

Name: \_\_\_\_\_

Period: \_\_\_\_\_

Seat#: \_\_\_\_\_

**Directions:** Any worksheet that is labeled with an \* means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website...and the entire internet! See me if you need help finding practice on a topic you are struggling with.

- **Show work for ANY math problem.**
  - **Include ALL units.**
  - **Some answers provided at the end of the question. The answers are underlined.**
- 1) Calculate the percentage composition for each element in the following compounds (three sig. figs)
    - a. CO
    - b. CO<sub>2</sub>
    - c. KMnO<sub>4</sub>
    - d. Co(NO<sub>3</sub>)<sub>2</sub>
  - 2) An oxide of osmium (symbol Os) is a pale yellow solid. If 2.89 g of the compound contains 2.16 g of osmium, what is its empirical formula? OsO<sub>4</sub>
  - 3) Potassium manganate is a dark green, crystalline substance whose composition is 39.6% K, 27.9% Mn, and 32.5% O, by mass. What is its empirical formula? K<sub>2</sub>MnO<sub>4</sub>
  - 4) Acrylic acid, used in the manufacture of acrylic plastics, has the composition 50.5% C, 5.6% H, and 44.4% O. What is the empirical formula? C<sub>3</sub>H<sub>4</sub>O<sub>2</sub>
  - 5) Two compounds have the same composition: 92.25% C and 7.75% H.
    - a. Obtain the empirical formula corresponding to this composition. CH
    - b. One of the compounds has a molecular weight of 52.03 amu; the other 78.05 amu. Obtain the molecular formula of both compounds. C<sub>4</sub>H<sub>4</sub>, C<sub>6</sub>H<sub>6</sub>
  - 6) Putrescine, a substance produced by decaying animals has the empirical formula C<sub>2</sub>H<sub>6</sub>N. Several determinations of molecular weight have values in the range of 87 to 90 amu. Find the molecular formula of putrescine. C<sub>4</sub>H<sub>12</sub>N<sub>2</sub>
  - 7) Oxalic acid is a toxic substance used by laundries to remove rust stains. Its composition is 26.7% C, 2.2% H, and 71.1% O (by mass), and its molecular weight is 90 amu. What is its molecular formula? C<sub>2</sub>H<sub>2</sub>O<sub>4</sub>
  - 8) Compounds of boron with hydrogen are called boranes. One of these boranes has the empirical formula BH<sub>3</sub> and molecular weight of 28 amu. What is its molecular formula?
  - 9) Adipic acid is used in the manufacture of nylon. The composition of the acid is 49.3% C, 6.9% H, and 43.8% O (by mass), and the molecular weight is 146 amu. What is the molecular formula?
  - 10) Natural gas is a mixture of several hydrocarbons, but is primarily methane. Find the empirical formula of this important natural resource if it's composed of 74.8% carbon and 25.2% hydrogen. CH<sub>4</sub>
  - 11) Upon decomposing an opal, a chemist found it contains 4.58 g silicon and 5.21 g oxygen, plus water and minute traces of metals. Find the empirical formula of the basic component of opals, and give its chemical name. SiO<sub>2</sub>
  - 12) While trace impurities of iron and chromium in natural corundum form the gemstones ruby and sapphire, they are basically a binary compound of aluminum and oxygen, with 52.9% Al. Find the empirical formula and give the chemical name for corundum. Al<sub>2</sub>O<sub>3</sub>

## Dougherty Valley HS Chemistry

### Adv. Chemical Ratios – Extra % Comp. and Empirical

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- 13) Butyric acid gets its name from the Latin "butyrum", meaning butter, and is the compound in rancid butter that gives it its terrible smell. A 2.50 g sample of butyric acid was found to consist of 1.36 g carbon, 0.23 g hydrogen, and 0.91 g oxygen. Find its empirical formula. C<sub>2</sub>H<sub>4</sub>O
- 14) An even less popular chemical among organic chemistry students than butyric acid (because it smells much, much worse) is pyridine. Find its empirical formula if a 10.00 g sample contains 7.59 g carbon, 0.64 g hydrogen, and the rest nitrogen. C<sub>5</sub>H<sub>5</sub>N
- 15) A 3.927 g sample of glycerin was found to contain 1.536 g carbon, 0.345 g hydrogen, and the rest oxygen. Find the empirical formula of this important lubricant. C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>
- 16) A student extracted the citric acid from an orange, and then decomposed the acid. Her sample contained 1.875 g carbon, 2.965 g oxygen, and 0.210 g hydrogen. Find the empirical formula for this tasty organic acid. [Careful: don't over round this one!] C<sub>6</sub>O<sub>7</sub>H<sub>8</sub>
- 17) A team of students took a 47.66 g sample of pure lead, and burned it to produce a 51.34 g oxide of lead. Find the empirical formula of this oxide. Can you name it, with the proper Roman numeral for the charge on the lead? PbO
- 18) Determine the molecular formula with the information given
- Empirical formula C<sub>3</sub>H<sub>7</sub>, molecular weight 86 g/mole
  - Empirical formula S, molecular weight 256 g/mole
  - Empirical formula CH, molecular weight 26 g/mole
  - Empirical formula NO<sub>2</sub>, molecular weight 46/gmole
- 19) Determine the molar mass of the following compounds
- P<sub>2</sub>O<sub>3</sub>
  - BaSO<sub>4</sub>
  - Mg(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub>
  - Lithium carbonate
- 20) Calculate the percent composition of oxygen in the following compounds
- SO<sub>3</sub>
  - CH<sub>3</sub>COOH
  - Ca(NO<sub>3</sub>)<sub>2</sub>
  - Ammonium sulfate
- 21) Calculate the empirical formula for the following compounds using composition data below:
- 0.0130 mol C, 0.0390 mol H, 0.0065 mol O C<sub>2</sub>H<sub>6</sub>O
  - 11.66 g iron, 5.01 g oxygen Fe<sub>2</sub>O<sub>3</sub>
  - 40.0 percent C, 6.7 percent H, and 53.3 percent O by mass CH<sub>2</sub>O
  - 15.8% carbon and 84.2% sulfur CS<sub>2</sub>
  - 43.6% phosphorus and 56.4% oxygen P<sub>2</sub>O<sub>5</sub>
  - 28.7% K, 1.5% H, 22.8% P and 47.0% O KH<sub>2</sub>PO<sub>4</sub>
- 22) Calculate the molecular formula for the following compounds using the data given below:
- Empirical formula CH, molar mass = 78 g/mol C<sub>6</sub>H<sub>6</sub>
  - Empirical formula NO<sub>2</sub>, molar mass = 92.02 g/mol N<sub>2</sub>O<sub>4</sub>
  - Caffeine 49.5% C, 5.15% H, 28.9% N, 16.5% O by mass, molar mass = 195g/mol C<sub>8</sub>H<sub>10</sub>N<sub>4</sub>O<sub>2</sub>
- 23) Calculate the % Composition of each element in C<sub>2</sub>H<sub>5</sub>OH C = 52.14%, H = 13.13%, O = 34.73%
- 24) A compound containing only carbon, hydrogen and oxygen is found to be 48.38% carbon and 8.12% hydrogen by mass. What is its empirical formula? C<sub>3</sub>H<sub>6</sub>O<sub>2</sub>