams. Find the empirical and molecular formulas for the compound.

5. Oxalic acid is a compound used in cosmetics and paints. A 0.725 gram sample of oxalic acid was found to contain 0.016 grams of hydrogen, 0.194 grams of carbon, and 0.516 grams of oxygen. If the molar mass of oxalic acid is 90.04 g/mol, what is the molecular formula?

$$H: \quad \frac{0.016\ grams}{} \times \frac{1\ mol\ H}{1.008\ grams} = 0.01587\ mol\ ; \quad \frac{0.01587\ mol}{0.01587\ mol} = 1$$

$$C: \quad \frac{0.194\ grams}{} \times \frac{1\ mol\ C}{12.01\ grams} = 0.01615\ mol\ ; \quad \frac{0.01615\ mol}{0.01587\ mol} = 1$$

$$O: \quad \frac{0.516\ grams}{} \times \frac{1\ mol\ O}{16.00\ grams} = 0.0322\ mol\ ; \quad \frac{0.0322\ mol}{0.01587\ mol} = 2$$

$$(HCO_2)_n = 12.01g + 1.008g + (2)16g = 45.018g\ ; \qquad n = \frac{90.04\ g}{45.018\ g} = 2$$

$$(HCO_2)_2 = H_2C_2O_4$$

6. In areas where temperatures get extremely cold, people must take special precautions to make sure machinery runs properly. One compound contains 83% rubidium, 16% oxygen, and 1% hydrogen is used in low-temperature storage batteries. What is the empirical formula for this compound.

7. What is the formula for a hydrate that is 90.70% SrC_2O_4 and 9.30% H_2O?

$$SrC_2O_4: \quad \frac{90.70\ grams}{} \times \frac{1\ mol\ SrC_2O_4}{175.62\ grams} = 0516\ mol\ ; \quad \frac{0.516\ mol}{0.516\ mol} = 1$$

$$H_2O: \quad \frac{9.30\ grams}{} \times \frac{1\ mol\ H_2O}{18.016\ grams} = 0.516\ mol\ ; \quad \frac{0.516\ mol}{0.516\ mol} = 1$$

$$SrC_2O_4 \bullet H_2O$$

8. What is the formula for a hydrate that is 76.06% $La_2(CO_3)_3$ and 23.94% H_2O?

9. What is the formula for a hydrate that is 86.70% Mo_2S_5 and 13.30% H_2O?

$$Mo_2S_5: \quad \frac{86.70\ grams}{} \times \frac{1\ mol\ Mo_2S_4}{352.18\ grams} = 0.246\ mol\ ; \quad \frac{0.246\ mol}{0.246\ mol} = 1$$

$$H_2O: \quad \frac{13.30\ grams}{} \times \frac{1\ mol\ H_2O}{18.016\ grams} = 0.738\ mol\ ; \quad \frac{0.738\ mol}{0.246\ mol} = 3$$

$$Mo_2S_5 \bullet 3\ H_2O$$